

**Amended Application for New License**  
**Major Project – Existing Dam**

**Exhibit D**  
**Statement of Project Costs and Financing**

**Security Level: Public**

Yuba River Development Project  
FERC Project No. 2246



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**List of Attachments**

None.

## EXHIBIT D

# STATEMENT OF PROJECT COSTS AND FINANCING

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## 1.0 Introduction

The Yuba County Water Agency (YCWA or Licensee) has prepared this Exhibit D, Project Economics and Financing, as part of its Amended Application for a New License Major Project – Existing Dam (Amended FLA)<sup>1</sup> from the Federal Energy Regulatory Commission (FERC or Commission) for the Yuba River Development Project (Project), FERC Project Number 2246. This exhibit is prepared in conformance with Title 18 of the Code of Federal Regulations (C.F.R.), Subchapter B (Regulations Under the Federal Power Act), Part 5 (Integrated Licensing Process). In particular, this exhibit conforms to the regulations in 18 C.F.R. Section (§) 5.18(a)(5)(iii), which require in part that the application include an Exhibit D, Statement of Project Costs and Financing, in conformance with 18 C.F.R. Section 4.51(e). As a reference, 18 C.F.R. Section 4.51(e) states:

The [Exhibit D] statement must contain:

- (1) If the application is for an initial license, a tabulated statement providing the actual or approximate original cost (approximate costs must be identified as such) of:
  - (i) Any land or water right necessary to the existing project; and
  - (ii) Each existing structure and facility described under paragraph (b) of this section (Exhibit A).
- (2) If the applicant is a licensee applying for a new license, and is not a municipality or a state, an estimate of the amount which would be payable if the project were to be taken over pursuant to section 14 of the Federal Power Act upon expiration of the license in effect [see 16 U.S.C. 807], including:
  - (i) Fair value;
  - (ii) Net investment; and
  - (iii) Severance damages.
- (3) If the application includes proposals for any new development, a statement of estimated costs, including:
  - (i) The cost of any land or water rights necessary to the new development; and
  - (ii) The cost of the new development work with a specification of:
    - (A) Total cost of each major item;
    - (B) Indirect construction costs such as costs of construction equipment, camps, and commissaries;
    - (C) Interest during construction; and
    - (D) Overhead, construction, legal expenses, taxes, administrative and general expenses, and contingencies.
- (4) A statement of the estimated average annual cost of the total project as proposed, specifying any projected changes in the costs (life-cycle costs) over the estimated financing or licensing period if the applicant takes such changes into account, including:
  - (i) Cost of capital (equity and debt);

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<sup>1</sup> YCWA filed with FERC an Application for a New License Major Project – Existing Dam – (Final License Application, or FLA) for the Project on April 27, 2014.

- (ii) Local, state, and Federal taxes;
  - (iii) Depreciation or amortization;
  - (iv) Operation and maintenance expenses, including interim replacements, insurance, administrative and general expenses, and contingencies; and
  - (v) The estimated capital cost and estimated annual operation and maintenance expense of each proposed environmental measure.
- (5) A statement of the estimated annual value of project power, based on a showing of the contract price for sale of power or the estimated average annual cost of obtaining an equivalent amount of power (capacity and energy) from the lowest cost alternative source, specifying any projected changes in the cost of power from that source over the estimated financing or licensing period if the applicant takes such changes into account.
- (6) A statement specifying the source and extent of financing and annual revenues available to the applicant to meet the costs identified in paragraphs (e)(3) and (4) of this section.
- (7) An estimate of the cost to develop the license application.
- (8) The on-peak and off-peak values of project power, and the basis for estimating the values, for projects which are proposed to operate in a mode other than run-of-river.
- (9) The estimated average annual increase or decrease in project generation, and the estimated average annual increase or decrease of the value of project power due to a change in project operations (i.e., minimum bypass flows, limits on reservoir fluctuations).

Besides this introductory section, this Exhibit D includes 12 sections. Section 2.0 describes the approach to estimating Project economics. Sections 3.0 and 4.0 address the cost of the original Project and cost related to takeover of the Project by another party, respectively. Section 5.0 describes Project cost of operations and gross power benefits under the No Action Alternative (i.e., existing conditions). Section 6.0 provides similar cost and power value for the Project as proposed by YCWA in this Amended FLA. Section 7.0 compares the amount of power and value of power under the existing Project and YCWA's proposed Project. Section 8.0 describes how YCWA would finance continued Project operations and maintenance (O&M). Section 9.0 describes the need in the region for the Project power. Section 10.0 describes other developmental benefits of the Project. The last major section, 11.0, describes the consequences should FERC not issue a new license to YCWA. Section 12.0 includes a list of references cited.

See Exhibit A for a description of Project facilities and features, Exhibit B for a description of Project operations, Exhibit C for a construction history and a construction schedule, and Exhibit E for a discussion of potential environmental effects and YCWA's proposed resource management measures. Project design drawings and Project maps are included in Exhibit F and G, respectively. Exhibit H contains a detailed description of the need for the electricity provided by the Project, the availability of electrical energy alternatives and other miscellaneous information.

## **2.0 Project Economics Approach**

### **2.1 Current Cost Approach**

Under the FERC's approach to evaluating the economics of hydropower projects as articulated in the Commission's Order Issuing a New License to the Mead Corporation (FERC 1995), the



Commission employs a “current cost approach” in that all costs are presented in current dollars (e.g., no consideration for potential future power costs, inflation, escalation, or deflation beyond the license issuance date; and costs to be expended over the license term are summed and normalized as current dollars). The Commission’s current cost economic analysis provides a general estimate of the potential developmental benefits and costs<sup>2</sup> and non-developmental benefits and costs of a project.<sup>3</sup> YCWA has prepared this Exhibit D using the Commission’s current cost method.

All costs in this exhibit are provided in 2016 United States (U.S.) dollars, unless otherwise specified.

This Exhibit D provides economic information regarding two alternatives:<sup>4</sup>

- No Action Alternative.<sup>5</sup> This is the current operation of the Project under its existing license and the current waterway environment. Under the No Action Alternative, the inflow to the Project is the same as it has been historically (i.e., with the existing licenses for the upstream water projects), and downstream water demands are the same as they have been historically. In addition, under the No Action Alternative, there are no changes to existing Project facilities, and no changes to existing Project operations.
  - Costs under the No Action Alternative are YCWA’s best estimate of the costs to operate the Project in the future. While YCWA has relied somewhat on historic costs, it has not used those costs without adjustment for future considerations.
  - Power benefits under the No Action Alternative are based on modeled generation using Lower Yuba River Accord flow requirements, historic agricultural demand, and hydrologic records from water year (WY) 1970 through WY 2010, and current market prices. YCWA has not used historic generation or its recently expired power purchase contract with PG&E to estimate power benefits because these would be misleading for this analysis. YCWA currently sells most of the electrical output from the Project into the California Independent System Operator (CAISO) daily and real-time energy markets, and receives payment from the CAISO pursuant to the CAISO daily and real-time energy market payment rules. YCWA engages outside firms to act as scheduling coordinator for the CAISO, and to provide assistance on bidding and settlements for the CAISO markets. YCWA also has a bilateral Power Purchase Agreement (PPA) with PG&E, executed September 30, 2016, for energy output from its Minimum Flow Powerhouse. The Minimum Flow Powerhouse qualifies as a Renewable Power Source (RPS), because its rated capacity of 0.15 MW is less than the maximum limit of 30 MW for a RPS qualifying generating facility. The power

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<sup>2</sup> Developmental benefits of the Project include power generation, water supply, flood control, irrigation and river navigation.

<sup>3</sup> Non-developmental benefits of a waterway include fish and wildlife resources, recreational opportunities and other aspects of environmental quality.

<sup>4</sup> Though not described in this Exhibit D, YCWA also developed Water Balance/Operations Model runs for YCWA’s proposed Project (Future) conditions. The model run is included in Appendix E6 of YCWA’s Amended FLA.

<sup>5</sup> No Action Alternative is synonymous with the “baseline” (FERC 1991). YCWA’s relicensing Water Balance/Operations Model considers the No Action Alternative to be the “Base Case Scenario” or “Base Case Model Run.”

purchase contract for this powerhouse is separate from the rest of the Project and runs for 15 years, through September 30, 2031. YCWA sells some of the capacity benefits of the Project (Resource Adequacy) via bilateral contracts. All electrical generation scheduling is driven by water throughput requirements to meet regulatory flow requirements, consumptive demands, and flood control objectives.

