NRG California South LP
Ormond Beach Generating Station
6635 S. Edison Drive
Oxnard, CA 93033

November 29, 2016

Mr. Thomas Howard
Executive Director
State Water Resources Board
Division of Water Quality
1001 I Street, 15th Floor
Sacramento, CA 95814

Re: Once Through Cooling Policy Interim Mitigation Fee Response for Ormond Beach Generating Station, NPDES CA0001198, Order R4-2015-0172, CI-5619; Letter dated September 26, 2016

Dear Mr. Howard,

NRG California South LP, owner of the Ormond Beach Generating Station (OBGS) and wholly owned subsidiary of NRG Energy, Inc. (NRG), submits its response to the State Water Resources Control Board's (SWRCB) September 26, 2016 letter in which the SWRCB requested information in order to calculate the Interim Mitigation Requirements for OBGS pursuant to the Use of Coastal and Estuarine Water for Power Plant Cooling (Policy). Ormond Beach respectfully submits the requested information as described below.

1. *Valid entrainment data, if available;*

On April 1, 2011, OBGS submitted the "Implementation Plan for the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling" to the Los Angeles Regional Water Quality Control Board (RWQCB). The Implementation Plan, provided herein as Attachment A, included the results of the Impingement Mortality and Entrainment (IM&E) study that was conducted from February 2006 thru February 2007. In addition, NRG provides herein as Attachment B "Entrainment Estimates for GenOn Ormond Beach and Mandalay Generating Stations," dated December 29, 2010. These entrainment estimates were included in the April 1, 2011 Implementation Plan as Exhibit E.

2. *Monthly and total intake volume for October 1, 2015 thru September 30, 2016;*

The monthly and total discharge volume for OBGS from October 1, 2016 thru September 30, 2016 is summarized in Attachment C. OBGS had an actual flow of 26,821.36 million gallons during this time period. OBGS' once through cooling (OTC) water structure is designed such that the amount of water drawn in by the pump system is the same amount discharged from the condensers to the OBGS outfall. Note these are the same data reported to the RWQCB in the CIWQS reporting system per the requirements of NPDES Permit CA0001198, CI No. 5619.

3. *If considering installing an intake flow measuring device for measuring future intakes, feasibility and timeframe needed for completion; and*

OBGS does not intend to install any intake flow-measuring device for measuring future intake flows.

4. *Actual annual impingement data in total pounds of fishes impinged from October 1, 2015 thru September 30, 2016, or the annual total of fishes impinged on previous years.*

Under the current 2015 NPDES Permit CA0001198, Order No. R4-2015-0172, CI-5619, OBGS currently conducts quarterly Impingement Fish Counts; previous NPDES Permit CA0001198, Order No. R4-2001-092 required Impingement sampling at least once every two months. The Impingement Fish Count results from 2013 thru 2016 are provided herein as Attachment D. In addition, the Implementation Plan provided as Attachment A includes a summary of historical impingement as well as entrainment studies in Exhibit A, Summary of IM&E Studies at Ormond Beach Generating Station.

I anticipate the above response has addressed the SWRCB's information request. If you have any questions, comments, or concerns, please do not hesitate to contact me at george.piantka@nrg.com or at (760) 710-2156, or contact Tom Di Ciolli at thomas.diciolli@nrg.com or at (805) 984-5241.

Sincerely,
NRG California South LP

George L Piantka

George L. Piantka, PE
Sr. Director, Regulatory Environmental Services
NRG Energy, West Region

cc: Tom Di Ciolli, NRG Ormond Beach Generating Station
Scott Warnock, NRG Ormond Beach Generating Station
Peter Landreth, NRG West Region
Timothy Sisk, NRG West Region
Julie Babcock, NRG West Region

Attachments:

- Attachment A - Ormond Beach Generating Station Implementation Plan for the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling, April 1, 2011
- Attachment B - Entrainment Estimates for GenOn Ormond Beach and Mandalay Generating Stations, December 29, 2010
- Attachment C - 2015-2016 Ormond Beach Generating Station Actual Discharge Flows
- Attachment D - Impingement Fish Counts at Ormond Beach Generating Station, 2013-2016

Attachment A

Ormond Beach Generating Station Implementation Plan for the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling, April 1, 2011

GenOn

GenOn West, L.P.
696 W. 10th St.
P.O. Box 192
Pittsburg, CA 94565

April 1, 2011

Mr. Philip Isorena
Chief, NPDES Unit
State Water Resources Control Board
Division of Water Quality, 15th Floor
1001 I Street
Sacramento, CA 95814

Re: Ormond Beach Generating Station Implementation Plan for the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Policy)

Dear Mr. Isorena,

GenOn West, L.P. (GenOn) owns and operates the Ormond Beach Generating Station (OBGS), which is subject to the Policy. Attached is GenOn's Implementation Plan for the OBGS, submitted pursuant to Section 3(A)(1) of the Policy and the November 30, 2010 letter from the State Water Resources Control Board setting forth information requirements related to the Policy's requirement to submit implementation plans.

Please contact me with any questions at (925) 427-3567 or peter.landreth@genon.com.

Sincerely,

Peter Landreth
Director, California Environmental Policy
GenOn West, L.P.

ORMOND BEACH GENERATING STATION IMPLEMENTATION PLAN FOR THE STATEWIDE WATER QUALITY CONTROL POLICY ON THE USE OF COASTAL AND ESTUARINE WATERS FOR POWER PLANT COOLING

GenOn West, L.P.

April 1, 2011

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List of Exhibits:

- Summary of IM&E Studies at Ormond Beach Generating Station (Exhibit A)
- Entrainment Monitoring Plan (Exhibit B)
- Ormond Becah Velocity Cap Effectiveness Report (Exhibit C)
- Alternative Flow Reduction Technology Evaluation (Exhibit D)
- Screening and Other Aquatic Impact Reduction Technology Evaluation (Exhibit E)
- Entrainment Estimates for GenOn Ormond Beach and Mandalay Generating Stations (Exhibit F)
- Discussion of Market and Contracting Factors Related to Investment in Compliance Measures for the Once-Through Cooling Policy (Exhibit G)

I. INTRODUCTION

GenOn West, L.P. (GenOn) intends to comply with the State Water Resources Control Board's (State Board) "Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling" (Policy) at the Ormond Beach Generating Station (OBGS) by the prescribed deadline of December 31, 2020, through implementing a combination of technological and operational measures under Track 2. GenOn has assessed the feasibility of complying with Track 1 based on currently available information and has concluded that compliance under Track 1 at the OBGS is not feasible, as that term is defined in the Policy. Several technological, logistical, environmental and permitting hurdles render cooling towers infeasible at the OBGS.

Accordingly, GenOn proposes to comply with the Policy under Track 2 by (1) conducting a baseline entrainment study that meet the requirements set forth in Section 4(B)(1) of the Policy; (2) achieving compliance with the Policy's impingement mortality reduction standards by implementing technological and/or operational measures to reduce impingement mortality to comparable level to that which would be achieved under Track 1, consistent with Section 2(A)(2)(a)(ii) of the Policy; (3) achieving compliance with the Policy's entrainment reduction performance standard by implementing a combination of one or more technological and operational measures to reduce entrainment to a comparable level to that which would be achieved under Track 1, consistent with Section 2(A)(2)(b)(ii) of the Policy; and (4) monitoring the effectiveness of such measures consistent with Sections 4(A)(2) and 4(B)(2) of the Policy, as applicable.

As a threshold matter for the purposes of compliance under either Track 1 or Track 2, a fundamental hurdle to any major capital improvement project is the facility's ability to fund the project. Without net revenue certainty, it would be infeasible to install significant capital improvements even if they were otherwise feasible from a technical, logistical and environmental perspective. This implementation plan addresses the market-based constraints that will be relevant to GenOn's compliance with the Policy.

Section II of this Plan describes the OBGS and specifically its once-through cooling operations. Section III sets forth the proposed method of compliance with Track 2, including a discussion go market-based constraints that would be associated with any major improvements at the OBGS. Section IV demonstrates the infeasibility of complying with Track 1, including a consideration of critical technological and logistical factors. Finally, Section V documents GenOn's proposed compliance with the interim requirements set forth in Section 2(C) of the Policy.

II. OBGS FACILITY DESCRIPTION

The OBGS occupies an approximately 37-acre parcel adjacent to Ormond Beach and the Pacific Ocean in the City of Oxnard, California. The facility borders undeveloped areas on the northwest and southwest, which are designated for wetland restoration. Agricultural lands are located to the north of the facility. The OBGS is located approximately 2.5 miles northwest of the U.S. Navy's Point Mugu Naval Air Station and is approximately 2.5 miles southeast of Port Hueneme.

The OBGS is an existing natural gas-fired electric generating facility, comprising two conventional steam-electric generating units. Unit 1 is rated 745MW and Unit 2 is rated 775MW, and both use ocean water for once-through cooling. Each unit consists of a steam turbine structure, which is approximately 100 feet tall, and a red-and-white-striped stack approximately 240 feet tall. The facility also contains a switchyard and other equipment ancillary to electrical generation. The OBGS steam units are connected to an onsite 230KV substation, which is in turn connected to the electrical grid via four 220 kV transmission lines terminating at the Southern California Edison Moorpark Substation in Moorpark, California. The OBGS is located south of Transmission Path 15 and south of Transmission Path 26.

The OBGS withdraws ocean water for cooling from an offshore cooling water intake structure located approximately 2,375 feet offshore in the Pacific Ocean at a depth of 35 feet Mean Low Lower Water (MLLW). The OBGS discharges into the Pacific Ocean via an outfall coffer located approximately 1,790 feet offshore at a depth of 20 feet MLLW. Cooling water withdrawal and wastewater discharges are authorized under NPDES Permit No. CA0001198 (Los Angeles Regional Water Quality Control Board Order No. 01-092), which is currently pending renewal.

The onshore portion of the OBGS cooling water intake structure comprises four screen bays, each approximately 11 feet wide. Each bay is fitted with a vertical traveling screen with 5/8-inch mesh panels. The screens rotate periodically for cleaning based on a pressure differential between the screens' upstream and downstream faces. A high-pressure spray removes any debris or fish that have become impinged on the screen face. Downstream of each screen, each unit has two circulating water pumps (CWPs) rated at 119,000 gallons per minute (gpm). The four CWPs provide a total facility capacity of 476,000 gpm, or 685.4 million gallons per day (MGD). In addition to the CWPs, a single 45 gpm pump is located at the intake structure that provides backup cooling to the steam unit bearing water heat exchangers when the steam units are out of service. The discharge from the 45 gpm pump is recirculated to the intake structure and thus does not result in any increase in once-through cooling flows.[1]

The entrance to the cooling water intake conduit is equipped with a velocity cap that has been in place since the late 1970s and was installed for the purpose of reducing impingement mortality.

The units at the OBGS no longer operate as baseload generation resources servicing the California electric market, and normally operate as capacity resources to serve critical grid

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[1] A mariculture lab located on the site (see Section V(a) below) ties into the bearing water cooling flow loop but does not result in an incremental increase in flows.

support functions during periods of high electric load demand and transmission system emergencies. Consequently, in lieu of the 80%+ capacity factors anticipated for baseload units, recent capacity factors at this station are relatively low (Table II-1). The average composite capacity factor during the last five years was 4.0% for the station.

Table II-1: *Average OBGS Capacity Factors 2006-2010*

Unit Number	**Capacity Factor**					
	2006	*2007*	*2008*	*2009*	*2010*	*Five Year Average*
Unit 1	0.2%	5.6%	4.3%	2.4%	0.8%	2.7%
Unit 2	6.7%	9.7%	7.4%	2.0%	1.0%	5.4%
Combined	3.5%	7.7%	5.9%	2.2%	0.9%	4.0%

The capacity factor data in the table above illustrate the overall utilization of the total OBGS capacity, but to understand the operating profile of the OBGS it is also important to note the variability in unit loads. The California Independent System Operator (CAISO) will often take advantage of the OBGS' low minimum operating level and its ramping capabilities and operate the OBGS at minimum loads to meet existing and anticipated electrical reliability needs. Table II-2 shows that average loads have generally been well below maximum loads.

Table II-2: *OBGS 2006-10 Average Operating Profile*

5 Year Average (2006 - 2010)		
Power Output (MW)	*U1*	*U2*
0 MW	91.5%	84.9%
> 35 MW	7.5%	13.7%
> 70 MW	7.4%	9.2%
> 200 MW	3.3%	8.0%
> 400 MW	1.9%	4.7%

5 Year Average (2006 - 2010)		
Power Output (MW)	*U1*	*U2*
> 600 MW	0.9%	2.7%
> 700 MW	0.1%	0.7%

Note: Unit 1 is rated 745 MW, Unit 2 is rated 775 MW.

The OBGS is anticipated to operate below 10% capacity into the foreseeable future, at load levels similar to those represented in Table II-2.

III. TRACK 2: OPERATIONAL AND TECHNOLOGICAL MEASURES TO ACHIEVE 83.7% REDUCTION FROM DESIGN FLOW BASELINE LEVELS OF ENTRAINMENT AND IMPINGEMENT

GenOn proposes to comply with the Policy under Track 2 by implementing one or more operational and structural measures to reduce entrainment from baseline levels by at least 83.7% pursuant to Section 2(A)(2)(b)(ii) of the Policy (i.e., at least 90% of 93%); and to maintain compliance with the impingement mortality reduction standard in Section 2(A)(2)(a)(ii) through the continued use of an existing velocity cap on the offshore intake. Potential entrainment reduction measures are also expected to further reduce impingement mortality levels beyond those already achieved by the velocity cap. This section first addresses GenOn's compliance with Section 2(A)(2)(a)(ii) through the continued implementation of a velocity cap that effectively achieves a reduction in impingement mortality from a design flow baseline of at least 83.7%. This section then addresses proposed steps to achieve compliance with the Track 2 entrainment performance standard. Based on preliminary evaluations, GenOn believes that a combination of flow reduction and screen technologies, such as variable frequency drives (VFDs), operating restrictions and cylindrical wedgewire screens, can effectively reduce entrainment mortality to achieve compliance under Track 2.

The final design and capital cost of physical modifications necessary to achieve Track 2 compliance cannot be fully defined until after the monitoring studies (described further below) are complete. Additionally, any operating restrictions imposed as part of Track 2 compliance may reduce expected revenues, or increase uncertainty around net revenues available to pay interest and principal or to recover GenOn's investment. Section III(f) provides an overview of the market and contractual considerations relevant to GenOn's assessment of additional investments in its generating stations. It is possible that revenues available from existing market structures and contracting mechanisms will be insufficient to support GenOn's investment in a Track 2 compliance plan. As a result, GenOn cannot at this time commit to such investment until estimated costs and operating restrictions can be estimated, and GenOn is able to reasonably forecast the impact of the OBGS Track 2 compliance plan on the adequacy of net revenues. GenOn will continue to evaluate these market-based constraints through the implementation process described below.

a. Existing Entrainment and Impingement Mortality Baseline Data

Section 4 of the Policy requires baseline impingement and entrainment studies unless prior studies accurately reflect current levels of entrainment and impingement. GenOn believes that existing impingement studies and data accurately reflect current impacts and meet the impingement baseline requirements of Section 4 the Policy, but existing entrainment data are insufficient to accurately reflect current impacts or meet the requirements of Section 4. Accordingly, GenOn proposes to conduct a new baseline entrainment monitoring study, as discussed in more detail below.

Baseline impingement monitoring was first conducted at the OBGS from 1978-1980 as part of the original 316(b) compliance demonstration, and NPDES Permit-related impingement monitoring was initiated in 1981 and has continued through the present. Thus, impingement data at the OBGS have been collected each year since 1978, and many of those years have included a significant number of data samples. The results of these monitoring studies and analysis are summarized in Exhibit A. GenOn believes these data are representative of the OBGS impingement rates and meet the requirements of Section 4 of the Policy so that they are suitable for use in future impingement estimates. Consequently, GenOn does not propose any additional impingement monitoring for the purposes of complying with the Policy.

In contrast, current entrainment data are limited to a single year of sampling (2006-2007). The data is insufficient to meet the guidelines in the Policy, which require 36 consecutive months of data. Further, GenOn’s biological consultant, Tenera, has questioned the reliability of the data. As discussed in Exhibit A, prepared by Tenera, while the taxa represented in the entrainment data appear reasonable and representative of expected conditions in the vicinity of the OBGS, the relative concentrations of each taxon, seasonal abundance and seasonal variation, were substantially lower in total quantities than comparable data sets in the same coastal region based on Tenera’s experience.

Therefore, GenOn proposes to conduct a three-year entrainment monitoring program at the OBGS to meet the requirements of the Policy and ensure that a robust set of baseline information is available to support further analysis.

GenOn’s consultant Tenera has prepared a proposed entrainment monitoring plan, attached as Exhibit B for the State Board’s review and approval.

b. Track 2 Impingement Compliance Analysis

The OBGS cooling water intake structure includes a velocity cap that has been in place since the 1970s. Like similar velocity caps installed at other coastal facilities, the velocity cap has always served to minimize aquatic impacts. Attached as Exhibit C is a Velocity Cap Effectiveness Report prepared by GenOn's consultant Tenera. Studies conducted at the OBGS and at similar facilities equipped with velocity caps indicate that the OBGS velocity cap likely reduces impingement mortality from design flow levels by upwards of 90%. Based on the analysis presented in Exhibit C, GenOn believes that the OBGS has achieved compliance with the impingement mortality reduction requirement in Section 2(A)(2)(a)(ii). Additionally, the entrainment-related Track 2 measures will further reduce impingement mortality. As part of the implementation process described below, GenOn will develop a compliance monitoring program to ensure that GenOn continues to meet the impingement mortality reduction performance standard.

c. Track 2 Entrainment Compliance Analysis

A review of the OBGS operational data shows that there are opportunities available to reduce use of circulating water, though actual cooling water flows have consistently been well below design capacity in recent years. Analysis of pump operating information during the last five years yields the following circulating water flows as a percentage of the annual design circulating water flow for the station (Table III-1). Composite annual circulating water flows, as a percentage of annual design flow during the last five years, averaged 18.0%. Circulating water flows are not derived linearly from the capacity factors and the variability in water use is driven by variable load levels, which are not reflected in the overall capacity factors; nevertheless, the cooling water flows are significantly higher than corresponding capacity factors, indicating an opportunity to achieve reductions in entrainment by reducing flows to more closely match capacity factors.

Table III-1: *OBGS Average Cooling Water Flows as Percentage of Annual Design Flow 2006-2010*

Unit Number	**Actual Annual Circulating Water Flow as Percentage of Annual Design Circulating Water Flow**					
	2006	*2007*	*2008*	*2009*	*2010*	*Five Year Average*
Unit 1	5.7%	17.8%	19.9%	15.5%	8.9%	13.6%
Unit 2	28.7%	32.3%	29.9%	10.7%	10.5%	22.4%
Combined	17.2%	25.0%	24.9%	13.1%	9.7%	18.0%

Accordingly, for the purposes of entrainment reduction, GenOn has conducted a preliminary analysis of various currently known operational and technological measures designed to either reduce the volume of water being pumped through the cooling system or reduce rates of entrainment. Based on this preliminary assessment, flow reduction measures such as VFDs appear to be extremely beneficial in reducing entrainment (as well as impingement) and could achieve a significant percentage of the total 83.7% minimum reduction required under Track 2. Screening technologies, particularly cylindrical wedgewire screens, also appear to be effective at complementing flow reduction technologies. Accordingly, GenOn's preliminary conclusion is that a combination of flow reduction and screening technologies can be employed to achieve compliance under Track 2. Additional flow reduction measures, such as operating restrictions, will also be assessed. The assessment of these measures will be informed by baseline monitoring, pilot studies, and effectiveness studies as discussed below.

This preliminary conclusion is based on the following analysis of potential flow reduction technologies and operational measures as well as screening and other technologies. It is important to note that this assessment reflects currently available technologies and information. GenOn anticipates that technologies with the potential to reduce entrainment and/or impingement will continue to develop and evolve, especially as the national regulation of once-through cooling moves forward. The proposed revisions to the federal 316(b) Phase II Rule were published on March 28, 2011, with the final rule scheduled to be issued in July 2012. GenOn anticipates that this regulatory driver will result in vendors pursuing new or improved technologies that can provide compliance benefits to owners of existing once-through cooled facilities. Accordingly, within the timeframes set forth in Section III(e) of this Implementing Plan, the final compliance proposal may evolve as technology develops.

These measures that were considered are generally summarized below.

1. *Flow Reduction Technologies and Operational Measures Analyzed*

The various operational measures described below all effectively reduce intake flows. As entrainment and, to a large extent, impingement are directly proportional to intake flows, reductions in aquatic impacts attributable to such flow-based measures can be readily quantified and verified. GenOn believes that flow reduction measures will be an essential and integral component of Track 2 compliance given the logical and proven effectiveness of reducing aquatic impacts by reducing cooling water volumes.

i. Variable Frequency Drives

VFDs will allow GenOn to reduce the speed of the CWPs to more closely match the minimum flow requirements for acceptable cooling and backpressure on the steam turbine generators. VFDs can be very effective at minimizing entrainment and impingement at facilities where operations are generally at less than full load, as is the case at the OBGS (see Table II-2 above).[2] Based on a conceptual VFD design, GenOn estimated the impact on total circulating water flow requirements if the units at the OBGS had been equipped with VFDs and the units operated in the same manner they actually did in each year between 2006 and 2009. Based on this analysis GenOn estimates that VFDs would have allowed the OBGS to operate in the same manner it actually did during this period while at the same time reducing flows to 30% to 40% of actual levels (already far below design flows as noted above in Table III-1), thereby achieving significant reductions in entrainment and further reductions in impingement mortality. VFDs were selected as a Track 2 compliance measure to be evaluated for final implementation, consistent with the process set forth below in Section III(d).

ii. Circulating Water Pump Recirculation

This flow-control measure involves modifying the discharge piping of the CWP to add a recirculation control valve. Under this CWP Recirculation technology, valve position is modulated as required to maintain sufficient flow through the unit condenser to maintain optimal steam turbine backpressure. This minimizes circulating water flow through the condenser, and the balance of the water is returned to the intake structure forebay through the recirculation valve. This in turn effectively reduces the amount of makeup water entering the intake structure, reducing makeup water flow requirements and associated entrainment and impingement levels. CWP Recirculation is easier to implement than VFDs, but has higher net operating costs. GenOn will evaluate CWP recirculation as a potential Track 2 compliance measure as part of the process set forth below in Section III(d).

iii. Enforceable Operating Restrictions

As noted in Section II above, capacity factors at the OBGS in recent years have steadily decreased to between 1% and 10% of full load output, and associated circulating water flows have decreased to between 6% and 32% of baseline design flows. GenOn expects that capacity factors will remain well below design capacity for the foreseeable future. As a result, GenOn believes that committing to operating restrictions for the OBGS, in conjunction with other measures, could be a practical measure that could be implemented to meet the Track 2 performance standard. Operating restrictions could include restrictions on operating hours, loads and/or flows, and could be in annual, seasonal and/or diurnal terms. GenOn will evaluate enforceable operating restrictions as part of the process set forth below in Section III(d).

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[2] As explained in Section III(f) and Exhibit G, the California Independent System Operator relies on the availability and capability of these units to operate at full load to assure reliable operation of the electric grid.

iv. Other Flow Reduction Technologies

Other variations on reduced speed pumps or recirculation are further described in Exhibit D. These alternatives qualitatively appear to be inferior to VFDs or the CWP recirculation measures described above, and therefore, are not considered potential Track 2 measures at this time.

2. *Screening and Other Technologies Analyzed*

GenOn commissioned a qualitative assessment to identify technologies that potentially could be implemented as compliance measures under Track 2. Various technological measures were evaluated that could achieve a reduction in entrainment and/or impingement and are described in Exhibit E. These technologies are summarized by category below.

i. Screening Technologies

There are a number of different technologies that fit into this category, generally either (1) fixed-screen technologies or (2) variations on traveling screens. Based on a preliminary evaluation, GenOn believes fixed-screen technologies hold the most promise for Track 2 compliance at the OBGS. GenOn intends to focus specifically on evaluating cylindrical wedgewire screens. A preliminary evaluation of cylindrical wedgewire screens, discussed in more detail below, indicates that substantial reductions could be achieved in entrainment, while also reducing approach velocities to a level sufficient to significantly reduce impingement mortality. As discussed in Exhibit E, other fixed-screen technologies that were evaluated but eliminated from further consideration at this time include the following:

- Stationary Angled Flat Panel Screens, Eicher Screens, or Modular Inclined Screens will not be considered further as they would be difficult to retrofit into the existing intake structure and would not appear to provide a significant advantage over cylindrical wedgewire screens;

- Aquatic Filter Barriers will not be considered further as this technology is still experimental in nature, and existing installations have faced serious biofouling and overtopping problems;

- Seasonal Barrier Nets and Screens will not be considered further because there is no proven experience with net or mesh sizes sufficient to reduce entrainment; and

- Filtrex Filter Screens and Other Media Filters will not be considered further as they require media that can become clogged, and are not appropriate for the volumes of water used at the OBGS.

With respect to variations on traveling screens, retrofitting such technologies into the existing intake structure at the OBGS would be difficult as they would require a total redesign and reconfiguration of the intake system. They also require fish return systems that would pose significant logistical challenges given the offshore location of the intake and discharge conduits. In addition, there are a number of components in these technologies that will substantively impact plant operation and maintenance (O&M) costs, without providing an appreciable advantage over less complex and costly fixed-screen technologies.

ii. Filtration Through Natural Materials

These technologies utilize natural materials, such as rocks constructed in a dike, or the seafloor itself, to filter organisms out of intake water and are described further in Exhibit E. These technologies are not being considered further due to unproven entrainment reduction performance and the physical size requirements of the technology in order to deliver the required quantity of cooling water.

iii. Other Technologies

This category includes other miscellaneous technologies that do not readily fit into the previous two categories. These technologies are described further in Exhibit E and were eliminated from further consideration at this time for the reasons discussed below.

- Louver Systems and Behavioral Barriers will not be considered further as currently available forms of these technologies have little or no proven value in reducing entrainment;

- Relocation of Intake Structure will not be considered since the performance of the existing velocity cap at the OBGS shows that the offshore intake is already optimally located; and

- A Flow Velocity Enhancement System is not being considered at this time. Its potential application in conjunction with cylindrical wedgewire screens to facilitate sweeping flows is not anticipated to be necessary at the OBGS as ocean currents at the existing submerged intake would be expected to provide sufficient sweeping flows.

d. Proposed Steps to Implement Track 2

Based on the preliminary evaluation summarized above, GenOn is confident that the OBGS can achieve compliance with the Policy under Track 2 by maintenance and use of the velocity cap to meet the applicable impingement performance standard as well as by implementing a combination of technological and operational measures to meet the applicable entrainment performance standard. A discussion of implementation steps follows.

1. *Conduct Baseline Monitoring*

As noted in Section III(a) above, impingement data is sufficient to inform the baseline, but to meet the terms of the Policy, GenOn is proposing to conduct a three-year entrainment monitoring study in compliance with Section 4(B)(1) of the Policy prior to finalizing and implementing its compliance strategy. The monitoring proposal prepared by Tenera is included as Exhibit B. GenOn would initiate monitoring activities following State Board approval of the proposed monitoring plan.

2. *Conduct Effectiveness Studies*

During the same three-year period as the baseline monitoring, GenOn intends to fund the pilot studies discussed below with respect to cylindrical wedgewire screens to determine their suitability for application at the OBGS. GenOn will also evaluate flow-reduction technologies and operational measures as discussed below.

i. Cylindrical Wedgewire Screens

The three-year monitoring program described above will be necessary to meet the requirements of Section 4 of the Policy and to develop an accurate entrainment baseline for Track 2 compliance. For discussion purposes, GenOn evaluated existing entrainment data, which suggest that wedgewire screens with a 2mm slot size could reduce entrainment in OBGS intake water. GenOn accordingly commissioned URS to develop a conceptual design configuration for 2mm cylindrical wedgewire screens to inform GenOn's ongoing evaluation of Track 2 technologies.

At the OBGS, the conceptual wedgewire screen arrangement would require a total of fourteen 8.0' diameter, 26.5' long wedgewire screens to accommodate the full design flow of 476,000 gpm required for both units. The screens would be attached to a 50' by 180' spud barge. In a conceptual design, the spud barge would be located on top of the existing intake tunnel, and circulating water flow would flow through the screens, into the spud barge, and then into the existing intake tunnel. A potential challenge associated with installing wedgewire screens at OBGS is the distance offshore of the intake structure and its impact on screen cleaning. Currents around the existing intake may be sufficient to keep cylindrical wedgewire screens clean. Where currents are insufficient to serve this function, screens are typically cleaned by releasing bursts of compressed air into each screen. The resulting sudden water displacement cleans the slot openings. This compressed air system is known as a "Hydroburst" system. Due to the distance between the offshore screens and the onshore facility at the OBGS, it would not be possible to install a Hydroburst system at the plant and then pump the compressed air to the screens at a velocity adequate to clean the screens. Instead, GenOn believes it would be necessary to install the air compressor at the plant and locate an appropriately rated air receiver on top of the spud barge. The compressor would be used to charge the air receiver which in turn will provide the motive force to clean the screens. Natural ocean currents would be utilized to provide the sweeping flow necessary to move fish and larvae that have been prevented from being entrained by the wedgewire screens away from the screens.

URS' analysis demonstrates that cylindrical wedgewire screens would be conceptually feasible at the OBGS, but further site-specific evaluation and pilot studies, as well as analysis of the monitoring data to be collected during the three-year monitoring program, would be necessary to determine the optimal screen configuration. Selecting the proper screen size to achieve reductions in entrainment while minimizing and mitigating fouling, excessive pressure drop, and other undesirable effects, is critical to designing and implementing an effective system. GenOn intends to co-fund a Pilot Study program jointly proposed by MBC Applied Environmental Sciences and Tenera Environmental that will examine issues associated with utilization of specific entrainment and reduction technologies to comply with the Policy. Specific tasks that will support potential application of cylindrical wedgewire screens include (i) specific field tests to evaluate the effectiveness of 0.5mm, 1.0mm, and 2.0mm slot size wedgewire screens in reducing entrainment, (ii) measurement of length and head capsule dimensions of larval fish for different taxa collected from California entrainment studies, (iii) determination of larval fish shrinkage correction factors, (iv) hydrodynamic studies on wedgewire screen intake designs, and (v) assessment of the potential release of copper from the metal alloy used by the manufacturers of the screens. Based on the results of these initial studies, GenOn anticipates commissioning additional site-specific studies to optimize the design of specific screening installations at the OBGS, particularly with respect to screen-slot sizing.

ii. Variable Frequency Drives and Circulating Water Pump Recirculation

VFDs and CWP Recirculation are two alternative flow-reduction technologies that could be employed at the OBGS. GenOn has conducted a preliminary conceptual assessment of VFDs, described below, and will conduct further evaluation of both technologies.

A precise estimation of the performance of potential flow-control technologies measures depends on an accurate entrainment mortality baseline. Using the limited one-year data set available, however, GenOn commissioned Tenera to estimate reductions in impingement and entrainment that would have occurred from baseline levels during the years 2006 through 2009 with the application of VFDs, assuming impingement and entrainment concentrations and frequency variations match those determined during monitoring conducted from February 2006 through January 2007. This study, attached as Exhibit F, indicates that individual species entrainment reductions during this four year period would have varied from a low of 75.3% to a high of 98.9%, with a total fish larvae reduction ranging between 89.3% and 96.5%, and a four year average reduction of 92.3%. These preliminary calculated reductions compare favorably with the required reduction of 83.7% from baseline entrainment values.

GenOn's preliminary technology evaluation indicates that VFDs or CWP Recirculation would be conceptually feasible at the OBGS, and Tenera's preliminary assessment of VFDs suggests that VFDs in particular would be effective at reducing entrainment. A thorough review of the data to be collected during the proposed three-year monitoring program will be essential to informing the ultimate evaluation of whether either of these measures could contribute to achieving the performance standards in the Policy. Follow-up activities that GenOn will conduct in parallel to the monitoring program to more specifically evaluate these alternatives and inform GenOn's ultimate Track 2 compliance proposal include an assessment of design feasibility, permitting issues, estimated capital costs, and estimated O&M costs.

iii. Enforceable Operating Restrictions

As noted previously, capacity utilization factors at the OBGS have been consistently well below those of baseload facilities. By committing to operating restrictions, GenOn could ensure that the cooling water intake flows are limited and achieve the required reduction from design flows for the purposes of Track 2 compliance. A determination of the kinds of operating restrictions that would be the most environmentally beneficial will depend heavily on the three-year monitoring study. For example, if monitoring data indicates that entrainable species in the vicinity of the OBGS intake are more abundant at night, then nighttime operating restrictions, if feasible, would be a logical control measure. GenOn will need to conduct a detailed assessment of operations alongside the proposed entrainment monitoring to identify optimal operating restrictions and determine whether such restrictions can be implemented without significantly reducing revenues and while continuing to enable the OBGS to meet electrical reliability needs.

3. *Review Data and Develop Final Compliance Proposal*

Following the completion of the monitoring program, GenOn will submit a final monitoring report to the State Board for approval, to confirm that GenOn has obtained an accurate entrainment baseline meeting the requirements of Section 4 of the Policy. GenOn anticipates engaging consultants to analyze the monitoring data and compare them to the results of the pilot studies and other conceptual studies of operational and technological measures to develop a final compliance proposal. GenOn anticipates that the State Board's review of the data, and GenOn's internal evaluation of the data and Track 2 compliance measures, will take approximately 1 year. GenOn will then submit a final Track 2 compliance proposal to the State Board for approval.

4. *Design, Engineer and Permit Track 2 Compliance Measures*

Following the final determination of a Track 2 compliance proposal and the State Board's approval, GenOn will proceed with designing, engineering, and permitting the Track 2 compliance measures. The complexity of the design, engineering and permitting process will vary depending on the specific details of the selected compliance measures, but GenOn estimates that this phase will take approximately two years. GenOn anticipates that various permits would be required from the City of Oxnard for most potential Track 2 measures. Depending on the nature and extent of work required in the Pacific Ocean at the offshore intake, additional approvals could be required from the U.S. Army Corps of Engineers, the National Marine Fisheries Service, the Los Angeles Regional Water Quality Control Board, the California Coastal Commission, the California State Lands Commission, the California Department of Fish and Game, and the County of Ventura. Environmental review of Track 2 measures would also be required under the California Environmental Quality Act (CEQA). Once a final Track 2 compliance proposal and associated costs are identified, GenOn will also need to evaluate how the implementation of the selected Track 2 measures may be funded. Several factors will inform this evaluation, including the total cost of the measures required, market conditions, and projected revenues, as discussed further below in Section III(f).

5. *Construct and Implement Track 2 Compliance Measures*

Construction and implementation time will vary depending on the selected alternative, but for planning purposes GenOn estimates that the installation process will take approximately one year. Outages will be avoided if possible, but GenOn will work closely with the CAISO to coordinate any periods during which generation will not be possible. GenOn expects that with sufficient lead time and coordination, there will be no significant challenges with outages related to the construction and implementation of the types of Track 2 compliance measures under consideration.

6. *Conduct Compliance Monitoring*

Once the Track 2 compliance measures are in place, GenOn will monitor the effectiveness of the measures, consistent with the requirements in Section 4 of the Policy. GenOn will submit a specific compliance monitoring plan along with the final compliance proposal described in Section III(d)(3) above.

e. Track 2 Compliance Implementation Timeline

In order to complete the various Track 2 compliance evaluation activities described above, GenOn anticipates a schedule comprising five sequential elements, summarized below with estimates of how long each step will take. However, GenOn anticipates that State Board review and approval will be required for each of these proposed steps (for example, approval of the Monitoring Plans). It is difficult for GenOn to estimate the review time that will be required for State Board staff over the course of the Implementation Plan process, so establishing a definitive schedule at this point is not possible. The main schedule elements are summarized in Table III-2 below:

Table III-2: *Track 2 Compliance Implementation Schedule*

Implementation Step		Estimated Timeframe
1	Conduct entrainment baseline monitoring; technology pilot studies	3 years
2	Review data and develop final compliance proposal	1 year
3	Design, engineer and permit Track 2 compliance measures, and secure any necessary contracts or financing required	2 years
4	Construct and implement Track 2 compliance measures	1 year
5	Conduct compliance monitoring	Post-implementation

f. Market-Based Constraints

As noted above, GenOn will not be able to commit to an investment in Track 2 compliance measures until estimated costs and operating restrictions can be estimated, and GenOn is able to reasonably forecast the impact of the OBGS Track 2 compliance plan on the adequacy of net revenues. A fundamental hurdle to any major capital improvement project is the facility's ability to fund the project. In the Supplemental Environmental Document (SED), State Board staff expressly recognized "the complexities of financing" and acknowledged that obtaining financing is a prerequisite to actually constructing improvements.[3] As explained in this subsection, obtaining financing is essentially contingent upon obtaining a sufficiently reliable revenue stream for the OBGS units. Without net revenue certainty, it would be infeasible to install significant capital improvements even if they were otherwise feasible from a technical, logistical and environmental perspective.

Any compliance plan will require investment. The larger the investment, the greater the required revenue certainty and the longer the time that is likely required to recover the investment.

Exhibit G provides an overview of the landscape that must be considered in evaluating such investments. GenOn has limited long-term market opportunities, and as an independent power producer in California, GenOn faces significant market and regulatory risks that create uncertainty regarding revenues and costs.

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[3] SED Appendix G at p. G-194.

Exhibit G elaborates on the investment criteria that GenOn must consider, and then explains the operating characteristics and capabilities of the OBGS and GenOn's nearby Mandalay Generating Station, as well as the Pittsburg Generating Station owned by GenOn Delta, LLC. An introduction is then provided to the market structure in California including how resource adequacy (RA) capacity requirements are developed and how load serving entities contract for RA capacity. The CAISO operates the only transparent competitive markets for energy and ancillary services in California, and a high-level summary of the role and design of those markets is also provided.

In light of these market and regulatory circumstances, Exhibit G explains the many sources of uncertainty GenOn faces, from the economic outlook to market rules, and summarizes the implications of these uncertainties for investment in significant capital improvements for the purposes of compliance with the Policy.

The foregoing market-based constraints, explained in detail in Exhibit G, will be considered as noted in the implementation timeline outlined above in Section III(e).

g. Track 2 Compliance Conclusion

In summary, while additional data collection and analysis is required before GenOn can implement a final compliance strategy, GenOn is confident it can comply with the Track 2 requirements of the Policy by applying a combination of one or more operational and technological measures, including, but not limited to, flow reduction measures, cylindrical wedgewire screens, and/or operating restrictions in the OBGS NPDES permit, as well as continuing to maintain the impingement mortality reduction provided by the existing velocity cap. GenOn intends to achieve compliance under Track 2 no later than December 31, 2020.

IV. TRACK 1: DEMONSTRATION OF INFEASIBILITY

a. Overview

GenOn has assessed the feasibility of implementing two forms of closed-cycle wet cooling for potential compliance with the Policy under Track 1 at the OBGS: (1) fresh water cooling towers (FWCT), and (2) salt water cooling towers (SWCT).[4] Overall, these two alternatives face similar logistical, technical and permitting/environmental constraints, but issues unique to each alternative are addressed below.

There are numerous reasons that closed-cycle cooling would be infeasible at the OBGS. The definition of "not feasible" in the Policy includes "the inability to obtain necessary permits due to… unacceptable environmental impacts." The OBGS is located within the coastal zone in the City of Oxnard and is subject to the City's Local Coastal Program, which implements the California Coastal Act. Any major improvements at the OBGS would likely require a Coastal Development Permit from the City, which would be the lead agency for the purposes of conducting environmental review under CEQA. The City of Oxnard is considering changes to its Local Coastal Program through development of its draft 2030 General Plan to prohibit non-coastal dependent non-renewable energy uses in Oxnard's coastal zone.[5] Additionally, there are numerous potential environmental impacts associated with the installation of cooling towers at the OBGS that may be considered unacceptable. GenOn can only speculate as to how the City of Oxnard and other responsible agencies would evaluate those potential impacts under CEQA. Therefore, this Implementation Plan focuses primarily on those specific technological and logistical issues that represent critical feasibility constraints. Based on these critical constraints, GenOn has concluded that compliance under Track 1 is not feasible at the OBGS. Moreover, even if it were feasible from a logistical/technical or, permitting/environmental perspective to install cooling towers, market-based constraints and uncertainties would make it infeasible to commit to installing cooling towers at this time, as discussed further below.

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[4] This Implementation Plan does not specifically evaluate repowering for OBGS Units 1 and 2, as repowering would be functionally equivalent to retiring the units and is beyond the scope of regulation of "cooling water intake structures" under Clean Water Act Section 316(b) and the Policy. As State Board staff noted in the SED, the "intent [of the Policy] is not to force OTC [Once-Through Cooling] plants to repower… [and] repowering… is in no way required by the Policy." SED at p. G-51. Similarly, this Implementation Plan does not specifically evaluate retrofitting the OBGS units to use dry cooling. While, as noted in the Policy, dry cooling would meet the minimum requirements of Track 1, the Policy does not require that the existing units achieve reductions in intake flow rate commensurate with dry cooling, and a requirement to assess the feasibility of dry cooling under the Policy would effectively impose a higher "best technology available" standard than Section 316(b) or Track 1 of the Policy requires.

[5] Goals related to the Local Coastal Program in the City of Oxnard's Final Draft 2030 General Plan are found in Chapter 3, Community Development, page 3-37, available at: http://developmentservices.cityofoxnard.org/Department.aspx?DepartmentID=7&DivisionID=76&ResourceID=876 The City is considering these amendments to its General Plan in light of the California Coastal Commission's decision granting Southern California Edison's appeal of the City's denial of a Coastal Development Permit for a new 45-MW "peaker" plant, located near GenOn's Mandalay Generating Station. The Coastal Commission concluded that the new peaker plant would be consistent with the City's current Local Coastal Program. See Appeal No. A-4-OXN-07-096 (April 8, 2009).

As a threshold matter, Tetra Tech concluded in its 2008 study, "California's Coastal Power Plants: Alternative Cooling System Analysis," prepared for the State Board, that wet cooling towers would be logistically infeasible at the OBGS primarily based on the fact that (1) adverse effects of a conventional cooling tower plume on the Point Mugu Naval Air Station would necessitate plume-abated cooling towers but that (2) plume-abated cooling towers could not fit within the available space at the OBGS site without creating serious corrosion threats to existing power generation and transmission equipment or conflicting with local height restrictions.

Specifically, Tetra Tech reached the following pertinent conclusions:

> The existing site's configuration and the total available area present significant challenges to identifying sufficient space on which to place wet cooling towers…. Placement of towers in [the northwest portion of the site] is impractical due to the proximity to the generating units and the prevailing wind direction, which places the towers immediately upwind of the power block at a distance of less than 150 feet. Drift from wet cooling towers in this location would likely settle on sensitive equipment and pose significant maintenance challenges from salt corrosion.
>
> Use of [the area north-northeast] of the units would minimize this effect on the power block but create similar impacts on the switchyard and transmission lines that extend northward…. Drift deposition and salt corrosion on switchyard equipment and transmission lines would likely be a significant issue and, if wet cooling towers were constructed here, equipment and lines might require relocation or replacement with gas insulated switchgear….
>
> The space limitations at OBGS are more restrictive when attempting to design plume-abated towers for the site. If configured in an in-line arrangement, these towers would be nearly twice the length of a conventional tower design. Consultations with cooling tower vendors indicated a round plume-abated tower might be feasible, but would have to be very tall (70 to 80 feet). This would likely conflict with building height restrictions in the coastal zone for Ventura County and might present design challenges to comply with Zone 4 seismic construction requirements.[6]

Accordingly, Tetra Tech concluded that plume-abated towers at the OBGS "could not be configured at the site" and are therefore "logistically infeasible." GenOn does not dispute the conclusions of the Tetra Tech study with respect to the infeasibility of installing cooling towers

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[6] Tetra Tech Report at pp. K-10-11.

at the OBGS. As discussed more fully below, GenOn has further assessed FWCTs and SWCTs and concluded that additional factors demonstrate the infeasibility of installing either option at the OBGS.

b. Engineering and Technical Feasibility

With that background, this section evaluates the engineering and technical feasibility of SWCT and FWCT installations at the OBGS (i.e. the ability to design, procure and erect the selected cooling tower option in the absence of any other constraints). As discussed above, GenOn does not dispute the conclusions in the Tetra Tech study that FWCTs and SWCTs would be infeasible at the OBGS due to logistical constraints. However, to provide an up-to-date and complete analysis, GenOn independently analyzed cooling tower options.

1. *Siting*

To understand the design considerations and physical site constraints and opportunities at the OBGS with respect to siting cooling towers, GenOn engaged URS to consider the physical feasibility of installing FWCTs or SWCTs. As discussed below, URS concluded that both forms of cooling towers could theoretically be physically constructed at the OBGS, but this conclusion is independent of all other technical/ logistical and permitting/environmental constraints that significantly impact the feasibility of installing closed-cycle cooling at the OBGS site. The physical design and siting issues for each cooling technology are discussed below.

As a threshold matter, due to the visual impacts that would result from a cooling tower plume on the Point Mugu Naval Air Station and on visual resources, especially adjacent beach recreation areas, plume abatement would be required for any FWCT or SWCT installation at the OBGS under the provision of CEQA. Therefore, throughout the rest of this Implementation Plan, the descriptions and analysis of FWCTs and SWCTs assume that they incorporate plume abatement. As a "rule of thumb" the physical footprint dimensions of a plume-abated tower are nominally 20% larger than those of its "non-abated" counterpart.

There are two potential options for plume abatement technology: the conventional "Hybrid" type tower and the "Clear Sky" type cooling tower.[7] Hybrid towers are significantly larger and may

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[7] In the Hybrid approach, the heated, evaporated water passes through a bank of heating coils mounted on top of the tower in its upward movement, so that it exits the tower under-saturated and it remains such even when mixed with outside air after exiting the tower. The coils are heated by the incoming hot water from the condenser. In this way, approximately 20% of the total heat load is dispersed in a "dry section" of the tower. One of the secondary effects of this arrangement is proportionally reducing the amount of evaporation and corresponding makeup requirements. Heat transfer in the coils is most effective at lower ambient temperatures; therefore, water savings occur mostly in winter. In the Clear Sky approach, the warm air saturated with water exchanges heat with ambient air in its upward movement in a bank of plastic "plate" type heat exchanging surfaces, thereby losing some moisture in condensation. This under-saturated moist air flow is then mixed with the drier air that has been heated in the heat exchange process. Heat transfer in the "dry section" and recovery of condensate lead to water savings that are comparable to the Hybrid tower, most of which occur at lower ambient temperatures. For purposes of designing the required size

be appropriate for FWCTs. In saltwater applications, however, Hybrid towers would require installation of costly titanium heating coils, which would require frequent, extensive maintenance. For these reasons, only the Clear Sky technology would be practical for a SWCT application, although it could also be used in FWCTs. It is important to note, however, that there has been no full-scale commercial application of a Clear Sky cooling tower to date. While there is a significant technological feasibility question regarding the full-scale commercial application of the Clear Sky product, for the purpose of assessing feasibility at the OBGS, this analysis assumed it would be available and effective commercially.

i. FWCT

Due to space availability constraints and the required size of a Hybrid plume–abated FWCT, URS concluded that a Hybrid plume-abated tower could not be installed at the OBGS. For a Clear Sky plume-abated FWCT at the OBGS, URS assessed the existing site layout and facilities to come up with an optimal conceptual configuration. The primary physical elements of a FWCT would include: a cooling tower for each unit; new, larger auxiliary equipment heat exchangers for each unit; new booster pumps and an associated pump pit to pump the recirculated cooling water through the new cooling tower; and a new water storage tank to maintain sufficient on-site water supply to maintain reliability of the FWCT.

URS considered two plume-abated cooling towers of 12 cells each, with each tower measuring approximately 84 feet wide by 616 feet long by 67 feet high. As noted above, There would not be sufficient space to incorporate the Hybrid plume abatement design, which requires 900 feet. Each cooling tower would require a circulating flow of 238,000 gallons per minute (gpm), requiring a maximum make-up flow of 6,077 gpm per unit. On-site water storage sufficient to maintain a back-up make-up water supply would require 4.6 million gallons, stored in two new tanks each measuring roughly 90 feet in diameter and 44 feet high.

URS determined that, based on site layout, the configuration of the existing units, and available space at the OBGS site, a Clear Sky plume-abated FWCT could theoretically be constructed at the site. However, critical feasibility factors discussed in Section IV(b)(2)(i) below render the FWCT infeasible.

ii. SWCT

Design performance differs between FWCT and SWCT technologies due to the properties of salt water, which has a lower specific heat and a higher specific gravity than fresh water. Due to its lower vapor pressure, salt water is also more difficult to evaporate. This necessitates more

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of the plume abatement equipment, URS set the ambient design conditions for plume abatement at 24F and 80% RH for the Hybrid (tower with heating coils) design and 30F and 80% RH for the Clear Sky design. These design points were selected by SPX as practical limits of design. The 24F design provides plume abatement 100% of the time and the 30F design leaves approximately 30 hours per year that plume abatement would not be effective at this site.

cooling tower surface area in a SWCT for evaporation to occur, increasing the tower's physical size and also increasing auxiliary power demands. Additionally, salt water is highly corrosive, requiring special, and more costly, materials to withstand the higher corrosiveness, separate and apart from plume-abatement considerations.

The primary elements of a conceptual SWCT at the OBGS would be similar to those of the FWCT described above, except that the cooling towers with the Clear Sky technology plume abatement would be significantly larger, and no on-site water storage would be required. A conceptual plume-abated SWCT would measure approximately 96 feet wide by 616 feet long by 71 feet high. There would not be sufficient space to incorporate the Hybrid plume abatement design, which requires 900 feet. A SWCT would continue to withdraw seawater from the existing offshore intake to provide the 17,484 gpm make-up water per unit.

Another important consideration related to SWCTs is the potential impacts of saltwater corrosion on downwind existing power generation and transmission equipment due to drift from the SWCT. Tetra Tech specifically noted this concern at the OBGS in connection with potential SWCTs given the site's space limitations.[8] Even with drift elimination incorporated into the cooling tower design, there would still be significant rates of salt deposition. Neither URS nor Tetra Tech specifically evaluated the potential impacts of corrosion on downwind equipment, but corrosion impacts could potentially preclude SWCTs at OBGS.

URS determined that, based on site layout, the configuration of the existing units, and available space at the OBGS site, a Clear Sky plume-abated SWCT could theoretically be physically constructed. However, critical feasibility factors discussed in Section IV(b)(2)(ii) below render the SWCT infeasible.

2. *Critical Feasibility Factors*

While the FWCT and SWCT designs can both be hypothetically sited on the OBGS site, there are technical, logistical and/or environmental considerations that render them infeasible. These key feasibility constraints are discussed below with respect to each cooling tower option.

i. FWCT

The primary technical and logistical constraint affecting the feasibility of FWCTs at the OBGS is the availability of a freshwater supply. The existing source water for the OBGS is saltwater from the Pacific Ocean used for once-through cooling. Plume-abated FWCT facilities at the OBGS would require approximately 17.5 million gallons per day (MGD) of make-up water at full load. Once sufficient water was supplied to initiate the FWCT process, cooling system evaporation would account for most of the consumptive water use. Make-up supplies would be required to offset evaporation losses. The extent of make-up water consumption would be proportional to

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[8] Tetra Tech Report at pp. K-10-11.

actual operational levels. Based on prior OBGS operations, make-up water demand for plume-abated FWCT facilities would be approximately 6,815 acre-feet per year (AFY).

The OBGS is located in the City of Oxnard's water service area. The City's current water supplies consist of groundwater, and surface water supplies imported under an agreement with the Calleguas Municipal Water District. Calleguas is supplied by the Southern California Metropolitan Water District, which obtains water primarily from State Water Project (SWP) and the Colorado River (City of Oxnard Water Division, 2005 Urban Water Management Plan (Rev 8, Kennedy-Jenks, 2006)) (UWMP). The UMWP, and subsequent water analyses in environmental documents prepared by the City (see e.g., City of Oxnard Planning Division, Sakioka Farms Business Park Specific Plan Draft Environmental Impact Report, September 2010 (Sakioka DEIR)) indicate that existing groundwater and SWP imports will be insufficient to meet anticipated future demands. Groundwater available to the City is regulated by the Fox Canyon Groundwater Management Agency (GMA), which was created by state legislation in 1983 to manage regional aquifers. The GMA's groundwater allocations to local users, including the City, have been successively reduced by approximately 25% through 2010 (Sakioka DEIR, page IV.N-3). The City's imported supplies are subject to significant climate variability, endangered species impacts related to SWP pumps located on the southern edge of the Sacramento Delta, and by legal disputes affecting the availability of Colorado River water in California (Sakioka DEIR, page IV.N-5 to IV.N-12). To meet future demand, the City intends to construct new treatment facilities with the capacity to produce approximately 17,500 AFY of tertiary-treated recycled water. The City anticipates that it will receive proportionate groundwater or other potable water use credits by offsetting existing uses or supplementing the local aquifer with approximately 17,500 AFY of tertiary-treated supply, an amount the City has identified as necessary to meet demand by 2030 (UMWP, page 101: Sakioka DEIR page IV.N-13).

Groundwater or imported water use by the MGS would be inconsistent with State Board policies that strongly discourage the use of fresh water for power plant cooling purposes.[9] Such use would also (i) generate substantial new demand for potable water beyond levels previously considered by regional water planning agencies, including the City, (ii) be inconsistent with the GMA's objective to reduce regional groundwater use, and (iii) be inconsistent with statewide efforts to reduce SWP water use. As a result of these constraints and state regulations that would require fresh or tertiary-treated water use in FWCT cooling facilities (see 22 CCR 60306), the only potentially available supply for the OBGS would be tertiary-treated recycled water.

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[9] State Resolution 75-58 states in relevant part that, "It is the Board's position that from a water quantity and quality standpoint the source of power plant cooling water should come from the following sources in this order of priority depending on site specifics such as environmental, technical and economic feasibility consideration: (1) wastewater being discharged to the ocean, (2) ocean, (3) brackish water from natural sources or irrigation return flow, (4) inland wastewaters of low TDS, and (5) other inland waters….Where the Board has jurisdiction, use of fresh inland waters for power plant cooling will be approved by the Board only when it is demonstrated that the use of other water supply sources or other methods of cooling would be environmentally undesirable or economically unsound."

Potential sources of recycled water in the vicinity of the OBGS include the City of Ventura Water Reclamation Facility (VWRF), the City of Oxnard Wastewater Treatment Plant (WTP), and the Camarillo, Camrosa, and Santa Paula wastewater treatment facilities. Only the VWRF generates substantial amounts of tertiary-treated wastewater. The VWRF's treatment capacity is approximately 14 MGD, and in 2010 the facility produced approximately 8,200 AFY of tertiary-treated wastewater (City of San Buenaventura 2005 Urban Water Management Plan, Section 7 (December 2005)). The VWRF is located outside the boundaries of, and does not serve, the City of Oxnard. There is no connectivity between the City of Oxnard's water system and any other water purveyor, including the VWRF (UMWP, page 27). If constructed, a water supply interconnection with Ventura would be limited to emergency supplies due to certain water supply incompatibilities between the two systems (UMWP, page 27). Tertiary-treated recycled water is not feasibly available from the VWRF or the Camarillo, Camrosa, and Santa Paula wastewater treatment facilities due to jurisdictional, supply and interconnection constraints.

The WTP currently provides secondary-level wastewater treatment within the City of Oxnard. The plant has an average dry weather flow design capacity of 31.7 MGD, an ultimate design capacity of 39.7 MGD, and currently treats about 20 MGD (Sakioka DEIR, page IV.N-18). As required by regulation, tertiary treated water is required for industrial cooling water (22 CCR 60306). Although, as discussed above, the City intends to augment its water supplies by constructing new tertiary treatment facilities with a capacity of approximately 17,500 AFY, the City's water plans do not contemplate any recycled or other City-supplied water use by the OBGS, and none of the anticipated recycled water conveyance facilities would service the OBGS (Sakioka DEIR, pages IV.N-18 to IV.N-22).

Use of tertiary-treated recycled water obtained from the WTP for the OBGS is infeasible for several reasons. Supplying onsite FWCT facilities with tertiary-treated water would require additional, presently unplanned and unfunded delivery infrastructure within the WTP service area extending to the south of the WTP. Diverting a portion of the WTP's anticipated recycled water to the OBGS would also significantly disrupt the City's long-term water planning, which depends on generating proportional groundwater offsets and credits from tertiary-treated water. The OBGS does not use potable supplies that would be eligible for the offsets and credits the City desires to obtain. Consequently, additional potable water demand of at least 6,815 AFY, or the amount of make-up water that the FWCT facilities would consume, would be generated by OBGS recycled water use. Based on the UWMP and recent City projections, no additional and reliable potable groundwater or imported water resources of this magnitude are currently available to meet future water needs in the region. Finally, at peak operation, FWCT facilities would require approximately 17.5 MGD of make-up water. This level of use would be approximately 87.5% of the WTP's current daily capacity (20 MGD) and 55% of the WTP's design capacity (31.7 MGD). The WTP was not designed to and could not feasibly accommodate peak recycled water demands of this magnitude.

Accordingly, based on currently available information, existing and potential future reclaimed water supplies are not available and insufficient to meet the demand of an OBGS FWCT. The unavailability of these resources renders FWCTs at the OBGS infeasible.

ii. SWCT

The primary environmental impact distinguishing SWCTs from FWCTs is the emission of particulate matter (PM) due to the high level of total dissolved solids (TDS) in salt water, resulting in several severe logistical constraints. PM emissions trigger various air quality permitting requirements. The OBGS is under the jurisdiction of the Ventura County Air Pollution Control District (VCAPCD). Section B of VCAPCD Regulation II, Rule 26 (New Source Review [NSR] Requirements) requires emission offsets for a new, replacement, modified or relocated emissions unit with an emission increase of 15 tons per year (tpy) or greater of PM less than 10 microns in diameter (PM10).

The assumed salt content of the make-up water for a seawater cooling tower at the OBGS was based on receiving water quality parameters taken at nine offshore locations during winter and summer 2009, as part of NPDES monitoring and reporting requirements. The highest salinity concentration measured in receiving waters of the OBGS during either flood or ebb conditions was approximately 33.5 psu.

Based on this salinity concentration, and using U.S. EPA's guidance on emission factors for wet cooling towers (U.S. EPA, AP 42, Section 13.4), GenOn estimated PM emissions for SWCTs at the OBGS would be 90.3 tons per year, conservatively using the high end of recent representative operating years. Note, however, that these emission levels are based on actual operations. For permitting purposes, GenOn would need to obtain authorization for emissions up to the facility's full potential to emit (PTE), which would be much higher than these calculated levels. Even assuming these actual levels, however, PM emission from an OBGS SWCT would exceed the NSR threshold of 15 tpy and require the provision of offsets under VCAPCD rules.

GenOn conducted an assessment of the VCAPCD PM10 ERC market to determine whether sufficient ERCs would be available to meet the offset requirements of the VCAPCD's NSR requirements based on projected cooling tower emissions. The results of this assessment are summarized below:

- As noted above, the working estimate for projected PM10 emissions in an OBGS SWCT is 90.3 tpy. Under applicable VCAPCD rules, GenOn would be required to offset these emissions at a rate of 1.1, which would require 99.3 tons of ERCs. (See VCAPCD Rule 26.2(c)).
- The existing inventory of PM10 ERCs in the VCAPCD emissions bank is 42.4 tons.

- The entire stationary source inventory in the VCAPCD is approximately 263 tpy.
- The 99.3 ton ERC demand for an OBGS SWCT therefore represents:
    - *more than twice* the existing inventory of PM10 ERCs in the VCAPCD's emissions bank, and
    - *more than 34%* of the entire stationary source inventory in the VCAPCD.
- Therefore, to procure sufficient ERCs based on the existing inventory in the VCAPCD, GenOn would have to procure the entire inventory in the bank and somehow procure almost 60 additional tons.
- To do this, GenOn would either have to (1) secure the retirement of 60 tpy of PM10 emissions within the VCAPCD (i.e. almost 25% of all PM10 emissions in the district) to create 50 tons of ERCs, (2) attempt to create ERCs using interpollutant trading, and/or (3) secure ERCs from other districts. The latter two approaches, however, have rarely been used and are generally disfavored, and in any case the supply of ERCs of PM10 precursors in the VCAPCD, as well as PM10 ERCs in neighboring districts, is similarly constrained.
- Therefore, GenOn's analysis indicates that it would not be feasible to procure sufficient ERCs to offset the emissions associated with a SWCT under applicable air quality regulations.

In addition to the challenges associated with obtaining sufficient ERCs, the exceedance of the 15 tpy threshold also has much broader implications under the Clean Air Act and other federal laws. The installation of cooling towers would also be considered a "major modification of a major facility" for NSR purposes and would therefore require a Prevention of Significant Deterioration (PSD) Permit from the U.S. EPA. As a federal action, PSD permit issuance also triggers compliance with the National Environmental Policy Act (NEPA), as well as requiring consultation with the National Marine Fisheries Service and/or the U.S. Fish and Wildlife Service under the federal Endangered Species Act. Thus, a PSD permit would add numerous permitting hurdles, likely extending and complicating the permitting timeline, if not completely precluding SWCTs.

In sum, the unavailability of sufficient ERCs, in addition to the federal permitting complications, due to PM emissions associated with saltwater render SWCTs infeasible.

c. Market-Based Constraints

Notwithstanding the feasibility factors discussed above regarding cooling towers at the OBGs, as explained above in Section III(f), a fundamental hurdle to any major capital improvement project is the facility's ability to fund the project. This hurdle is much more significant for a project on the scale of cooling towers, which would require significant revenue certainty over many years. The market-based constraints described in Section III(f) and in Exhibit G would preclude the installation of cooling towers at the time even if they were otherwise feasible.

d. Cooling Tower Conclusions

Both of the potential cooling tower configurations at the OBGS, whether an FWCT or SWCT, face insurmountable hurdles that render them infeasible. The foregoing discussion of feasibility factors focuses only on the most prominent issues. There are numerous other potential environmental impacts associated with cooling towers, such as those related to noise, natural resources, water quality or greenhouse gas emissions, that would additionally impair their feasibility at the OBGS. Therefore, compliance under Track 1 of the Policy is not feasible for the OBGS. Additionally, even if all of the technical, environmental and permitting hurdles could be cleared to theoretically construct a FWCT or SWCT, as a practical matter GenOn would not be able to actually commence engineering and construction without financing, which could not be secured without sufficient net revenue certainty. Accordingly, even if Track 1 compliance were otherwise feasible, GenOn could not commit to installing cooling towers at this time.

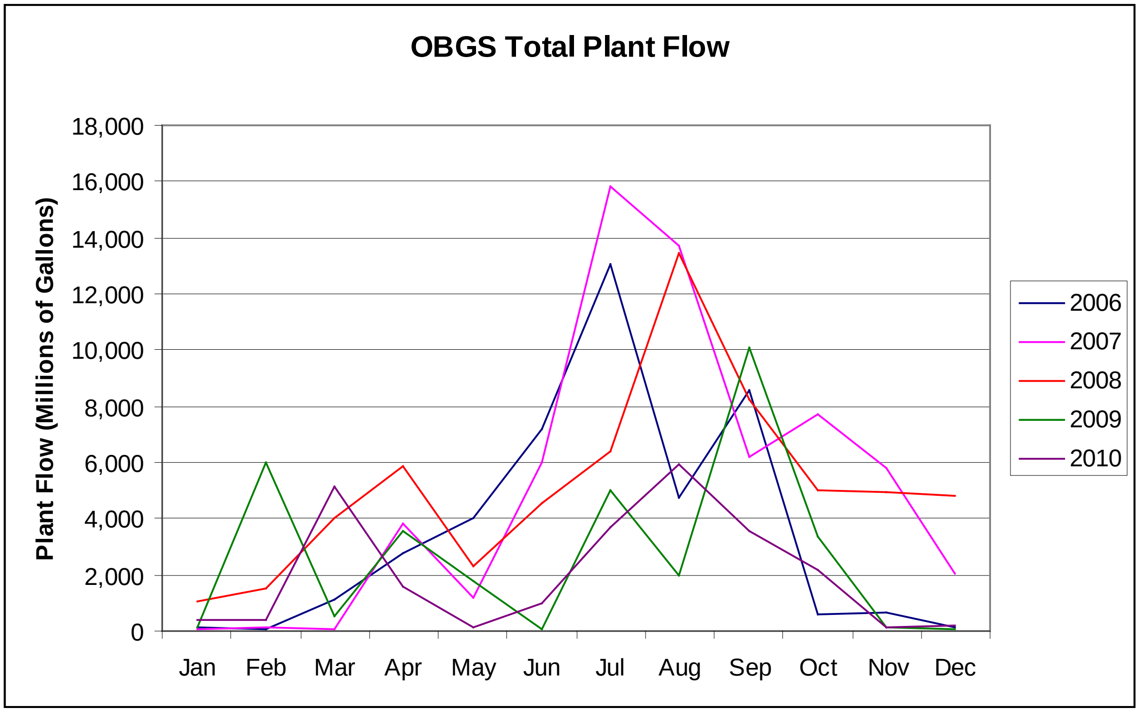
V. COMPLIANCE WITH INTERIM REQUIREMENTS

a. Offshore Intake Screening

There is an existing large organism exclusion device installed at the OBGS. This device currently has bars spaced on 14" centers. Under Section 2(C)(1) of the Policy, GenOn must retrofit this installation with bars spaced no greater than 9" on center no later than October 1, 2011. GenOn has completed engineering of the design modifications required to complete this retrofit and released the contractor for procurement. GenOn anticipates that the design modifications will be installed by May 31, 2011, well in advance of the October 1 deadline.

b. Curtailment of Intake Flows

Section 2(C)(2) of the Policy requires an existing power plant unit that is subject to the Policy to cease intake flows when not engaging in power-generating activities, or critical system maintenance, unless a reduced minimum flow is necessary for operations. The November 30, 2010 Implementation Plan Requirements letter requested "information regarding when it is likely that each unit in your facility may not be generating power, or when you are performing critical system maintenance that would result in the cessation of flows." As illustrated in the graph below, OBGS flows (and corresponding operations) are typically concentrated in the hottest summer months, when demand for generation is highest. However, the OBGS may be dispatched at any time, and consumption in a given month varies from year to year. Accordingly, while a discussion of monthly generation trends can indicate when flows are more or less likely to occur during the year, based on likely electrical demand, they are only illustrative, and GenOn cannot guarantee that the annual generation profile in a given year will look exactly the same as another year.



OBGS operating procedures will be modified prior to October 1, 2011 to specifically require CWPs to be removed from service whenever the units are not directly engaged in power-generating activities or critical system maintenance, as such terms are defined in the Policy. The OBGS has certain essential equipment that is directly related to power generation, such as air compressors, that continue to operate even if the units are offline, and a low-volume stream bearing cooling water continues to be required to service this equipment. As noted in Section II, a low-volume 45 gpm pump at the intake is also used to provide flows for the bearing cooling water heat exchangers when the units are out of service, but this flow is returned to the intake structure and does not increase intake flows. In addition, OBGS must start a circulator as a requirement of its NPDES permit, and consistent with the California Ocean Plan, whenever onsite retention basins must be drained to maintain minimum required freeboard as required by the NPDES permit.[10]

c. Interim Mitigation

Section 2(C)(3) of the Policy requires facilities that have not achieved final compliance by October 1, 2015 to provide for interim mitigation of impingement and entrainment impacts from that date until final compliance is achieved. Based on the implementing schedule set forth in

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[10] See NPDES Permit No. CA0001198 (Los Angeles Regional Water Quality Control Board Order No. 01-092) at paragraph 30; see also California Ocean Plan Section III(C)(8)(d).

Section III(e) of this Implementation Plan, GenOn does not anticipate that the OBGS will have achieved final compliance by October 1, 2015, so GenOn proposes to provide for interim mitigation as discussed below.

1. *Existing Mitigation Efforts*

GenOn is committed to supporting projects that preserve and protect the natural resources in the City of Oxnard and the surrounding areas and has engaged in numerous restoration and mitigation efforts that it believes should be credited against the Policy's mitigation requirements. During the last decade, the OBGS and GenOn's nearby Mandalay Generating Station have been actively involved in projects that benefit the marine environment. Throughout Ventura County, and with an emphasis on programs in the City of Oxnard, the stations have invested more than $250,000 – and thousands of employee volunteer hours – in support of vital habitat restoration, environmental education, and threatened and endangered species protection projects. In addition to actively supporting the Channel Islands Marine Resource Institute and its marine habitat enhancement and marine educational programs, and providing funding and volunteer support to local marine mammal stranding efforts in Ventura County, GenOn's City of Oxnard facilities have (a) provided funds to assist with restoration efforts in the Ormond Beach Wetlands; and (b) provided funds to support multiple Nature Conservancy projects aimed at enhancing sensitive fish and wildlife habitats.

Finally, a portion of the OBGS site has been set aside for the operation of a marine science laboratory operated by marine biologist Dr. Tom McCormick. In that facility, Dr. McCormick and local students have worked to expand the populations of White Sea Bass and abalone, and to curtail the expansion of invasive vegetation on the valuable dune habitats along the beach.

In conjunction with the proposed interim mitigation described below, GenOn will work on quantifying the value of the existing mitigation programs that restore and/or enhance coastal marine or estuarine habitat and provide protection of marine life as described above for potential credit against the interim mitigation requirements in the Policy.

2. *Proposed Interim Mitigation*

Assuming that the existing mitigation measures described above are not sufficient to meet the interim mitigation requirements, GenOn proposes additional interim mitigation as follows to make up the difference. The State Board has identified the preferred mitigation method as providing funding to the California Coastal Conservancy that will ultimately be used "for mitigation projects directed toward increases in marine life associated with the State's Marine Protected Areas in the geographic region of the facility." The California Coastal Conservancy has identified several restoration projects in the South Coast region that, when implemented, would provide increases in habitat and production of marine life.