- **YCWA’s Proposed Project.** This is YCWA’s proposed Project, including YCWA’s proposed conditions, which is described in YCWA’s Amended FLA. YCWA’s proposed Project scenario in this Amended FLA assumes water would be dispatched between Narrows 2 and Narrows 1 powerhouses as it is dispatched today.<sup>6</sup>

Costs under YCWA’s proposed Project are similar to the costs under the No Action Alternative, with the exception of YCWA’s proposed additions to the Project and proposed protection, mitigation and enhancement (PM&E) conditions.

For ease of comparison, power benefits under YCWA’s proposed Project were estimated in the same manner that power benefits were estimated for the No Action Alternative – using published information in the current California electricity market for the unit value of the power (i.e., same unit values used in the No Action Alternative), and estimated generation under YCWA’s proposed Project conditions.

Basic economic assumptions used by YCWA in developing costs and benefits under both the No Action Alternative and YCWA’s proposed Project are summarized in Table 2.1-1.

**Table 2.1-1. Assumptions YCWA used in developing costs and power benefits under the YCWA proposed Project.**

Assumption	Value
Period of Analysis	30 Years
Term of Financing	30 Years
Insurance Rate	0%
Base Year for Costs and Benefits	2016
Interest Rate	2.0%
Discount Rate	5.0%

While FERC’s current cost approach requires an applicant to base costs in Exhibit D on a 30-year license term, as described in the Initial Statement of YCWA’s Amended FLA, YCWA requests, with good cause, from the Commission a new license with a term of 50 years. YCWA believes that the Project as proposed in this Amended FLA, including construction of the New Bullards Bar Reservoir Auxiliary Flood Control Outlet and the New Colgate Powerhouse TDS, together with the extensive recreation improvements and other PM&E measures in YCWA’s proposal, clearly warrants a 50-year new license term.

<sup>6</sup> YCWA and PG&E have negotiated a new agreement for the coordinated operations of the Narrows 1 and Narrows 2 powerhouses for the period beginning on May 1, 2016 (after expiration of YCWA’s current power purchase agreement with PG&E on April 30, 016). However, no substantial changes in operations between the Narrows 1 and Narrows 2 powerhouses are expected, and modeling assumed the same general operations of the two facilities for the No Action and Proposed Project.

Pursuant to the Commission’s current policy on license terms, for relicenses the Commission will grant:

30-year terms for the licenses for projects with little or no proposed redevelopment, new construction, new capacity or environmental mitigative and enhancement measures; 40-year terms for projects with a moderate amount of proposed redevelopment, new construction, new capacity or mitigative and enhancement measures; and 50-year terms for projects with proposed extensive redevelopment, new construction, new capacity, or mitigative and enhancement measures.<sup>7</sup>

When considered collectively, there can be no question that the construction initiatives, recreation improvements, and other PM&E measures contemplated under YCWA’s proposal qualify as “extensive” under this standard, therefore justifying a 50-year new license term.

Both the New Colgate Powerhouse TDS and the New Bullards Bar Reservoir Auxiliary Flood Control Outlet are major new construction initiatives. YCWA’s estimated construction cost of the Auxiliary Flood Control Outlet is \$158,923,400 and its estimated construction cost of the New Colgate Powerhouse TDS is \$14,453,000, totaling \$173,376,400 (Tables 6.1-2 and 6.1-1, respectively). The annualized cost of constructing, maintaining and operating these facilities for 30 years would be \$5,779,213, the annualized cost would be 50 years would be \$3,467,528.

While these infrastructure improvements alone would likely qualify the Project for a 50-year new license term, YCWA also proposes extensive recreation improvements and a suite of new PM&E measures for inclusion in the new license. These measures propose significant facility modifications and enhancement of fishery, wildlife, cultural, transportation, recreational and other resources. YCWA estimates that its total capital costs of all recreation and PM&E measures proposed for incorporation into the new license over a 30-year term is \$48,791,500 (Table 6.2-2). It is reasonable to assume that these capital costs would double over 50 years to approximately \$100,000,000 due to facility replacements. YCWA also expects to expend \$3,040,355 annually in implementing the new measures (Table 6.2-2), with an additional annualized \$1,308,677 cost in lost energy and ancillary services opportunities (Table 7.0-1). In total, YCWA’s total cost associated with the new recreation and other PM&E measures, including capital costs over a 50-year period would be approximately \$317,000,000 (\$100,000,000 for capital costs + \$152,000,000 for implementation + \$65,000,000 for lost generation and ancillary services), or more than \$6,000,000 per year.

Together, the annualized costs of both the major infrastructure improvements and the recreation and other PM&E measures proposed in the Amended FLA over a 50-year period are expected to be approximately \$9,500,000. For these reasons, YCWA believes that the new license, as proposed in this Amended FLA, unquestionably meets the Commission’s “extensive redevelopment, new construction, new capacity, or mitigative and enhancement measures” test and is deserving of a 50-year new license term. Such a term would provide YCWA with an

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<sup>7</sup> *Mead Corp.*, 72 FERC ¶ 61,027, at p. 61,077 (1995).

appropriate amount of time to recoup its investment in the major undertakings contemplated in the Amended FLA. This would also be consistent with the Commission’s finding that licenses of longer duration “encourage license applicants (1) to be better environmental stewards, and (2) to propose more balanced and comprehensive development of our river basins.”<sup>8</sup>

### **3.0 Cost of Original Project**

The initial license for the Project, issued by the Federal Power Commission, FERC’s predecessor, to YCWA on June 24, 1963, was effective on May 1, 1963, for a term ending April 30, 2013. The Federal Power Commission’s May 6, 1966, Order Amending License changed the license’s effective date to May 1, 1966, for a term ending on April 30, 2016.

Because this is not an application for an initial license, a tabulated statement of the actual original cost of Project land, water rights, structures and facilities is not required to be included in YCWA’s Amended FLA.

### **4.0 Cost of Project Takeover**

YCWA is a municipality, established under the laws of the State of California, within the meaning of Section 3(7) of the Federal Power Act (FPA); since YCWA is a State subdivision, the Project is not subject to the takeover provisions of Section 14 of the FPA (16 U.S.C. § 807). Accordingly, an estimate of the amount which would be payable if the Project was taken over pursuant to Section 14 is not required to be included in YCWA’s Amended FLA.

### **5.0 Annual Cost of Operations and Gross Power Benefits Under the No Action Alternative**

Section 5 is divided into three major sections, each of which addresses the No Action Alternative. Section 5.1 discusses Project costs, Section 5.2 discusses Project power benefits, and Section 5.3 provides a summary of costs and benefits.

#### **5.1 Cost of Operations**

This annual cost reflects past investment costs owed on the Project, anticipated future investment costs, and current O&M costs. Specifically, this section provides annual cost estimates for: 1) unrecovered past capital additions (i.e., the depreciated plant in-service costs); 2) costs related to management of the existing power purchase contract; 3) local, State of California and federal fees and payments unrelated to environmental and recreation measures; 4) capital costs unrelated to environmental and recreation measures; 5) normal O&M expenses unrelated to environmental and recreation measures; 6) capital costs related to environmental and recreation measures; and 7) normal O&M costs related to environmental and recreation measures. As shown in

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<sup>8</sup> *Consumers Power Co.*, 68 FERC ¶ 61,077, at pp. 61,383-84 (1994).

Table 5.1-1, the estimated annual cost of Project operation under the No Action Alternative is \$32,073,848. Each of the cost components is discussed in the subsections below.

**Table 5.1-1. YCWA’s estimated average annual costs over 30 years in 2016 U.S. dollars for the No Action Alternative.**

Item	Total Capital, One-Time, or Repeating Costs Over 30 Years (2016 U.S. Dollars)	Average Annual Expenses (2016 U.S. Dollars)	Average Annual Cost <sup>1</sup> (2016 U.S. Dollars)
<b>COSTS UNRELATED TO EXISTING ENVIRONMENTAL AND RECREATION CONDITIONS</b>			
Depreciated Plant In-Service Costs <sup>2</sup>	--	\$4,000,000	\$4,000,000
Power Purchase Contract Management Costs <sup>3</sup>	--	\$3,300,000	\$3,300,000
Local, State and Federal Fees and Payments <sup>4</sup>	--	\$1,500,000	\$1,500,000
Capital Additions Costs <sup>5</sup>	\$150,000,000	--	\$5,000,000
Normal O&M Costs <sup>6</sup>	--	\$11,500,000	\$11,500,000
FERC License Application Costs <sup>7</sup>	--	\$1,266,667	\$1,266,667
Operating Reserve <sup>8</sup>	--	\$1,953,333	\$1,953,333
Transmission Costs <sup>9</sup>	--	\$7,848	\$7,848
<i>Subtotal</i>	<i>\$150,000,000</i>	<i>\$23,527,848</i>	<i>\$28,527,848</i>
<b>COSTS RELATED TO EXISTING ENVIRONMENTAL AND RECREATION CONDITIONS</b>			
Normal O&M Costs Related to Environmental and Recreation Conditions <sup>10</sup>	--	\$3,346,000	\$3,546,000
<i>Subtotal</i>	<i>--</i>	<i>\$3,346,000</i>	<i>\$3,546,000</i>
<b>Total</b>	<b>\$150,000,000</b>	<b>\$26,873,848</b>	<b>\$32,073,848</b>

<sup>1</sup> Average Annual Cost is calculated by summing Total Capital, One-Time or Repeating Costs Over 30 Years and the total of Annual Expenses over 30 years, and dividing the sum by 30 years.

<sup>2</sup> As described in Section 5.1.1.

<sup>3</sup> As described in Section 5.1.2.

<sup>4</sup> As described in Section 5.1.3.

<sup>5</sup> As described in Section 5.1.4.

<sup>6</sup> As described in Section 5.1.5.

<sup>7</sup> As described in Section 5.1.6.

<sup>8</sup> As described in Section 5.1.7.

<sup>9</sup> As described in Section 5.1.8.

<sup>10</sup> As described in Section 5.1.9.

### 5.1.1 Depreciated Plant In-Service Costs

The original Yuba River Development Project facilities were constructed with funds from the issuance of \$185,000,000 in A and B bonds with a maturity date of 2016 and an interest rate of 4 to 6 percent. The annual debt service for principal and interest was \$7,700,000.

YCWA depreciated Project plant and equipment using the straight-line method over the estimated useful lives of the following facilities: 100 years for dams; 50 years for plants and turbines; 20 to 35 years for major equipment; and 5 to 10 years for accessory equipment.

As of December 2016, the total replacement cost of plant and equipment of the Project was approximately \$439,000,000, and is considered by YCWA as the Project’s Net Book Value. The annual depreciation expense was \$4,000,000.

### 5.1.2 Power Purchase Contract Management Costs

Over the term of the new license, YCWA intends to seek out and enter into short-term power purchase contracts for the sale of Project’s power. Besides the costs of soliciting proposals, YCWA must also manage the new contracts. The cost for these activities (i.e., periodically soliciting and entering into a power purchase contract, managing the contracts, power scheduling and settlements, 24/7 real-time monitoring, fees and commissions) is estimated to average \$3,300,000 annually over the term of the new license.

### 5.1.3 Local, State and Federal Fees and Payments Unrelated to Environmental and Recreation Measures

As a public agency, YCWA is generally exempt from public taxation. However, YCWA pays various fees to federal, State of California, and local governments for Project-related support services unrelated to environmental or recreation measures. Table 5.1-2 includes a list of the fees and payments unrelated to environmental or recreation measures paid by YCWA in Calendar Year (CY) 2016. These annual fees and payments totaled \$1,120,000.

**Table 5.1-2. Federal, State, and local fees and payments unrelated to environmental or recreation measures paid by YCWA in CY 2016.<sup>1</sup>**

Agency to which Payment Was Made	Description of Payment	Annual Payment (2016 U.S. Dollars)
Federal Energy Regulatory Commission	Use of Federal Land, including National Forest System (NFS) Land and Land Managed by the United States Army Corps of Engineers	\$177,000 <sup>2</sup>
Federal Energy Regulatory Commission	Project Administration	\$553,000
California State Water Resources Control Board (SWRCB)	Water Rights	\$157,000
United States Army Corps of Engineers (USACE)	Payment for Storage of Water in Englebright Reservoir	\$100,000
California Division of Safety of Dams	Dam Safety	\$133,000
<b>Total</b>	--	<b>\$1,120,000</b>

<sup>1</sup> Federal State and local sales tax on capital improvement equipment is included in the costs for the capital improvement equipment shown in Sections 5.1.4 and 5.1.6.

<sup>2</sup> Based on 3,834,470 acres of Zone F federal land in the FERC Project Boundary, per FERC’s most recent Statement of Use Annual Charges for U.S. Lands.

YCWA anticipates local, state and federal fees will increase from the existing annual costs to approximately \$1,500,000. In part, this increase is due to payments to the federal government for use of Englebright Dam in accordance with FPA § 11.4.

### 5.1.4 Capital Addition Costs Unrelated to Environmental and Recreation Measures

Over the past 3 years, YCWA’s Project capital expenses have averaged approximately \$7,500,000 annually.

YCWA anticipates its annual capital addition costs going forward will total over 30 years \$150,000,000, and average of \$5,000,000 per year. The costs will vary from year to year based on the scheduling of capital work, which will include life cycle costs such as runner

replacements, generator rewinds, and oil circuit breaker replacements, building replacements and routine replacement of vehicles and tools. The costs do not include contingency for unexpected repair work that are covered under the operating reserve (Section 5.1.7).

### **5.1.5 Normal O&M Costs Unrelated to Environmental and Recreation Measures**

In 2016, YCWA's expenses to operate the Project, excluding costs associated with environmental and recreation items were approximately \$10,000,000. The expenses include YCWA's O&M staff time, interim replacement costs, insurance, administration and general expenses.

YCWA anticipates normal O&M in the future will expand to include at least a 24-hr-per-day/7-days-per-week control room function, snow survey and hydrologic forecasting, and the addition of management and engineering staff. YCWA has implemented full-time control room function since January of 2016. YCWA anticipates that the normal average annual O&M costs will be \$11,500,000.

### **5.1.6 FERC License Application Costs**

To date, YCWA has expended about \$33,000,000 to prepare its application. These costs include YCWA's internal administrative costs, costs spent on outside consultants including the cost to complete the relicensing studies, and the cost for the pre-filing consultation process with the resource agencies and other Relicensing Participants through late 2016. YCWA's cost to complete the relicensing process may be as high as an additional \$5,000,000 if, as provided under the Energy Policy Act, evidentiary trial-type hearings occur and parties choose to offer alternative measures. Therefore, the total cost for relicensing is estimated to be \$38,000,000. Assuming these costs are recovered over a 30-year term, the average annual cost is \$1,266,667. YCWA plans to recover these costs from the Project over the term of the new license.

### **5.1.7 Operating Reserve**

YCWA plans to build an operating reserve of \$29,300,000. As parts or all of this reserve are expended, the reserve will be re-established. Assuming the reserve is built-up, totally depleted and built-up again over 30 years, the annualized cost of creating and replenishing the reserve is \$1,953,333 annually.

### **5.1.8 Transmission Line Access Costs**

For continued Project O&M and delivery of Project power, YCWA has obtained transmission access.<sup>9</sup> According to the current interconnection agreements, there is no monthly transmission interconnection fee for the New Colgate Powerhouse, and a monthly transmission interconnection fee for the Narrows 2 Powerhouse of \$654.21, for an annual total of

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<sup>9</sup> The Project itself contains no transmission lines. Refer to Section 2.3 of Exhibit H, *Miscellaneous Filing Material*, for a description of how Project power enters the California electric grid.

approximately \$7,848. The special facilities charge for transmission line access and capacity through a third party does not apply to Project facilities.

### 5.1.9 Costs Related to Environmental and Recreation Measures

From 2008 through 2012, YCWA expended \$250,000 for recreation facilities improvements (e.g., upgrades to the water treatment plant, purchase of a boat for United States Department of Agriculture, Forest Service, construction and installation of bear boxes, and placement of vehicular barriers). The average annual expenditure was approximately \$50,000.<sup>10</sup>

YCWA also makes payments to the Forest Service and Emerald Cove Marina, Inc. for concessionaire-type services, expends YCWA staff time for concessionaire-type work, makes payments to the County Sheriff for patrols and makes payments to the United States Army Corps of Engineers. These total approximately \$750,000 each year.

In addition, YCWA anticipates that if the conditions in the existing license did not change, it would spend on average over 30 years approximately \$1,300,000 on replacing and maintaining Project recreation facilities, including replacing the burnt Cottage Creek Picnic Area with a new Cottage Creek Group Campground and providing additional parking at Dark Day Boat Ramp.

The current FERC license for the Project includes articles for the protection, mitigation and enhancement of environmental resources and recreation. Table 5.1-3 provides YCWA’s best estimate of normal O&M annual average costs associated with the primary measures.