GenOn proposes to provide funding to the Coastal Conservancy for the implementation of projects in the vicinity of the OBGS that would provide increases in the habitat and production of marine life, as interim mitigation from October 1, 2015 and continuing up to and until the OBGS achieves final compliance with the Policy. For reference, GenOn notes that on December 14, 2010, the State Board proposed amendments to its Policy that included additional language to Policy Section 3(A)(1)(c). That additional language would have clarified compliance with Section 2(C)(3)(a)-(c) and (e) of the Policy by establishing a $3 per million gallons fee payable annually for the purposes of meeting the mitigation requirements set forth in those subsections. GenOn believes the $3/million gallons mitigation approach provides a reasonable and practicable method for meeting the Policy's requirements. Accordingly, GenOn proposes to provide $3/million gallons of actual flows withdrawn by each unit. The amount provided would be based on the actual cooling water intake flow of each unit during each calendar year (January 1 through December 31), or prorated year depending on when final compliance is achieved and interim mitigation is no longer required. Discharge data submitted to the Los Angeles Regional Water Quality Control Board would be used for the volume calculations. The calculations would be performed by the OBGS for the prior year, and the funds would be submitted to the Coastal Conservancy by February 1 of each calendar year.

This approach would allow for the consistent, equitable implementation of the Policy among all the plants that are required to conduct interim mitigation; it would provide a predictable and easily quantifiable rate of mitigation; and it would provide meaningful, reliable funding for coastal restoration projects. By providing funding on an annual basis it would also address uncertainties related to the volume of cooling water necessary to support operations at the OBGS. This approach avoids the complexity and difficulty of attempting to quantify in monetary terms the extent of mitigation or restoration that should correspond to a given level of entrainment and impingement. It also avoids the uncertainties that are associated with the implementation of any restoration project and the difficulties in determining the appropriate level of funding for projects that might continue to require funding and provide benefits well beyond the date when final compliance is achieved.

Exhibit A

Summary of IM&E Studies at Ormond Beach Generating Station

March 18, 2010

Prepared by:
Tenera Environmental
141 Suburban Rd., Suite A2
San Luis Obispo, CA 93401
805.541.0310

Ormond Beach Generating Station

This section describes previous impingement mortality and entrainment (IM&E) sampling done at the OBGS, including the comprehensive studies conducted from February 2006 through February 2007 (2006 Study) following the publication of the EPA 316(b) Phase II Rule in February 2004.

Historical Studies

Impingement and entrainment sampling was done at the OBGS as part of the original 316(b) compliance demonstration in the late 1970s and early 1980s. Impingement sampling was also done as part of receiving water monitoring required under the facility's NPDES permit in the 1990s and from 2000 to the present. The historical entrainment and impingement studies are briefly described below and are followed by a description of the sampling done for the 2006 Study.

1978–1980 316(b) Compliance Demonstration IM&E Sampling

Impingement monitoring data were collected on a weekly basis at OBGS between October 1978 and July 1980, with sampling increasing to twice weekly in August and September 1980. Species collected from the material washed off the traveling screens were grouped into algal, invertebrate, and fish categories. The following data were recorded for all individuals collected during normal operations: (1) number of species; (2) number of individuals per species; and (3) total weight per species. Fifteen species of fish were targeted for further analysis, including shiner surfperch queenfish, anchovy, white surfperch, walleye surfperch, white croaker, Pacific butterfish, kelp bass, barred sand bass, sargo, spotfin croaker, bocaccio, black surfperch, yellowfin croaker, and black croaker. The standard length to the nearest millimeter (mm) was measured for up to 200 individuals of the target species and up to 50 individuals were sexed.

Non-target species found in large numbers were also counted and sexed. Heat treatment data was collected at approximately four to six week intervals. Fish were separated by species, counted and weighed. Select species were measured for length frequency distributions. The total estimated impingement was calculated by averaging the daily impingement rate across the 163 normal operations and 20 heat treatment samples collected during the study. The rate of impingement mortality for normal and heat treat operations was determined to be 1,811.8 fish per day. Target species comprised 96.8% of total daily impingement during the two-year period; of the fish collected 54.2% were queenfish; 14.9% white croaker; 7.1% walleye surfperch; and 6.7 % northern anchovy.

NPDES Impingement Monitoring

The NPDES permit for the OBGS required impingement sampling during representative periods of normal operation and during all heat treatment operations. A normal operation survey was defined as a sample of all fish and macroinvertebrates impinged onto the traveling screens during a 24-hour period with all circulating pumps operating, if possible. Normal operations sampling was conducted at approximately weekly intervals from 1981 through 1994 and approximately monthly from 1995 through 2010 (**Table 1**). Impingement sampling included the characterization, enumeration, and weighing of all fish, macroinvertebrates, and plants entrained in the seawater cooling system and impinged on the OBGS traveling screens during a 24-hour period. Information on the number of seawater circulation pumps in operation, the seawater flow direction, water temperature, and weather was also collected. At least one of the four seawater circulation pumps had to be in operation to conduct a fish count. The yearly abundance and biomass of impinged species under normal operation were estimated by multiplying the daily mean catch per unit effort by the annual total cooling water flow. During heat treatments, impinged fish and macroinvertebrates were collected, sorted by species, counted and weighed. Data from the heat treatment samples were combined with the estimated normal operation data to determine the total impingement losses for the year.

The estimates of annual impingement varied among years due to the differences in plant and pump operation, and the timing of plant operation with changes in fish abundance. For example the estimates of annual impingement for 2001–2005, ranged from a low of 5,000 fish in 2004 to a high of 16,209 fish in 2002 (**Table 2**). The years with the highest and lowest impingement biomass were different reflecting the variation in the ages and species collected each year. The biomass ranged from a total of 970 lb (440 kg) in 2002 to 5,923 lb (2,687 kg) in 2001.

Table 1. Numbers of normal operations and heat treatment impingement samples at the Ormond Beach Generating Station from 1981 through 2010. The large number of samples in 2006 include the period of sampling for the IM&E Characterization Study when samples were collected approximately four times each 24 hours from March through December for a total of 72 samples. Sampling for the study continued through February 2007 when two additional samples were collected for the study.

Year	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**
Heat Treatment	9	6	6	5	6	6	7	6	7	8
Normal Operations	50	37	49	47	49	51	50	42	39	30
Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Heat Treatment	6	12	6	8	5	8	5	5	7	6
Normal Operations	38	47	50	44	7	4	8	5	8	12
Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Heat Treatment	7	5	4	2	1	0	0	0	0	0
Normal Operations	12	12	12	11	10	91	9	12	7	5

Table 2. Total estimated annual impingement including heat treatments at the Ormond Beach Generating Station from 1991 through 2010 for NPDES reporting period of October 1 through September 30 each year.

Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Numbers of Fishes	51,860	28,796	94,602	23,403	41,996	8,664	19,266	31,545	761	3,078
Numbers of Taxa	65	54	60	59	48	41	38	47	28	42
Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Numbers of Fishes	15,382	16,209	11,132	4,987	6,216	4,910	416	1,206	786	363
Numbers of Taxa	49	54	53	41	47	41	11	16	21	8

2006–2007 316(b) IM&E Study

Impingement

The 2006 Study impingement sampling was conducted on an approximately bi-weekly basis from March 2006 through February 2007 when the facility was generating power, or on the next day of normal facility operation in the event that it was not operating on the scheduled sampling date. Due to intermittent operations at the plant, a total of 21 sampling events occurred during the study. Although each sampling event was conducted over 24-hours and samples were planned to be collected every six hours at approximately 06:00 (morning), 12:00 (noon), 18:00 (evening), and 00:00 (midnight) hours in order to evaluate diel variation, a total of only 74 samples were collected due to changes in pump operation during the sampling. The processing of the samples for the study was identical to the processing for the NPDES sampling. No heat treatments occurred during the study.

Entrainment

Entrainment sampling was completed on a bi-weekly basis from February 2006 through February 2007 (24 sampling events) at the location of the submerged offshore intake for OBGS. Sampling was conducted using a 333 micrometer (µm) plankton net with a 1.6 ft (0.5 m) diameter mouth. Samples were collected four times per 24-hour period, at approximately 06:00 (morning), 12:00 (noon), 18:00 (evening), and 00:00 (midnight) hours in order to evaluate diel variation. Duplicate samples were collected during each time period. The net was equipped with a passive impeller to record the volume of water filtered by the net. The target filtered volume was 26,400 gal (100 m^3). Actual sampled volume as well as the plant cooling water flow rate was recorded. Upon retrieval of the net, the net was rinsed to transfer organisms that may be attached to the net into the end of the net (codend). The codend was then removed and the contents carefully poured into a sample container. Following this initial step, the codend was inverted over the sample container and gently rinsed with a squirt bottle containing filtered seawater to ensure that all contents had been transferred. Samples were initially preserved in 10% formalin solution with Rose Bengal stain. An appropriate amount of seawater was added to the container in the field prior to adding the collected sample. After 48 hours all liquid was decanted and 40-percent isopropyl alcohol or 70-percent ethanol was added to the collection container for permanent preservation.

All samples were transferred to a laboratory for processing where they were logged, sorted by date and type, and stored for processing. When a sample contained a large number of organisms, a Folsom plankton splitter was used to split the sample. The number of times each sample was split was recorded to allow for extrapolation of data from the split sample to the original sample composition. The samples were processed by transferring the whole or split samples to counting trays for examination under a dissecting microscope. All larval fishes, fish eggs, and larval shellfishes were identified to the lowest practicable taxon. Measurements appropriate for the life stage were recorded as well as physical characteristics relevant to life stage (oil drop present, size of oil drop, pigmentation, ocular development, presence of byssal threads, etc). Appropriate reference literature and electronic databases were used to assist in taxonomic determinations and a quality assurance program was used to evaluate the quality of the processing.

The results of the entrainment sampling included the following:

- The average estimated entrainment rate was 3.48 fish eggs and larvae per m^3 and 0.84 invertebrates per m^3.
- The estimated annual entrainment using design flow for ichthyoplankton included 3.2 billion fish eggs and 41 million fish larvae.

- The estimated annual entrainment using actual 2006 flow data for ichthyoplankton included 638.7 million fish eggs and 82.4 million fish larvae.

Summary

GenOn is proposing that entrainment monitoring be conducted at the OBGS due to potential deficiencies with the entrainment data collected during the 2006 Study. A substantial baseline of impingement data is available from the historic weekly and/or monthly NPDES sampling from 1981–2010, and approximately biweekly sampling during the 2006 Study (**Table 1**). This historical data provides a solid basis for characterizing impingement at the plant, so no further baseline impingement monitoring is proposed

In contrast, entrainment data are limited to the outdated 1978-1980 study and the more recent single year of sampling in 2006-2007. The reliability of the recent 2006-2007 entrainment data appears questionable due to unusually low ichthyoplankton concentrations. The average concentrations of larval fishes from the study were approximately an order of magnitude lower than concentrations at similar coastal sites in southern California. Despite the large difference a detailed analysis of the data and field notes from the sampling was unable to determine the source of any problems that may have existed with the sampling procedures or gear. The new entrainment sampling proposed for OBGS to comply with the OTC Policy will occur at the same offshore location used in the 2006 Study and should help resolve any problems with the data from the previous study and provide data that can be reliably used in estimating baseline levels of entrainment.

Exhibit B

GenOn West, L.P.
Ormond Beach Generating Station

Entrainment Monitoring Plan

March 16, 2011

Submitted to:

Mr. Rick Eckersley
GenOn Energy, Inc.
1000 Main St.
Houston, TX 77253

Prepared by:

TENERA Environmental
141 Suburban Rd., Suite A2, San Luis Obispo, CA 93401
(805) 541-0310, FAX (805) 541-0421

ESLO2011-008.2

1.0 Introduction

This study plan presents the rationale and protocol for conducting sampling to monitor levels of entrainment at the GenOn West, L.P. (GenOn) Ormond Beach Generating Station (OBGS) in Oxnard, California. The plan is designed to enable OBGS to comply with the *Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling* (Policy) adopted by the California State Water Resources Control Board (SWRCB) in May 2010, which became effective on October 1, 2010. The requirements for entrainment monitoring for plants pursuing compliance under Track 2 of the Policy are provided in Section 4: *Track 2 Monitoring Provisions* (Section 4.B.(1)). As noted in the OBGS Implementation Plan sufficient impingement mortality data are available to establish a reliable baseline for the purposes of compliance with the Policy, and data also indicate that the existing velocity cap in place at the OBGS cooling water intake structure effectively achieves compliance with the impingement mortality reduction standards in the Policy under Track 2. Accordingly, no further baseline impingement monitoring is proposed.

1.1 Study Plan Rationale

This plan is only for the monitoring provisions of the Policy and does not cover any additional studies that might be required under Sections 4.A.(2) and 4.B.(2) of the Policy to confirm the effectiveness of Track 2 controls in reducing the levels of impingement mortality and entrainment (IM&E), respectively. Although the Policy requires that these additional studies are consistent with the monitoring in Sections 4.A.(1) and 4.B.(1), the sampling and design of these studies will be different from the sampling done for the monitoring. Data collected during the monitoring phase would be of limited use to confirm the effectiveness of IM&E reduction technologies because such studies would be designed to provide statistically valid estimates of IM&E reductions and therefore require a study approach focused on that goal alone. The purpose of the monitoring data is entirely different and is required in the Policy to characterize the composition and abundance of the biological organisms impinged and entrained by the OBGS, and their seasonal and diel variation.

The Policy provides specific guidelines for the design of the monitoring studies.

The requirements for entrainment are listed in Sections 4.(B).1.a–b, and include the following:

a) that the study sample all species of ichthyoplankton and invertebrate meroplankton, and that identification be done to the lowest taxonomic level practicable, and if practicable, that genetic identification be used to assist in the identification; and

b) that the study be conducted for 36 months over different seasons, and that sampling account for variation in oceanographic conditions.

The details of the Entrainment Monitoring Plan provided in the following sections meet the requirements in the Policy listed above. This plan was designed based on entrainment studies that have been conducted at coastal power plants throughout California over the past several years. The designs of many of these studies have been reviewed by independent scientists from academic institutions and are largely consistent with the concepts provided in a report on the design of power plant impact assessments prepared for the California Energy Commission (Steinbeck et al. 2007). This report, authored by scientists from academic institutions and industry, has been used in the design of many of the power plant studies.

As a threshold matter, this plan addresses the practical challenges of sampling ichthyoplankton. The Policy states in Section 2.A.(2).b.(ii) that compliance with entrainment under the policy will be determined based on sampling of ichthyoplankton, and megalops and phyllosoma larval stages of crustaceans (crabs and lobster), and squid paralarvae fractions of meroplankton. The policy defines ichthyoplankton as "..the planktonic early life stages of fish (i.e., the pelagic eggs and larval forms of fishes)." The processing of the monitoring samples will extract and identify all of the fish larvae and invertebrate larval stages specified in the Policy, but will not include the processing of fish eggs. There are several reasons for not processing fish eggs:

a) It is very difficult or impossible without considerable additional analysis to determine if all of the collected eggs are fertilized and viable. Many of the eggs released by female fishes into the water column during spawning are never fertilized. The chance of fertilization depends on many factors such as the proximity and abundances of males, and ocean conditions. The entrainment of unfertilized eggs has no effect on these fish populations and should not be included in the sample processing and analysis.

b) Positive identification of a majority of fish eggs to lower taxonomic levels is not possible. Many species within a family or order of fishes have eggs of similar sizes and morphological characteristics, especially at very early developmental stages.

c) The majority of the fish larvae entrained at OBGS are from fishes that do not have a planktonic egg stage. The goby and blenny larvae that dominate the ichthyoplankton in coastal embayments in California such as Channel Islands Harbor are hatched from nests where the eggs are attached to various substrates or protected in burrows.

d) Finally, there are numerous modeling approaches for estimating the levels of egg entrainment for fish larvae with planktonic egg stages that may be collected during the entrainment sampling. While there are levels of uncertainty associated with these modeling techniques the uncertainty is usually quantifiable, which is not the case with determining the percentage of unfertilized eggs that cannot be sourced to a specific species of fish.

1.2 Facility Description

The OBGS is located in southern California along the coast of the Pacific Ocean approximately three miles (4.8 km) northwest of the Mugu Lagoon and approximately 2.5 miles (4.0 km) southeast of the entrance to Port Hueneme (**Figure 1**). OBGS has two natural gas-fired units (Units 1 and 2) and has a combined rated capacity of 1,520 megawatts. Units 1 and 2 have separate, but conjoined cooling water intake structures (CWIS). Cooling water for both units is withdrawn from the Pacific Ocean through a vertical intake structure equipped with a velocity cap located approximately 2,375 ft (724 m) offshore at a depth of 35 ft (10.7 m) (mean lower low water [MLLW]). The top of the cap is 20 ft (6.1 m) MLLW below the water surface. The average through-cap velocity is 2.7 ft (0.8 m) per sec. The CWIS has a design capacity of 476,000 gpm (1,803 m^3) or 685.4 million gallons (2.59 x 10^6 m^3) per day (MGD) which is conveyed to the onshore intake structure through a single 14 ft (4.3 m) inside diameter conduit at a velocity of 6.9 ft (2.1 m) per sec.

The onshore intake area consists of four 11.2 ft (3.4 m) wide bays, each fitted with trash racks, traveling water screens, and cooling water pump. The trash racks are sloped and have 4½-inch typical bar spacing. The traveling water screens have $^5/_8$ inch (1.6 cm) mesh and are located upstream of the circulating water pumps. Screens are rotated automatically based on head differential across the screen and washed.

Cooling water is discharged to the Pacific Ocean via a discharge structure located approximately 1,790 ft (546 m) offshore (**Figure 2**). Total permitted discharge from the plant through the conduit (cooling water and small volumes of process water) is approximately 688.2 million gallons (2.61 x 10^6 m^3) per day (MGD).

1.3 Study Plan Organization

The following sections of this plan provide further details on the methods for obtaining data on the composition and abundances of marine organisms entrained by the OBGS. Section 2 presents information on the proposed entrainment sampling. The quality assurance and control measures for each of the study components are provided in the corresponding sections.

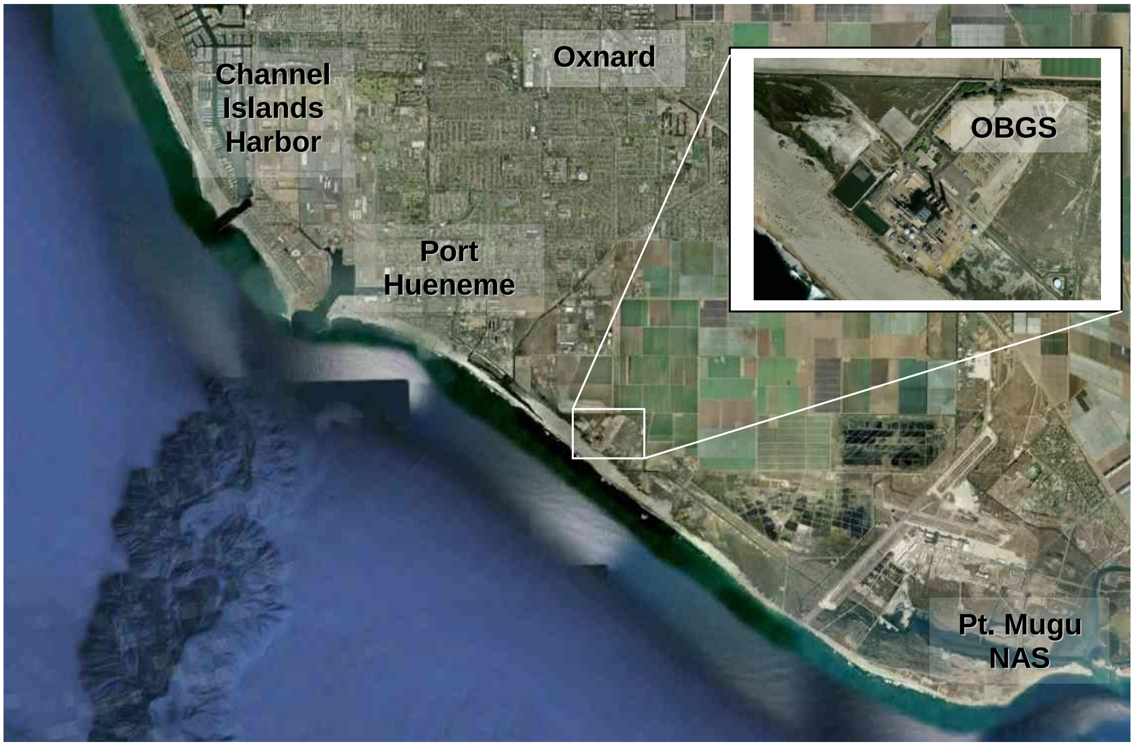

Figure 1. Ormond Beach Generating Station (OBGS) location map.

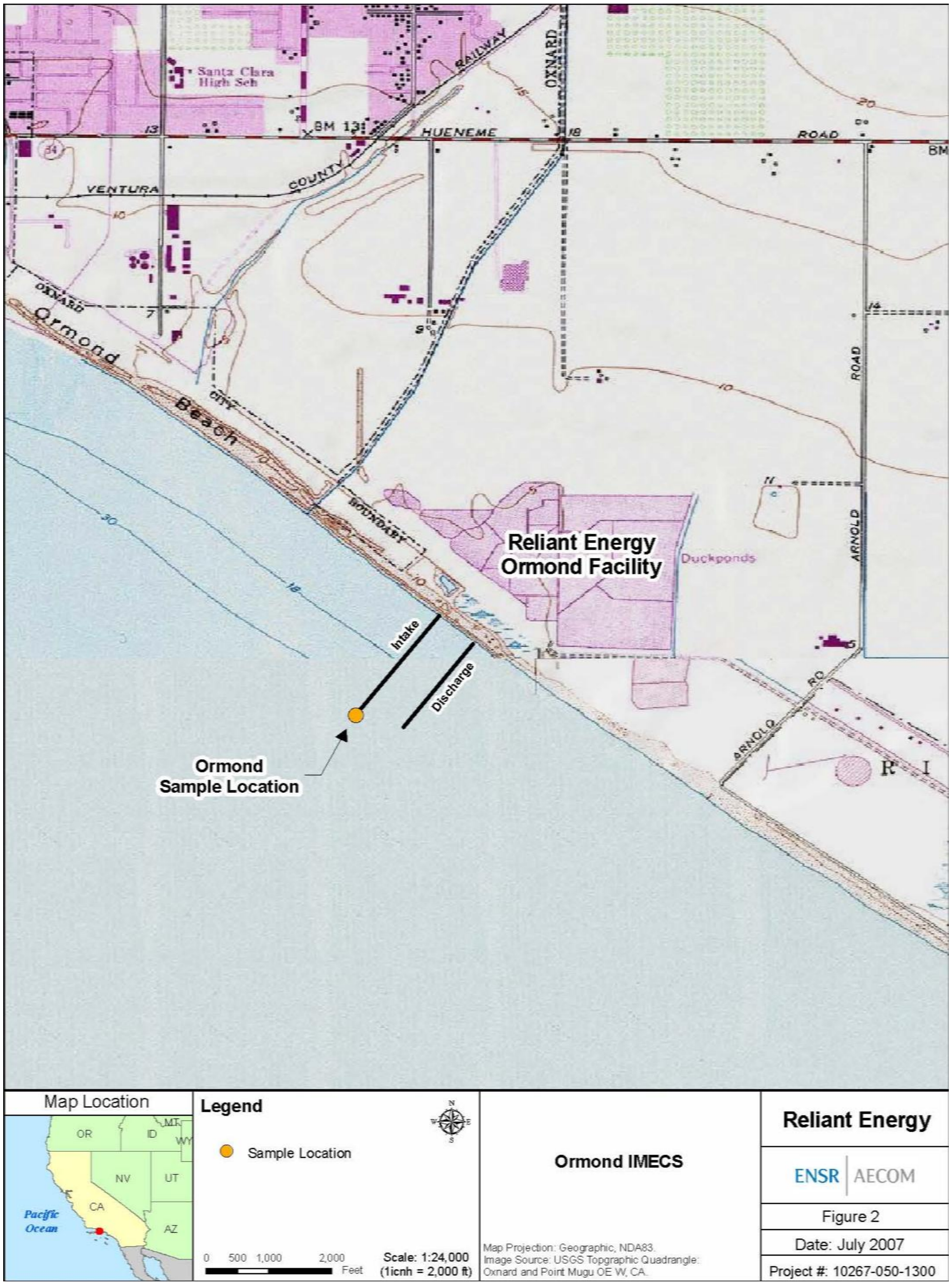

Figure 2. Ormond Beach Generating Station intake and discharge and location of entrainment sampling for monitoring. Figure from ENSR/AECOM, 1997: *Draft Report to Reliant Energy Impingement Mortality and/or Entrainment Characterization Study-Reliant Energy Ormond Beach Generating Station*. Document No.: 10267-0510-1300.

2.0 Entrainment Sampling

The purpose of the entrainment study is to provide data for estimating the composition and abundance of ichthyoplankton and invertebrate meroplankton entrained by the OBGS. The sampling is designed to provide estimates of the abundance, biomass, taxonomic composition, diel periodicity, and seasonality of organisms entrained through the $^5/_8$ inch (1.6 cm) mesh traveling screens at the OBGS intake in compliance with the guidelines for the design of entrainment monitoring provided in Section 4.(B).1.(a) and 4.(B).1.(b) of the policy. The data from the sampling will be used to estimate the concentration of the organisms entrained which can then be extrapolated to estimate the numbers of organisms entrained based on actual, design, or projected cooling water volumes. The concentrations of organisms in the source water subject to entrainment vary on several temporal scales (e.g., hourly, daily, and monthly), and due to ocean conditions, while the rate of cooling water flow varies with power plant operations and can change at any time.

2.1 Entrainment Sample Collection

In compliance with guidelines in the Policy, the sampling will be conducted for a period of 36 months, with sampling occurring four times over a 24-hour period one day per month to assess both seasonal and diel variation. The sampling will be conducted at the offshore intake location (**Figure 2**). One sample will be collected every six hours using 335-micron mesh plankton nets, the mesh size specified in the Policy, fixed to a bongo frame that allows collection of samples in both nets during a tow. This size mesh is designed to collect ichthyoplankton, and the megalops and phyllosoma larval stages of crustaceans (crabs and lobster), and squid paralarvae. These are the fractions of the meroplankton that will be used in determining compliance with the entrainment reductions in the Policy as specified in Section 2.A.(2).b.(ii). The frame and nets will be towed through the entire water column from the surface to near the bottom. A calibrated flowmeter will be attached at the opening of each net to record the volume of water filtered. Prior to and after each tow, the flowmeter counter values will be recorded on a sequenced waterproof datasheet to allow a calculation of the volume of water filtered during each sample, with a target volume of 20-30 m^3 (5,300–8,000 gallons) per net. If necessary, the nets will be redeployed until the target volume has been filtered. After the nets are retrieved, the readings from the flowmeters will be recorded and the contents of each net will be washed down into the collection bucket (codend) at the end of the net by gently spraying from the outside of the net to insure that any organisms in the spray do not enter the net. The contents from the codends will then be decanted into pre-labeled sample containers and preserved with alcohol or buffered formalin-seawater solution. The contents of both nets will be preserved together as in a single sample. The date, time, flowmeter readings, sampling personnel and sampling conditions (ocean and weather conditions) will be recorded on a sequenced waterproof datasheet along with a unique code that will be used to identify and track the sample in the laboratory and the data management systems.

All samples will be recorded on a sample chain of custody form and delivered to the laboratory for recording and processing.

Sampling will also be done to comply with the requirement in the Policy (Section 4.B.(1)) that "..additional samples shall also be collected using a 200-micron mesh to provide a broader characterization of other meroplankton entrained." One meroplankton sample will be collected during one of the nighttime six-hour sample cycles by towing a frame with a single 200-micron mesh net towed in the same fashion as the bongo frame and nets. Calibrated flowmeters will be attached at the mouth of the net to record the volume of ocean water filtered. The target volume for each sample will be 10–20 m^3 (2,600–5,300 gallons). The contents from the codend will then be decanted into a pre-labeled sample container and preserved with alcohol or buffered formalin-seawater solution. The date, time, flowmeter readings, sampling personnel and sampling conditions (ocean and weather conditions) will be recorded on a sequenced waterproof datasheet along with a unique code that will be used to identify and track the sample in the laboratory and the data management systems. All samples will be recorded on a sample chain of custody form and delivered to the laboratory for recording and processing.

2.2 Entrainment Sample Processing

The 335-micron and 200-micron mesh samples will be returned to the laboratory, and after approximately 72 hours any of the samples preserved in the formalin-seawater solution will be transferred into 70–80% ethanol. Processing of the 335-micron mesh samples will consist of examining the collected material under a dissecting microscope, and removing and counting larval fishes, megalopal stages of cancrid crabs, spiny lobster phyllosome larvae, and squid paralarvae. These organisms will be placed in labeled vials and then identified to the lowest taxonomic level possible. In addition, the developmental stage of fish larvae (yolk-sac, preflexion, flexion, postflexion, transformation) will be recorded on the data sheet. The entire volume of filtered material from the sample will be sorted unless the plankton volume is very high, in which case the sample may be subdivided and a subsample processed. The estimated concentration of organisms from these samples will be adjusted to account for the volume sorted.

Many larval fish cannot be identified to the species level; these fish will be identified to the lowest taxonomic classification possible (e.g., genus and species are lower orders of classification than order or family). Overall body shape, myomere count, and pigmentation patterns are used to identify many species; however, this can be problematic for some species. For example, different species members of one common group of fishes, gobies (Family Gobiidae), share similar characteristics during early life stages, making visual identification of the separate species difficult (Moser 1996). In these cases the unidentified species will be grouped into higher taxonomic categories.

The 200-micron mesh meroplankton sample will be poured into a glass beaker to a known volume and the sample mixed so that all organisms are distributed randomly in the sample volume. Approximately 15 percent of the original sample volume will be analyzed for meroplankton identification. For example, with a 400 ml sample, four 15 ml aliquots will be withdrawn using with a Hensen-Stempel pipette and placed in a Ward plankton wheel. Depending on the organism concentration, the samples may be split first using a Folsom plankton-splitter. The organisms in the sample will be examined and compared against a list of broad categories of larval stages and taxonomic groups. The items on the list that are found in the sample will be recorded as percent.

2.3 Data Management, and Quality Assurance/Quality Control

Field and laboratory data will be recorded on preprinted data sheets formatted for entry into a computer database for analysis and archiving. All field and laboratory data recorded on sequenced datasheets will be entered into an Access® computer database that will be verified for accuracy against the original data sheets.

A QA/QC program will be implemented for the field and laboratory components of the study. The field survey procedures will be reviewed with all personnel prior to the start of the study and all personnel will be given printed copies of the procedures that will be included with the final study report. In addition to ongoing training and periodic review of sampling procedures, quality control assessments will be completed once or twice during each year of the study to ensure that the field sampling continues to be conducted properly.

A detailed QA/QC program will also be applied to all laboratory processing. The laboratory procedures will be reviewed with all personnel prior to the start of the study and all personnel will be given printed copies of the procedures that will be included with the final study report. The first ten samples sorted by an individual will be re-sorted by a designated quality control (QC) sorter. A sorter is allowed to miss a maximum of one fish larva when the total number of larvae in the sample is less than 20. For samples with 20 or more larvae the sorter must maintain a sorting accuracy of 90 percent. After a sorter has sorted ten consecutive samples with greater than 90 percent accuracy, the sorter will have one of their next ten samples randomly selected for a QA/QC check. If the sorter fails to achieve an accuracy level of 90 percent, their next ten samples will be re-sorted by the QC sorter until they meet the required level of accuracy. If the sorter maintains the required level of accuracy, one of their next ten samples will be re-sorted by QC personnel.

A QA/QC program will be conducted for the taxonomists identifying the samples. After a taxonomist has identified the larvae from 10 samples, one sample is randomly chosen and the larvae are re-identified and counted by a second taxonomist. The taxonomic results are compared between the two taxonomists by comparing the number of identification and count agreements between the two taxonomist, and then calculating a percent taxonomic disagreement (PTD). The error rate is quantified as the proportion of individual specimens in the sample identified or counted differently by the two taxonomists. A PTD goal of ≤10 percent is targeted. If the PTD goal of 10 percent is not attained, taxonomist interaction is used to determine problem areas, identify consistent disagreements, and define corrective actions. If the first taxonomist maintains a PTD goal of ≤10 percent then they will continue to have one of each of their next ten samples checked by a second taxonomist. If they fall below this level, then the next ten consecutive samples they have identified will be checked for accuracy by a second taxonomist. Identifications will be verified with taxonomic voucher collections maintained by Tenera.

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Exhibit C

Ormond Beach Velocity Cap Effectiveness

March 17, 2011

Prepared by:
Tenera Environmental
141 Suburban Rd., Suite A2
San Luis Obispo, CA 93401
805.541.0310

Introduction

This report presents information on the effectiveness of the velocity cap at the Ormond Beach Generating Station (OBGS) intake in reducing impingement mortality to a level that meets or exceeds the requirements in the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Policy), which was adopted by the California State Water Resources Control Board (SWRCB) in May 2010, and became effective on October 1, 2010. Under Section 2.A.(2).(c) of the Policy, existing facilities can take credit for "Technology-based improvements that are specifically designed to reduce impingement mortality and/or entrainment and were implemented prior to October 1, 2010" in meeting compliance requirements under Track 2 of the Policy. Under Track 2 of the Policy, impingement is required to be reduced to "..a level that achieves at least 90 percent of the reduction in impingement mortality required under Track 1." Based on the required minimum reduction of 93 percent under Track 1, a plant would be in compliance under Track 2 if it could demonstrate a reduction of 83.7 percent (90 percent of 93percent).

The information in this report is based on extensive studies done at several power plants in southern California, including the OBGS, that demonstrate the effectiveness of velocity caps at reducing impingement mortality. All of the studies were done at power plants that were originally built and operated by Southern California Edison (SCE), and therefore they all have intake system designs similar to the intake system at the OBGS. This report summarizes the results from those studies, which support the conclusion that the OBGS currently meets the Track 2 compliance requirements for reducing impingement mortality through application of the existing velocity cap.

Description of OBGS Intake and Velocity Cap

Cooling water for the OBGS is withdrawn from the Pacific Ocean through a vertical intake structure equipped with a velocity cap located approximately 2,375 ft (724 m) offshore at a depth of approximately 35 ft (10.7 m) (mean lower low water [MLLW]). The top of the cap is 20 ft (6.1 m) MLLW below the water surface (**Figure 1**). The top of the cap is 34.17 ft x 27.17 ft (10.4 m x 8.3 m) and sits 4.0 ft (1.2 m) above the lip of the intake riser that is 24.67 ft (7.5 m) in width and leads to the 14 ft (4.3 m) diameter intake conduit that delivers seawater to the onshore intake structure. The average through-cap velocity is 2.7 ft (0.8 m) per second.

Historical Velocity Cap Studies

All of the studies discussed below required the power plants to be operated in two flow modes: normal flow where cooling water was withdrawn from the intake structure with the velocity cap in place, the normal mode of operation at the plants, and reverse flow where cooling water was withdrawn from the discharge structure without a velocity cap. The transition from normal to reverse flow required the opening and closing of the circulating water intake and discharge valves within the power plant intake systems. The opening and closing of the intake and discharge valves resulted in the plant withdrawing cooling water from the discharge structure (without the velocity cap), and discharging cooling water out through the intake structure (**Figure 2**). During the early studies at the El Segundo Generating Station (ESGS) in El Segundo, California, the Huntington Beach Generating Station (HBGS) in Huntington Beach, California, and the OBGS (described below), flow reversals were performed after the fishes within the system were removed through chlorination of the lines. Heat treatment was used to remove the fishes from the system in the more recent study at the Scattergood Generating Station (SGS). The fish removals were necessary to provide accurate counts of the fishes entrapped in the system during the tests and ensure that no fishes were in the system prior to each trial.