**Table 5.1-3. YCWA’s estimated average annual costs in 2016 U.S. dollars for implementation of existing environmental and recreation measures.**

Article or Measure	Description	Average Annual Costs (2016 U.S. Dollars)
<b>CURRENT FERC LICENSE</b>		
Article 6	Activities related to gaging, such as coordination with the United States Geological Survey for reservoir and streamflow gaging, including payment for publication of data and gage rating; and YCWA staff time and expenses to O&M gages	\$235,000
Article 7	Activities related to keeping reservoir and Project facilities safe for public use and consistent with environmental issues, such as keeping the reservoir free of floating material, placing log booms and managing for species listed under the Federal Endangered Species Act, controlling non-native invasive species, participation in a water temperature advisory committee, and management of hazardous materials.	\$300,000
Article 33	Maintaining Minimum Streamflows and Ramping Rates	\$200,000
Article 34	Activities related to adherence to the New Bullards Bar minimum pool requirement.	\$1,000
Article 46	Activities related to coordination of the Project operations with the USACE for flood control	\$10,000
Article 56	Replacement and maintenance of existing recreation facilities.	\$1,300,000
	This includes payments to the Forest Service and Emerald Cove Marina, Inc. for concessionaire-type services, YCWA staff time for concessionaire-type work, payments to the County Sheriff for patrols and payments to the United States Army Corps of Engineers.	\$750,000
<i>Subtotal</i>		\$2,796,000

<sup>10</sup> The estimate does not include capital improvements made by the Forest Service directly from Forest Service funds, or by YCWA and/or the Forest Service through grants.



**Table 5.1-3. (continued)**

Article or Measure	Description	Average Annual Costs (2016 U.S. Dollars)
<b>LOWER YUBA RIVER ACCORD</b>		
--	Annual funding of the Lower Yuba River Accord Yuba River Management Team (RMT)	\$750,000
	<i>Subtotal</i>	<i>\$750,000</i>
	<b>Total</b>	<b>\$3,546,000</b>

## 5.2 Gross Power Benefits

Gross power benefits reflect the avoided cost of replacing the Project’s energy generation and dependable capacity with equally reliable energy and capacity from an alternative source.

This section is divided into four subsections. Section 5.2.1 provides an estimate of energy generation under the No Action Alternative from three sources: 1) historical actual generation from 2008 through 2016; 2) modeled generation from WY 1970 through WY 2010 using the most recent version of YCWA’s Yuba River Development Project Water Balance/Operations Model (Operations Model), which incorporates the Lower Yuba Accord flow regime (see Section 5.2.1.2) and can be found in Appendix E6 of this Amended FLA; and 3) modeled ancillary services from WYs 1970 through 2010 using YCWA’s Operations Model. Section 5.2.2 includes Project authorized installed capacity and estimates dependable capacity. Installed capacity is FERC’s authorized installed capacity (i.e., nameplate rating), and dependable capacity is provided as historical dependable capacity and modeled dependable capacity, the latter using YCWA’s Operations Model. Section 5.2.3 provides an estimate of the unit value of power for capacity; energy, including off peak, peak, partial peak and super peak energy; and ancillary services. Section 5.2.4 estimates the value of the power under the No Action Alternative using modeled energy generation provided in Sections 5.2.1 and 5.2.2 and the market prices of energy and capacity provided in Section 5.2.3. Section 5.2.5 provides an estimate of the cost of the Project’s power if it was provided by combined-cycle natural gas-fired generation, the most likely replacement power alternative.

### 5.2.1 Energy Generation

#### 5.2.1.1 Historical Energy Generation

Table 5.2-1 shows the historical monthly gross generation in megawatt-hours (MWh) at New Colgate, New Bullards Bar Minimum Flow, and Narrows 2 powerhouses each, and the combined gross generation from these powerhouses from CY 2008 through 2016.

**Table 5.2-1. Total and average monthly gross generation in megawatt-hours for CYs 2008 through 2016 at each powerhouse in the Project.**

Month	Monthly Total Generation by Calendar Year (MWh)									Average Monthly & Average Annual Generation (MWh)
	2008	2009	2010	2011	2012	2013	2014	2015	2016	
<b>NEW COLGATE POWERHOUSE</b>										
January	44,963	31,794	38,092	181,483	40,731	110,688	39,976	26,414	6,208	57,817
February	44,722	17,369	44,826	115,626	30,660	67,771	11,659	18,256	20,649	41,282
March	28,435	11,267	42,161	174,549	56,089	68,510	7,356	30,626	152,574	63,507
April	63,529	86,042	53,317	205,378	150,595	62,556	22,166	50,073	122,622	90,698
May	88,951	150,474	114,061	221,565	135,021	105,459	77,893	50,483	115,133	117,671
June	81,679	135,506	207,853	228,706	112,936	81,071	75,991	56,858	148,630	125,470
July	107,230	140,703	211,577	233,779	147,477	111,340	95,780	65,467	116,718	136,675
August	91,074	130,479	158,872	196,310	144,413	93,823	79,960	46,908	84,744	114,065
September	58,147	53,531	57,543	55,500	66,610	39,975	32,750	29,847	44,772	48,742
October	641	43,377	46,344	42,615	58,063	61,236	44,536	39,361	53,406	43,287
November	0	48,695	45,238	48,977	57,198	59,540	40,702	32,201	43,059	41,734
December	17,497	37,015	135,605	44,149	103,692	42,971	10,034	15,903	145,120	61,332
<i>Subtotal</i>	<i>626,868</i>	<i>886,252</i>	<i>1,155,489</i>	<i>1,748,637</i>	<i>1,103,485</i>	<i>904,940</i>	<i>538,803</i>	<i>462,397</i>	<i>1,053,635</i>	<i>942,278</i>
<b>NEW BULLARDS BAR MINIMUM FLOW POWERHOUSE</b>										
January	71	92	79	99	91	90	100	103	106	92
February	70	61	87	53	84	58	77	80	100	74
March	99	96	102	71	66	91	94	103	91	90
April	71	91	96	93	76	95	106	100	104	92
May	0	95	96	101	90	97	103	101	98	87
June	0	93	98	92	93	97	105	101	106	87
July	0	104	96	98	95	95	103	105	104	89
August	57	62	84	98	94	81	99	106	7	76
September	95	92	95	94	95	93	97	102	13	86
October	76	89	99	94	98	97	97	101	106	95
November	102	95	90	96	83	88	92	94	101	93
December	83	88	83	98	75	87	91	97	106	90
<i>Subtotal</i>	<i>724</i>	<i>1,058</i>	<i>1,105</i>	<i>1,087</i>	<i>1,040</i>	<i>1,070</i>	<i>1,165</i>	<i>1,195</i>	<i>1,042</i>	<i>1,054</i>
<b>NARROWS 2 POWERHOUSE</b>										
January	11,361	0	6,781	34,571	1,765	14,527	5,662	0	0	8,296
February	11,030	4,613	11,425	22,188	44	5,515	5,552	6,322	33	7,414
March	0	5,297	13,436	35,940	13,664	4,860	3,315	2,080	34401	12,555
April	11,762	18,099	16,101	37,839	30,066	6,275	4,614	7,730	33855	18,482
May	18,392	35,465	23,891	39,228	24,030	9,150	13,865	9,261	31872	22,795
June	13,628	17,369	37,281	37,749	11,637	10,442	12,388	9,115	22813	19,158
July	18,513	19,987	34,290	37,164	18,133	17,621	17,301	10,533	19826	21,485
August	16,077	15,658	20,213	27,849	17,349	10,831	14,763	2,249	13843	15,426
September	372	121	80	442	0	0	66	0	891	219
October	2,787	185	1,499	3,590	858	4,728	4,096	0	9307	3,006
November	1,436	0	2,265	9,781	6,589	6,811	6,829	0	9405	4,791
December	0	0	29,573	8,083	29,632	7,056	6,265	0	28713	12,147
<i>Subtotal</i>	<i>105,358</i>	<i>116,794</i>	<i>196,835</i>	<i>294,424</i>	<i>153,767</i>	<i>97,816</i>	<i>94,716</i>	<i>47,290</i>	<i>204,959</i>	<i>145,773</i>
<b>TOTAL PROJECT</b>										
January	56,395	31,886	44,952	216,153	42,587	125,305	45,738	26,517	6,314	66,205
February	55,822	22,043	56,338	137,867	30,788	73,344	17,288	24,658	20,782	48,770
March	28,534	16,660	55,699	210,560	69,819	73,461	10,765	32,809	187,066	76,153
April	75,362	104,232	69,514	243,310	180,737	68,926	26,886	57,903	156,581	109,272
May	107,343	186,034	138,048	260,894	159,141	114,706	91,861	59,845	147,103	140,553
June	95,307	152,968	245,232	266,547	124,666	91,610	88,484	66,074	171,549	144,715
July	125,743	160,794	245,963	271,041	165,705	129,056	113,184	76,105	136,648	158,249
August	107,208	146,199	179,169	224,257	161,856	104,735	94,822	49,263	98,594	129,567
September	58,614	53,744	57,718	56,036	66,705	40,068	32,913	29,949	45,676	49,047
October	3,504	43,651	47,942	46,299	59,019	66,061	48,729	39,462	62,819	46,387
November	1,538	48,790	47,593	58,854	63,870	66,439	47,623	32,295	52,565	46,619
December	17,580	37,103	165,261	52,330	133,399	50,114	16,390	16,000	173,939	73,568
<b>Total</b>	<b>732,950</b>	<b>1,004,104</b>	<b>1,353,429</b>	<b>2,044,148</b>	<b>1,258,292</b>	<b>1,003,826</b>	<b>634,684</b>	<b>510,882</b>	<b>1,259,636</b>	<b>1,089,106</b>

Some of the generated power is used at the Project’s powerhouses for station use. Station energy use annually is about 1 MWh at New Colgate Powerhouse and less than 0.1 MWh at New Bullards Bar Minimum Flow and Narrows 2 powerhouses each.

### 5.2.1.2 Modeled Energy Generation

YCWA has operated the Project since 1970. However, Project operations have changed through time. Therefore, in some cases historical information may not provide the best picture of existing conditions. To better describe existing energy generation over a range of hydrologic conditions, YCWA developed its Operations Model to represent the current operating regime, and used the hydrological period of record 1970 through 2010 as input to the model. This hydrological period of record was used throughout the relicensing process. Table 5.2-2 provides a summary of annual generation by powerhouse based on a run of the Operations Model under the No Action Alternative.

**Table 5.2-2. YCWA’s modeled average annual generation in megawatt-hours for WYs 1970 through 2010 at each Project powerhouse under the No Action Alternative.**

Powerhouse	Average Annual Total Generation Under the No Action Alternative (MWh/yr)					Maximum Average Annual Generation (MWh/yr) <sup>1</sup>
	Peak	Partial Peak	Off Peak	Super Off Peak	Total	
New Colgate Powerhouse	150,895	434,579	515,345	90,645	1,191,464	2,194,381
New Bullards Bar Minimum Flow	115	380	571	213	1,280	1,291
Narrows 2 Powerhouse	20,348	66,824	100,579	37,550	225,301	382,403
<b>Total</b>	<b>171,358</b>	<b>501,783</b>	<b>616,495</b>	<b>128,408</b>	<b>1,418,045</b>	<b>2,578,075</b>

Source: No Action Alternative Model Run of Yuba River Development Water Balance/Operations Model, which is in Exhibit E, Appendix E6, of YCWA’s Amended FLA, and post-processing.

<sup>1</sup> The maximum powerhouse capability is the maximum average annual generation for that powerhouse from WY 1970 through WY 2010 under the No Action Alternative. The maximum total generation for the New Colgate and Narrows 2 powerhouses occurred in 1983 and at the New Bullards Bar Minimum Flow Powerhouse in 1984

The Project’s average annual generation from Calendar Year 2008 through WY 2016 listed in Table 5.2-1 of 1,089,106 MWh is less than the Project average annual generation of 1,418,045 MWh listed in Table 5.2-2 because: 1) the total of Table 5.2-1 is historical data and Table 5.2-2 is Operations Model data, and the period of record for these two averages is not the same; 2) releases from the Project for CYs 2008 through 2016 were somewhat lower than the average releases of the Operations Model period of WYs 1970 through 2010 due to drier hydrology; and 3) the historical CY 2008 included several months when the New Colgate Powerhouse was shut down for maintenance and installation of a penstock guard valve, which was not represented in the Operations Model.

Table 5.2-3 shows definitions of time blocks for peak, partial peak, off peak and super off peak that are used in the remainder of this exhibit. These time blocks are defined by PG&E pursuant to California Public Utility Commission (CPUC) Decision D.10-12-035 (PG&E Short-Run Avoided Cost (SRAC) Energy Prices for Qualifying Facilities). YCWA uses these time blocks in this exhibit because the Project resides within the PG&E load service area. Although the CPUC has adopted new definitions, times and seasons for super peak, peak, off peak and super

off peak in recent proceedings (Rulemaking 15-12-012 and associated filings), those new rate structures are only being applied to retail tariffs at this time, and have not yet been applied to wholesale power procurement actions.

**Table 5.2-3. Time block definitions used in Table 5.2-2.<sup>1</sup>**

Time of Use Periods	Time Blocks		
	Period A—Summer (May 1–October 31)	Period B—Winter (November 1–April 30)	Days Applicable
Peak	Noon–6:00 p.m.	NA	Weekdays
Partial-Peak	8:30 a.m.–Noon	8:30 a.m.–9:30 p.m.	Weekdays
	6:00 p.m.–9:30 p.m.		Weekdays
Off-Peak	9:30 p.m.–1:00 a.m.	9:30 p.m.–1:00 a.m.	Weekdays
	5:00 a.m.–8:30 a.m.	5:00 a.m.–8:30 a.m.	Weekdays
	5:00 a.m.–1:00 a.m.	5:00 a.m.–1:00 a.m.	Weekends
Super Off-Peak	1:00 a.m.–5:00 a.m.	1:00 a.m.–5:00 a.m.	All days

<sup>1</sup> Actual time blocks include exceptions for holidays that are not used in the table calculations of this Exhibit D.

Table 5.2-4 shows the estimated monthly average generation in MWh for WYs 1970 through 2010 by time block for the three Project powerhouses and the Project overall under the No Action Alternative based on results of the Operations Model.

**Table 5.2-4. Modeled average monthly generation in megawatt-hours for WYs 1970 through 2010 by time block for each Project powerhouses and the Project overall under the No Action Alternative.**

Month	Peak (MWh)	Partial-Peak (MWh)	Off-Peak (MWh)	Super Off Peak (MWh)	Total (MWh)
<b>NEW COLGATE POWERHOUSE</b>					
January	0	40,574	42,954	8,365	91,892
February	0	43,354	47,913	11,769	103,036
March	0	49,050	55,662	13,228	117,940
April	0	42,963	52,710	8,485	104,158
May	29,089	41,686	70,986	16,865	158,627
June	37,500	40,226	66,700	15,725	160,151
July	38,467	36,074	54,794	8,769	138,104
August	33,290	30,721	37,956	2,783	104,750
September	10,572	25,206	15,220	0	50,998
October	1,977	26,205	21,824	0	50,006
November	0	27,061	22,602	1,104	50,767
December	0	31,458	26,024	3,553	61,036
<i>Subtotal</i>	<i>150,895</i>	<i>434,579</i>	<i>515,345</i>	<i>90,645</i>	<i>1,191,464</i>
<b>NEW BULLARDS BAR MINIMUM FLOW POWERHOUSE</b>					
January	0	41	47	18	106
February	0	37	43	16	97
March	0	41	47	18	106
April	0	40	46	17	103
May	19	22	48	18	106
June	18	21	46	17	103
July	19	22	47	18	106
August	19	22	47	18	106
September	18	21	46	17	103
October	19	22	47	18	106
November	0	39	46	17	102
December	0	41	47	18	105
<i>Subtotal</i>	<i>113</i>	<i>371</i>	<i>558</i>	<i>208</i>	<i>1,250</i>
<b>NARROWS 2 POWERHOUSE</b>					
January	0	7,420	8,565	3,197	19,182
February	0	8,312	9,580	3,578	21,470
March	0	9,885	11,330	4,243	25,457

**Table 5.2-4. (continued)**

Month	Peak (MWh)	Partial-Peak (MWh)	Off-Peak (MWh)	Super Off Peak (MWh)	Total (MWh)
<b>NARROWS 2 POWERHOUSE (cont'd)</b>					
April	0	9,039	10,502	3,908	23,449
May	5,290	6,171	13,253	4,943	29,657
June	4,934	5,756	12,254	4,589	27,532
July	4,160	4,853	10,405	3,884	23,302
August	3,249	3,790	8,147	3,037	18,223
September	1,345	1,569	3,342	1,251	7,506
October	1,371	1,599	3,524	1,299	7,793
November	0	3,839	4,413	1,650	9,903
December	0	4,591	5,265	1,971	11,827
<i>Subtotal</i>	<i>20,348</i>	<i>66,824</i>	<i>100,579</i>	<i>37,550</i>	<i>225,301</i>
<b>TOTAL PROJECT</b>					
January	0	48,035	51,566	11,579	111,180
February	0	51,704	57,536	15,363	124,603
March	0	58,976	67,039	17,488	143,503
April	0	52,042	63,258	12,411	127,711
May	34,398	47,880	84,287	21,825	188,390
June	42,452	46,003	79,000	20,331	187,786
July	42,646	40,949	65,247	12,670	161,512
August	36,558	34,534	46,150	5,838	123,079
September	11,935	26,796	18,608	1,268	58,607
October	3,367	27,826	25,395	1,316	57,904
November	0	30,940	27,060	2,772	60,772
December	0	36,090	31,336	5,542	72,968
<b>Total</b>	<b>171,355</b>	<b>501,775</b>	<b>616,482</b>	<b>128,404</b>	<b>1,418,015</b>

Source: No Action Alternative Model Run of Yuba River Development Water Balance/Operations Model, which is in Exhibit E, Appendix E6, of YCWA's Amended FLA, and post-processing.