Early Studies by Southern California Edison Company

The installation of velocity caps at the OBGS and other power plants was based on results from model studies for the HBGS, and full-scale tests at the ESGS that showed velocity caps would be effective in reducing impingement. The model studies for the HBGS were done using a 16 inch (40.6 cm) pipe in a 5 ft x 7 ft (1.5 m x 2.1 m) tank, and showed that small fishes that avoided being pulled into the pipe when a velocity cap was in place were pulled into the pipe when the velocity cap was removed. These model studies were followed up by full-scale tests at the ESGS where impingement from July 1956 through June 1957 prior to velocity cap installation was compared with impingement from July 1957 to June 1958 after the velocity cap was installed. Total impingement between the two periods was reduced from 272.2 to 14.95 tons of fish, a reduction of 95%. The results of the model studies and the full-scale tests at the ESGS were presented in the Proceedings of the American Society of Civil Engineers (Weight 1958). The shortcomings of this early study were that data on species composition were not available, and the comparison used in calculating efficiency was between two periods separated by several months during which fish composition could have changed. Therefore, there was some uncertainty related to the contribution of these differences to the reduction in impingement observed when the velocity cap was present.

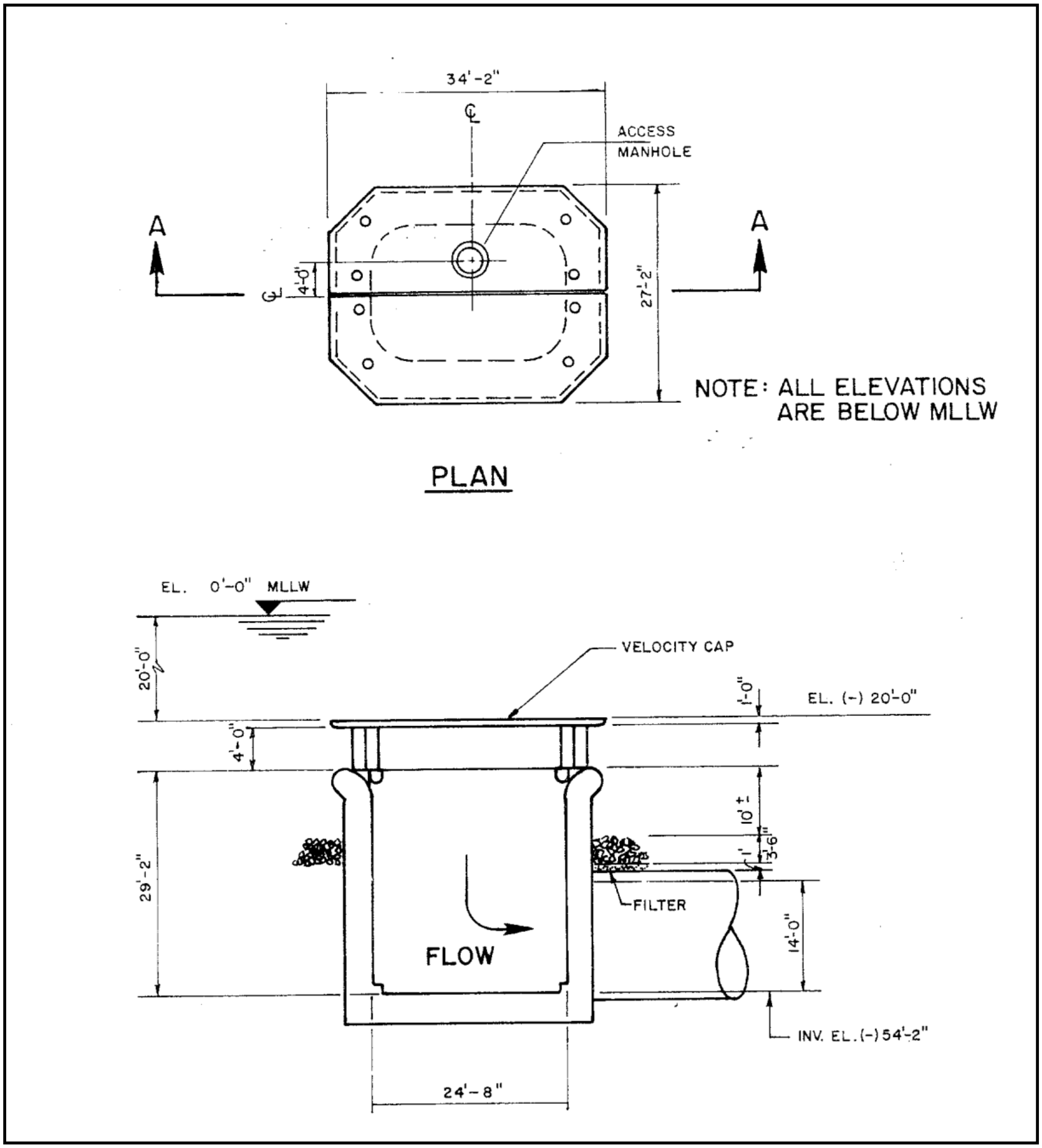

Figure 1. Diagram of Ormond Beach Generating Station offshore intake structure (source: McGroddy et al. 1980).

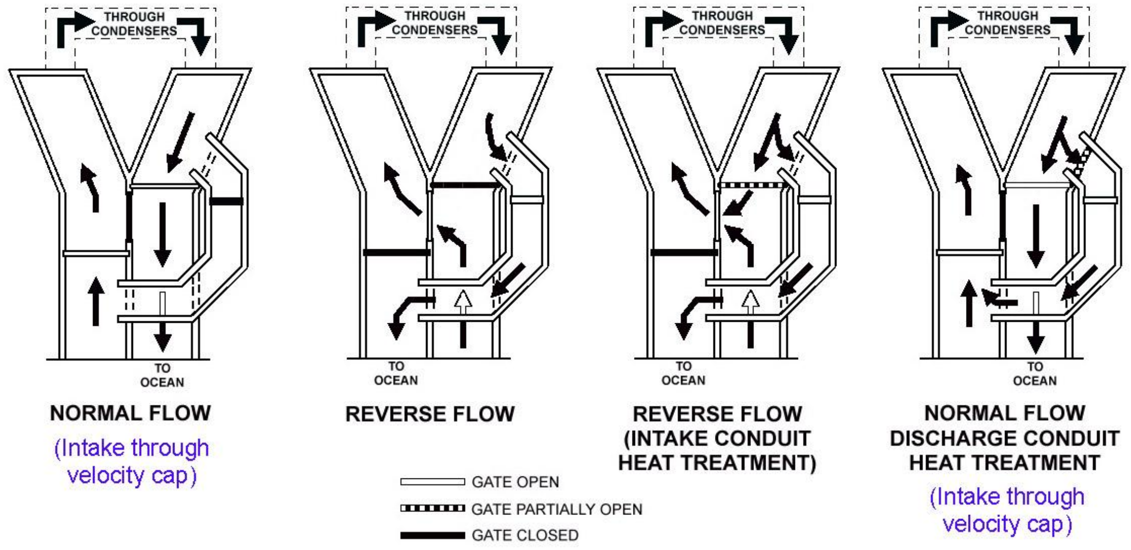

Figure 2. Diagram of flow regimes during the velocity cap effectiveness studies. (source: MBC 2007)

1979–1980 Study at Huntington Beach Generating Station (HBGS)

An extensive study on the effectiveness of velocity caps was conducted at the HBGS as part of a comprehensive evaluation of velocity caps at several SCE owned facilities. The study was done by a team of researchers from the University of Washington College of Fisheries. The study at the HBGS probably represents the most comprehensive evaluation of velocity cap effectiveness conducted. The results of the study were reported in several University of Washington technical reports (Johnson et al. 1979, Johnson et al. 1980, Thomas et al. 1979, Thomas et al. 1980a, Thomas et al. 1980b, Thomas et al. 1980c), and scientific journals and meetings (Thomas and Johnson 1980, Thorne 1980). Data were also collected at the OBGS as part of the studies, but were much less extensive. A summary of the study at the OBGS is provided below.

The study consisted of a series of field trials at four different power plants over one year, with the majority of the trials at the HBGS. The seven trials at the HBGS resulted in 123 hourly estimates of impingement and source water fish abundances, based on 70 observations at full flow with the velocity cap in place. This was the control condition, and was used to compare impingement and source water abundances under several plant operating conditions that varied the amount of flow. Source water abundances of fishes were estimated using hydroacoustic sampling that was supplemented with net sampling to verify the composition of the acoustic targets. Gill nets were also positioned at different depths in the water column to determine the vertical distribution of the different species. Data were also collected with the plant under full operation in reverse flow (without velocity cap).

The HBGS study incorporated several unique features that improved the ability to measure the effectiveness of the velocity cap. First, unlike the 1950s study at the ESGS, test conditions were evaluated for a few hours or days and then changed to evaluate another set of test conditions. This insured that fish composition and source water abundances did not change dramatically between tests. Secondly, the intake tunnels were cleared of fishes between observations by injecting chlorine at the upstream end of the screenwell in concentrations that forced the fishes towards the traveling screens. This insured a complete count of fish entrapment during each trial. In addition, several trials of each test condition were conducted over the course of the study to ensure that seasonal differences in ocean conditions and fish composition were taken into account. Finally, the entrapment data were combined with estimates of source water fish populations in the vicinity of the intakes to calculate estimates of entrapment vulnerability. The source water population estimates were made using net and hydroacoustic sampling. This enabled the effects of the velocity cap to be evaluated independently of offshore population abundances. The statistical technique for adjusting the entrapment rates was to calculate the ratio of entrapment to fish densities in the source water in the vicinity of the intake (E/B). This ratio was used to estimate the relative vulnerability of fishes to entrapment by the intake.

The use of the vulnerability ratio (E/B) in assessing differences among treatments had additional benefits that increased the statistical power to determine if there was a significant decrease in the vulnerability of fishes to impingement in the control condition with the velocity cap in place. The ratio of vulnerability resulted in a measure that adjusted the impingement data for the abundances of fishes in the source water during each observation to insure that any differences in impingement were the results of the presence or absence of the velocity cap and not source water abundances. This decreased the variation among observations within a treatment, which contributed to the ability to detect differences among treatments. The use of the E/B ratio and the large number of replicates of each treatment increased the statistical power of the study to detect differences due to the velocity cap.

The final report from the study presents results both for total impingement of all fish species combined (**Table 1**) and three individual fishes: queenfish, white croaker, and northern anchovy (Thomas et al 1980c). There were also large numbers of silversides collected, but they were mostly collected in the source water sampling, and were only collected from impingement sampling during reverse operations in the absence of the velocity cap. Although not analyzed in the report due to the absence of normal operations data for comparison, the results for silversides provided a good example of the effectiveness of the velocity cap. Results showed that silversides were primarily distributed in the surface layers where they were less likely to be pulled into the system during normal operations with the velocity cap. In the absence of the velocity cap, the intake draws water vertically from surface layers resulting in greater impingement of silversides.

Table 1. Entrapment densities for total fishes during velocity cap effectiveness studies at the Huntington Beach Generating Station in 1979 and 1980.

Year	Velocity Cap Present	Time	Entrapment Density (kg/hr)	Effectiveness
1979	No	Day/Night 18-hr	20.45	
1979	Yes	Day/Night 18-hr	1.97	90%
1979	No	Night	32.93	
1979	Yes	Night	15.53	53%
			Average:	**72%**
1980	No	Day	47.2	
1980	Yes	Day	0.65	99%
1980	No	Night	52.99	
1980	Yes	Night	6.78	87%
			Average:	**93%**
			Overall:	**82%**

*Data from 1979 and 1980 Velocity Cap Studies (source: Thomas et al. 1980c, Table 3, p. 18).

The vulnerability ratios used by the researchers in the study provided a more accurate measure of the true effectiveness of the velocity cap (**Figure 3**). As illustrated in **Figure 3,** the difference in vulnerability for Treatment 2 (full flow with the velocity cap) and Treatment 3 (full flow without the velocity cap) was highly significant, which was verified by analyzing the data with a one-tailed Mann-Whitney U-Test ($p < 0.0001$). Although these results clearly demonstrate the effectiveness of the velocity cap, the estimated efficiency is conservative since data from silversides were not included in the analysis.

1979–1980 Study at Ormond Beach Generating Station (OBGS)

Concurrent with the study at the HBGS, data were also collected at the OBGS by the same team of researchers from the University of Washington (Thomas et al. 1980c). The study consisted of 35 hourly estimates of entrapment (compared with 123 at the HBGS); 24 estimates of the control condition with the velocity cap, and 11 estimates with no velocity cap in place. Entrapment vulnerability indices corroborated the results from the HBGS; the difference in vulnerability between velocity cap and no velocity cap was statistically significant (one-tailed Mann Whitney U-Test, p=0.0083). Overall, reductions in fish entrapment rates, due to the velocity cap, were 61 percent (nighttime) and 87 percent (daytime). Data from the study were adjusted to account for unusually high abundances of mackerel (*Scomber japonicus* and *Trachurus symmetricus*) in the study area, which could have obscured species-specific trends of target species of fishes in lower abundance, which were the focus of the study. The data from these mackerel schools were removed from the analysis when determining velocity cap effectiveness. This approach was also used in analyzing the data from the HBGS where data on silversides, which only occur in the upper water column, were removed from the analysis. Therefore, the actual velocity cap effectiveness at the OBGS is likely much higher than the estimates presented by Thomas et al. (1980c).

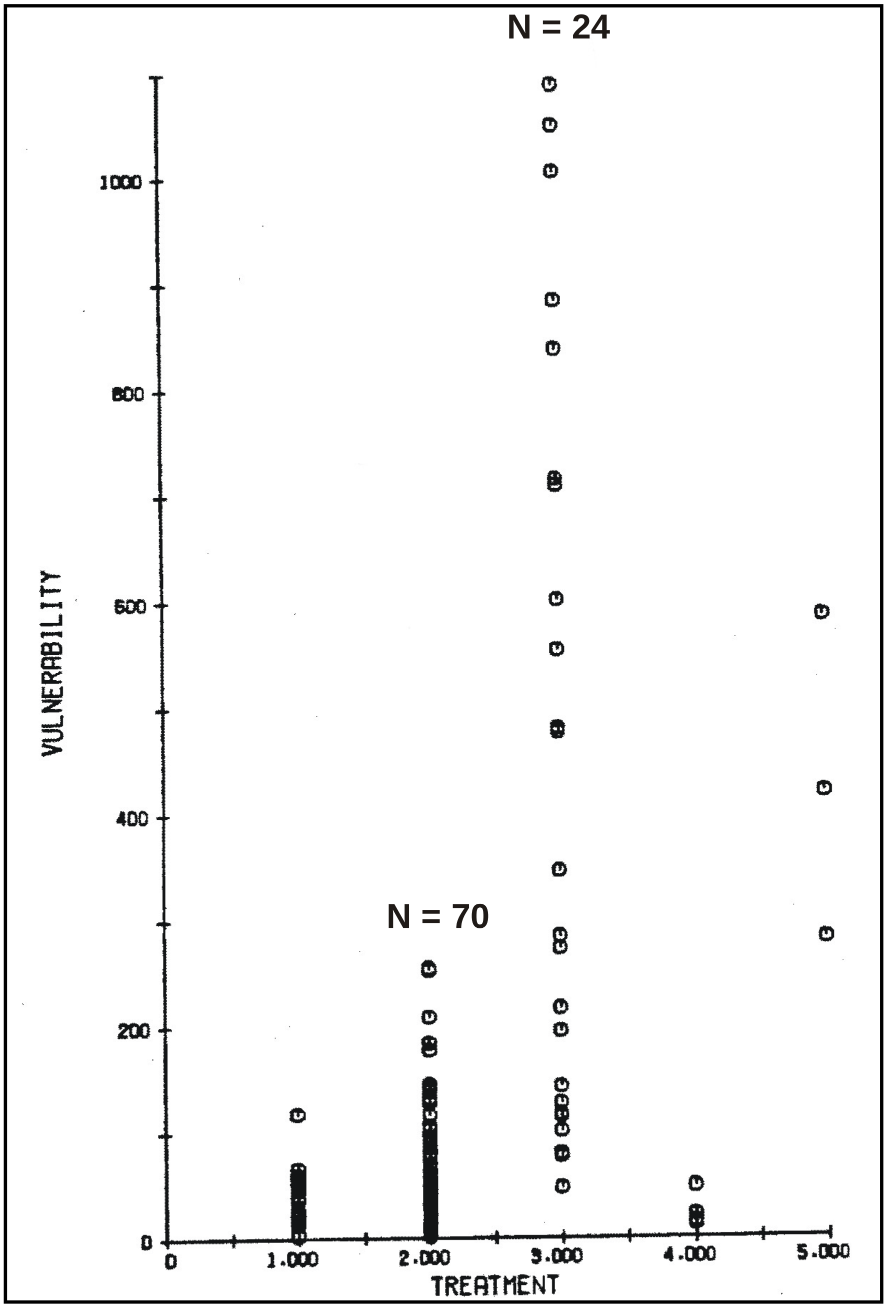

Figure 3. Vulnerability (E/B x 104) for all fishes combined by treatment from velocity cap study at Huntington Beach Generating Station. Treatments levels were as follows: 1) reduced-flow with velocity cap; 2) full-flow with velocity cap; 3 = full-flow without velocity cap; 4 = reduced-flow without velocity cap; and 5 = tunnel swapping, i.e., the transition period between reversed and normal flow directions. The data were collected at Huntington Beach in 1979 and 1980 (source: Thomas et al. 1980c, Figure 6 p.14).

2006 Study at Scattergood Generating Station (SGS)

A study of the velocity cap at the SGS in Santa Monica Bay just to the south of the OBGS was conducted in 2006 to demonstrate compliance with the impingement reductions required under the Clean Water Act Section 316(b) Phase II Final Rule for existing facilities that went into effect on September 7, 2004 (MBC et al. 2007). The study incorporated many of the design features of the HBGS studies by conducting several trials, removing the fish from the system prior to testing through the use of heat treatment (instead of the chlorination used in the earlier HBGS study), and having concurrent field sampling in the vicinity of the current location being used as the intake to ensure that the results were not affected by differences in fish abundance at the two locations (intake and discharge). Hydroacoustic field sampling was done to estimate fish biomass at the two intake locations, which was the same approach used in the earlier study at the HBGS.

The study was planned to be conducted over a 12-week period with alternating two-week periods of normal and reverse intake flow. During normal intake flow, the intake structure with a velocity cap was used to withdraw cooling water from the source waterbody into the forebay, and during reverse intake flow, the discharge structure without a velocity cap was used to withdraw cooling water into the forebay. The plant cooling water flow was reversed approximately every two weeks to ensure that conditions between sampling periods were as similar as possible. During the two week periods, normal impingement sampling was done weekly, as well as heat treatment impingement surveys at the end of each period. Instead of six alternating trials of normal and reverse flow, only two complete trials were completed (**Table 2**). The Los Angeles Regional Water Quality Control Board directed that the study not continue due to the large numbers of fishes being killed during the reverse flow operations without the velocity cap.

Prior to each approximately two-week survey period, all fish species from within the forebay were removed by conducting heat treatments. Heat treatments were performed by controlling the opening and closing of the circulating water intake and discharge valves causing the water temperature in the forebay to increase. During and after this period, the traveling screens were run until all heat-treated fishes were removed from the forebay. Heat treatments were conducted between each of the survey periods to ensure that all of the organisms that may have entered the forebay during the previous sampling period were included in the estimate of total impingement. Once impingement on the circulating water screens subsided to near zero after the heat treatment, and the flow direction had been reversed, the next sampling period was initiated.

Table 2. SGS velocity cap effectiveness study periods and flow regimes (source: MBC et al. 2007).

Survey Period	Flow Direction	Start Date	End Date	No. of Days	Mean Daily Flow Rate m^3/day (Gallons/day)
N_1	Normal	Oct. 10, 2006	Oct. 23, 2006	13.0	1,302,562 (344,100,283)
R_1	Reverse	Oct. 23, 2006	Nov. 9, 2006	17.2	1,297,023 (342,637,127)
N_2	Normal	Nov. 9, 2006	Nov. 20, 2006	10.8	1,267,659 (334,880,133)
R_2	Reverse	Nov. 20, 2006	Dec. 11, 2006	21.2	1,326,718 (350,481,797)
N_3	Normal	Dec. 11, 2006	Jan. 3, 2007	22.8	1,281,746 (338,601,419)
R_3	Reverse	*	*	*	*

Hydroacoustic surveys were done during the study periods at the SGS to determine if any differences in fish abundances could be detected between the intake and discharge structures when the impingement sampling was occurring. A consistent difference in abundance between locations could indicate that any differences in impingement between periods of normal and reverse flow were not entirely the result of the presence or absence of the velocity cap. There were four survey sets during normal and reverse flow collected. During each survey, three replicate samples of 14 transects were collected during the day and three replicate samples of 14 transects were collected during the night at both intake and discharge locations. Transect estimates were grouped into offshore and inshore components for analysis by normal (velocity cap) and reverse (no velocity cap) intake conditions. Overall, during normal intake flow conditions, fish densities averaged 0.0109 kg/m^3 while during reverse flow average fish densities were 0.0093 kg/m^3. A statistically significant difference in fish densities was not detected between reverse and normal flow conditions indicating that the impingement results during the test period were not affected by differences in fish densities between the two intake locations.

The results of the impingement sampling from the five study periods demonstrates the effectiveness of the velocity cap in reducing impingement during normal plant operations, but also reducing the entrapment of fishes into the intake system that would be impinged during heat treatments (**Table 3**). The calculated effectiveness of the SGS velocity cap on all fishes, as determined by impingement rate, was 97.56 percent based on abundance, and 95.30 percent based on biomass. Analysis of impingement rate takes into account differences in flow between survey periods. The t-statistic and associated p-value for abundance was statistically significant; however, the results for biomass were not statistically significant. A possible explanation for the disparity between the two is the impingement of relatively low numbers of high-biomass species, such as Pacific electric ray and thornback during the third normal flow period.

Table 3. Results from normal impingement sampling and total impingement including heat treatment sampling for the SGS velocity cap effectiveness study periods. Study periods correspond to the dates shown in **Table 2** (source: MBC et al. 2007).

Sample Period	***N1***	***R1***	***N2***	***R2***	***N3***
Normal Impingement Sampling					
Total Fishes	43	31,175	655	80,818	5,406
Total Biomass (kg)	18.9	828.6	131.1	1,444.9	415.1
Total Taxa	11	24	21	39	51
Normal and Heat Treatment Impingement Sampling					
Total Fishes	1,054	220,065	1,050	411,754	16,218
Total Biomass (kg)	52.4	7,428.5	141.9	7,733.0	651.6
Total Taxa	21	41	35	47	61
Period Volume (m^3)	16,911,607	22,263,200	13,739,444	28,176,876	29,255,423

Consequently, the estimate of the effectiveness of the SGS velocity cap from the 2006 study was higher than estimates from the previous studies at the ESGS and the HBGS. This was probably due, in large part, to the current presence of Pacific sardine in the source waters. Pacific sardine was not abundant off southern California in the 1970s and early 1980s, a period which marked the end of a cool water regime and a transition to warm water conditions (Moser et al. 2001, Horn and Stephens 2006). During a two-year impingement study (1978–1980) at eight coastal generating stations in southern California, over 4.5 million fish were impinged (Herbinson 1981). However, only eight Pacific sardine were recorded during the study. No Pacific sardine were impinged at the SGS in 1979 during the 316(b) demonstration (IRC 1981). Abundance of Pacific sardine off southern California has increased since the 1990s, making them more susceptible to impingement than in previous studies. Topsmelt and jacksmelt may also be more abundant today than they were 30 to 50 years ago. Abundance of these two species during three heat treatments at the SGS in 1978-1979 represented less than 0.8 percent of the total impingement abundance (IRC 1981). Numbers of topsmelt and jacksmelt in heat treatment impingement samples at the SGS has varied substantially since 1990, but there appears to be a trend of increasing abundance (MBC 2006).

Conclusions

The results from these studies demonstrate that velocity caps are extremely effective at reducing impingement mortality at power plants with offshore intake structures similar to the intake at

OBGS. The results of these studies are directly applicable to the OBGS, as the plants were all originally designed and constructed by Southern California Edison using similar design criteria. The species of fishes affected by impingement at the OBGS should be very similar to the species affected at plants like the SGS, the ESGS, and the HBGS, since all of the facilities are located in southern California, the coastline distance from the OBGS to the SGS is only approximately 50 miles (80 km), and the seafloor habitats (largely sand) are similar at all of the facilities.

While the estimates of the effectiveness of the velocity caps vary among the studies, they are all within the range of reductions required under the Track 2 compliance pathway in the Policy. The most recent studies at the SGS are especially relevant, due to the high mortality of fishes during the operation of the plant in reverse flow. Most of these fishes were Pacific sardines which have become much more abundant in California waters over the past decade, due to changes in ocean conditions (Moser et al. 2001, Horn and Stephens 2006). Schooling fishes are very vulnerable to intakes that are not fitted with velocity caps, as large numbers of fishes can be potentially impinged at once. The presence and abundances of these schools are also highly variable as shown in the velocity cap study at the OBGS where the data on impinged schools of Pacific mackerel had to be removed from the analysis since they were not consistently abundant during all of the test trials and obscured results for fishes targeted by the study (Thomas et al. 2007c). Results from the more recent study at the SGS also showed that including results from these schooling fishes dramatically affect the results providing even higher estimates of the velocity cap effectiveness. These studies verify the effectiveness of the velocity cap at the OBGS and demonstrate that it complies with the reductions required under Track 2 of the state Policy.

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Exhibit D

Alternative Flow Reduction Technology Evaluation for GenOn's Mandalay Generating Station and Ormond Beach Generating Station

Technology[1]	Design Concept Description	Design and Operation	IM&E Reduction	Information Used to Determine Performance	Potential Application at GenOn Stations
1. Variable Frequency Drives- (VFD)s	Install variable frequency drives on existing circulating water pumps.	Drives allow the operation of circulating water pumps at less than 100% speed, which results in a reduction in flow at less than 100% plant load.	Entrainment is assumed to be reduced in proportion to any reduction in the required quantity of cooling water. Reduction in impingement is also likely to occur.	Vendor information, Operational experience	Yes – technology selected for supplemental evaluation
2. Variable-speed Fluid Turbo Couplings	Install variable-speed fluid turbo couplings on existing circulating water pumps. Speed control offers higher efficiency compared to throttle control during plant part-load operation.	Coupling acts to vary the speed of cooling water pumps to selectively reduce the usage of cooling water.	Entrainment is assumed to be reduced in proportion to any reduction in the required quantity of cooling water. Reduction in impingement is also likely to occur.	Vendor information	No, similar to VFDs, but VFD preferred based on more operating experience
3. Two-speed Pumps	Two -speed pumps allow for two withdrawal rates, which will offer reduced flow during partial load operation.	Similar concept to variable-speed fluid turbo couplings and VFDs, however less flexibility in withdrawal rates; only two flow rate options.	Entrainment is assumed to be reduced in proportion to any reduction in the required quantity of cooling water. Reduction in impingement is also likely to occur.	Vendor information, Operational experience	No, VFDs provide more flexibility
4. Circulating Water Pump Recirculation	Redirection of flow from the circulating water pump discharge back to the intake. This will result in less ocean water withdrawal.	Recirculation of a portion of the intake water reduces ocean water withdrawal. This alternative will not increase the temperature of the intake water.	Assumed reduction in E is proportional to the reduction in ocean water used	Theoretical	Yes, this approach was studied and found to be potentially effective
5. Condenser Cooling Water Recirculation	Redirection of flow from condenser discharge back to the intake. This will result in less ocean water withdrawal.	Cooling water temperature will increase, possibly affecting generating capacity. Reduction in flow limited by permitted outfall temperature.	Assumed reduction in E is proportional to the reduction in ocean water used	Operational experience	No, circ water pump recirculation would be a superior choice.

Notes:
CWIS = cooling water intake structure
E = Entrainment
fps = feet per second
I = Impingement
IM = Impingement Mortality
O & M = Operation and Maintenance

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[1] Or combination of these technologies

Exhibit E

Screening and Other Aquatic Impact Reduction Technology Evaluation for GenOn's Mandalay Generating Station and Ormond Beach Generating Station

Technology[1]	Design Concept Description	Design and Operation	IM&E Reduction	Information Used to Determine Performance	Potential Application at GenOn Stations
1. Ristroph-type Traveling Screens (finer-mesh)	Ristroph-type vertical traveling screens with smooth finer-mesh wire, low-pressure fish spray header, and fish return system	Designed to exclude smaller organisms. Fish return is required. Susceptible to clogging and fouling. Through-screen velocity and head loss may significantly increase. Increase in O & M costs. Screens as fine as 0.5 mm are operating successfully.	Reduces E by increasing I. May improve I survival by limiting physical damage to organisms during I. Survival of organisms may be an issue for very early lifestages and fragile species.	USEPA, EPRI, Vendor information, Operational experience	Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations,
2. Modified Ristroph-type Dual Flow Traveling Screen	Traveling water screens oriented perpendicular to the flow of water into the screenhouse. May increase screening area compared to through-flow screens. Eliminates carry over.	Designed to exclude smaller organisms. Larger traveling screens may require additional water and electric power supply for operation and control and modification to the screen house. Fish return is required. Screens as fine as 0.5 mm are operating successfully.	Increased screen area will reduce through-screen velocity. Modifications with finer mesh and fish handling features can decrease E and IM. Survival of organisms may be an issue for very early lifestages and fragile species.	USEPA, EPRI, Vendor information, Operational experience	Retrofit into existing intake structure may be more difficult at both stations than Ristroph screen depending on the screen width selected; required fish return system is a significant design issue at both stations
3. Modified Ristroph-type Traveling Screen with Finer-Mesh Overlays or Interchangeable Panels	Ristroph-type vertical traveling screens with interchangeable smooth standard mesh and finer-mesh wire, low-pressure fish spray header, and fish return system. Potentially allows for seasonal use of finer-mesh during periods of high E.	Designed to exclude smaller organisms. Fish return is required. Susceptible to clogging and fouling. Through-screen velocity and head loss may significantly increase. Increased O & M costs. These issues are partially mitigated by seasonal use. Dual flow screen arrangement may mitigate through-screen velocity and head loss issues. Screens as fine as 0.5 mm are operating successfully	Will reduce E but may cause additional I; survival of organisms may be an issue for very early lifestages and fragile species.	USEPA, EPRI, Vendor information, Operational experience	Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations
4. Finer-mesh Drum Screens	Redesign existing CWIS with partially submerged drum-shaped screens; filter drum rotating around a central horizontal axis in a completely redesigned CWIS.	Capable of reducing IM and E as physical barriers excluding fish or other organisms from the circulating water flow. No operating experience with finer-mesh design at a large power plant. Will need to combined with method to control CWIS fouling, such as special coatings or materials to minimize biological growth, as conventional heat treatment would not be possible.	Biological effectiveness is contingent on screen orientation and availability of a suitable bypass and fish return system. Fine screen mesh must be used to reduce E. Survival of organisms may be an issue for very early lifestages and fragile species.	Vendor information, Operational experience overseas and US hydroelectric facilities	Insufficient operating experience to consider for application at this time. Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations.
5. Cylindrical Wedgewire Screens	An array of wedgewire screens installed on the sea floor, on other in-water structures, or from a new bulkhead in front of the existing CWIS. Sized to maintain a <0.5 fps through-slot velocity for optimum performance.	These screens using wide slots are currently used at both large and small power plants with good to excellent biological effectiveness related to IM. No narrow-slot installation at large power facilities. Uses both physical and hydrodynamic exclusion. A sweeping flow past the screens is important to carry aquatic organisms and debris past the screens. The current velocity can be provided by fish pumps or ocean currents. Cost savings for mechanical equipment and maintenance costs. Biofouling and clogging may be a problem; a debris back flushing system may be needed. Will need to combined with method to control CWIS fouling, such as special coatings or materials to minimize biological growth, as conventional heat treatment would not be possible.	Screen approach velocity exerts only a very short zone of influence moving away from the screens, which reduces I. The screen incorporates flow-shaping internals which maintain a fairly uniform velocity across the screen surface, eliminating concentrated high velocity areas. Wide-slot screens eliminate IM with low through-slot velocity. Fine slots reduces E.	USEPA, EPRI, Vendor information, Operational experience, pilot studies	Yes- technology selected for further evaluation. Most practical technology for retrofit to existing intake structures; ensuring sufficient sweeping flow not a significant issue at OBGS, but could present challenges at Mandalay due to installation at the end of a canal. May have application at the entrance to the Mandalay canal.