### 5.2.1.3 Modeled Ancillary Services

Ancillary services are provided by the New Colgate Powerhouse. These capacity products include regulation-up, regulation-down and spinning reserve. The California energy market has other ancillary services, such as non-spinning reserve, but these other products are minor or not of significant value as compared with regulation-up, regulation-down and spinning reserve, which are the primary ancillary services of the Project.

The Operations Model does not calculate ancillary services directly. Rather, YCWA used a post-process analysis to determine the hourly capacity for each product. The New Colgate Powerhouse generating units can go from no load to full capacity in the time required to qualify the full generating capacity of the powerhouse for regulation and spinning reserve. The hourly theoretical capacity for each product is only limited by the full capacity of the powerhouse and the amount of energy already committed for that hour. For regulation-up, the theoretical amount of capacity available is the full powerhouse capacity minus the generation committed that day. For regulation-down, it is the committed generation that day, theoretically allowing the unit to reduce to zero energy. Spinning reserve theoretical capacity is the same calculation as regulation-up. For determining the hourly value of each of the ancillary service products, other limits are imposed to ensure the pricing assumptions used in the valuation are valid. YCWA's determination of ancillary services value is described in more detail in Section 5.2.4.1.1. Table 5.2-5 provides estimated monthly ancillary services opportunities for New Colgate Powerhouse.

**Table 5.2-5. Estimated average monthly ancillary services opportunities in megawatt-hours for WYs 1970 through 2010 by market for the New Colgate Powerhouse under the No Action Alternative.**

Month	Regulation-Up (MWh)	Regulation-Down (MWh)	Spinning Reserve (MWh)
January	24,839	18,257	95,141
February	19,916	20,151	76,768
March	21,250	22,728	84,701
April	23,771	19,931	98,102
May	16,045	29,567	65,918
June	14,487	29,723	58,952
July	19,521	26,310	78,618
August	25,192	20,790	99,771
September	33,904	10,671	133,117
October	35,282	10,753	136,789
November	33,077	10,874	126,396
December	31,709	12,554	120,884
<b>Total</b>	<b>298,993</b>	<b>232,309</b>	<b>1,175,158</b>

Source: No Action Alternative Model Run of Yuba River Development Water Balance/Operations Model, which is in Exhibit E, Appendix E6, of YCWA's Amended FLA, and post-processing.

## 5.2.2 Project Capacity

### 5.2.2.1 FERC Authorized Installed Capacity

The Project has three powerhouses and one of the powerhouses, New Colgate, has two generating units. Table 5.2-6 shows the FERC total authorized installed capacity in kilowatts (kW) for each powerhouse and the total FERC-authorized installed nameplate capacity for the Project, based on a June 10, 1992 FERC order.

**Table 5.2-6. FERC-authorized installed nameplate capacity in kilowatts by Project powerhouse.**

Powerhouse	FERC-Authorized Nameplate Capacity (kW)
New Colgate, Unit 1	157,500
New Colgate, Unit 2	157,500
New Bullards Bar Minimum Flow, Unit 1	150
Narrows 2, Unit 1	46,750
<b>Total</b>	<b>361,900</b>

Under favorable conditions, historical generation from the Project has at times exceeded the Project's total authorized installed capacity by as much as approximately 10 percent.

### 5.2.2.2 Historical Dependable Capacity

The dependable capacity of a generating facility is defined as “*the generating capacity that the plant can deliver under the most adverse water supply conditions to meet the needs of an electric power system with a given maximum demand.*” (Elliott et al. 1997). One of the critical parameters for defining dependable capacity is the period over which the capacity must be provided. Traditionally, a year or season from time of maximum storage to minimum storage is used for the time period over which capacity is calculated. For a peaking plant, the dependable

capacity critical period is less precisely defined and is specific to the plant demand and constraints.

For base load generation, the time period of the most adverse hydrology was WY 1977, characterized by the most extreme 1-year drought conditions in the hydrologic period of record, which also followed WY 1976, also a dry WY. The annual unimpaired runoff of the Yuba River measured at the Smartsville Gage, which is located on the Yuba River downstream of Narrows 2 Powerhouse, was 370,000 acre-feet (ac-ft) in WY 1977, which was about a 1-in-200 year occurrence. In WY 1977, the amount of inflow to New Bullards Bar Reservoir, including diversions from the Middle Yuba River and Oregon Creek, totaled about 164,000 ac-ft of water, or an annual average flow rate of 226 cubic feet per second (cfs).

For peaking facilities such as the New Colgate Powerhouse, the typical time period for assessing dependable capacity in the California power system is the most critical 6 hour time period. Unless New Bullards Bar Reservoir runs dry or is at the minimum pool with insufficient inflow, the full capacity of 315 megawatts (MW) of New Colgate Powerhouse is available for any 6 hour time period. However, a powerhouse’s capacity is affected by a range of the variables of head, power factor, flow and efficiency.

Table 5.2-7 shows the estimated dependable capacity at each powerhouse and the overall Project.

**Table 5.2-7. Historical dependable annual capacity in kilowatts for New Colgate, Narrows 2, and the New Bullards Bar Minimum Flow powerhouses.**

Powerhouse	WY of Lowest Available Capacity	Dependable Capacity in that WY (kW)
New Colgate Powerhouse <sup>1</sup>	1977	247,261
Narrows 2 Powerhouse <sup>2</sup>	1977	0
New Bullards Bar Minimum Flow <sup>3</sup>	2001	70
<b>Total</b>	--	<b>247,331</b>

<sup>1</sup> New Colgate Powerhouse dependable capacity is full capacity (315 MW), limited by available head. New Bullards Bar Reservoir was drawn down to its FERC-minimum pool (elevation 1,732 ft) in November and December 1977.

<sup>2</sup> Because there are two powerhouses at Englebright Dam and the Narrows 1 Powerhouse is used in lower flow conditions, the Narrows 2 Powerhouse did not operate for extended periods in 1977, the critically dry period, due to all releases from Englebright Dam being made through the Narrows 1 Powerhouse.

<sup>3</sup> The New Bullards Bar Minimum Flow Powerhouse operates with a continuous flow of about 5 cfs. Dependable capacity determined by computing the average hourly capacity for the low-generation month since January 2000 for September 2001.

### 5.2.2.3 Modeled Dependable Capacity

For WY 1977, storage in New Bullards Bar Reservoir played a significant role in augmenting the water supply available for release through the New Colgate Powerhouse. Modeling of the No Action Alternative as detailed in Technical Memorandum 2.2, *Water Balance/Operations Model*, which can be found in Appendix E6, of this Amended FLA, provides results of releases and generation using current minimum flow requirements (i.e., the Lower Yuba River Accord) and current consumptive demands.

In WY 1977, the lowest modeled annual average flow through each of the Project powerhouses occurred. The total release through the New Colgate Powerhouse was 384,539 ac-ft, with an

annual generation of 357,320 MWh of electricity, based on the Operations Model results. Because the New Colgate Powerhouse is a peaking facility, for the most critical 6-hour period, which is the typical time period for assessing dependable capacity in the California power system, the full capacity of 315 MW is available for dispatch and defines the dependable capacity of this powerhouse.

As with the historical capacity, the New Colgate Powerhouse modeled dependable capacity is based on a peaking powerhouse metric, which is the capacity over the most critical 6 hour period, with consideration to head.

As discussed in previous sections, the Narrows 2 Powerhouse is a base-loaded power generation facility. Therefore, the dependable capacity of the Narrows 2 Powerhouse is determined by the period of the most adverse hydrology, which was WY 1977. The annual flow volume at USACE's Englebright Reservoir for WY 1977, based on the Operations Model results is 453,072 ac-ft. This included 388,908 ac-ft of releases from New Bullards Bar Reservoir and the remaining amount from local accretions from the Middle Yuba and South Yuba rivers.

In WY 1977, the modeled operations of the Project results in no flow at Englebright Dam available for power generation through the Narrows 2 Powerhouse except for a week in November 1976, because the model assumes that the rest of the Englebright Dam releases would be used to generate power at Narrows 1 Powerhouse. As described above for the No Action Alternative, the determination of releases through the powerhouses is based on required release rate, facility capacity and facility efficiency as well as a preference for RPS<sup>11</sup> power at the Narrows 1 Powerhouse. For WY 1977, the maximum Englebright Dam release rate was 915 cfs. The Operations Model uses the Narrows 1 Powerhouse plus releases through the Narrows 2 Full Bypass for flows from zero to 900 cfs from Englebright Dam and Narrows 2 Powerhouse releases for flows between 900 cfs and 1,600 cfs from Englebright Dam. Under the No Action Alternative, the model does not consider the relative priorities of the water rights for the Narrows 1 and Narrows 2 powerhouses. Since it is possible for there to be no generation from Narrows 2 powerhouse for an extended period, the Narrows 2 Powerhouse's dependable capacity is 0 kW.<sup>12, 13</sup>

The New Bullards Bar Minimum Flow Powerhouse is a base-loaded powerhouse. Its dependable capacity is calculated as the modeled minimum-daily average generation, in kilowatt-hours (kWh), divided by 24, which occurred on December 13, 1977.

Table 5.2-8 provides modeled dependable capacity by powerhouse and for the Project overall.

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<sup>11</sup> Senate Bill X1-2, signed by Governor Brown in April 2011.

<sup>12</sup> YCWA and PG&E have negotiated a new agreement for the operations of the Narrows 1 and Narrows 2 powerhouses for the period beginning on May 1, 2016. However, no substantial changes in operations between the Narrows 1 and Narrows 2 powerhouses are expected, and modeling assumed the same general operations of the two facilities for the No Action and Proposed Project.

<sup>13</sup> For modeling and evaluation purposes, Project operations are assumed to be similar to current operations and the value of the generation from the Narrows 1 and Narrows 2 powerhouses is assumed to be split according to the coordinated operations agreement between YCWA and PG&E.



**Table 5.2-8. Modeled dependable capacity in kilowatts for New Colgate, Narrows 2 and New Bullards Bar Minimum Flow powerhouses.**

Powerhouse	WY of Lowest Available Capacity	Dependable Capacity in that WY (kW)
Narrows 2 Powerhouse	1977	0
New Bullards Bar Minimum Flow	1977	101
New Colgate Powerhouse	1977	230,158
<b>Total</b>	--	<b>230,259</b>

Source: No Action Alternative Model Run of Yuba River Development Water Balance/Operations Model, which is in Exhibit E, Appendix E6, of YCWA's Amended FLA, and post-processing.

The difference between the historical dependable capacity of 247,331 kW shown in Table 5.2-7 and the modeled dependable capacity of 230,259 kW shown in Table 5.2-8 is minor and is due to the No Action Alternative's assumption that New Bullards Bar Reservoir's water surface elevation would be reduced below the FERC minimum pool in 1977.

### 5.2.3 Unit Value of Power<sup>14</sup>

#### 5.2.3.1 Market Price of Capacity

There are two categories of capacity products that are provided by the Project - Resource Adequacy and Ancillary Services. For the California power market, the CPUC has established that sufficient capacity to serve expected load must be provided by load serving entities (LSE) as Resource Adequacy (California Public Utilities Code Section 380). Additionally, the CAISO identifies target levels of system, local and flexible Resource Adequacy for each LSE. Currently there is no transparent market for Resource Adequacy products because each LSE provides and acquires the necessary resources through the development of bilateral negotiations. In addition to market transparency challenges, the different Resource Adequacy types (system, local and flex) have different values, and the volume and term of transaction dictate different pricing structures that further confound accurate pricing. Finally, California is currently experiencing a glut of Resource Adequacy which results in a depressed and uncertain market for Resource Adequacy. Due to the limitations on determining the market for capacity and the availability of capacity values, this element of the benefits of the Project cannot be determined.

Ancillary Services are capacity products that are transacted in the CAISO markets, where some or all of the available capacity of the generating facility is made available as regulation or stabilization products to respond to variations and uncertainties in system load and generation on the energy grid. Ancillary Services products are provided by the New Colgate Powerhouse, and historical prices for these products and their use in determining Project value are described in the sections below.

<sup>14</sup> Any use of the market prices of installed and dependable capacity and energy information in this Exhibit D for forecasting current or future value of Project power is speculative, may be inappropriate, and is subject to the user's assumptions and risk.

### 5.2.3.2 Market Price of Energy

Under California’s RPS regulations, California investor-owned utilities, electric service providers, and community choice aggregators must increase procurement from eligible renewable energy resources to 50 percent of total procurement by 2030. One of the Project’s powerhouses qualifies as an RPS-eligible generating unit (nameplate capability of less than 30 MW) - New Bullards Bar Minimum Flow Powerhouse, which has a FERC nameplate rating of 150 kW). One powerhouse, the Narrows 2 Powerhouse, is not RPS-eligible and is not used for ancillary services, which are discussed below. The third Project powerhouse, New Colgate Powerhouse, is not RPS-eligible and is used for ancillary services. YCWA’s approach to valuing energy generated by each of the powerhouses is discussed below.

#### 5.2.3.2.1 Narrows 2 Powerhouse – Peak, Partial Peak, Off-Peak and Super Off Peak Power Values

The CAISO publishes current and historical prices for each of the several thousand nodes within its electrical balancing area using a web based system called Open Access Same-time Information System (OASIS). In OASIS, settled prices are provided for the various markets run by the CAISO, including the Day-Ahead Market, which provides for hourly pricing of energy and ancillary services. The Narrows 2 Powerhouse is represented as a node in the system, and a Locational Marginal Price (LMP) is published for each hour of the day for this node. To determine prices to be used with the energy generation under the No Action Alternative resulting from YCWA’s Operations Model, 2 years of hourly LMPs from January 2015 to December 2016 were averaged to obtain a single representative year of recent historical hourly values. Table 5.2-9 lists a summary of Narrows 2 Powerhouse LMPs in dollars per MWh, averaged by month for the four CPUC time blocks.<sup>15,16</sup>

**Table 5.2-9. CAISO’s published monthly average of Day-Ahead hourly Locational Marginal Prices for Narrows 2 Powerhouse by CPUC Time Block based on historical data from January 2015 through December 2016.**

Month	Peak (Dollars/MWh)	Partial Peak (Dollars/MWh)	Off Peak (Dollars/MWh)	Super Off Peak (Dollars/MWh)
January	--	\$34.12	\$31.54	\$26.04
February	--	\$28.99	\$27.03	\$22.51
March	--	\$24.38	\$24.20	\$17.41
April	--	\$26.35	\$23.72	\$18.77
May	\$26.22	\$27.91	\$25.70	\$22.25
June	\$36.62	\$35.57	\$28.97	\$22.82
July	\$38.44	\$37.97	\$29.74	\$25.17
August	\$37.78	\$37.34	\$31.42	\$26.67
September	\$36.73	\$38.70	\$33.25	\$28.31
October	\$32.13	\$39.63	\$32.05	\$26.73
November	--	\$31.95	\$29.72	\$24.47
December	--	\$33.84	\$32.26	\$26.43

<sup>15</sup> Table 5.2-3 describes the time blocks used in Table 5.2-8.

<sup>16</sup> Narrows 2 Powerhouse is a base load facility and does not operate for peaking; however, peak hour prices are applied to the generation that occurs during the peak hours to obtain the total power value for each hour.

5.2.3.2.2 New Colgate Powerhouse - Peak, Partial Peak, Off-Peak and Super Off Peak Power Values

As with the Narrows 2 Powerhouse, the New Colgate Powerhouse is represented as a node in the OASIS system, and a LMP is published for each hour of the day for this node. To determine prices to be used with the energy generation under the No Action Alternative resulting from YCWA’s Operations Model, 2 years of hourly LMPs from January 2015 to December 2016 were averaged to obtain a single representative year of hourly power values. Table 5.2-10 lists a summary of New Colgate Powerhouse LMP values averaged by month for the four CPUC time blocks.