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[1] Or combination of these technologies

Screening and Other Aquatic Impact Reduction Technology Evaluation for GenOn's Mandalay Generating Station and Ormond Beach Generating Station

Technology[1]	Design Concept Description	Design and Operation	IM&E Reduction	Information Used to Determine Performance	Potential Application at GenOn Stations
6. Stationary Angled Flat-panel Finer-mesh Screens (Woven Mesh or Wedgewire Screens)	Install angled flat-panel finer-mesh screens or wedgewire screens to guide fish and debris into a bypass.	Cost savings for mechanical equipment. Maintenance costs will increase. Limited use for US power plant intakes. Angled screens divert fish from intake. Fish pumps and bypass flow would be required. Biofouling and clogging may be a problem; cleaning system would be needed.	Relies on the swimming ability of fish to guide into fish bypass to avoid IM. Finer-mesh screens would likely reduce E by acting as a physical barrier that excludes most life stages of fish and shellfish. However, IM of larvae may increase. More surface area than cylindrical wedgewire arrangement will result in lower through-screen velocity.	Operational experience	Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stationsf
7. Geiger Multi-Disc™ Screening System (Geiger Screens)	Install finer-mesh Geiger screens with fish collection system. The system is comprised of sickle-shaped panels rotating in a single plane. May provide an O&M benefit by eliminating debris carryover and reduced head loss.	Fish return is required. Capable of higher travel speed than conventional screens. Improved debris handling. Could be installed in combination with cylindrical wedgewire at Ormond Beach to address debris issues from sloughing of fouling organisms inside intake tunnels. In this application no fish return would be necessary since IM&E addressed at intake with wedgewire screens.	A comparison of preliminary data on the survival of most of the fish impinged by the Geiger screen showed similar results to the modified Ristroph screens and therefore it is assumed that the biological efficacy is similar. Survival of organisms may be an issue for very early lifestages and fragile species, unless used specifically for debris handling.	EPRI, Vendor information, Operational experience	Retrofit into existing intake structure would be difficult at both stations; if system is used for IM&E purposes, required fish return system is a significant design issue at both stations
8. Hydrolox™	Install finer-mesh Hydrolox™ screens with fish return system. Similar to traditional traveling screens.	Available in a variety of mesh sizes. Installed similarly to other traveling screens, but made of a lighter weight polymer. This material is not as strong as other screening material and may fail due to debris and head loss May travel faster than a traditional screen, , which may result in other O&M issues due to increased fouling on screens that are always wet or submerged..	Effectiveness varies with species of fish, screen travel speed, through-screen velocity, fouling and debris, and maintenance of the system. Testing showed similar results to the modified Ristroph screens. Survival of organisms may be an issue for very early lifestages and fragile species.	Pilot study, Operational experience at a small facility	Insufficient operating experience to consider for application at this time. Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations
9. Beaudrey Water Intake Protection (WIP) System	Install finer-mesh submersed Beaudrey WIP System with fish collection system.	Similar to Geiger screens, this technology eliminates debris carryover. This screen relies on a fish pump to remove fish and debris from the face of a circular screen.	Effectiveness varies with species of fish, screen travel speed, through-screen velocity, fouling and debris, and maintenance of the system. Requires E survival study for fish pumps.	Ongoing studies at a power plant's intake	Insufficient operating experience to consider for application at this time. Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations
10. Aquatic Filter Barrier (AFB)	Barrier placed across the intake. May be deployed for seasonal use. Uses filter fabric to exclude aquatic organisms. May be floating, flexible, or fixed. Gunderboom MLES is one example.	Large area and bypass flow required. Biofouling and clogging can be significant; may be controlled with an air purge system if adequate current flushing available. High O&M.	Very low velocities protect organisms. Little damage to fish eggs and larvae if drawn up against fabric. Predators rapidly utilize fabric.	Still considered experimental; only full-scale use was at one river power plant (Gunderboom MLES has been tested at Unit 3 of Lovett Station, NY which is now decommissioned). Removed at Bethlehem Energy Center in Albany NY due to failures.	No, lack of space and significant biofouling issues

Technology[1]	Design Concept Description	Design and Operation	IM&E Reduction	Information Used to Determine Performance	Potential Application at GenOn Stations
11. Seasonal Barrier Net or Screens	Net or screens placed across the intake. May be deployed for seasonal use. Finer-mesh nets must be used for additional E reduction.	Need large area for deployment. Biofouling and clogging can be significant. High O&M.	Physical exclusion depends of mesh size.	Finer-mesh design is an experimental technology. Failed during a pilot test.	No, unproven E control
12. Substratum Intake Structure	An array of perforated intake piping buried below the seafloor; cooling water drawn and filtered through the substrate.	A porous stratum with high water conductance is needed. Large bottom area required to maintain low velocity. An engineering pilot test would be required. Clogging of system may be an issue.	Very low velocity and fine pores reduces I & E. Experimental design. Unknown operation and I & E efficacy.	Vendor information	No, experimental; no operating experience; unproven E control; ability to apply this technology with volumes of water required is highly questionable.
13. Porous Dike (Rock Structure)	Also known as leaky dams or dikes. This is a filter surrounding the cooling water intake with a core consisting of cobble or gravel, allowing water to pass through. The dike acts as both a physical and behavioral barrier.	Biological effectiveness is life-stage-specific. Lower design velocity requires larger dike area. Can become clogged and backflushing is not feasible with porous dikes. May provide habitat that would increase presence of certain fish species in the intake.	Biological effectiveness is life-stage-specific. Predation of screened organisms may offset benefits.	Biological effectiveness and engineering practicability currently under study: resultshave been positive in the Great Lakes.	No, Very large structure required in order to minimize headloss and through-pore velocity. Unproven E control. ;
14. Filtrex Filter System (FFS)	Filtrex filters are columns of (typically) thermoplastic filter material with a variety of pore sizes available. Each column is relatively small, and a large array would be required for large withdrawal rates. An array of Filtrex filters installed on the sea floor, or from a new bulkhead in front of the existing CWIS.	New technology which is still considered experimental and has not been deployed in the marine environment. Clogging may an issue. Critical design parameters include flow requirements, available space, type and amount of debris, fouling, and effectiveness of the cleaning systems. Large number of units needed to maintain low velocity. High O & M predicted.	Very low through-filter velocity reduces IM. Small openings to reduce E. Although survival of impinged organisms has been shown to be low, there are significant overall reductions in I & E	Lab and limited field studies. Untested at power plant intakes.	No, experimental; no operating experience
15. Eicher Screens (Vertically Angled Screens)	A complete redesign of the intakes with flat-panel wedgewire screens set at an angle to divert organisms to a fish pump system. The Eicher screen is a passive-pressure screen that is effective for diverting fish in hydroelectric penstocks, but was not designed for use at steam electric station cooling water intakes.	Designed for high velocities. Fish pumps and bypass flow would be required.	Sweeps fish towards a bypass using higher flow velocities. Theoretically may be designed with finer slots to reduce E.	EPRI, Pilot study, Operational experience in hydroelectric penstocks	Insufficient operating experience to consider for application at this time. Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations.
16. Modular Inclined Screens (MIS)	Redesign intake with surface MIS with a fish bypass. The MIS is designed to divert fish and debris at water velocities ranging from 2.0 to 10.0 fps.	Critical design parameters include flow requirements, available space, type and amount of debris, and fish diversion. Fish pumps and bypass flow would be required.	Effectiveness depends on responsiveness of important fish species and the ability to survive the fish pump. Experimentally, juvenile fresh water fish were diverted. Theoretically may be designed with finer slots to reduce E.	Although this technology has undergone lab and pilot testing, there are no full-scale MIS facilities in operation.	Insufficient operating experience to consider for application at this time. Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations

Technology[1]	Design Concept Description	Design and Operation	IM&E Reduction	Information Used to Determine Performance	Potential Application at GenOn Stations
17. Other Media Filters	This group includes perforated pipes, artificial filter beds, and radial wells. Water is often drawn through filter media such as sand and stone.	Critical design parameters include flow requirements, available space, type and amount of debris, and fouling, Clogging may be an issue. Water flow requirements may limit application of some of these technologies. Low O & M costs. Fish pumps and bypass flow would be required.	Can be designed for very low inlet velocities. Very low velocity and fine pores reduces I & E.	A stone filter has been in used at a large power plant. Radial wells have been reliably used for many years for obtaining highly filtered industrial and municipal water, but not for once-through cooling at power plants. Perforated Pipes: Used by nine steam electric units in the US. Each unit uses closed-cycle cooling systems with low make-up intake flow ranging from 7 to 36 MGD.	Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations
18. Bed-level Intake	Construct an off-shore bed-level intake opening. A conglomerate of structurally independent pre-cast, reinforced concrete units, namely: centre-piece, non-porous modules, non-porous modules with a removable hatch, porous modules, peripheral porous modules, and peripheral corner porous modules.	The velocity of water through the slots near the centre piece would be between 0.5 and 1.5 fps. This velocity is <0.1 fps towards the perimeter of the intake structure. Critical design parameters include: type of marine habitat and substrate encountered along pipeline route, flow requirements, type and amount of debris, cross currents, effectiveness of the cleaning systems, and fouling controls.	Low through-slot velocity reduces IM. Reduction in E primarily achieved by moving intake away from high densities of susceptible organisms.	Operational experience	No, primarily relies on decreased numbers of organisms offshore to decrease E which is unlikely in this application
19. Louver System	Install a system of vertical slats (louvers) that help direct organisms away from the intake to a fish pump system.	Critical design parameters include: flow requirements, type and amount of debris, cross currents, and the swimming ability of fish to avoid IM or E. Debris removal system may also need to be installed. Fish pumps and bypass flow would be required.	This technology does not reduce larval E, may reduce juvenile E depending on the swimming ability of fish.	EPRI, Operational experience	No, not an effective E control. Retrofit into existing intake structure would be difficult at both stations; required fish return system is a significant design issue at both stations
20. Flow Velocity Enhancement System [FVES]	Install water jets to direct debris and organisms away from an intake structure to a bypass.	High velocity water creates a behavioral or diversion barrier that elicits an avoidance response. Proven effective for debris. Testing needed as a fish deterrent system.	May induce fish to bypass intake. Potential to move eggs/larvae off wedgewire or other screens to a bypass system.	Vendor information and some pilot testing	Insufficient operating experience. Not considered a primary control system; may potentially be applied with wedgewire or other stationary screens
21. Behavioral Barriers	Install behavioral barriers in front of the intake or intake canal, such as: light systems, air bubble curtains, acoustic barriers (sound), darkness/shading of intake, and light/sound hybrid barriers.	Behavioral barrier systems installed in front of the intake to induce an avoidance response to prevent fish from entering the intake or directing them to a bypass. Critical design parameters include: the swimming ability of fish and the behavioral response to the barrier.	May induce fish with swimming ability to avoid the intake. I control only; not used to reduce E. Some fish species are unresponsive or attracted to the barrier.	EPRI, Pilot study, Operational experience	No. will not reduce E; testing at SONGS demonstrated most technologies were not effective.
22. Offshore Intake (Mandalay only)	Relocate CWIS offshore. Low intake velocity reduces IM. Reduction in E achieved by moving intake away from high densities of organisms. May be combined with wedgewire screens or velocity cap.	Critical design parameters include: type of marine habitat and substrate encountered along pipeline route, flow requirements, type and amount of debris, cross currents, effectiveness of the cleaning systems, distribution of organisms and fouling controls.	Eliminate IM with low velocity, Reduction in E primarily achieved by moving intake away from high densities of susceptible organisms.	USEPA, EPRI, Vendor information, Operational experience	No, primarily relies on decreased numbers of organisms offshore to decrease E which is unlikely in this application; approval for installation of offshore intake unlikely

Notes:

CWIS = cooling water intake structure
E = Entrainment
fps = feet per second
I = Impingement
IM = Impingement Mortality
O & M = Operation and Maintenance

Exhibit F

Entrainment Estimates for GenOn Ormond Beach and Mandalay Generating Stations

December 29, 2010

Prepared for:	***Prepared by:***
Mr. Rick Eckersley GenOn Houston, TX 77253	Tenera Environmental 141 Suburban Rd., Suite A2 San Luis Obispo, CA 93401 805.541.0310

Introduction and Methods

The entrainment data on larval fishes collected during the February 2006–January 2007 studies at the Ormond Beach (OBGS) and Mandalay (MGS) Generating Stations were used to calculate hourly estimates of larval fish concentration for each of the taxonomic categories of fishes (taxa) collected as well as the total for all fish larvae. Estimates of entrainment for each taxa at each plant were calculated by multiplying the larval concentrations for each hour during the calendar year by the actual flow volume for the corresponding hours for each day during 2006–2009. Entrainment estimates using the hourly concentrations were also calculated for design flows and the estimated flows for 2006–2009 if variable speed drive (VSD) circulators were in use. The design flows for each circulating water pump at OBGS and MGS used in the calculations were 113,500 and 41,500 gpm, respectively. These values are less than the design flows of 119,000 and 44,000 gpm for OBGS and MGS, respectively, used in the entrainment estimates in the ENSR reports. Therefore, the estimates of annual entrainment for design flow are less in this report than the estimates reported by ENSR.

The daily estimates calculated using the various flows were summed for each month and over an entire calendar year to allow comparison among the various estimates. The potential reductions from both actual and design flow with the use of VSD circulators for 2006–2009 in absolute entrainment and on a percentage basis were also calculated.

Results and Conclusions

The monthly and total annual entrainment estimates for the two plants for the most abundant fish taxa and all larval fish combined using the different sources of flow data are provided in the attached tables. The data for the total of all larval fish are provided in **Tables 1** and **2**.

The differences in the entrainment estimates using actual flow for 2006–2009 reflect the differences in flow among those years both in volume and in the periods of time the circulators were in operation since the same larval concentrations were used in calculating the estimates for all four years.

The entrainment estimates for all larval fishes combined for OBGS in **Table 1** show that plant cooling water flow was lower in 2009 than in the other three years. The actual entrainment estimates for all four years were considerably less than the entrainment estimate calculated using design flows. As a result, the reduction in the entrainment estimates using the VSD circulator flows was considerably greater when compared to the design flow estimates and averaged over 92%.

The entrainment estimates for all larval fishes combined for MGS in **Table 2** show that plant cooling water flow was lower in 2006 and 2007 than in 2008 and 2009. The actual entrainment estimates for all four years were all less than the entrainment estimate calculated using design flows. As a result, the reduction in the entrainment estimates using the VSD circulator flows was considerably greater when compared to the design flow estimates and averaged almost 90%.

The results show the large potential reductions in entrainment available through the use of VSD circulators. The use of design flow as the baseline for compliance with the new state OTC Policy requires that the VSDs be used in combination with an additional screening technology, but as the results indicate, the performance of the screening technology may only have to provide minimal levels of reduction since the use of VSDs alone meet the required levels of reduction under the Track 2 compliance pathway. This will allow for much greater flexibility in achieving compliance under the new Policy.

Table 1. Monthly and total annual estimates of entrainment calculated using various flow data for Ormond Beach Generating Station for all larval fishes combined. Below the entrainment estimates are the reductions in entrainment and the corresponding percentages using the projected flow data for 2006–2009 that would occur if the plant was using variable speed drive circulators.

Month	Actual Flow 2006	Actual Flow 2007	Actual Flow 2008	Actual Flow 2009	Average Actual Flow 2006-2009	Design Flow	Projected VSD Flow 2006	Projected VSD Flow 2007	Projected VSD Flow 2008	Projected VSD Flow 2009
Jan	3,271	3,919	55,740	9,005	17,984	1,114,020	1,441	1,726	26,300	3,967
Feb	5,770	9,607	47,859	224,250	71,872	738,612	2,542	4,232	12,512	66,653
Mar	170,106	21,214	992,217	85,635	317,293	4,956,358	74,937	9,346	328,925	37,725
Apr	1,339,881	2,321,950	2,814,897	1,784,796	2,065,381	10,603,157	430,288	562,716	921,252	495,509
May	1,179,235	80,702	108,285	106,130	368,588	4,666,598	381,074	35,552	34,027	36,702
Jun	1,603,279	1,341,000	1,067,272	22,554	1,008,526	4,506,745	574,295	525,545	465,305	9,936
Jul	1,413,483	1,849,261	638,426	290,219	1,047,847	2,213,842	512,373	857,968	260,565	91,889
Aug	722,027	2,253,599	2,276,748	328,368	1,395,185	3,220,330	224,023	979,238	803,026	126,871
Sep	691,684	1,679,070	1,396,304	1,402,521	1,292,395	2,450,067	364,294	801,503	548,910	409,831
Oct	41,936	392,177	239,855	189,965	215,983	1,080,127	18,474	124,292	83,010	59,528
Nov	36,600	324,329	360,592	4,237	181,440	1,388,332	16,123	122,459	118,039	1,867
Dec	6,106	244,638	270,970	2,977	131,173	1,526,067	2,690	107,385	99,782	1,312
Total	7,213,376	10,521,466	10,269,163	4,450,658	8,113,666	38,464,252	2,602,554	4,131,962	3,701,653	1,341,790

VSD Reductions in Entrainment from Actual Flows

VSD Reduction 2006	4,610,822
% Reduction 2006	63.92%
VSD Reduction 2007	6,389,504
% Reduction 2007	60.73%
VSD Reduction 2008	6,567,510
% Reduction 2008	63.95%
VSD Reduction 2009	3,108,868
% Reduction 2009	69.85%
Average Reduction	64.61%

VSD Reductions in Entrainment from Design Flows

VSD Reduction 2006	35,861,698
% Reduction 2006	93.23%
VSD Reduction 2007	34,332,291
% Reduction 2007	89.26%
VSD Reduction 2008	34,762,599
% Reduction 2008	90.38%
VSD Reduction 2009	37,122,462
% Reduction 2009	96.51%
Average Reduction	92.34%

Table 2. Monthly and total annual estimates of entrainment calculated using various flow data for Mandalay Generating Station for all larval fishes combined. Below the entrainment estimates are the reductions in entrainment and the corresponding percentages using using the projected flow data for 2006–2009 that would occur if the plant was using variable speed drive circulators.

Month	Actual Flow 2006	Actual Flow 2007	Actual Flow 2008	Actual Flow 2009	Average Actual Flow 2006-2009	Design Flow	Projected VSD Flow 2006	Projected VSD Flow 2007	Projected VSD Flow 2008	Projected VSD Flow 2009
Jan	353,104	881,802	2,679,650	4,276,023	2,047,645	6,731,911	81,635	313,176	1,127,734	1,492,177
Feb	3,075,835	430,188	6,153,840	11,893,115	5,388,245	32,645,222	970,629	155,490	1,790,618	4,186,040
Mar	1,299,988	1,290,813	3,467,361	5,849,182	2,976,836	12,873,889	490,697	477,493	1,362,641	2,083,258
Apr	952,147	1,006,554	4,503,758	3,627,060	2,522,379	15,660,213	307,215	366,776	1,698,642	1,308,845
May	5,317,127	5,292,954	2,749,458	5,552,478	4,728,004	11,781,286	2,024,108	1,860,760	965,199	2,025,277
Jun	1,008,185	1,248,012	982,113	64,326	825,659	2,495,792	384,656	424,212	274,725	22,170
Jul	3,282,943	2,716,356	1,986,566	2,525,384	2,627,812	4,555,247	1,298,070	953,278	776,414	987,018
Aug	5,336,603	7,421,263	7,488,839	1,437,082	5,420,947	11,488,592	1,811,643	2,345,138	2,240,672	486,938
Sep	3,290,539	2,583,067	5,011,187	6,397,313	4,320,527	9,649,061	1,160,113	878,600	1,525,961	2,616,434
Oct	28,349	3,451,525	4,667,585	3,049,089	2,799,137	7,370,265	10,247	1,172,880	1,591,846	976,406
Nov	2,615,680	1,736,798	6,686,469	1,887,744	3,231,673	8,544,839	999,145	606,352	2,306,869	602,916
Dec	2,497,043	2,610,567	3,796,615	3,227,538	3,032,941	9,292,499	934,935	1,041,138	1,257,989	1,020,184
Total	29,057,544	30,669,899	50,173,441	49,786,334	39,921,805	133,088,817	10,473,093	10,595,291	16,919,308	17,807,664

VSD Reductions in Entrainment from Actual Flows

VSD Reduction 2006	18,584,451
% Reduction 2006	63.96%
VSD Reduction 2007	20,074,608
% Reduction 2007	65.45%
VSD Reduction 2008	33,254,134
% Reduction 2008	66.28%
VSD Reduction 2009	31,978,670
% Reduction 2009	64.23%
Average Reduction	64.98%

VSD Reductions in Entrainment from Design Flows

VSD Reduction 2006	122,615,724
% Reduction 2006	92.13%
VSD Reduction 2007	122,493,526
% Reduction 2007	92.04%
VSD Reduction 2008	116,169,509
% Reduction 2008	87.29%
VSD Reduction 2009	115,281,153
% Reduction 2009	86.62%
Average Reduction	89.52%

Monthly and total annual estimates of entrainment calculated using various flow data for Ormond Beach and Mandalay Generating Station for most abundant taxonomic categories of larval fish and all larval fishes combined based on actual flows during 2006–2009, design flow, and projected flows for the same years if the plant was using variable speed drive circulators.

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies Engraulidae	white croaker *Genyonemus lineatus*	northern lampfish *Stenobrachius leucopsarus*	blennies *Hypsoblennius spp*	California smoothtongue *Leuroglossus stilbius*	diamond turbot *Hypsopsetta guttulata*	queenfish *Seriphus politus*	sanddabs *Citharichthys spp*	California halibut *Paralichthys spp*	gobies CIQ gobies
Actual Flow 2006											
Jan	3,271	256	256	237	0	0	105	0	617	711	609
Feb	5,770	109	1,193	1,790	0	0	0	0	0	0	0
Mar	170,106	0	43,492	119	0	21,726	13,647	0	11,238	0	7,267
Apr	1,339,881	321,576	429,340	147,341	9,266	23,445	22,049	7,940	6,199	19,027	6,402
May	1,179,235	962,502	0	99,287	2,190	0	0	0	10,196	33,234	0
Jun	1,603,279	1,243,833	0	40,874	152,203	0	0	0	0	0	15,350
Jul	1,413,483	929,438	0	44,188	118,109	0	0	14,339	0	124,290	63,549
Aug	722,027	166,842	0	93,302	88,233	0	0	314,659	918	514	14,859
Sep	691,684	108,508	0	62,931	78,461	0	0	24,590	86,370	36,485	31,481
Oct	41,936	0	1,113	0	0	0	1,134	0	16,404	0	2,945
Nov	36,600	3,196	4,833	0	0	0	18,510	0	651	0	1,717
Dec	6,106	365	0	0	0	0	638	0	0	0	1,000
Total	7,213,376	3,736,625	480,227	490,069	448,462	45,171	56,083	361,528	132,592	214,261	145,178

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Actual Flow 2007											
Jan	3,919	0	331	712	0	0	535	0	123	580	353
Feb	9,607	545	1,988	2,983	0	0	0	0	0	0	0
Mar	21,214	0	4,501	358	0	8,517	339	0	261	0	935
Apr	2,321,950	1,546,720	313,663	170,601	0	40,147	19,726	0	13,948	33,929	11,468
May	80,702	59,422	0	3,564	1,138	0	0	0	4,776	5,731	0
Jun	1,341,000	997,516	0	29,616	154,565	0	0	0	0	0	16,095
Jul	1,849,261	1,262,976	0	62,519	122,899	0	0	26,850	0	114,307	85,911
Aug	2,253,599	575,788	0	247,274	254,997	0	0	645,613	88,143	36,999	52,143
Sep	1,679,070	283,558	0	169,329	208,129	0	0	64,665	232,359	101,747	3,148
Oct	392,177	14,519	114,745	0	0	0	75,201	0	4,557	0	42,690
Nov	324,329	33,346	33,831	0	0	0	167,817	0	10,303	0	12,017
Dec	244,638	17,369	8,384	0	0	0	765	0	0	0	34,698
Total	10,521,466	4,791,758	477,443	686,955	741,727	48,664	264,383	737,128	354,470	293,293	259,458

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Actual Flow 2008											
Jan	55,740	2,303	5,941	3,083	0	0	2,521	0	1,603	7,344	12,207
Feb	47,859	4,142	8,948	13,421	0	0	0	0	0	0	0
Mar	992,217	8,237	180,189	10,379	13,431	238,593	21,846	0	14,635	0	153,201
Apr	2,814,897	662,305	806,755	350,815	23,597	20,652	32,313	21,212	5,941	47,941	5,771
May	108,285	72,696	0	1,053	702	0	0	0	11,100	10,408	0
Jun	1,067,272	967,763	0	42,544	9,634	0	0	0	0	0	298
Jul	638,426	405,850	0	16,825	68,219	0	0	843	0	81,862	23,954
Aug	2,276,748	581,712	0	254,556	260,729	0	0	735,310	69,434	31,346	52,296
Sep	1,396,304	231,887	0	135,876	166,980	0	0	53,345	189,342	77,081	20,257
Oct	239,855	6,908	27,479	0	0	0	24,255	0	49,211	0	37,309
Nov	360,592	39,217	0	0	0	0	243,865	0	18,546	0	0
Dec	270,970	15,795	8,754	0	0	0	13,165	0	0	0	49,138
Total	10,269,163	2,998,815	1,038,066	828,552	543,291	259,245	337,965	810,710	359,812	255,982	354,431

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies Engraulidae	white croaker *Genyonemus lineatus*	northern lampfish *Stenobrachius leucopsarus*	blennies *Hypsoblennius* spp	California smoothtongue *Leuroglossus stilbius*	diamond turbot *Hypsopsetta guttulata*	queenfish *Seriphus politus*	sanddabs *Citharichthys* spp	California halibut *Paralichthys* spp	gobies CIQ gobies
Actual Flow 2009											
Jan	9,005	640	970	949	0	0	114	0	247	816	2,394
Feb	224,250	22,997	39,966	59,949	0	0	0	0	0	0	0
Mar	85,635	0	18,869	597	420	10,814	6,262	0	4,182	0	7,071
Apr	1,784,796	456,225	817,166	70,212	0	105,095	58,038	0	30,995	2,989	29,012
May	106,130	73,011	0	5,346	1,489	0	0	0	7,873	8,878	0
Jun	22,554	12,292	0	277	6,828	0	0	0	0	0	149
Jul	290,219	81,982	0	5,275	63,476	0	0	4,499	0	69,383	28,043
Aug	328,368	71,441	0	35,730	40,661	0	0	17,985	34,116	14,388	3,272
Sep	1,402,521	226,784	0	136,188	166,069	0	0	52,668	188,263	81,192	26,143
Oct	189,965	0	42,952	0	0	0	19,740	0	15,492	0	30,598
Nov	4,237	335	0	0	0	0	3,235	0	108	0	0
Dec	2,977	0	740	0	0	0	0	0	0	0	1,480
Total	4,450,658	945,707	920,663	314,522	278,942	115,909	87,389	75,151	281,276	177,647	128,161

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies Engraulidae	white croaker *Genyonemus lineatus*	northern lampfish *Stenobrachius leucopsarus*	blennies *Hypsoblennius* spp	California smoothtongue *Leuroglossus stilbius*	diamond turbot *Hypsopsetta guttulata*	queenfish *Seriphus politus*	sanddabs *Citharichthys* spp	California halibut *Paralichthys* spp	gobies CIQ gobies
Average Actual Flow 2006-2009											
Jan	17,984	800	1,875	1,245	0	0	819	0	647	2,363	3,891
Feb	71,872	6,948	13,024	19,536	0	0	0	0	0	0	0
Mar	317,293	2,059	61,763	2,863	3,463	69,913	10,523	0	7,579	0	42,119
Apr	2,065,381	746,707	591,731	184,742	8,216	47,335	33,031	7,288	14,270	25,972	13,164
May	368,588	291,908	0	27,312	1,380	0	0	0	8,486	14,563	0
Jun	1,008,526	805,351	0	28,328	80,807	0	0	0	0	0	7,973
Jul	1,047,847	670,062	0	32,202	93,176	0	0	11,633	0	97,460	50,364
Aug	1,395,185	348,946	0	157,716	161,155	0	0	428,392	48,153	20,812	30,642
Sep	1,292,395	212,684	0	126,081	154,910	0	0	48,817	174,084	74,126	20,257
Oct	215,983	5,357	46,572	0	0	0	30,082	0	21,416	0	28,385
Nov	181,440	19,023	9,666	0	0	0	108,357	0	7,402	0	3,433
Dec	131,173	8,382	4,470	0	0	0	3,642	0	0	0	21,579
Total	8,113,666	3,118,226	729,100	580,025	503,106	117,247	186,455	496,130	282,037	235,296	221,807

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	**Total Fish Larvae**	**anchovies**	**white croaker**	**northern lampfish**	**blennies**	**California smoothtongue**	**diamond turbot**	**queenfish**	**sanddabs**	**California halibut**	**gobies**
		Engraulidae	***Genyonemus lineatus***	***Stenobrachius leucopsarus***	***Hypsoblennius* spp**	***Leuroglossus stilbius***	***Hypsopsetta guttulata***	***Seriphus politus***	***Citharichthys* spp**	***Paralichthys* spp**	**CIQ gobies**
Design Flow											
Jan	1,114,020	46,061	101,625	85,383	0	0	41,940	0	44,388	143,087	254,399
Feb	738,612	73,243	133,618	200,427	0	0	0	0	0	0	0
Mar	4,956,358	43,086	937,296	48,675	57,083	1,207,026	125,658	0	87,813	0	679,772
Apr	10,603,157	3,703,567	3,083,369	974,635	41,510	237,047	175,809	39,816	68,188	127,918	67,677
May	4,666,598	3,690,822	0	321,035	107,190	0	0	0	61,953	139,746	10,730
Jun	4,506,745	3,228,016	0	86,756	607,411	0	0	0	0	0	60,803
Jul	2,213,842	1,406,877	0	70,024	189,919	0	0	30,365	0	191,676	114,507
Aug	3,220,330	853,005	0	363,608	365,843	0	0	997,462	88,143	36,999	78,214
Sep	2,450,067	395,326	0	233,348	286,647	0	0	91,462	323,192	135,663	62,414
Oct	1,080,127	19,671	197,922	0	0	0	118,100	0	142,165	0	167,368
Nov	1,388,332	144,967	57,089	0	0	0	801,341	0	57,265	0	30,951
Dec	1,526,067	94,079	47,348	0	0	0	43,245	0	0	0	263,686
Total	38,464,252	13,698,718	4,558,266	2,383,891	1,655,603	1,444,073	1,306,093	1,159,106	873,108	775,089	1,790,520

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies *Engraulidae*	white croaker *Genyonemus lineatus*	northern lampfish *Stenobrachius leucopsarus*	blennies *Hypsoblennius* spp	California smoothtongue *Leuroglossus stilbius*	diamond turbot *Hypsopsetta guttulata*	queenfish *Seriphus politus*	sanddabs *Citharichthys* spp	California halibut *Paralichthys* spp	gobies CIQ gobies
Projected VSD Flow 2006											
Jan	1,441	113	113	104	0	0	46	0	272	313	268
Feb	2,542	48	526	788	0	0	0	0	0	0	0
Mar	74,937	0	19,159	53	0	9,571	6,012	0	4,951	0	3,201
Apr	430,288	106,347	136,260	45,450	2,937	7,413	6,650	2,667	2,069	6,093	1,965
May	381,074	311,402	0	31,457	965	0	0	0	2,913	11,453	0
Jun	574,295	451,181	0	13,862	52,018	0	0	0	0	0	5,317
Jul	512,373	319,166	0	11,780	48,520	0	0	7,516	0	57,884	25,819
Aug	224,023	50,133	0	27,650	26,625	0	0	97,982	404	226	6,120
Sep	364,294	66,777	0	31,755	42,814	0	0	15,821	45,233	11,991	12,781
Oct	18,474	0	490	0	0	0	500	0	7,226	0	1,297
Nov	16,123	1,408	2,129	0	0	0	8,154	0	287	0	756
Dec	2,690	161	0	0	0	0	281	0	0	0	440
Total	2,602,554	1,306,736	158,677	162,900	173,879	16,984	21,643	123,985	63,353	87,961	57,966

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies Engraulidae	white croaker *Genyonemus lineatus*	northern lampfish *Stenobrachius leucopsarus*	blennies *Hypsoblennius spp*	California smoothtongue *Leuroglossus stilbius*	diamond turbot *Hypsopsetta guttulata*	queenfish *Seriphus politus*	sanddabs *Citharichthys spp*	California halibut *Paralichthys spp*	gobies CIQ gobies
Projected VSD Flow 2007											
Jan	1,726	0	146	313	0	0	236	0	54	256	156
Feb	4,232	240	876	1,314	0	0	0	0	0	0	0
Mar	9,346	0	1,983	158	0	3,752	149	0	115	0	412
Apr	562,716	354,524	91,804	39,758	0	11,738	5,828	0	3,998	7,528	3,270
May	35,552	26,177	0	1,570	501	0	0	0	2,104	2,525	0
Jun	525,545	416,322	0	12,610	45,152	0	0	0	0	0	4,579
Jul	857,968	623,462	0	22,707	44,513	0	0	14,529	0	50,853	37,357
Aug	979,238	262,812	0	89,602	104,415	0	0	232,645	50,016	9,716	30,211
Sep	801,503	154,927	0	73,354	98,205	0	0	38,717	105,545	26,833	1,387
Oct	124,292	4,591	37,594	0	0	0	22,503	0	2,007	0	13,110
Nov	122,459	12,324	10,381	0	0	0	66,003	0	4,707	0	3,687
Dec	107,385	7,443	4,884	0	0	0	337	0	0	0	17,480
Total	4,131,962	1,862,822	147,668	241,385	292,787	15,490	95,057	285,891	168,546	97,711	111,649

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies Engraulidae	white croaker *Genyonemus lineatus*	northern lampfish *Stenobrachius leucopsarus*	blennies *Hypsoblennius spp*	California smoothtongue *Leuroglossus stilbius*	diamond turbot *Hypsopsetta guttulata*	queenfish *Seriphus politus*	sanddabs *Citharichthys spp*	California halibut *Paralichthys spp*	gobies CIQ gobies
Projected VSD Flow 2008											
Jan	26,300	1,494	2,897	851	0	0	1,041	0	646	3,332	6,332
Feb	12,512	1,104	2,365	3,548	0	0	0	0	0	0	0
Mar	328,925	2,341	58,669	3,788	4,617	74,456	7,908	0	5,526	0	52,625
Apr	921,252	210,017	265,950	131,653	8,259	7,201	11,937	6,137	2,042	16,847	1,927
May	34,027	22,423	0	464	309	0	0	0	3,124	4,016	0
Jun	465,305	424,994	0	16,941	4,244	0	0	0	0	0	131
Jul	260,565	168,500	0	6,538	23,660	0	0	372	0	40,567	7,220
Aug	803,026	226,130	0	74,852	83,728	0	0	234,637	26,437	8,295	29,682
Sep	548,910	98,231	0	51,124	66,010	0	0	23,338	72,213	23,710	9,462
Oct	83,010	1,744	8,482	0	0	0	7,194	0	15,839	0	15,119
Nov	118,039	12,780	0	0	0	0	80,134	0	6,891	0	0
Dec	99,782	5,819	3,475	0	0	0	4,635	0	0	0	18,600
Total	3,701,653	1,175,577	341,838	289,759	190,827	81,658	112,849	264,484	132,719	96,768	141,098

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius spp*	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys spp*	*Paralichthys spp*	CIQ gobies
Projected VSD Flow 2009											
Jan	3,967	282	428	418	0	0	50	0	109	360	1,055
Feb	66,653	6,564	11,518	17,276	0	0	0	0	0	0	0
Mar	37,725	0	8,312	263	185	4,764	2,759	0	1,842	0	3,115
Apr	495,509	127,457	224,870	21,329	0	28,748	15,779	0	8,651	880	7,943
May	36,702	25,190	0	2,355	656	0	0	0	2,512	2,762	0
Jun	9,936	5,415	0	122	3,008	0	0	0	0	0	66
Jul	91,889	27,360	0	1,961	18,533	0	0	1,638	0	22,900	8,117
Aug	126,871	28,161	0	12,983	15,331	0	0	7,746	13,392	4,586	1,441
Sep	409,831	69,587	0	38,723	48,352	0	0	17,089	54,438	20,307	7,211
Oct	59,528	0	12,719	0	0	0	5,085	0	6,825	0	10,007
Nov	1,867	147	0	0	0	0	1,425	0	48	0	0
Dec	1,312	0	326	0	0	0	0	0	0	0	652
Total	1,341,790	290,164	258,172	95,429	86,065	33,512	25,098	26,474	87,817	51,794	39,606

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Average Actual '06-'09	8,113,666	3,118,226	729,100	580,025	503,106	117,247	186,455	496,130	282,037	235,296	221,807
Range (max-min)	6,070,808	3,846,051	560,623	514,031	462,786	214,074	281,882	735,559	227,220	115,646	226,270
VSD Reductions in Entrainment from Actual Flows											
VSD Reduction 2006	4,610,822	2,429,890	321,550	327,170	274,584	28,187	34,439	237,543	69,239	126,300	87,212
% Reduction 2006	63.92%	65.03%	66.96%	66.76%	61.23%	62.40%	61.41%	65.71%	52.22%	58.95%	60.07%
VSD Reduction 2007	6,389,504	2,928,936	329,776	445,570	448,940	33,173	169,327	451,238	185,923	195,582	147,809
% Reduction 2007	60.73%	61.12%	69.07%	64.86%	60.53%	68.17%	64.05%	61.22%	52.45%	66.68%	56.97%
VSD Reduction 2008	6,567,510	1,823,237	696,228	538,794	352,465	177,587	225,116	546,227	227,093	159,214	213,333
% Reduction 2008	63.95%	60.80%	67.07%	65.03%	64.88%	68.50%	66.61%	67.38%	63.11%	62.20%	60.19%
VSD Reduction 2009	3,108,868	655,544	662,491	219,092	192,877	82,397	62,291	48,678	193,459	125,853	88,555
% Reduction 2009	69.85%	69.32%	71.96%	69.66%	69.15%	71.09%	71.28%	64.77%	68.78%	70.84%	69.10%
Average Reduction	64.61%	64.07%	68.76%	66.58%	63.94%	67.54%	65.84%	64.77%	59.14%	64.67%	61.58%
Design Flow Totals	38,464,252	13,698,718	4,558,266	2,383,891	1,655,603	1,444,073	1,306,093	1,159,106	873,108	775,089	1,790,520
VSD Reductions in Entrainment from Design Flows											
VSD Reduction 2006	35,861,698	12,391,982	4,399,589	2,220,992	1,481,725	1,427,089	1,284,450	1,035,121	809,755	687,128	1,732,554
% Reduction 2006	93.23%	90.46%	96.52%	93.17%	89.50%	98.82%	98.34%	89.30%	92.74%	88.65%	96.76%
VSD Reduction 2007	34,332,291	11,835,895	4,410,598	2,142,506	1,362,816	1,428,583	1,211,036	873,215	704,562	677,378	1,678,871
% Reduction 2007	89.26%	86.40%	96.76%	89.87%	82.32%	98.93%	92.72%	75.34%	80.70%	87.39%	93.76%
VSD Reduction 2008	34,762,599	12,523,141	4,216,428	2,094,133	1,464,776	1,362,416	1,193,244	894,622	740,389	678,321	1,649,421
% Reduction 2008	90.38%	91.42%	92.50%	87.85%	88.47%	94.35%	91.36%	77.18%	84.80%	87.52%	92.12%
VSD Reduction 2009	37,122,462	13,408,554	4,300,094	2,288,462	1,569,538	1,410,561	1,280,995	1,132,632	785,292	723,295	1,750,913
% Reduction 2009	96.51%	97.88%	94.34%	96.00%	94.80%	97.68%	98.08%	97.72%	89.94%	93.32%	97.79%
Average Reduction	92.34%	91.54%	95.03%	91.72%	88.77%	97.44%	95.13%	84.88%	87.05%	89.22%	95.11%

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

		yellowfin goby	gobies	blennies	clingfish	longjaw mudsucker	anchovies
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius spp***	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Actual Flow 2006							
Jan	353,104	0	304,628	0	7,806	24,282	0
Feb	3,075,835	2,047,050	943,279	5,411	0	26,715	0
Mar	1,299,988	806,321	289,215	3,391	4,263	10,927	0
Apr	952,147	546,849	210,011	13,322	17,592	10,497	714
May	5,317,127	79,241	795,603	3,134,352	140,380	198,233	12,546
Jun	1,008,185	12,480	334,148	191,062	57,437	6,030	0
Jul	3,282,943	0	1,823,444	497,975	155,945	17,553	2,523
Aug	5,336,603	0	4,700,869	316,644	21,375	0	19,853
Sep	3,290,539	0	2,922,797	117,438	122,018	0	0
Oct	28,349	0	24,316	1,479	0	2,553	0
Nov	2,615,680	0	2,402,826	100,399	2,144	42,804	0
Dec	2,497,043	0	2,034,577	178,503	10,467	24,548	0
Total	29,057,544	3,491,941	16,785,712	4,559,975	539,427	364,142	35,635

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Actual Flow 2007							
Jan	881,802	0	773,296	0	14,974	13,687	0
Feb	430,188	286,452	132,275	601	0	3,678	0
Mar	1,290,813	799,822	254,330	3,017	2,174	8,171	0
Apr	1,006,554	346,644	218,659	248,108	50,970	18,682	1,523
May	5,292,954	66,847	757,600	3,269,808	156,164	167,207	9,385
Jun	1,248,012	15,659	379,364	211,021	65,921	7,549	0
Jul	2,716,356	0	1,696,375	355,095	107,290	11,702	3,665
Aug	7,421,263	0	6,493,923	449,129	30,875	0	25,271
Sep	2,583,067	0	2,171,090	128,201	100,472	0	0
Oct	3,451,525	0	3,279,602	58,832	22,523	32,186	0
Nov	1,736,798	0	1,604,734	59,196	1,429	33,120	0
Dec	2,610,567	0	2,143,336	183,372	10,537	24,758	0
Total	30,669,899	1,515,423	19,904,584	4,966,381	563,328	320,740	39,844

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Actual Flow 2008							
Jan	2,679,650	0	2,348,720	0	43,486	58,804	0
Feb	6,153,840	4,097,205	1,883,563	11,605	0	54,111	0
Mar	3,467,361	2,343,213	724,153	3,865	10,961	29,438	0
Apr	4,503,758	2,236,570	940,211	494,490	118,553	51,778	3,568
May	2,749,458	33,226	392,622	1,723,104	97,128	78,043	3,793
Jun	982,113	7,165	306,419	109,335	47,000	3,561	0
Jul	1,986,566	0	1,048,312	317,445	101,794	11,191	1,047
Aug	7,488,839	0	6,665,623	404,869	31,825	0	26,748
Sep	5,011,187	0	4,549,616	184,535	144,315	0	0
Oct	4,667,585	0	4,382,234	141,280	52,884	30,582	0
Nov	6,686,469	0	6,197,366	212,186	5,193	105,966	0
Dec	3,796,615	0	3,101,205	257,039	16,909	35,676	0
Total	50,173,441	8,717,379	32,540,045	3,859,754	670,049	459,150	35,157

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Actual Flow 2009							
Jan	4,276,023	0	3,756,182	0	68,677	100,205	0
Feb	11,893,115	8,754,419	2,841,568	29,849	0	148,497	0
Mar	5,849,182	4,060,227	1,372,877	4,317	30,796	66,616	0
Apr	3,627,060	1,076,500	858,429	978,387	238,168	78,705	7,850
May	5,552,478	72,110	797,933	3,421,313	184,391	175,783	9,483
Jun	64,326	0	23,404	4,742	3,432	0	0
Jul	2,525,384	0	1,449,935	370,201	112,956	12,956	2,380
Aug	1,437,082	0	1,117,326	147,535	4,560	0	3,903
Sep	6,397,313	0	5,705,011	275,266	180,351	0	0
Oct	3,049,089	0	2,871,298	78,045	31,379	19,600	0
Nov	1,887,744	0	1,784,834	34,210	0	36,856	0
Dec	3,227,538	0	2,663,166	196,083	14,467	31,446	0
Total	49,786,334	13,963,255	25,241,964	5,539,946	869,177	670,663	23,616

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

		yellowfin goby	**gobies**	**blennies**	**clingfish**	**longjaw mudsucker**	**anchovies**
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius* spp**	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Average Actual Flow 2006-2009							
Jan	2,047,645	0	1,795,706	0	33,736	49,245	0
Feb	5,388,245	3,796,282	1,450,171	11,866	0	58,250	0
Mar	2,976,836	2,002,396	660,144	3,648	12,048	28,788	0
Apr	2,522,379	1,051,641	556,827	433,577	106,321	39,916	3,414
May	4,728,004	62,856	685,939	2,887,144	144,516	154,817	8,802
Jun	825,659	8,826	260,834	129,040	43,448	4,285	0
Jul	2,627,812	0	1,504,517	385,179	119,496	13,351	2,404
Aug	5,420,947	0	4,744,435	329,544	22,159	0	18,944
Sep	4,320,527	0	3,837,128	176,360	136,789	0	0
Oct	2,799,137	0	2,639,363	69,909	26,697	21,230	0
Nov	3,231,673	0	2,997,440	101,498	2,192	54,686	0
Dec	3,032,941	0	2,485,571	203,749	13,095	29,107	0
Total	39,921,805	6,921,999	23,618,076	4,731,514	660,495	453,674	33,563

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Design Flow							
Jan	6,731,911	0	5,915,400	0	109,390	161,576	0
Feb	32,645,222	24,361,818	7,506,688	78,135	0	405,391	0
Mar	12,873,889	8,438,035	3,110,012	22,556	66,448	143,224	0
Apr	15,660,213	8,279,382	3,382,120	1,081,261	384,109	181,170	15,986
May	11,781,286	175,213	1,785,600	6,945,182	352,418	427,759	25,676
Jun	2,495,792	38,721	854,221	619,366	154,756	19,371	0
Jul	4,555,247	0	2,626,136	654,146	200,953	23,404	4,571
Aug	11,488,592	0	9,973,066	754,484	43,320	0	43,428
Sep	9,649,061	0	8,706,199	306,725	338,424	0	0
Oct	7,370,265	0	6,957,273	203,085	79,434	37,415	0
Nov	8,544,839	0	7,948,178	257,301	5,718	144,090	0
Dec	9,292,499	0	7,588,189	525,220	50,046	106,750	0
Total	133,088,817	41,293,169	66,353,081	11,447,462	1,785,016	1,650,151	89,661

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Projected VSD Flow 2006							
Jan	81,635	0	70,784	0	1,666	4,746	0
Feb	970,629	643,909	299,320	1,794	0	8,535	0
Mar	490,697	301,652	109,080	1,244	1,629	4,034	0
Apr	307,215	173,849	72,276	4,830	6,399	3,635	256
May	2,024,108	30,614	302,306	1,191,195	54,656	76,042	4,831
Jun	384,656	4,756	127,421	70,040	21,927	2,051	0
Jul	1,298,070	0	714,736	204,064	63,856	6,868	955
Aug	1,811,643	0	1,585,706	111,818	7,218	0	6,583
Sep	1,160,113	0	1,016,037	47,653	44,605	0	0
Oct	10,247	0	8,789	535	0	923	0
Nov	999,145	0	915,921	38,059	940	16,855	0
Dec	934,935	0	767,002	65,508	3,971	8,870	0
Total	10,473,093	1,154,781	5,989,379	1,736,739	206,867	132,558	12,624

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

		yellowfin goby	**gobies**	**blennies**	**clingfish**	**longjaw mudsucker**	**anchovies**
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius* spp**	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Projected VSD Flow 2007							
Jan	313,176	0	274,866	0	5,401	4,751	0
Feb	155,490	103,537	47,810	217	0	1,329	0
Mar	477,493	296,899	93,468	1,142	661	2,822	0
Apr	366,776	125,361	79,883	90,684	19,305	6,967	550
May	1,860,760	22,763	258,376	1,167,017	57,459	55,982	3,099
Jun	424,212	6,390	134,315	83,781	24,166	2,866	0
Jul	953,278	0	567,005	136,152	41,482	4,412	1,023
Aug	2,345,138	0	2,022,870	158,265	9,071	0	8,055
Sep	878,600	0	725,574	50,111	34,363	0	0
Oct	1,172,880	0	1,109,679	22,068	7,756	15,204	0
Nov	606,352	0	558,593	21,291	517	12,305	0
Dec	1,041,138	0	863,402	70,277	3,939	9,497	0
Total	10,595,291	554,950	6,735,841	1,801,004	204,121	116,135	12,728

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

		yellowfin goby	**gobies**	**blennies**	**clingfish**	**longjaw mudsucker**	**anchovies**
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius* spp**	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Projected VSD Flow 2008							
Jan	1,127,734	0	987,052	0	18,435	21,134	0
Feb	1,790,618	1,187,108	552,786	3,374	0	15,904	0
Mar	1,362,641	924,194	278,857	1,433	3,811	11,001	0
Apr	1,698,642	833,963	348,038	195,267	42,778	19,047	1,402
May	965,199	11,916	141,093	597,004	30,106	28,341	1,501
Jun	274,725	3,067	86,199	38,424	14,147	1,246	0
Jul	776,414	0	401,804	127,300	40,464	4,509	339
Aug	2,240,672	0	1,974,111	131,077	8,942	0	8,123
Sep	1,525,961	0	1,365,652	64,380	49,077	0	0
Oct	1,591,846	0	1,477,904	52,358	18,138	17,221	0
Nov	2,306,869	0	2,142,756	70,987	1,788	38,125	0
Dec	1,257,989	0	1,018,361	88,120	6,480	11,581	0
Total	16,919,308	2,960,248	10,774,614	1,369,725	234,166	168,110	11,365

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

		yellowfin goby	gobies	blennies	clingfish	longjaw mudsucker	anchovies
	Total Fish Larvae	*Acanthogobius flavimanus*	CIQ gobies	*Hypsoblennius* spp	*Gobiesox rhessodon*	*Gillichthys mirabilis*	*Engraulis mordax*
Projected VSD Flow 2009							
Jan	1,492,177	0	1,319,431	0	22,614	30,695	0
Feb	4,186,040	3,131,298	957,098	9,324	0	50,801	0
Mar	2,083,258	1,444,710	490,661	1,824	10,818	21,481	0
Apr	1,308,845	401,410	325,346	332,315	80,024	29,122	3,201
May	2,025,277	26,700	295,386	1,237,903	66,283	65,326	3,561
Jun	22,170	0	7,756	1,881	1,100	0	0
Jul	987,018	0	551,428	149,274	45,942	5,320	814
Aug	486,938	0	361,930	57,439	1,393	0	1,180
Sep	2,616,434	0	2,328,350	115,778	72,519	0	0
Oct	976,406	0	919,608	25,251	10,288	4,473	0
Nov	602,916	0	571,707	10,417	0	10,314	0
Dec	1,020,184	0	847,378	62,919	4,457	9,609	0
Total	17,807,664	5,004,117	8,976,077	2,004,326	315,437	227,141	8,755

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Average Actual '06-'09	39,921,805	6,921,999	23,618,076	4,731,514	660,495	453,674	33,563
Range (max-min)	21,115,897	12,447,832	15,754,332	1,680,192	329,750	349,924	16,228
VSD Reductions in Entrainment from Actual Flows							
VSD Reduction 2006	18,584,451	2,337,160	10,796,334	2,823,235	332,560	231,584	23,011
% Reduction 2006	63.96%	66.93%	64.32%	61.91%	61.65%	63.60%	64.57%
VSD Reduction 2007	20,074,608	960,473	13,168,743	3,165,377	359,207	204,604	27,116
% Reduction 2007	65.45%	63.38%	66.16%	63.74%	63.77%	63.79%	68.06%
VSD Reduction 2008	33,254,134	5,757,132	21,765,430	2,490,029	435,883	291,040	23,792
% Reduction 2008	66.28%	66.04%	66.89%	64.51%	65.05%	63.39%	67.67%
VSD Reduction 2009	31,978,670	8,959,137	16,265,887	3,535,620	553,740	443,523	14,861
% Reduction 2009	64.23%	64.16%	64.44%	63.82%	63.71%	66.13%	62.93%
Average Reduction	64.98%	65.13%	65.45%	63.50%	63.54%	64.23%	65.81%
Design Flow Totals	133,088,817	41,293,169	66,353,081	11,447,462	1,785,016	1,650,151	89,661
VSD Reductions in Entrainment from Design Flows							
VSD Reduction 2006	122,615,724	40,138,388	60,363,703	9,710,722	1,578,149	1,517,593	77,037
% Reduction 2006	92.13%	97.20%	90.97%	84.83%	88.41%	91.97%	85.92%
VSD Reduction 2007	122,493,526	40,738,220	59,617,240	9,646,458	1,580,896	1,534,016	76,934
% Reduction 2007	92.04%	98.66%	89.85%	84.27%	88.56%	92.96%	85.80%
VSD Reduction 2008	116,169,509	38,332,922	55,578,467	10,077,737	1,550,850	1,482,041	78,296
% Reduction 2008	87.29%	92.83%	83.76%	88.03%	86.88%	89.81%	87.32%
VSD Reduction 2009	115,281,153	36,289,052	57,377,004	9,443,136	1,469,579	1,423,010	80,906
% Reduction 2009	86.62%	87.88%	86.47%	82.49%	82.33%	86.24%	90.24%
Average Reduction	89.52%	94.14%	87.76%	84.91%	86.55%	90.24%	87.32%

Exhibit G

DISCUSSION OF MARKET AND CONTRACTING FACTORS RELATED TO INVESTMENT IN COMPLIANCE MEASURES FOR THE ONCE-THROUGH COOLING POLICY

AT

GENON'S MANDALAY, ORMOND BEACH & PITTSBURG GENERATING STATIONS

ORGANIZATION

DISCUSSION OF MARKET AND CONTRACTING FACTORS RELATED TO INVESTMENT IN COMPLIANCE MEASURES

GenOn West, L.P. has prepared Implementation Plans for the Mandalay Generating Station (MGS) and the Ormond Beach Generating Station (OBGS), and GenOn Delta, LLC has prepared an Implementation Plan for the Pittsburg Generating Station (PGS) to comply with the State Water Resources Control Board's (State Board) "Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling" (Policy).[1] GenOn has a viable Track 1 compliance plan for the PGS, and viable Track 2 compliance plans for the MGS and OBGS. Even though GenOn has viable compliance plans for each station, GenOn is unable at this time to make an unqualified commitment to the significant investment necessary to comply with Track 1 of the Policy at PGS, nor is GenOn necessarily able to commit to the investment required for compliance under Track 2 at the MGS and OBGS in light of significant market-based uncertainties facing independent power producers in California.[2] The purpose of this exhibit is to provide background and explain the market-based constraints that prevent GenOn from making an unqualified commitment to the significant capital investment required to undertake compliance with the Policy. If GenOn cannot secure the funding necessary to make the investment necessary to implement the identified Track 1 and Track 2 compliance measures, then GenOn would likely be forced to retire or repower its effected units.

This Exhibit first provides an overview of the criteria by which GenOn must evaluate incremental investment decisions, and then describes the reliability services that GenOn's once through cooled generating units are capable of providing. An overview of the contracting and market opportunities through which GenOn is compensated for providing reliability services is then presented, followed by a discussion of the external factors that contribute to the uncertainty GenOn faces in forecasting the future net revenues from the sale of these reliability services. This exhibit concludes with a summary of why, as of April 1, 2011, these uncertainties prevent GenOn from making an unqualified commitment to the investment required for the compliance measures described in the Implementation Plans for the PGS, MGS and OBGS.

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[1] Hereafter, GenOnWest, L.P. and GenOnDelta, LLC, either individually or collectively, are referred to as "GenOn." This Exhibit is common to the each of the Implementation Plans submitted by GenOn for the PGS, MGS and OBGS,

[2] For the PGS, Track 1 compliance would involve retirement of PGS Unit 7 and conversion of that unit's cooling towers for use by PGS Units 5 and 6. Track 1 compliance at the MGS and OBGS would require investment in new cooling towers, if feasible, while Track 2 would require the implementation of one or more technological measures to reduce impingement mortality and entrainment and may involve operating restrictions that could have a significant impact on revenues.

1. Investment Criteria

GenOn is a competitive energy company that produces and sells electricity in the United States. GenOn is focused on the operational performance of our generating facilities, and prudent growth of our business. GenOn makes major investments in environmental controls, and also employs a targeted maintenance program to ensure long-term availability of our generating stations. GenOn must factor in appropriate return for shareholders when deciding which investments to make, and must also comply with all covenants and restrictions associated with any project financing used to fund major capital projects.

GenOn sells capacity, energy and ancillary services on a short-term basis or through power sales agreements. GenOn is not guaranteed recovery of our costs or any return on our capital investments through regulated rates. Whether an appropriate return can be earned for investors depends on the sufficiency and the certainty of net revenues after meeting all operation and maintenance expenses, ordinary capital expenditures and payment obligations on any project financing. Operating revenue depends on market and competitive forces that are beyond GenOn's control.

Retrofit to closed-cycle cooling to comply with Track 1, or implementation of a combination of measures to meet Track 2 would require a significant investment as explained in each Implementation Plan. Given the uncertainty regarding the fixed and annual costs of compliance with the Policy, as well as significant uncertainty regarding revenues, GenOn cannot reasonably assure that it will recover the investment required for cooling towers, or any other combination of technologies and operating restrictions that might allow the generating units to comply with the Policy, and is therefore unable at this time to commit without qualification to those investments. These factors are discussed in more detail below.

2. Operating Characteristics and Available Services

The following describes the existing operating characteristics and capabilities of the MGS, OBGS and PGS. When matched with the contracting and market opportunities discussed later, these capabilities define the potential revenues that must support any capital investment at those plants.

A. Operating Characteristics

The operating characteristics of the PGS, MGS and OBGS allow these plants to play a key role in supporting reliable operation of the electric grid.

An important characteristic of each station is its location. The California Independent System Operator (CAISO) relies on the PGS, MGS and OBGS units to support local and system reliability during maintenance of the high voltage grid. Both the MGS and OBGS are in the Big Creek Ventura Area, and are used by the CAISO to assure that load in Ventura and Santa Barbara Counties can be served when the transmission lines providing imports to the local area are threatened, particularly by fires or other natural disasters.

The MGS and OBGS turbines also provide rotating mass that contributes inertia required to support imports into Southern California.

The PGS is located in the Pittsburg sub-area of the Greater Bay Area. The PGS supports grid operations in the Greater Bay Area and provides support for the transmission system in the North Bay Area as well. This support not only protects the local grid but enables imports into the load centers located in the Bay Area from the bulk transmission system connecting the Bay Area with northern California and the Northwest.

The MGS units have relatively quick start-up times, particularly when the units are hot and start times are less than two hours. This allows the CAISO to cycle these units daily. The minimum load of each unit is 20 MW, which is less than 10% of the peak capability. The OBGS and PGS units have wide operating ranges and fast ramp rates which are important characteristics for reliability purposes.[3] While the OBGS ramp rates are already high (e.g. up to 12 MW/Min), there is on-going analysis to increase OBGS ramp rates to even higher levels in response to forecasted flexibility needs. Both OBGS units have also been tested to operate at reduced minimum loads.

While there are some key differences among the PGS, MGS and OBGS stations, each station plays an important role in supporting electric system reliability and integrating intermittent renewable resources. The services available from these facilities are described in more detail below.

B. Available Services

The CAISO presently relies on several services provided by the PGS, MGS and OBGS. Some of these services are defined as market products that are procured in advance of the operating day, and for which there is some degree of fungibility so that the products can be competitively procured and priced. The services available from each unit represent the potential sources of revenue. Contracting and market mechanisms to compensate suppliers for providing these services are discussed later.

1. Resource Adequacy (RA) Capacity

The CAISO performs technical studies to establish minimum capacity requirements for each of several “local reliability areas” to assure that load in those areas can be reliably served. All load-serving entities (LSEs) are then required to demonstrate that they have procured sufficient “net qualifying capacity” to serve their peak load, plus a planning reserve margin of 15% to 17%. The net qualifying capacity of each resource is determined by the CAISO based on testing, verification, applicable performance criteria and deliverability for the purpose of meeting peak demands, based on rules for determining the qualifying capacity of each resource type as established by the California Public Utilities Commission (CPUC). According to this process, the MGS, PGS and OBGS have net qualifying capacity equal to the maximum output of each unit, as shown below:

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[3] An operating range is the difference between a unit’s Net Qualifying Capacity and its Pmin. In the case of OBGS Unit 2, the operating range is 725 MW (NQC of 775 MW minus Pmin of 50 MW).

Unit	Net Qualifying Capacity (MW)
PGS 5	312
PGS 6	317
PGS 7	682
MGS 1	215
MGS 2	215
OBGS 1	741
OBGS 2	775

As explained in more detail below, the CAISO performs technical studies to establish minimum capacity requirements for each identified local reliability area to assure that load in those areas can be served without violating transmission constraints. Some portion of the total capacity required to serve load in each of these local reliability areas is then required to be located within the local reliability area (i.e., that portion of the capacity requirement cannot be provided by resources external to the local reliability area).

RA capacity is obligated to be available and capable of being committed and dispatched. Since the CAISO could call on these units at any time, the PGS, MGS and OBGS units support reliability of the grid even when the units are off-line and not producing energy. The RA capacity value of these units helps assure the long term reliability of the grid, and that value is independent of how much energy they actually produce.

2. *Local Emergency Capacity*

During certain conditions that have occurred recently, the CAISO has relied upon the MGS and OBGS to assure reliable electric service to the local reliability area. For example, due to wildfires in September 2009 that were threatening the transmission lines across which energy is imported to Santa Barbara and Ventura Counties, the CAISO relied upon the MGS and OBGS units to assure that load in these two counties could be served without interruption.

3. *Energy*

When committed and dispatched to minimum load or greater, the PGS, MGS and OBGS units provide energy that helps the CAISO perform its obligation to continuously balance loads and resources within the CAISO Balancing Authority Area, while respecting all transmission limits. Energy bids are submitted to the CAISO for use in the day-ahead and real-time markets, and the CAISO commits and dispatches resources to economically serve load and relieve any transmission congestion that might arise.

4. *Regulation*

Regulation is generally regarded as the highest value Ancillary Service that the CAISO procures to assure the reliable operation of the grid. Regulation requires a unit to change output in response to signals provided by the CAISO’s energy management system every four seconds through automatic generation control. Each of the MGS and OBGS units, and PGS Unit 5, are certified to provide regulation. The CAISO competitively procures Regulation through its markets.

5. Spinning Reserve

The CAISO is required to maintain sufficient spinning reserve, which is synchronized and available to immediately respond when dispatched. This capacity service is required so that the CAISO is able to respond when a contingency occurs, such as the loss of a major transmission line or generating unit, assuring that applicable reliability criteria are met. The CAISO competitively procures Spinning Reserve through its markets.

6. Frequency Response

Conventional generating units are synchronous machines that are electrically coupled to the grid. All of the PGS, MGS and OBGS units meet applicable WECC criteria for frequency response, and when operating and synchronized these units respond immediately and automatically in proportion to frequency deviations through the action of a governor set according to the minimum governor performance standards defined by the CAISO (i.e., 5 percent droop and +/- 0.036 Hz deadband). There is currently no CAISO market for frequency response.

7. Voltage Support

The PGS, MGS and OBGS units are operated to follow voltage schedules established by the CAISO by producing or consuming “Mvars” which is a measure of reactive power. Reactive power is necessary to maintain system voltage in an alternating current system. Synchronous generators such as the PGS, MGS and OBGS units represent one of the most flexible and effective sources of reactive power available to the grid, and play a key role in assuring the voltage stability of the grid. There is currently no CAISO market for voltage support.

8. Inertia

The MGS and OBGS play a key role in supporting energy imports to Southern California. The stability of the grid depends on assuring a balance between imports across these paths, and the amount of inertia, or rotating mass available in southern California. The PGS provides the same function for Northern California and specifically the Greater Bay Area load center, which depends on significant imported energy over several paths. There is currently no CAISO market for inertia.

3. California Electric Market Structure Overview

The purpose of this section is to explain the existing wholesale electric market design in California. This understanding is essential background to an assessment of the financial feasibility of the capital investments required to comply with the Policy.

There are two principal categories of customers – the LSEs who must purchase RA capacity (e.g. PG&E, SCE, SDG&E, energy service providers (ESPs) and local publicly-owned utilities) and the CAISO, which acts as an intermediary between suppliers and loads by operating day ahead and real time markets for energy and ancillary services. GenOn sells RA capacity from the MGS and OBGS and bids those units into the CAISO markets. For the PGS, GenOn has entered a "tolling" agreement under which PG&E has acquired the rights to all the RA capacity, energy and Ancillary Services through 2013, with an option to extend this agreement through 2015. PG&E has the right to all the PGS RA capacity, and is responsible for bidding and scheduling those units in the CAISO markets.

A. RA Program

The RA program is an existing bilateral framework administered by the CPUC, the California Energy Commission (CEC) and the CAISO. The CPUC establishes resource adequacy requirements for all LSEs in its jurisdiction, which include the three major investor-owned utilities (IOUs) serving bundled customers, and the energy service providers (ESPs) who serve load under California's rules for retail competition. Each LSE is required to maintain physical generating capacity that is both adequate to meet its load requirements (including peak demand and planning and operating reserves) and deliverable to load. The capacity procured must be sufficient to meet the planning reserve and reliability criteria established by the Western Electricity Coordinating Council.[4]

The local publicly-owned utilities in California are not under the jurisdiction of the CPUC, but are required to prudently plan for and procure resources that are adequate to meet peak demand and provide the reserves necessary to provide reliable electric service to its customers. The CEC has authority to oversee the resource adequacy programs of the local publicly-owned utilities.[5]

1. Demand Forecasts

An initial step in the annual RA process is the preparation of demand forecasts for the coming year. Each May of the year preceding the RA compliance year, LSEs regulated by the CPUC submit demand forecasts for the RA compliance year to the CEC. CEC staff review the forecasts and make adjustments as needed so that the sum of the adjusted forecasts is within one percent of the adopted CEC forecast for each distribution service area. The CEC then transmits the demand forecasts to the CPUC, which in turn transmits them to LSE's, usually in the July prior to the RA compliance year.

2. Local Capacity Technical Studies

Each year the CAISO conducts a Local Capacity Area Technical Study (referred to as the Local Capacity Requirements or LCR Study) to identify the minimum capacity required in each local capacity area defined by the CAISO. In October 2010, the CAISO began the process to define local capacity requirements for 2012 by publishing a draft manual on the criteria, method and assumptions to be used in the LCR Study. The CAISO adopted a final manual in December 2010, presented draft results in March 2011, and will publish its final LCR report for 2012 by the end of April. The CPUC will then review the conclusions of the CAISO LCR Study in its annual resource adequacy proceeding. The CPUC adopts local capacity requirements by the end of June so that LSEs are able to procure local RA capacity for the following year in accordance with the requirements adopted by the CPUC.

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[4] Section 380 of the California Public Utilities Code.
[5] Section 9620 of the California Public Utilities Code.

The CAISO Tariff provides that in conducting the LCR Study, the CAISO will identify and resolve contingencies based on performance levels specified in North American Electric Reliability Corporation (NERC) Reliability Standards, as supplemented by CAISO reliability criteria. While the studies are carefully performed to meet the NERC standards, they are also designed to maximize the import capability in each local area and minimize the local generation required to meet reliability requirements. The CAISO identifies the most stringent contingencies based on NERC criteria, and then loads the limiting element to 100% of its applicable rating for constraints that result from equipment loading limits, while targeting the minimum allowable voltage and/or reactive margin after the most restrictive contingencies are taken.[6]

The LCR Study defines the portion of the total capacity required to serve load in each of these local reliability areas that is required to be located within the local reliability area (i.e., that portion of the capacity requirement cannot be provided by resources external to the local reliability area). The results of the LCR Study may show a surplus in a local area, but that does not necessarily mean that generation equal to that surplus can be retired. The CAISO acknowledges that not all capacity in a local area is equally effective in solving local constraints.[7] The PGS, MGS and OBGS all have high effectiveness factors. The CAISO may also require generation in local areas for other purposes that are not considered in the LCR Study. For example, additional generation in a local area may be required to allow maintenance to the high voltage transmission grid, or to provide inertia to support transmission limits and the stability of the grid.

3. *Local and System Resource Adequacy Obligations*

Based on the minimum local requirements identified in the CAISO's annual LCR Study, the CPUC adopts local capacity requirements, which are assigned to LSEs based on what share of load they serve in that local area. Each July the CPUC staff provides each LSE with load forecasts and local obligations. Each September, LSEs must demonstrate they have procured 100% of their share of the local capacity requirement for the coming year. The difference between an LSE's share of the capacity requirement for the local capacity area, and the total capacity required to serve that LSE customers in the local area, can be procured from the net qualifying capacity of any local or system resource. As explained above, the PGS is in the Greater Bay Area, and the MGS and OBGS are in the Big Creek / Ventura Area, meaning that each station is eligible to meet the local capacity obligations of LSEs under the RA program.

Each October, LSEs must demonstrate procurement of 90% of system obligations, with demonstration of remaining system obligations due on a month-ahead basis during the compliance year. The timing of these obligations defines the opportunities for marketing RA capacity from the MGS and OBGS currently, and for the PGS after the tolling agreement with PG&E expires.

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[6] California ISO, *Final Manual - 2012 Local Capacity Area Technical Study*, December 2010, page 7. (available at: http://www.caiso.com/2867/286794795d0b0.pdf)

[7] Id.

4. *Standard Capacity Product*

Operators of units with RA commitments are subject to must-offer obligations in the CAISO markets, and also are subject to availability charges and bonuses based on the extent of unplanned outages that render the resource adequacy resource unavailable for commitment and dispatch by the CAISO. The risk of non-availability charges and possible opportunity to earn availability bonuses must be taken into account during operations, and in planning outages to maintain and replace equipment.

B. Energy and Ancillary Services Markets

The CAISO provides open and non-discriminatory access to the high voltage transmission network under its operational control, operates Day Ahead markets for energy and ancillary services, and establishes schedules for energy and load that are consistent with applicable constraints on transmission facilities and other elements of the grid. In operating the day ahead market, the CAISO first assesses market power, determines what bids need to be mitigated, and then determines what reliability must-run units must be committed to meet reliability requirements. It then operates an integrated forward market to schedule resources and set prices.

The integrated forward market uses a security constrained unit commitment optimization to determine the commitment and dispatch of resources to jointly minimize the cost of required locational energy, and all ancillary services forecast to be required to meet reliability criteria each hour of the next operating day, while respecting all applicable transmission constraints. Hourly locational prices are set for energy and ancillary services. The ancillary services procured include regulation up, regulation down, spinning reserve and non-spinning reserve. To the extent that the demand scheduled in the integrated forward market falls short of the CAISO forecast, then a residual unit commitment market is run to commit additional capacity to meet the difference in forecast and scheduled demand.

A real-time unit commitment tool is used in both the hour ahead scheduling process and the real time markets to adjust energy schedules and to procure any additional ancillary services required due to changed conditions. The real-time unit commitment process is run every 15 minutes, and the CAISO dispatches energy based on bid prices to set locational marginal prices every 5 minutes to balance the system, with regulation used to provide moment to moment balancing and maintain system frequency.

C. Exceptional Dispatch

If the CAISO market models fail to reflect all applicable constraints, or do not specify all the products that the CAISO requires to reliably operate the system, then the CAISO may rely on an out-of market process referred to as “exceptional dispatch” to commit and dispatch resources based on their locational and operating characteristics. Units that are exceptionally dispatched are compensated based on mitigated bids if the exceptional dispatch is needed to relieve a non-competitive transmission constraint.

D. Reliability Must Run

The CAISO has the authority to procure uneconomic capacity that it determines to be essential to local reliability through a cost-of-service mechanism provided by reliability must-run (RMR) contracts. The CAISO makes the determination of whether a generator is required for reliability based on the LCR Study, or other technical analysis that the CAISO conducts. The RMR contract gives the CAISO the right to call on energy, or to require the supplier to provide ancillary services. When designated for RMR, a generating unit that might otherwise retire is obligated to provide the CAISO with proposed rates for reliability must-run services, which are then filed with the Federal Energy Regulatory Commission (FERC).

The RMR contract is a year-to year contracting mechanism that requires the generator to develop comprehensive cost exhibits supporting its proposed rates. Under the CAISO tariff, the RMR contract is designed for addressing local reliability, black start services, voltage support and non-competitive constraints, and does not allow the CAISO to procure or dispatch such capacity for broader system reliability purposes that might be fulfilled by other generating units.

E. Capacity Procurement Mechanism

The CAISO tariff allows the CAISO to procure capacity from resources without a resource adequacy contract under the CAISO's "interim capacity procurement mechanism" which expired March 31, 2011. The CAISO has proposed a permanent backstop capacity procurement mechanism (CPM) that would compensate resources based on their "going forward" costs. The new CPM became effective April 1, 2011.

Features of the CAISO's permanent CPM mechanism include expanded authority to designate resources without RA contracts for a CPM contract. This authority includes designations for units at risk of retirement that the CAISO determines are needed for reliability. Parties protested the CAISO's proposal at FERC, seeking changes in the purpose, pricing, term and amount of capacity that the CAISO is authorized to procure under CPM. In a March 17, 2011 decision adopting most of the CAISO's proposed design details, FERC concluded that the CAISO's proposal to pay going forward costs "may create the potential for distorted pricing signals and deny resources a reasonable opportunity to recover fixed costs," and directed FERC staff to schedule a technical conference to explore CPM pricing.[8] The ability to recover fixed costs is an essential prerequisite for GenOn to fund Track 1 or Track 2 measures required to comply with the Policy.

F. Renewable Integration and New Products

The CAISO forecasts substantial reductions in revenues to the existing thermal fleet as renewable resource penetration increases, and energy generated by thermal resources is displaced by renewable energy. Specifically, the CAISO recently concluded that:

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[8] Federal Energy Regulatory Commission, Order on Tariff Revisions, Docket No. ER11-2256-000 Order 134 FERC ¶ 61,211, paragraph 57.

> “The combination of increased production of wind and solar energy will lead to displacement of energy from thermal (gas-fired) generation in both the daily off-peak and on-peak hours. Due to this displacement and to simultaneous reduction in market clearing prices, there may be significant reductions in energy market revenues to thermal generation across the operating day in all seasons.”[9]

The revenue impact of this displacement of energy by renewable resources will depend on many factors as discussed herein, but certainly inhibits investments such as those required to comply with the Policy.

While energy revenues to thermal power plants are projected to decrease, the CAISO will have significantly greater need for many of the services these resources provide. In operating a power system, it is vital that sufficient generation resources are available to allow hourly and real-time deviations between forecasted load and supply to be balanced by the grid operator. These deviations can take place in the upward or downward direction and have historically have been caused by changes in load. With increasing reliance on intermittent renewable resources, which are characterized by deviations in output that can be large and difficult to predict, the root cause of the CAISO’s need for resources to balance the system is evolving.

Intermittent renewable resources contribute significant variability in hour-to-hour and intra-hour output, as well as significant uncertainty in forecasting that output, and generally do not contribute the same benefits of frequency response and inertia that are essential to assuring the security of the grid. As more renewable resources are added, the CAISO’s need for additional regulation, ramping, reserves and on-line capacity is likely to materially increase.

For these reasons, it is critical that the CAISO has enough dispatchable resources and other reliability services under its control. The CAISO is performing extensive analysis of the impact of California’s renewable portfolio standard (RPS) on reliable operation of the CAISO balancing area, and has concluded that substantially more ancillary service capacity will be required to integrate renewable resources.[10] At a recent symposium, the CAISO’s CEO spoke about the operational challenges in integrating renewables, and estimated that procurement of some ancillary service products will need to double or triple.[11]

To assure that the CAISO is procuring the required capability from the existing fleet of generators, the CAISO has developed a flexible ramping constraint which is incorporated into the market optimization software. By using this constraint, the CAISO can impose a minimum ramping capability across a specified period of time, which may result in

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[9] Integration of Renewable Resources - Operational Requirements and Generation Fleet Capability at 20% RPS, CAISO (Aug. 31, 2010), p. v. This report is available at the following link: http://www.caiso.com/2804/2804d036401f0.pdf.

[10] Id.

[11] Yakout Mansour, *ISO Symposium Keynote Speech*, October 19, 2010, available at: http://www.caiso.com/2836/2836f22a24980.pdf

changes in the commitment and dispatch of resources if this constraint is binding. The use of such a constraint is not fully transparent and does not properly value the capacity services that are thereby made available to the CAISO. Recognizing that new products may be required, the CAISO is initiating a process in April 2012 to examine its requirements and to consider defining new ancillary service products to facilitate the integration of intermittent renewable resources.

G. Other Western Markets

NERC is the national entity responsible for developing reliability standards, which are the planning and operating rules that assure that each operating entity supports system reliability. The Western Electricity Coordinating Council (WECC) is the regional entity responsible for coordinating reliability of the bulk electric system in the western interconnection, which includes 14 western states, two Canadian provinces, and part of Mexico. The CAISO is obligated to comply with the planning and operating standards administered by WECC and NERC, and to procure the required ancillary services to assure the reliable operation of the CAISO's balancing area.

The CAISO is the only centrally administered day-ahead and real-time market in the western states. WECC members are considering the establishment of an imbalance energy market as part of the "efficient dispatch toolkit." Such a mechanism has the potential to increase liquidity, transparency and reliability of the western interconnection.

H. Procurement Background

1. CPUC Long Term Procurement Planning (LTPP) Process

The LTPP Rulemaking provides a biennial review of the IOUs' procurement process, established pursuant to AB57. The IOUs submit LTPPs that serve as the basis for utility procurement and comprehensively integrate Commission decisions from all procurement related proceedings. By approving ten-year procurement plans in advance, the CPUC provides up-front standards for procurement which eliminates the need for after-the-fact reasonableness review by the CPUC of the specific resource procurement decisions each IOU pursues in implementing the approved procurement plan.

Independent power producers engage in the LTPP process to better understand the energy and capacity needs of the IOUs. As stated in a recent assigned commissioner ruling issued in the CPUC's current LTPP process:

> "Track I will identify California Public Utilities Commission (CPUC)-jurisdictional needs for new resources to meet system or local resource adequacy and to consider authorization of IOU procurement to meet that need, including issues related to long-term renewables planning and need for replacement generation infrastructure to eliminate reliance on power plants using once-through- cooling (OTC)."[12]

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[12] Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans, R.10-05-006, Assigned Commissioner and Administrative Law Judge's Joint Scoping Memo and Ruling (December 3, 2010), Attachment 2 (Standardized Planning Assumptions (Part 2 –

As an independent power producer in California with both existing assets and a new project in development,[13] GenOn participates in each LTPP process to understand how all of our current assets and future developments may play a role in meeting the aforementioned Track I needs.

2. *Utility and ESP Procurement Practices*

Traditionally, California's IOUs have procured capacity, energy, and ancillary products from existing assets through short-term (up to five years out) Request-For-Offer (RFO) processes. GenOn, and its predecessor companies, have always participated in these processes and it is the primary means for securing contracts for capacity, energy, and ancillary products. California's IOUs have historically purchased bundled capacity and energy products from new facilities through long-term (generally 10 years) RFO's designed specifically for new facilities. Existing assets are not eligible to participate in these "new-build" RFOs.

California's Energy Service Providers (ESPs) have a much shorter term business model and they tend to just purchase capacity and energy products a year in advance. Most of this contracting takes place bi-laterally.

The net result of the IOU and ESP purchasing practices is that there is little financial certainty beyond 2-3 years in terms of contracted revenues. Accordingly, it becomes very difficult to forecast revenues beyond this window. In addition, while market participants such as GenOn have access to forward supply and demand forecasts from various California agencies, there is very little information provided in terms of what specific generating assets will be needed in the future. Independent power producers like GenOn face substantial uncertainty in interpreting available data, forecasting future demand for services from each plant, and estimating future revenues from the sale of such services. This uncertain environment and short horizon for procurement by our customers may lead to suboptimal decisions for the broader market as capital intensive businesses such as power plant development and operation have longer term planning horizons for capital expenditures.

3. *Once-Through Cooling Capacity Replacement*

As stated in the "State Water Resources Control Board Resolution No. 2010-0020":

> The State Water Board staff formed an Interagency Working Group (IAWG) that met regularly to develop realistic implementation plans and schedules for this Policy that will ensure that the beneficial uses of the State's coastal and estuarine waters are protected while also ensuring that the electrical power needs essential for the welfare of the citizens of the State are met. The IAWG included representatives from the California Air Resources Board, the California Coastal

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Renewables) for System Resource Plans), p. 6. A copy of Attachment 2 is available at the following link: http://docs.cpuc.ca.gov/efile/RULC/127544.pdf.

[13] The Marsh Landing Generating Station, owned by GenOn Marsh Landing, LLC, an affiliate of GenOn Delta, LLC and Genon West, L.P., is currently under construction.

Commission, the California Energy Commission (CEC), the California Public Utilities Commission (CPUC), the California State Lands Commission, the California Independent System Operator (CAISO), and the State Water Board.

The compliance dates for the Policy were developed in consideration of a report produced by the energy agencies, titled "Implementation of OTC Mitigation Through Energy Infrastructure Planning and Procurement Changes."[14] The key milestones in planning for the PGS, MGS and OBGS compliance dates are set forth below:

Infrastructure Replacement Milestone	**Description**	**PGS Date**	**MGS OBGS Date**
CAISO Enhanced LCR Study	CAISO completes an enhanced Local Capacity Requirement (LCR) study identifying the impacts of specific OTC retirements or transmission developments on the local area's LCR projections 10 years out.	Q4 2009	Q4 2010
Infrastructure Replacement Plan	The CAISO, CEC, and the CPUC complete Infrastructure Replacement Plan identify the complete set of infrastructure needed to make OTC plants/units redundant for grid reliability. It would advise the SWRCB about the reliability designations of specific power plants.[15]	Q1 2010	Q2 2011
CAISO Annual Transmission Plan	Transmission solutions (upgrade and/or new addition) that would make specified OTC system redundant would be analyzed in the California ISO Annual Transmission Plan. The California ISO will consider SWRCB directives and schedules limiting or canceling water permits required to operate OTC plants/units in the 2011 and subsequent annual Transmission Planning Process (TPP). The California ISO will conduct analysis as part of its TPP reflecting projected OTC plant/unit retirements as a result of SWRCB directives and schedules, which shall be incorporated in to the California ISO's annual Transmission Plan that serves as the basis for further transmission upgrades or additions.	2011	2012
LTPP Approval	CPUC modifies LTPP proceeding and procurement processes to require the IOUs to assess replacement infrastructure needs, conduct targeted RFOs to acquire replacement or repowered generation capacity, and order the IOUs to procure new (or repowered) fossil generation for system reliability.	2011	2013
Generation Project Approval	Once authorized to procure by a CPUC LTPP decision, it takes 18 months for the IOUs to issue an RFO for generation (new or repowered), sign contracts and submit applications to the CPUC for approval. Approval by the CPUC takes 9 months.	2013	2015
CPUC Transmission Permitting	Proposed transmission facilities to meet needs identified in the California ISO Annual Transmission Plan to replace OTC plants/units would be brought to the CPUC for approval.	2015	2016

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[14] California Energy Commission, California Public Utilities Commission, California Independent System Operator, *Implementation of Once-Through Cooling Mitigation Through Energy Infrastructure Planning and Procurement*, Appendix B, July 2009, available at: http://www.energy.ca.gov/2009publications/CEC-200-2009-013/CEC-200-2009-013-SD.PDF

[15] No "Infrastructure Replacement Plan" that identifies the complete set of infrastructure needed to make OTC plants/units redundant for grid reliability has been published on the CEC, CPUC or CAISO web sites as of March 31, 2011.

Infrastructure Replacement Milestone	**Description**	**PGS Date**	**MGS OBGS Date**
Unspecified Replacement Infrastructure Operational	These compliance dates may change subject to the California ISO-Energy Commission-CPUC Infrastructure Replacement Plan produced in Q1 2010 and updated periodically. All dates assume a generation solution that requires an Energy Commission permit. If a permit has been acquired prior to CPUC contract approval, then an earlier on line date is possible. If transmission solutions are selected, then longer time lines would be expected.	2017	2020

The energy agencies worked diligently to develop the schedule outlined above, and it is instructive to consider the performance to that schedule over the 18 months since it was published. In developing the Policy, the State Board recognized that the compliance dates in this Policy may need to be revised based on the reliability needs of the electric system as determined by the energy agencies included in the Statewide Advisory Committee on Cooling Water Intake Structures (SACCWIS). Among the responsibilities of the SACCWIS is the review of generator implementation plans to consider whether or not local and system reliability has been considered.

One task planned by the energy agencies in the above schedule to support planning for the potential retirements that may arise due to the Policy is the development of “infrastructure replacement plans” in the first quarter of 2010 and 2011 that would identify the “complete set” of infrastructure needed to make OTC plants/units “redundant for grid reliability.” Although the CAISO and other agencies have performed substantial analysis and planning for OTC retirements and the impacts of building out renewable resources to serve 20% to 33% of energy serving load in California, no infrastructure replacement plans have been developed, demonstrating the significant complexity of planning for the implementation of the Policy.

4. Sources of Uncertainty

The purpose of this section is to further describe several of the important uncertainties regarding costs and revenues that GenOn faces, and to then explain how these uncertainties leave GenOn with insufficient confidence in the adequacy of net revenues to recover the cost of the substantial investment required to comply with the Policy given the current market and contracting structures, thereby preventing an unqualified commitment to such investment at this time.

A. Economic Outlook

A major source of uncertainty facing any company evaluating the merits of a major investment to comply with a regulatory policy is the economic outlook in California. The recent recession has depressed the demand for electricity. A CEC report issued in March 2011 shows reductions in forecasted peak demand for 2011 and 2012 ranging from 2.9% to 4.7% below what had previously been forecasted in 2009 for the same period.[16] In

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[16] See Miguel Garcia-Cerrutti, Tom Gorin. Chris Kavalec. Lynn Marshall. Committee Final Report: Revised Short-Term (2011-2012) Peak Demand Forecast. California Energy Commission, Electricity

other words, in a relatively short period of time, demand forecasts show significant fluctuation due to the recession. As these reductions in the demand forecasts suggest, the overall demand for electricity is less than what is was before the recession. Given the reduced demand for electricity and uncertain economic outlook, there is significant uncertainty about the volume or price of energy sales from GenOn's generating stations.

B. Environmental Mitigation Costs

Among the requirements of the Policy is the development of interim mitigation measures that must be in place by October 1, 2015. The mitigation plan may include existing mitigation efforts, or a California Coastal Conservancy project funded by GenOn, and will be overseen by a panel of experts. There is substantial uncertainty regarding the cost of this program.

As explained in the OBGS and MGS Implementation Plans, GenOn will also examine operating restrictions as a potential flow-based compliance measure to reduce impingement and entrainment. Such measures could limit the availability of these stations to provide energy and related services, potentially reducing revenues to a degree that compliance with the Policy, if dependent on such operating restrictions, is uneconomic.

C. Ongoing Capital Expenditures

GenOn employs a condition-based maintenance program to ensure that we meet reliability standards for each of our units. A condition-based maintenance program is a program in which ongoing capital expenditures are valued by the economic return of restoring equipment life and/or improving functionality. This is largely dependent on the remaining economic life of the plant over which the investment is recouped.

Availability standards are typically discussed in terms of a target for NERC Generating Availability Data System (GADS) Equivalent Forced Outage Rate for Demand ($EFOR_d$), but other factors such as contractual availability rebates and CAISO Standard Capacity Product charges also play a key role in the development of GenOn's operations and maintenance program. GenOn sets an aggressive $EFOR_d$ target for our California assets, but that target is set based on GenOn's expectation that net revenues from operations will support the capital investment required to maintain this level of reliable performance. Both the amount of capital expenditures and the adequacy of net revenues to support such investment are uncertain.

D. Renewable Integration

There is significant uncertainty regarding the extent of renewable development, the amount by which energy revenues to thermal resources are reduced, the future requirements for operating flexibility from renewable resources, and the market revenues from existing or new ancillary services procured to support renewable integration.

Supply Analysis Division. CEC-200-2011-002-CTF. This report is available at the following link: http://www.energy.ca.gov/2011publications/CEC-200-2011-002/CEC-200-2011-002-CTF.PDF .

One key challenge in forecasting the role GenOn's units would play in renewable integration is estimating the pace of renewable development and the operating characteristics of renewable projects. It is not clear as to which types of renewable projects will get fully developed, permitted and eventually built. Policy makers, regulators, and market participants are all grappling with various RPS build-out scenarios as the mix of renewable technologies (e.g. wind vs. solar), location and dispatchability can have vastly different implications in terms of reserve capacity and ancillary services required for integration.

There is also significant uncertainty about how the intermittency of renewable resources will be addressed. If the CAISO relies on operating constraints such as the flexible ramping constraint discussed above, rather than competitively procured and priced market products, then revenues to suppliers like GenOn will be negatively affected, increasing uncertainty and reducing net revenues.

E. RA Rules

As currently constructed, the RA rules only require a year-ahead demonstration by an LSE that it has procured sufficient capacity to serve its needs. As a result, existing generation only has access to relatively short term capacity contracts. This short timeframe of current year-ahead process does not support investment in new generating capacity, which also means there is little to no supply flexibility. For the magnitude of the investment likely required to comply with the Policy, it may not be possible to structure a capacity offer that is both competitively structured, and of sufficient value (based on MW, price and duration) to compensate investors or support debt financing.

The current bilateral contracting framework does not recognize the full value of capacity, does not provide transparent prices, significantly increases transaction costs, and fails to provide an integrated, durable backstop procurement mechanism. Efforts to improve the forward capacity contracting process through the creation of a centralized capacity market have not yet succeeded.[17] The uncertainty surrounding the creation of a centralized capacity market adds to the difficulty of knowing whether market revenues will be sufficient to support the investment necessary to comply with the Policy. Finally, possible changes to the planning reserve margin and related RA reliability metrics further complicate any projection of what revenues might be available to recover the investment required to comply with the Policy.

F. CAISO Market Rules

Evolving CAISO market rules create additional uncertainty. For example, in April 2011, FERC staff is expected to conduct a technical conference to explore what changes in

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[17] "Valuing capacity products in the state is still far from market basis. But the only way to reflect a market value of a product is to have a market and the stakeholders are split on whether to have one. In the meantime, our only available approach is the regulated, largely cost based approach. Believe me, we don't dislike it any less than the generator community does and we see no way around creating a capacity products market for this purpose and equally important opening a wider door for demand response. We will have to reopen the debate again, hopefully this time in a conclusive consensus when guided by the recent findings." See Yakout Mansour's keynote address from the 2010 Stakeholder Symposium at http://www.caiso.com/2836/2836f22a24980.pdf .

pricing are necessary to assure that the CPM, described above in Section 3(E), is just and reasonable, and allows generators an opportunity to recover fixed costs.

Another important initiative discussed above is the CAISO's consideration of new products required to integrate renewable resources. It is unclear whether the CAISO will ultimately decide to establish new products, or simply use tools such as the flexible ramping constraint to obtain the services required. The outcome could have significant implications for revenues available to capacity resources. These uncertainties make it difficult to project future net revenues to support additional investment.

G. Infrastructure Requirements

There are substantial uncertainties about the nature, cost and timing of the transmission system improvements required to support integration of renewable resources, uncertainty about the availability of emission reduction credits necessary to build new thermal generation or repower existing project, and uncertainty about which OTC generators will be required beyond their compliance deadlines to provide inertia and other ancillary services in support of reliable system operation.

H. Demand Side Management and Energy Efficiency

Demand-side management and energy efficiency play a key role today in California's energy markets and will be important resources that California will depend upon to meet AB 32's greenhouse gas reduction objectives.

According to the 2010 CPUC LTPP Load and Resource Tables, demand-side management will account for approximately 9% of the peak demand starting in 2013 for the period through 2020.[18] From the same tables, incremental uncommitted energy efficiency will grow from 1.5% of the peak demand in 2013 to 10% in 2020. These are impressive forecasts, but some of this technology and many of the new programs are untested, making it difficult to forecast their impact, and some of these forecasts have been challenged by consumer advocates.[19]

GenOn believes that there is significant uncertainty regarding the actual results of these programs, and whether or not more conservative estimates of their impacts will be adopted. Such a step may be prudent until there is a proven track record with regard to specific technologies, program participation, and reliability of estimated savings. The growth of these demand-side resources and intermittent renewable resources creates a market in 2020 where approximately 30% of the capacity is coming from non-

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[18] Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans, R.10-05-006, Assigned Commissioner and Administrative Law Judge's Joint Scoping Memo and Ruling (December 3, 2010), Attachment 1 (Standardized Planning Assumptions (Part 1) for System Resources). A copy of Attachment 1 is available at the following link: http://docs.cpuc.ca.gov/efile/RULC/127543.pdf.

[19] "TURN takes the position that the settlement agreement business case overstates the likely benefits of a Peak-Time Rebate (PTR) program, and the assumptions underlying the analysis of PTR should be adjusted to reflect lower expected benefits." Source: DECISION APPROVING SETTLEMENT ON SOUTHERN CALIFORNIA EDISON COMPANY ADVANCED METERING INFRASTRUCTURE DEPLOYMENT - Decision 08-09-039 September 18, 2008

conventional resources (e.g. renewables, demand response, energy efficiency and combined heat and power). Accordingly, reserve margins may be over-estimated, leading to the erroneous conclusion that some existing generating units are no longer needed. This uncertainty inhibits investment in existing thermal resources that may prove to be needed beyond their currently assumed retirement dates.

I. Technological Innovations

California is aggressively pursuing modernization of its electric grid into a smart grid. The "smart grid" encompasses several technological enhancements, from the tools and data available to system operators to monitor every important element of the transmission network with perfect synchronization, to the use of smart meters to control appliances and give customers more information that will help them lower their electric bills by reducing or shifting electric consumption. A smart grid will also take advantage of distributed generation resources, which lower transmission losses and the need for new transmission lines, and energy storage resources, which adapt energy production to energy consumption.

Like demand-side management and efficiency programs, these innovations also hold a lot of promise and in some cases can be considered to be transformative. As such, they will require an unprecedented level of coordination and communication between all market participants and policy makers. The cost and scale of these technologies create uncertainty regarding the extent to which they will be adopted, and how that adoption will affect market opportunities for existing resources relying on conventional technology. This uncertainty can inhibit investment necessary to comply with the Policy.

J. Regulatory Policy

General regulatory uncertainty further clouds the availability of future revenues for gas-fired generation, adding to the difficulty of preparing a compliance plan for the Policy. A description of some of the areas of regulatory policy impacting the operation of the plants follows.

1. Climate Change Policy and Implementation

While the California Air Resources Board (ARB) has indicated it will implement a cap-and-trade program for greenhouse gas (GHG) emissions effective as of January 1, 2012, ARB has yet to adopt final details related to how that cap-and-trade program will actually work. What is known is that GenOn will have to purchase credits to cover its GHG emissions. ARB has specified a floor price for those credits at $10 per ton but has not established a hard cap on the cost of those credits. At this point, GenOn cannot predict the cost to procure the requisite GHG credits to cover its operations or whether the application of a carbon fee will allow its plant to remain competitive. A recent court ruling found deficiencies in the ARB's environmental review, adding additional uncertainty to the timing and cost of a final policy.

2. Technology Set-Aside Policy

California's demand for technology set-asides in the context of serving the electrical grid adds to regulatory uncertainty and whether there will be sufficient revenues to cover significant infrastructure investment. Current law requires IOUs to meet a 20% renewable portfolio standard by 2010.[20] In 2008, Governor Schwarzenegger adopted an Executive Order establishing a 33% renewable electricity standard.[21] Legislation has been passed by the California Legislature to place into statute the 33% requirement established by executive order.[22] As noted earlier, the displacement of thermal energy from conventional power plants will cause significant reductions in revenues to those resources – the same resources that provide the ramping and reserves necessary to reliably integrate intermittent renewable resources. The prospect of lower revenues reduces the ability of independent power producers to commit to incremental investments.

Pursuant to a directive issued by AB 2514,[23] the CPUC recently initiated a rulemaking to examine the role that storage will play, and one possible result could be the creation of a storage portfolio standard. All such technology set-asides increase uncertainty about the availability of future revenues that are necessary to finance the investment to comply with the Policy.

5. Availability of Funding for Compliance Measures

As explained in the Implementation Plans for the PGS, MGS and OBGS, GenOn has completed significant engineering and environmental work to evaluate compliance alternatives and develop reasonable programs for additional studies necessary to define final compliance plans. GenOn has identified preliminary Track 2 compliance plans at the MGS and OBGS and a viable Track 1 plan for the PGS, but GenOn cannot determine whether any of the compliance plans is financially feasible as of April 1, 2011. GenOn will seek to reduce the multiple sources of uncertainty that prevent a reasonable forecast of compliance costs, future revenues, and the sufficiency and certainty of net revenues to support funding the final plans over the next several years.

GenOn first must be able to reasonably estimate the final cost of the compliance plans, including any negative impact on revenues resulting from operating restrictions necessary for the MGS and OBGS to meet the Track 2 requirements for reduced impingement and entrainment. When costs and any operating restrictions are reasonably defined, GenOn can evaluate the amount, duration and certainty of available revenues from RA contracts, tolling contracts or other contracting or market mechanisms. Only then can a reasonable assessment of the sufficiency of net revenues, including expected value, term and security of net revenues be assessed against the capital requirements of each compliance plan.

In each Implementation Plan, GenOn has proposed a schedule for conducting additional studies and other work necessary to finalize the compliance alternative for each unit in time to allow a decision on whether to pursue the compliance investments for each facility sufficiently in advance of the prescribed compliance deadlines in the Policy (December 31, 2017 for the PGS, and December 31, 2020 for the MGS and OBGS).

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[20] SB 1078 (Stats. 2002, Ch. 516).

[21] Executive Order S-14-08 (Nov. 17, 2008).

[22] S.B. No. 2 (1st Extraordinary Session), sponsored by Senators Simitian, Kehoe and Steinberg.

[23] Stats. 2010, Ch. 469.

GenOn will also endeavor to secure the multi-year forward commitments to buy capacity, energy and and/or ancillary services from each unit that will be necessary to commit to investing in compliance with the policy. GenOn will seek such commitments with sufficient lead time to allow engineering and construction to be completed so that the units at each station can be taken out of service at a time and on a schedule acceptable to the CAISO, and compliance measures are fully implemented and operational as of the compliance deadlines specified in the Policy.

However, as explained above, there are many sources of uncertainty beyond GenOn’s control that may make it impossible for GenOn to commit to funding compliance investments in time to meet the Policy’s deadlines. If GenOn ultimately determines that investment in compliance measures is uneconomic for any unit, GenOn will work with the CAISO and the SACCWIS to consider extending the compliance deadline, or pursue other options for the assets which may include repowering or retirement.

Attachment B
Entrainment Estimates for GenOn Ormond Beach and Mandalay Generating Stations, December 29, 2010

Entrainment Estimates for GenOn Ormond Beach and Mandalay Generating Stations

December 29, 2010

Prepared for:
Mr. Rick Eckersley
GenOn
Houston, TX 77253

Prepared by:
Tenera Environmental
141 Suburban Rd., Suite A2
San Luis Obispo, CA 93401
805.541.0310

Introduction and Methods

The entrainment data on larval fishes collected during the February 2006–January 2007 studies at the Ormond Beach (OBGS) and Mandalay (MGS) Generating Stations were used to calculate hourly estimates of larval fish concentration for each of the taxonomic categories of fishes (taxa) collected as well as the total for all fish larvae. Estimates of entrainment for each taxa at each plant were calculated by multiplying the larval concentrations for each hour during the calendar year by the actual flow volume for the corresponding hours for each day during 2006–2009. Entrainment estimates using the hourly concentrations were also calculated for design flows and the estimated flows for 2006–2009 if variable speed drive (VSD) circulators were in use. The design flows for each circulating water pump at OBGS and MGS used in the calculations were 113,500 and 41,500 gpm, respectively. These values are less than the design flows of 119,000 and 44,000 gpm for OBGS and MGS, respectively, used in the entrainment estimates in the ENSR reports. Therefore, the estimates of annual entrainment for design flow are less in this report than the estimates reported by ENSR.

The daily estimates calculated using the various flows were summed for each month and over an entire calendar year to allow comparison among the various estimates. The potential reductions from both actual and design flow with the use of VSD circulators for 2006–2009 in absolute entrainment and on a percentage basis were also calculated.

Results and Conclusions

The monthly and total annual entrainment estimates for the two plants for the most abundant fish taxa and all larval fish combined using the different sources of flow data are provided in the attached tables. The data for the total of all larval fish are provided in **Tables 1** and **2**.

The differences in the entrainment estimates using actual flow for 2006–2009 reflect the differences in flow among those years both in volume and in the periods of time the circulators were in operation since the same larval concentrations were used in calculating the estimates for all four years.

The entrainment estimates for all larval fishes combined for OBGS in **Table 1** show that plant cooling water flow was lower in 2009 than in the other three years. The actual entrainment estimates for all four years were considerably less than the entrainment estimate calculated using design flows. As a result, the reduction in the entrainment estimates using the VSD circulator flows was considerably greater when compared to the design flow estimates and averaged over 92%.

The entrainment estimates for all larval fishes combined for MGS in **Table 2** show that plant cooling water flow was lower in 2006 and 2007 than in 2008 and 2009. The actual entrainment estimates for all four years were all less than the entrainment estimate calculated using design flows. As a result, the reduction in the entrainment estimates using the VSD circulator flows was considerably greater when compared to the design flow estimates and averaged almost 90%.

The results show the large potential reductions in entrainment available through the use of VSD circulators. The use of design flow as the baseline for compliance with the new state OTC Policy requires that the VSDs be used in combination with an additional screening technology, but as the results indicate, the performance of the screening technology may only have to provide minimal levels of reduction since the use of VSDs alone meet the required levels of reduction under the Track 2 compliance pathway. This will allow for much greater flexibility in achieving compliance under the new Policy.

Table 1. Monthly and total annual estimates of entrainment calculated using various flow data for Ormond Beach Generating Station for all larval fishes combined. Below the entrainment estimates are the reductions in entrainment and the corresponding percentages using the projected flow data for 2006–2009 that would occur if the plant was using variable speed drive circulators.

Month	Actual Flow 2006	Actual Flow 2007	Actual Flow 2008	Actual Flow 2009	Average Actual Flow 2006-2009	Design Flow	Projected VSD Flow 2006	Projected VSD Flow 2007	Projected VSD Flow 2008	Projected VSD Flow 2009
Jan	3,271	3,919	55,740	9,005	17,984	1,114,020	1,441	1,726	26,300	3,967
Feb	5,770	9,607	47,859	224,250	71,872	738,612	2,542	4,232	12,512	66,653
Mar	170,106	21,214	992,217	85,635	317,293	4,956,358	74,937	9,346	328,925	37,725
Apr	1,339,881	2,321,950	2,814,897	1,784,796	2,065,381	10,603,157	430,288	562,716	921,252	495,509
May	1,179,235	80,702	108,285	106,130	368,588	4,666,598	381,074	35,552	34,027	36,702
Jun	1,603,279	1,341,000	1,067,272	22,554	1,008,526	4,506,745	574,295	525,545	465,305	9,936
Jul	1,413,483	1,849,261	638,426	290,219	1,047,847	2,213,842	512,373	857,968	260,565	91,889
Aug	722,027	2,253,599	2,276,748	328,368	1,395,185	3,220,330	224,023	979,238	803,026	126,871
Sep	691,684	1,679,070	1,396,304	1,402,521	1,292,395	2,450,067	364,294	801,503	548,910	409,831
Oct	41,936	392,177	239,855	189,965	215,983	1,080,127	18,474	124,292	83,010	59,528
Nov	36,600	324,329	360,592	4,237	181,440	1,388,332	16,123	122,459	118,039	1,867
Dec	6,106	244,638	270,970	2,977	131,173	1,526,067	2,690	107,385	99,782	1,312
Total	7,213,376	10,521,466	10,269,163	4,450,658	8,113,666	38,464,252	2,602,554	4,131,962	3,701,653	1,341,790

VSD Reductions in Entrainment from Actual Flows

VSD Reduction 2006	4,610,822
% Reduction 2006	63.92%
VSD Reduction 2007	6,389,504
% Reduction 2007	60.73%
VSD Reduction 2008	6,567,510
% Reduction 2008	63.95%
VSD Reduction 2009	3,108,868
% Reduction 2009	69.85%
Average Reduction	64.61%

VSD Reductions in Entrainment from Design Flows

VSD Reduction 2006	35,861,698
% Reduction 2006	93.23%
VSD Reduction 2007	34,332,291
% Reduction 2007	89.26%
VSD Reduction 2008	34,762,599
% Reduction 2008	90.38%
VSD Reduction 2009	37,122,462
% Reduction 2009	96.51%
Average Reduction	92.34%

Table 2. Monthly and total annual estimates of entrainment calculated using various flow data for Mandalay Generating Station for all larval fishes combined. Below the entrainment estimates are the reductions in entrainment and the corresponding percentages using using the projected flow data for 2006–2009 that would occur if the plant was using variable speed drive circulators.

Month	Actual Flow 2006	Actual Flow 2007	Actual Flow 2008	Actual Flow 2009	Average Actual Flow 2006-2009	Design Flow	Projected VSD Flow 2006	Projected VSD Flow 2007	Projected VSD Flow 2008	Projected VSD Flow 2009
Jan	353,104	881,802	2,679,650	4,276,023	2,047,645	6,731,911	81,635	313,176	1,127,734	1,492,177
Feb	3,075,835	430,188	6,153,840	11,893,115	5,388,245	32,645,222	970,629	155,490	1,790,618	4,186,040
Mar	1,299,988	1,290,813	3,467,361	5,849,182	2,976,836	12,873,889	490,697	477,493	1,362,641	2,083,258
Apr	952,147	1,006,554	4,503,758	3,627,060	2,522,379	15,660,213	307,215	366,776	1,698,642	1,308,845
May	5,317,127	5,292,954	2,749,458	5,552,478	4,728,004	11,781,286	2,024,108	1,860,760	965,199	2,025,277
Jun	1,008,185	1,248,012	982,113	64,326	825,659	2,495,792	384,656	424,212	274,725	22,170
Jul	3,282,943	2,716,356	1,986,566	2,525,384	2,627,812	4,555,247	1,298,070	953,278	776,414	987,018
Aug	5,336,603	7,421,263	7,488,839	1,437,082	5,420,947	11,488,592	1,811,643	2,345,138	2,240,672	486,938
Sep	3,290,539	2,583,067	5,011,187	6,397,313	4,320,527	9,649,061	1,160,113	878,600	1,525,961	2,616,434
Oct	28,349	3,451,525	4,667,585	3,049,089	2,799,137	7,370,265	10,247	1,172,880	1,591,846	976,406
Nov	2,615,680	1,736,798	6,686,469	1,887,744	3,231,673	8,544,839	999,145	606,352	2,306,869	602,916
Dec	2,497,043	2,610,567	3,796,615	3,227,538	3,032,941	9,292,499	934,935	1,041,138	1,257,989	1,020,184
Total	29,057,544	30,669,899	50,173,441	49,786,334	39,921,805	133,088,817	10,473,093	10,595,291	16,919,308	17,807,664

VSD Reductions in Entrainment from Actual Flows

VSD Reduction 2006	18,584,451
% Reduction 2006	63.96%
VSD Reduction 2007	20,074,608
% Reduction 2007	65.45%
VSD Reduction 2008	33,254,134
% Reduction 2008	66.28%
VSD Reduction 2009	31,978,670
% Reduction 2009	64.23%
Average Reduction	64.98%

VSD Reductions in Entrainment from Design Flows

VSD Reduction 2006	122,615,724
% Reduction 2006	92.13%
VSD Reduction 2007	122,493,526
% Reduction 2007	92.04%
VSD Reduction 2008	116,169,509
% Reduction 2008	87.29%
VSD Reduction 2009	115,281,153
% Reduction 2009	86.62%
Average Reduction	89.52%

Monthly and total annual estimates of entrainment calculated using various flow data for Ormond Beach and Mandalay Generating Station for most abundant taxonomic categories of larval fish and all larval fishes combined based on actual flows during 2006–2009, design flow, and projected flows for the same years if the plant was using variable speed drive circulators.

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Actual Flow 2006											
Jan	3,271	256	256	237	0	0	105	0	617	711	609
Feb	5,770	109	1,193	1,790	0	0	0	0	0	0	0
Mar	170,106	0	43,492	119	0	21,726	13,647	0	11,238	0	7,267
Apr	1,339,881	321,576	429,340	147,341	9,266	23,445	22,049	7,940	6,199	19,027	6,402
May	1,179,235	962,502	0	99,287	2,190	0	0	0	10,196	33,234	0
Jun	1,603,279	1,243,833	0	40,874	152,203	0	0	0	0	0	15,350
Jul	1,413,483	929,438	0	44,188	118,109	0	0	14,339	0	124,290	63,549
Aug	722,027	166,842	0	93,302	88,233	0	0	314,659	918	514	14,859
Sep	691,684	108,508	0	62,931	78,461	0	0	24,590	86,370	36,485	31,481
Oct	41,936	0	1,113	0	0	0	1,134	0	16,404	0	2,945
Nov	36,600	3,196	4,833	0	0	0	18,510	0	651	0	1,717
Dec	6,106	365	0	0	0	0	638	0	0	0	1,000
Total	7,213,376	3,736,625	480,227	490,069	448,462	45,171	56,083	361,528	132,592	214,261	145,178

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	**Total Fish Larvae**	**anchovies** **Engraulidae**	**white croaker** ***Genyonemus lineatus***	**northern lampfish** ***Stenobrachius leucopsarus***	**blennies** ***Hypsoblennius* spp**	**California smoothtongue** ***Leuroglossus stilbius***	**diamond turbot** ***Hypsopsetta guttulata***	**queenfish** ***Seriphus politus***	**sanddabs** ***Citharichthys* spp**	**California halibut** ***Paralichthys* spp**	**gobies** **CIQ gobies**
Actual Flow 2007											
Jan	3,919	0	331	712	0	0	535	0	123	580	353
Feb	9,607	545	1,988	2,983	0	0	0	0	0	0	0
Mar	21,214	0	4,501	358	0	8,517	339	0	261	0	935
Apr	2,321,950	1,546,720	313,663	170,601	0	40,147	19,726	0	13,948	33,929	11,468
May	80,702	59,422	0	3,564	1,138	0	0	0	4,776	5,731	0
Jun	1,341,000	997,516	0	29,616	154,565	0	0	0	0	0	16,095
Jul	1,849,261	1,262,976	0	62,519	122,899	0	0	26,850	0	114,307	85,911
Aug	2,253,599	575,788	0	247,274	254,997	0	0	645,613	88,143	36,999	52,143
Sep	1,679,070	283,558	0	169,329	208,129	0	0	64,665	232,359	101,747	3,148
Oct	392,177	14,519	114,745	0	0	0	75,201	0	4,557	0	42,690
Nov	324,329	33,346	33,831	0	0	0	167,817	0	10,303	0	12,017
Dec	244,638	17,369	8,384	0	0	0	765	0	0	0	34,698
Total	10,521,466	4,791,758	477,443	686,955	741,727	48,664	264,383	737,128	354,470	293,293	259,458

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

		anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
Month	**Total Fish Larvae**	**Engraulidae**	***Genyonemus lineatus***	***Stenobrachius leucopsarus***	***Hypsoblennius* spp**	***Leuroglossus stilbius***	***Hypsopsetta guttulata***	***Seriphus politus***	***Citharichthys* spp**	***Paralichthys* spp**	**CIQ gobies**
Actual Flow 2008											
Jan	55,740	2,303	5,941	3,083	0	0	2,521	0	1,603	7,344	12,207
Feb	47,859	4,142	8,948	13,421	0	0	0	0	0	0	0
Mar	992,217	8,237	180,189	10,379	13,431	238,593	21,846	0	14,635	0	153,201
Apr	2,814,897	662,305	806,755	350,815	23,597	20,652	32,313	21,212	5,941	47,941	5,771
May	108,285	72,696	0	1,053	702	0	0	0	11,100	10,408	0
Jun	1,067,272	967,763	0	42,544	9,634	0	0	0	0	0	298
Jul	638,426	405,850	0	16,825	68,219	0	0	843	0	81,862	23,954
Aug	2,276,748	581,712	0	254,556	260,729	0	0	735,310	69,434	31,346	52,296
Sep	1,396,304	231,887	0	135,876	166,980	0	0	53,345	189,342	77,081	20,257
Oct	239,855	6,908	27,479	0	0	0	24,255	0	49,211	0	37,309
Nov	360,592	39,217	0	0	0	0	243,865	0	18,546	0	0
Dec	270,970	15,795	8,754	0	0	0	13,165	0	0	0	49,138
Total	10,269,163	2,998,815	1,038,066	828,552	543,291	259,245	337,965	810,710	359,812	255,982	354,431

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Actual Flow 2009											
Jan	9,005	640	970	949	0	0	114	0	247	816	2,394
Feb	224,250	22,997	39,966	59,949	0	0	0	0	0	0	0
Mar	85,635	0	18,869	597	420	10,814	6,262	0	4,182	0	7,071
Apr	1,784,796	456,225	817,166	70,212	0	105,095	58,038	0	30,995	2,989	29,012
May	106,130	73,011	0	5,346	1,489	0	0	0	7,873	8,878	0
Jun	22,554	12,292	0	277	6,828	0	0	0	0	0	149
Jul	290,219	81,982	0	5,275	63,476	0	0	4,499	0	69,383	28,043
Aug	328,368	71,441	0	35,730	40,661	0	0	17,985	34,116	14,388	3,272
Sep	1,402,521	226,784	0	136,188	166,069	0	0	52,668	188,263	81,192	26,143
Oct	189,965	0	42,952	0	0	0	19,740	0	15,492	0	30,598
Nov	4,237	335	0	0	0	0	3,235	0	108	0	0
Dec	2,977	0	740	0	0	0	0	0	0	0	1,480
Total	4,450,658	945,707	920,663	314,522	278,942	115,909	87,389	75,151	281,276	177,647	128,161

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Average Actual Flow 2006-2009											
Jan	17,984	800	1,875	1,245	0	0	819	0	647	2,363	3,891
Feb	71,872	6,948	13,024	19,536	0	0	0	0	0	0	0
Mar	317,293	2,059	61,763	2,863	3,463	69,913	10,523	0	7,579	0	42,119
Apr	2,065,381	746,707	591,731	184,742	8,216	47,335	33,031	7,288	14,270	25,972	13,164
May	368,588	291,908	0	27,312	1,380	0	0	0	8,486	14,563	0
Jun	1,008,526	805,351	0	28,328	80,807	0	0	0	0	0	7,973
Jul	1,047,847	670,062	0	32,202	93,176	0	0	11,633	0	97,460	50,364
Aug	1,395,185	348,946	0	157,716	161,155	0	0	428,392	48,153	20,812	30,642
Sep	1,292,395	212,684	0	126,081	154,910	0	0	48,817	174,084	74,126	20,257
Oct	215,983	5,357	46,572	0	0	0	30,082	0	21,416	0	28,385
Nov	181,440	19,023	9,666	0	0	0	108,357	0	7,402	0	3,433
Dec	131,173	8,382	4,470	0	0	0	3,642	0	0	0	21,579
Total	8,113,666	3,118,226	729,100	580,025	503,106	117,247	186,455	496,130	282,037	235,296	221,807

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Design Flow											
Jan	1,114,020	46,061	101,625	85,383	0	0	41,940	0	44,388	143,087	254,399
Feb	738,612	73,243	133,618	200,427	0	0	0	0	0	0	0
Mar	4,956,358	43,086	937,296	48,675	57,083	1,207,026	125,658	0	87,813	0	679,772
Apr	10,603,157	3,703,567	3,083,369	974,635	41,510	237,047	175,809	39,816	68,188	127,918	67,677
May	4,666,598	3,690,822	0	321,035	107,190	0	0	0	61,953	139,746	10,730
Jun	4,506,745	3,228,016	0	86,756	607,411	0	0	0	0	0	60,803
Jul	2,213,842	1,406,877	0	70,024	189,919	0	0	30,365	0	191,676	114,507
Aug	3,220,330	853,005	0	363,608	365,843	0	0	997,462	88,143	36,999	78,214
Sep	2,450,067	395,326	0	233,348	286,647	0	0	91,462	323,192	135,663	62,414
Oct	1,080,127	19,671	197,922	0	0	0	118,100	0	142,165	0	167,368
Nov	1,388,332	144,967	57,089	0	0	0	801,341	0	57,265	0	30,951
Dec	1,526,067	94,079	47,348	0	0	0	43,245	0	0	0	263,686
Total	38,464,252	13,698,718	4,558,266	2,383,891	1,655,603	1,444,073	1,306,093	1,159,106	873,108	775,089	1,790,520

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Projected VSD Flow 2006											
Jan	1,441	113	113	104	0	0	46	0	272	313	268
Feb	2,542	48	526	788	0	0	0	0	0	0	0
Mar	74,937	0	19,159	53	0	9,571	6,012	0	4,951	0	3,201
Apr	430,288	106,347	136,260	45,450	2,937	7,413	6,650	2,667	2,069	6,093	1,965
May	381,074	311,402	0	31,457	965	0	0	0	2,913	11,453	0
Jun	574,295	451,181	0	13,862	52,018	0	0	0	0	0	5,317
Jul	512,373	319,166	0	11,780	48,520	0	0	7,516	0	57,884	25,819
Aug	224,023	50,133	0	27,650	26,625	0	0	97,982	404	226	6,120
Sep	364,294	66,777	0	31,755	42,814	0	0	15,821	45,233	11,991	12,781
Oct	18,474	0	490	0	0	0	500	0	7,226	0	1,297
Nov	16,123	1,408	2,129	0	0	0	8,154	0	287	0	756
Dec	2,690	161	0	0	0	0	281	0	0	0	440
Total	2,602,554	1,306,736	158,677	162,900	173,879	16,984	21,643	123,985	63,353	87,961	57,966

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies Engraulidae	white croaker *Genyonemus lineatus*	northern lampfish *Stenobrachius leucopsarus*	blennies *Hypsoblennius spp*	California smoothtongue *Leuroglossus stilbius*	diamond turbot *Hypsopsetta guttulata*	queenfish *Seriphus politus*	sanddabs *Citharichthys spp*	California halibut *Paralichthys spp*	gobies CIQ gobies
Projected VSD Flow 2007											
Jan	1,726	0	146	313	0	0	236	0	54	256	156
Feb	4,232	240	876	1,314	0	0	0	0	0	0	0
Mar	9,346	0	1,983	158	0	3,752	149	0	115	0	412
Apr	562,716	354,524	91,804	39,758	0	11,738	5,828	0	3,998	7,528	3,270
May	35,552	26,177	0	1,570	501	0	0	0	2,104	2,525	0
Jun	525,545	416,322	0	12,610	45,152	0	0	0	0	0	4,579
Jul	857,968	623,462	0	22,707	44,513	0	0	14,529	0	50,853	37,357
Aug	979,238	262,812	0	89,602	104,415	0	0	232,645	50,016	9,716	30,211
Sep	801,503	154,927	0	73,354	98,205	0	0	38,717	105,545	26,833	1,387
Oct	124,292	4,591	37,594	0	0	0	22,503	0	2,007	0	13,110
Nov	122,459	12,324	10,381	0	0	0	66,003	0	4,707	0	3,687
Dec	107,385	7,443	4,884	0	0	0	337	0	0	0	17,480
Total	4,131,962	1,862,822	147,668	241,385	292,787	15,490	95,057	285,891	168,546	97,711	111,649

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Projected VSD Flow 2008											
Jan	26,300	1,494	2,897	851	0	0	1,041	0	646	3,332	6,332
Feb	12,512	1,104	2,365	3,548	0	0	0	0	0	0	0
Mar	328,925	2,341	58,669	3,788	4,617	74,456	7,908	0	5,526	0	52,625
Apr	921,252	210,017	265,950	131,653	8,259	7,201	11,937	6,137	2,042	16,847	1,927
May	34,027	22,423	0	464	309	0	0	0	3,124	4,016	0
Jun	465,305	424,994	0	16,941	4,244	0	0	0	0	0	131
Jul	260,565	168,500	0	6,538	23,660	0	0	372	0	40,567	7,220
Aug	803,026	226,130	0	74,852	83,728	0	0	234,637	26,437	8,295	29,682
Sep	548,910	98,231	0	51,124	66,010	0	0	23,338	72,213	23,710	9,462
Oct	83,010	1,744	8,482	0	0	0	7,194	0	15,839	0	15,119
Nov	118,039	12,780	0	0	0	0	80,134	0	6,891	0	0
Dec	99,782	5,819	3,475	0	0	0	4,635	0	0	0	18,600
Total	3,701,653	1,175,577	341,838	289,759	190,827	81,658	112,849	264,484	132,719	96,768	141,098

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies	white croaker	northern lampfish	blennies	California smoothtongue	diamond turbot	queenfish	sanddabs	California halibut	gobies
		Engraulidae	*Genyonemus lineatus*	*Stenobrachius leucopsarus*	*Hypsoblennius* spp	*Leuroglossus stilbius*	*Hypsopsetta guttulata*	*Seriphus politus*	*Citharichthys* spp	*Paralichthys* spp	CIQ gobies
Projected VSD Flow 2009											
Jan	3,967	282	428	418	0	0	50	0	109	360	1,055
Feb	66,653	6,564	11,518	17,276	0	0	0	0	0	0	0
Mar	37,725	0	8,312	263	185	4,764	2,759	0	1,842	0	3,115
Apr	495,509	127,457	224,870	21,329	0	28,748	15,779	0	8,651	880	7,943
May	36,702	25,190	0	2,355	656	0	0	0	2,512	2,762	0
Jun	9,936	5,415	0	122	3,008	0	0	0	0	0	66
Jul	91,889	27,360	0	1,961	18,533	0	0	1,638	0	22,900	8,117
Aug	126,871	28,161	0	12,983	15,331	0	0	7,746	13,392	4,586	1,441
Sep	409,831	69,587	0	38,723	48,352	0	0	17,089	54,438	20,307	7,211
Oct	59,528	0	12,719	0	0	0	5,085	0	6,825	0	10,007
Nov	1,867	147	0	0	0	0	1,425	0	48	0	0
Dec	1,312	0	326	0	0	0	0	0	0	0	652
Total	1,341,790	290,164	258,172	95,429	86,065	33,512	25,098	26,474	87,817	51,794	39,606

OBGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Top Ten Fishes Entrained

Month	Total Fish Larvae	anchovies Engraulidae	white croaker *Genyonemus lineatus*	northern lampfish *Stenobrachius leucopsarus*	blennies *Hypsoblennius spp*	California smoothtongue *Leuroglossus stilbius*	diamond turbot *Hypsopsetta guttulata*	queenfish *Seriphus politus*	sanddabs *Citharichthys spp*	California halibut *Paralichthys spp*	gobies CIQ gobies
Average Actual '06-'09	8,113,666	3,118,226	729,100	580,025	503,106	117,247	186,455	496,130	282,037	235,296	221,807
Range (max-min)	6,070,808	3,846,051	560,623	514,031	462,786	214,074	281,882	735,559	227,220	115,646	226,270
VSD Reductions in Entrainment from Actual Flows											
VSD Reduction 2006	4,610,822	2,429,890	321,550	327,170	274,584	28,187	34,439	237,543	69,239	126,300	87,212
% Reduction 2006	63.92%	65.03%	66.96%	66.76%	61.23%	62.40%	61.41%	65.71%	52.22%	58.95%	60.07%
VSD Reduction 2007	6,389,504	2,928,936	329,776	445,570	448,940	33,173	169,327	451,238	185,923	195,582	147,809
% Reduction 2007	60.73%	61.12%	69.07%	64.86%	60.53%	68.17%	64.05%	61.22%	52.45%	66.68%	56.97%
VSD Reduction 2008	6,567,510	1,823,237	696,228	538,794	352,465	177,587	225,116	546,227	227,093	159,214	213,333
% Reduction 2008	63.95%	60.80%	67.07%	65.03%	64.88%	68.50%	66.61%	67.38%	63.11%	62.20%	60.19%
VSD Reduction 2009	3,108,868	655,544	662,491	219,092	192,877	82,397	62,291	48,678	193,459	125,853	88,555
% Reduction 2009	69.85%	69.32%	71.96%	69.66%	69.15%	71.09%	71.28%	64.77%	68.78%	70.84%	69.10%
Average Reduction	64.61%	64.07%	68.76%	66.58%	63.94%	67.54%	65.84%	64.77%	59.14%	64.67%	61.58%
Design Flow Totals	38,464,252	13,698,718	4,558,266	2,383,891	1,655,603	1,444,073	1,306,093	1,159,106	873,108	775,089	1,790,520
VSD Reductions in Entrainment from Design Flows											
VSD Reduction 2006	35,861,698	12,391,982	4,399,589	2,220,992	1,481,725	1,427,089	1,284,450	1,035,121	809,755	687,128	1,732,554
% Reduction 2006	93.23%	90.46%	96.52%	93.17%	89.50%	98.82%	98.34%	89.30%	92.74%	88.65%	96.76%
VSD Reduction 2007	34,332,291	11,835,895	4,410,598	2,142,506	1,362,816	1,428,583	1,211,036	873,215	704,562	677,378	1,678,871
% Reduction 2007	89.26%	86.40%	96.76%	89.87%	82.32%	98.93%	92.72%	75.34%	80.70%	87.39%	93.76%
VSD Reduction 2008	34,762,599	12,523,141	4,216,428	2,094,133	1,464,776	1,362,416	1,193,244	894,622	740,389	678,321	1,649,421
% Reduction 2008	90.38%	91.42%	92.50%	87.85%	88.47%	94.35%	91.36%	77.18%	84.80%	87.52%	92.12%
VSD Reduction 2009	37,122,462	13,408,554	4,300,094	2,288,462	1,569,538	1,410,561	1,280,995	1,132,632	785,292	723,295	1,750,913
% Reduction 2009	96.51%	97.88%	94.34%	96.00%	94.80%	97.68%	98.08%	97.72%	89.94%	93.32%	97.79%
Average Reduction	92.34%	91.54%	95.03%	91.72%	88.77%	97.44%	95.13%	84.88%	87.05%	89.22%	95.11%

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

		yellowfin goby	gobies	blennies	clingfish	longjaw mudsucker	anchovies
	Total Fish Larvae	*Acanthogobius flavimanus*	CIQ gobies	*Hypsoblennius spp*	*Gobiesox rhessodon*	*Gillichthys mirabilis*	*Engraulis mordax*
Actual Flow 2006							
Jan	353,104	0	304,628	0	7,806	24,282	0
Feb	3,075,835	2,047,050	943,279	5,411	0	26,715	0
Mar	1,299,988	806,321	289,215	3,391	4,263	10,927	0
Apr	952,147	546,849	210,011	13,322	17,592	10,497	714
May	5,317,127	79,241	795,603	3,134,352	140,380	198,233	12,546
Jun	1,008,185	12,480	334,148	191,062	57,437	6,030	0
Jul	3,282,943	0	1,823,444	497,975	155,945	17,553	2,523
Aug	5,336,603	0	4,700,869	316,644	21,375	0	19,853
Sep	3,290,539	0	2,922,797	117,438	122,018	0	0
Oct	28,349	0	24,316	1,479	0	2,553	0
Nov	2,615,680	0	2,402,826	100,399	2,144	42,804	0
Dec	2,497,043	0	2,034,577	178,503	10,467	24,548	0
Total	29,057,544	3,491,941	16,785,712	4,559,975	539,427	364,142	35,635

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

		yellowfin goby	**gobies**	**blennies**	**clingfish**	**longjaw mudsucker**	**anchovies**
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius* spp**	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Actual Flow 2007							
Jan	881,802	0	773,296	0	14,974	13,687	0
Feb	430,188	286,452	132,275	601	0	3,678	0
Mar	1,290,813	799,822	254,330	3,017	2,174	8,171	0
Apr	1,006,554	346,644	218,659	248,108	50,970	18,682	1,523
May	5,292,954	66,847	757,600	3,269,808	156,164	167,207	9,385
Jun	1,248,012	15,659	379,364	211,021	65,921	7,549	0
Jul	2,716,356	0	1,696,375	355,095	107,290	11,702	3,665
Aug	7,421,263	0	6,493,923	449,129	30,875	0	25,271
Sep	2,583,067	0	2,171,090	128,201	100,472	0	0
Oct	3,451,525	0	3,279,602	58,832	22,523	32,186	0
Nov	1,736,798	0	1,604,734	59,196	1,429	33,120	0
Dec	2,610,567	0	2,143,336	183,372	10,537	24,758	0
Total	30,669,899	1,515,423	19,904,584	4,966,381	563,328	320,740	39,844

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

		yellowfin goby	**gobies**	**blennies**	**clingfish**	**longjaw mudsucker**	**anchovies**
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius* spp**	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Actual Flow 2008							
Jan	2,679,650	0	2,348,720	0	43,486	58,804	0
Feb	6,153,840	4,097,205	1,883,563	11,605	0	54,111	0
Mar	3,467,361	2,343,213	724,153	3,865	10,961	29,438	0
Apr	4,503,758	2,236,570	940,211	494,490	118,553	51,778	3,568
May	2,749,458	33,226	392,622	1,723,104	97,128	78,043	3,793
Jun	982,113	7,165	306,419	109,335	47,000	3,561	0
Jul	1,986,566	0	1,048,312	317,445	101,794	11,191	1,047
Aug	7,488,839	0	6,665,623	404,869	31,825	0	26,748
Sep	5,011,187	0	4,549,616	184,535	144,315	0	0
Oct	4,667,585	0	4,382,234	141,280	52,884	30,582	0
Nov	6,686,469	0	6,197,366	212,186	5,193	105,966	0
Dec	3,796,615	0	3,101,205	257,039	16,909	35,676	0
Total	50,173,441	8,717,379	32,540,045	3,859,754	670,049	459,150	35,157

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

		yellowfin goby	gobies	blennies	clingfish	longjaw mudsucker	anchovies
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius* spp**	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Actual Flow 2009							
Jan	4,276,023	0	3,756,182	0	68,677	100,205	0
Feb	11,893,115	8,754,419	2,841,568	29,849	0	148,497	0
Mar	5,849,182	4,060,227	1,372,877	4,317	30,796	66,616	0
Apr	3,627,060	1,076,500	858,429	978,387	238,168	78,705	7,850
May	5,552,478	72,110	797,933	3,421,313	184,391	175,783	9,483
Jun	64,326	0	23,404	4,742	3,432	0	0
Jul	2,525,384	0	1,449,935	370,201	112,956	12,956	2,380
Aug	1,437,082	0	1,117,326	147,535	4,560	0	3,903
Sep	6,397,313	0	5,705,011	275,266	180,351	0	0
Oct	3,049,089	0	2,871,298	78,045	31,379	19,600	0
Nov	1,887,744	0	1,784,834	34,210	0	36,856	0
Dec	3,227,538	0	2,663,166	196,083	14,467	31,446	0
Total	49,786,334	13,963,255	25,241,964	5,539,946	869,177	670,663	23,616

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

		yellowfin goby	gobies	blennies	clingfish	longjaw mudsucker	anchovies
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius* spp**	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Average Actual Flow 2006-2009							
Jan	2,047,645	0	1,795,706	0	33,736	49,245	0
Feb	5,388,245	3,796,282	1,450,171	11,866	0	58,250	0
Mar	2,976,836	2,002,396	660,144	3,648	12,048	28,788	0
Apr	2,522,379	1,051,641	556,827	433,577	106,321	39,916	3,414
May	4,728,004	62,856	685,939	2,887,144	144,516	154,817	8,802
Jun	825,659	8,826	260,834	129,040	43,448	4,285	0
Jul	2,627,812	0	1,504,517	385,179	119,496	13,351	2,404
Aug	5,420,947	0	4,744,435	329,544	22,159	0	18,944
Sep	4,320,527	0	3,837,128	176,360	136,789	0	0
Oct	2,799,137	0	2,639,363	69,909	26,697	21,230	0
Nov	3,231,673	0	2,997,440	101,498	2,192	54,686	0
Dec	3,032,941	0	2,485,571	203,749	13,095	29,107	0
Total	39,921,805	6,921,999	23,618,076	4,731,514	660,495	453,674	33,563

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

		yellowfin goby	**gobies**	**blennies**	**clingfish**	**longjaw mudsucker**	**anchovies**
	Total Fish Larvae	***Acanthogobius flavimanus***	**CIQ gobies**	***Hypsoblennius* spp**	***Gobiesox rhessodon***	***Gillichthys mirabilis***	***Engraulis mordax***
Design Flow							
Jan	6,731,911	0	5,915,400	0	109,390	161,576	0
Feb	32,645,222	24,361,818	7,506,688	78,135	0	405,391	0
Mar	12,873,889	8,438,035	3,110,012	22,556	66,448	143,224	0
Apr	15,660,213	8,279,382	3,382,120	1,081,261	384,109	181,170	15,986
May	11,781,286	175,213	1,785,600	6,945,182	352,418	427,759	25,676
Jun	2,495,792	38,721	854,221	619,366	154,756	19,371	0
Jul	4,555,247	0	2,626,136	654,146	200,953	23,404	4,571
Aug	11,488,592	0	9,973,066	754,484	43,320	0	43,428
Sep	9,649,061	0	8,706,199	306,725	338,424	0	0
Oct	7,370,265	0	6,957,273	203,085	79,434	37,415	0
Nov	8,544,839	0	7,948,178	257,301	5,718	144,090	0
Dec	9,292,499	0	7,588,189	525,220	50,046	106,750	0
Total	133,088,817	41,293,169	66,353,081	11,447,462	1,785,016	1,650,151	89,661

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Projected VSD Flow 2006							
Jan	81,635	0	70,784	0	1,666	4,746	0
Feb	970,629	643,909	299,320	1,794	0	8,535	0
Mar	490,697	301,652	109,080	1,244	1,629	4,034	0
Apr	307,215	173,849	72,276	4,830	6,399	3,635	256
May	2,024,108	30,614	302,306	1,191,195	54,656	76,042	4,831
Jun	384,656	4,756	127,421	70,040	21,927	2,051	0
Jul	1,298,070	0	714,736	204,064	63,856	6,868	955
Aug	1,811,643	0	1,585,706	111,818	7,218	0	6,583
Sep	1,160,113	0	1,016,037	47,653	44,605	0	0
Oct	10,247	0	8,789	535	0	923	0
Nov	999,145	0	915,921	38,059	940	16,855	0
Dec	934,935	0	767,002	65,508	3,971	8,870	0
Total	10,473,093	1,154,781	5,989,379	1,736,739	206,867	132,558	12,624

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

		yellowfin goby	gobies	blennies	clingfish	longjaw mudsucker	anchovies
	Total Fish Larvae	*Acanthogobius flavimanus*	CIQ gobies	*Hypsoblennius* spp	*Gobiesox rhessodon*	*Gillichthys mirabilis*	*Engraulis mordax*
Projected VSD Flow 2007							
Jan	313,176	0	274,866	0	5,401	4,751	0
Feb	155,490	103,537	47,810	217	0	1,329	0
Mar	477,493	296,899	93,468	1,142	661	2,822	0
Apr	366,776	125,361	79,883	90,684	19,305	6,967	550
May	1,860,760	22,763	258,376	1,167,017	57,459	55,982	3,099
Jun	424,212	6,390	134,315	83,781	24,166	2,866	0
Jul	953,278	0	567,005	136,152	41,482	4,412	1,023
Aug	2,345,138	0	2,022,870	158,265	9,071	0	8,055
Sep	878,600	0	725,574	50,111	34,363	0	0
Oct	1,172,880	0	1,109,679	22,068	7,756	15,204	0
Nov	606,352	0	558,593	21,291	517	12,305	0
Dec	1,041,138	0	863,402	70,277	3,939	9,497	0
Total	10,595,291	554,950	6,735,841	1,801,004	204,121	116,135	12,728

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Projected VSD Flow 2008							
Jan	1,127,734	0	987,052	0	18,435	21,134	0
Feb	1,790,618	1,187,108	552,786	3,374	0	15,904	0
Mar	1,362,641	924,194	278,857	1,433	3,811	11,001	0
Apr	1,698,642	833,963	348,038	195,267	42,778	19,047	1,402
May	965,199	11,916	141,093	597,004	30,106	28,341	1,501
Jun	274,725	3,067	86,199	38,424	14,147	1,246	0
Jul	776,414	0	401,804	127,300	40,464	4,509	339
Aug	2,240,672	0	1,974,111	131,077	8,942	0	8,123
Sep	1,525,961	0	1,365,652	64,380	49,077	0	0
Oct	1,591,846	0	1,477,904	52,358	18,138	17,221	0
Nov	2,306,869	0	2,142,756	70,987	1,788	38,125	0
Dec	1,257,989	0	1,018,361	88,120	6,480	11,581	0
Total	16,919,308	2,960,248	10,774,614	1,369,725	234,166	168,110	11,365

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

	Total Fish Larvae	yellowfin goby *Acanthogobius flavimanus*	gobies CIQ gobies	blennies *Hypsoblennius* spp	clingfish *Gobiesox rhessodon*	longjaw mudsucker *Gillichthys mirabilis*	anchovies *Engraulis mordax*
Projected VSD Flow 2009							
Jan	1,492,177	0	1,319,431	0	22,614	30,695	0
Feb	4,186,040	3,131,298	957,098	9,324	0	50,801	0
Mar	2,083,258	1,444,710	490,661	1,824	10,818	21,481	0
Apr	1,308,845	401,410	325,346	332,315	80,024	29,122	3,201
May	2,025,277	26,700	295,386	1,237,903	66,283	65,326	3,561
Jun	22,170	0	7,756	1,881	1,100	0	0
Jul	987,018	0	551,428	149,274	45,942	5,320	814
Aug	486,938	0	361,930	57,439	1,393	0	1,180
Sep	2,616,434	0	2,328,350	115,778	72,519	0	0
Oct	976,406	0	919,608	25,251	10,288	4,473	0
Nov	602,916	0	571,707	10,417	0	10,314	0
Dec	1,020,184	0	847,378	62,919	4,457	9,609	0
Total	17,807,664	5,004,117	8,976,077	2,004,326	315,437	227,141	8,755

MGS Entrainment Estimates and Projected VSD Reductions for Total Fish Larvae and Six Most Abundant Fishes Entrained

		yellowfin goby	gobies	blennies	clingfish	longjaw mudsucker	anchovies
	Total Fish Larvae	*Acanthogobius flavimanus*	CIQ gobies	*Hypsoblennius* spp	*Gobiesox rhessodon*	*Gillichthys mirabilis*	*Engraulis mordax*
Average Actual '06-'09	39,921,805	6,921,999	23,618,076	4,731,514	660,495	453,674	33,563
Range (max-min)	21,115,897	12,447,832	15,754,332	1,680,192	329,750	349,924	16,228
VSD Reductions in Entrainment from Actual Flows							
VSD Reduction 2006	18,584,451	2,337,160	10,796,334	2,823,235	332,560	231,584	23,011
% Reduction 2006	63.96%	66.93%	64.32%	61.91%	61.65%	63.60%	64.57%
VSD Reduction 2007	20,074,608	960,473	13,168,743	3,165,377	359,207	204,604	27,116
% Reduction 2007	65.45%	63.38%	66.16%	63.74%	63.77%	63.79%	68.06%
VSD Reduction 2008	33,254,134	5,757,132	21,765,430	2,490,029	435,883	291,040	23,792
% Reduction 2008	66.28%	66.04%	66.89%	64.51%	65.05%	63.39%	67.67%
VSD Reduction 2009	31,978,670	8,959,137	16,265,887	3,535,620	553,740	443,523	14,861
% Reduction 2009	64.23%	64.16%	64.44%	63.82%	63.71%	66.13%	62.93%
Average Reduction	64.98%	65.13%	65.45%	63.50%	63.54%	64.23%	65.81%
Design Flow Totals	133,088,817	41,293,169	66,353,081	11,447,462	1,785,016	1,650,151	89,661
VSD Reductions in Entrainment from Design Flows							
VSD Reduction 2006	122,615,724	40,138,388	60,363,703	9,710,722	1,578,149	1,517,593	77,037
% Reduction 2006	92.13%	97.20%	90.97%	84.83%	88.41%	91.97%	85.92%
VSD Reduction 2007	122,493,526	40,738,220	59,617,240	9,646,458	1,580,896	1,534,016	76,934
% Reduction 2007	92.04%	98.66%	89.85%	84.27%	88.56%	92.96%	85.80%
VSD Reduction 2008	116,169,509	38,332,922	55,578,467	10,077,737	1,550,850	1,482,041	78,296
% Reduction 2008	87.29%	92.83%	83.76%	88.03%	86.88%	89.81%	87.32%
VSD Reduction 2009	115,281,153	36,289,052	57,377,004	9,443,136	1,469,579	1,423,010	80,906
% Reduction 2009	86.62%	87.88%	86.47%	82.49%	82.33%	86.24%	90.24%
Average Reduction	89.52%	94.14%	87.76%	84.91%	86.55%	90.24%	87.32%

Attachment C

2015-2016 Ormond Beach Generating Station Actual Discharge Flows

2015 TO 2016 ORMOND BEACH GENERATING STATION ACTUAL DISCHARGE FLOWS

Month	Year	Actual Flow (Gal/Month)
October	2015	4,850,000,000
November	2015	-
December	2015	1,741,900,000
January	2016	357,300,000
February	2016	-
March	2016	2,155,300,000
April	2016	-
May	2016	2,078,000,000
June	2016	4,188,100,000
July	2016	5,216,600,000
August	2016	4,551,800,000
September	2016	1,682,300,000
	2015~2016 TOTAL:	**26,821,325,139**
	Flow in Million Gallons:	**26,821.36**

Attachment D

Impingement Fish Counts at Ormond Beach Generating Station, 2013-2016

Impingement Fish Counts at Ormond Beach Generating Station

Year	Month	Date	Actual Flow in Million Gallons	Fish Impingement (kg)	Fish Impingement (lbs)
2013	January	1/29/2013	343.67	0.001	0.00
2013	March	3/15/2013	247.88	0	0.00
2013	May	5/15/2013	249.07	0.46	1.01
2013	July	7/18/2013	285.6	0.074	0.16
2013	September	9/17/2013	171.36	0	0.00
2013	November	11/5/2013	343.91	0.211	0.47
2014	January	1/5/2014	308.21	0	0.00
2014	March	3/19/2014	172.19	0.048	0.11
2014	May	5/15/2014	379.37	0.004	0.01
2014	July	7/21/2014	172.19	0	0.00
2014	September	9/11/2014	171.36	0.012	0.03
2014	November	11/20/2014	171.36	0	0.00
2015	January	1/22/2015	181.95	0	0.00
2015	March	3/19/2015	171.36	0	0.00
2015	May	5/7/2015	171.36	8.566	18.88
2015	July	7/9/2015	349.86	0.154	0.34
2015	September	9/11/2015	685.44	0.154	0.34
2015	December	12/4/2015	347.72	0.457	1.01
2015	January	1/22/2016	216.34	0.048	0.11
2016	May	5/18/2016	249.90	0.023	0.051
2016	August	8/19/2016	519.08	0.09	0.198
2016	October	10/30/2016	128.48	0.001	0.002

Note: Ormond Beach does not perform heat treatments