**Table 5.2-10. CAISO’s published monthly average of Day-Ahead hourly Locational Marginal Prices for New Colgate Powerhouse by the CPUC’s time block based on historical data from January 2015 through December 2016.**

Month	Peak (Dollars/MWh)	Partial Peak (Dollars/MWh)	Off Peak (Dollars/MWh)	Super Off Peak (Dollars/MWh)
January	--	\$33.53	\$31.45	\$25.70
February	--	\$28.83	\$27.05	\$22.21
March	--	\$25.04	\$24.66	\$18.30
April	--	\$27.51	\$25.09	\$19.71
May	\$26.43	\$29.46	\$25.14	\$22.14
June	\$38.87	\$35.57	\$28.38	\$22.62
July	\$41.47	\$36.46	\$29.19	\$25.09
August	\$39.57	\$36.66	\$30.91	\$26.54
September	\$38.49	\$37.69	\$32.77	\$27.77
October	\$34.44	\$37.89	\$32.58	\$26.54
November	--	\$31.77	\$29.68	\$24.35
December	--	\$34.18	\$32.46	\$25.99

5.2.3.2.3 New Bullards Bar Minimum Flow Powerhouse - Peak, Partial Peak, Off-Peak and Super Off Peak Power Values

The power prices used in valuing generation for the New Bullards Bar Minimum Flow Powerhouse are described in YCWA’s Power Purchase Agreement (PPA) with PG&E, executed September 30, 2016. The power purchase contract for this powerhouse is separate from the rest of the Project and runs for 15 years, through September 30, 2031. The powerhouse rated capacity of 0.15 MW is less than the maximum limit of 30 MW for a RPS qualifying generating facility and qualifies for the higher prices for RPS energy, and the current contract reflects the added value of RPS credited power. Table 5.2-11 lists the PPA prices by month and time block for the New Bullards Bar Minimum Flow Powerhouse.

**Table 5.2-11. YCWA-PG&E Power Purchase Agreement energy prices by CPUC time blocks.**

Month	Peak (Dollar /MWh)	Partial Peak (Dollar /MWh)	Off Peak (Dollar /MWh)	Super Off Peak (Dollar /MWh)
January	--	\$91.02	\$84.21	\$88.25
February	--	\$91.02	\$84.29	\$88.25
March	--	\$91.02	\$84.19	\$88.25
April	--	\$78.84	\$79.01	\$87.24
May	\$80.29	\$77.61	\$79.00	\$87.24
June	\$80.29	\$77.61	\$79.01	\$87.24
July	\$99.82	\$95.95	\$85.27	\$88.70
August	\$99.82	\$95.95	\$85.27	\$88.70

**Table 5.2-11. (continued)**

Month	Peak (Dollar /MWh)	Partial Peak (Dollar /MWh)	Off Peak (Dollar /MWh)	Super Off Peak (Dollar /MWh)
September	\$99.82	\$95.95	\$85.32	\$88.70
October	\$92.55	\$89.71	\$84.19	\$88.25
November	--	\$91.02	\$84.22	\$88.25
December	--	\$91.02	\$84.19	\$88.25

### 5.2.3.3 Market Price of Ancillary Services

Prices for ancillary services are published by the CAISO on the OASIS system just as energy prices are published. Three ancillary service products that are provided by the New Colgate Powerhouse are used to quantify the current ancillary service value of the project. These ancillary services are: 1) regulation up; 2) regulation down; and 3) spinning reserve. The analysis of ancillary service benefits uses a single year of hourly ancillary service prices that are based on the average of 3 years of CAISO Day-Ahead market prices for the period from January 2015 to December 2016. Table 5.2-12 summarizes the ancillary services prices as average monthly prices for regulation up, regulation down and spinning reserve.

**Table 5.2-12. CAISO’s published monthly average of Day-Ahead hourly Ancillary Service Prices for New Colgate Powerhouse based on historical data from January 2015 through December 2016.**

Month	Regulation Up (Dollars/MW)	Regulation Down (Dollars/MW)	Spinning Reserve (Dollars/MW)
January	\$ 3.83	\$ 3.55	\$2.08
February	\$5.28	\$4.97	\$2.78
March	\$8.35	\$7.62	\$4.27
April	\$10.14	\$6.90	\$3.88
May	\$8.21	\$ 9.81	\$1.61
June	\$3.29	\$ 3.22	\$1.15
July	\$2.39	\$ 2.92	\$1.05
August	\$2.45	\$ 2.94	\$1.18
September	\$3.13	\$ 2.86	\$1.78
October	\$3.93	\$ 3.73	\$2.19
November	\$3.74	\$ 3.97	\$2.21
December	\$3.67	\$ 3.37	\$1.98

### 5.2.3.4 Market Price of Other Energy Products

YCWA may have opportunities to sell other energy products from time to time; additionally the CAISO may further modify its markets and products to include different energy products or pricing structures. Some potential energy product sales (e.g., “non-carbon” energy that is not RPS certified) may be of interest to buyers via bilateral contracts. Such products may be of only modest value and will not have transparent pricing associated with them. New CAISO markets or products may have transparent pricing, but it is impossible to speculate as to future products and values at this time. As a result, no revenue value is assigned to any energy products at this time, outside of those values discussed in the previous three sections.

## 5.2.4 Gross Power Benefits

### 5.2.4.1 Power Benefits Based on Market Prices

Power benefits were calculated based on WYs 2015 through 2016-averaged actual CAISO market prices and modeled generation, as calculated by YCWA’s Operations Model for the New Colgate Powerhouse, and the Narrows 2 Powerhouse under the No Action Alternative. The New Bullards Bar Minimum Flow Powerhouse power benefits use the YCWA-PG&E 2016 contract prices for power. The resulting energy generation power benefit by powerhouse is listed in Table 5.2-13. Due to the differences in operations of the powerhouses, the calculation of power benefits also differs for these facilities.

**Table 5.2-13. Simulated average annual gross power benefits in 2016 U.S. dollars by Project powerhouse for the No Action Alternative.**

Powerhouse	Average Annual Gross Power Benefits (2016 U.S. Dollars)					Total
	Energy					
	Peak	Partial Peak	Off Peak	Super Off Peak	Ancillary Services	
New Colgate	\$5,432,413	\$15,981,585	\$15,944,703	\$2,077,092	\$5,159,385	\$45,229,765
Narrows 2	\$705,153	\$2,146,849	\$2,930,469	\$899,926	\$0	\$6,682,398
New Bullards Bar Minimum Flow	\$10,618	\$33,793	\$47,532	\$18,797	\$0	\$110,665
<i>Subtotal</i>	<i>\$6,148,184</i>	<i>\$18,162,227</i>	<i>\$18,922,704</i>	<i>\$2,995,815</i>	<i>\$5,159,385</i>	<i>--</i>
<b>Total</b>		<b>\$46,228,930</b>			<b>\$5,159,385</b>	<b>\$51,388,315</b>

The following describes the calculations used to derive the power benefits of the Project for each Project powerhouse.

#### 5.2.4.1.1 New Colgate Powerhouse

New Colgate Powerhouse provides energy generation and ancillary services. YCWA’s Operations Model that was used to determine energy generation of the powerhouse does not have the capability to schedule generation on an hourly or daily basis to maximize power benefits based on market conditions, while operating within the system constraints. The New Colgate Powerhouse can produce power on a peak demand schedule as long as system constraints are satisfied. To approximate the peaking capability of the powerhouse, post processing of model output was done to determine the optimal energy generation schedule for each hour of each day of model output generation and by optimizing the generation for total power value of the 24-hour period. Once the optimization of energy generation was done, ancillary services opportunity benefit was calculated using a simplified set of assumptions regarding constraints of these products. The assumptions used to optimize generation and determine ancillary services capacity included perfect foresight of pricing to optimize generation, a limit on the quantity of regulation, and full utilization of capacity for spinning reserve.

Ancillary services values were determined once generation was allocated to optimize energy values each day of the period of simulation. With generation for each hour determined, the amount of regulation-up and regulation-down capacity that would be bid into the market was

calculated as the minimum of either the available capacity (i.e., remaining powerhouse capacity above generation for regulation-up, and generation down to a minimum value of 0 MW for regulations-down) or a selected pricing elasticity limit. Since historical market prices are used in the analysis and since in many hours the capacity of regulation at New Colgate Powerhouse bid into the market can significantly impact prices, a limit of 60 MW for regulation was selected as the limit of regulation capacity for which the use of historical market prices would no longer be a valid assumption. This is due to the elasticity of market prices with capacity supply bid into the market. The resulting regulation-up and -down capacity for each hour is multiplied times the historical hourly market price for that capacity product.

Spinning reserve capacity value was calculated by multiplying the remaining capacity after regulation-up capacity is determined times the historical hourly price for spinning reserve.

The above assumptions result in a very simplified analysis compared to actual market bidding and award conditions as well as other market complexities, but provide a reference for the relative value of the powerhouse output under the No Action Alternative. Resulting energy generation and ancillary service benefits for the New Colgate Powerhouse are listed in Table 5.2-13.

#### 5.2.4.1.2 Narrows 2 Powerhouse

For this powerhouse, which operates in a base load configuration and does not provide ancillary services, the only power benefit is energy generation. The energy generation benefit is determined by multiplying the market based hourly value as described in Table 5.2-9 times the mean-daily modeled generation described in Table 5.2-4 divided into 24 hours of equal generation. Resulting energy generation for the Narrows 2 Powerhouse is listed in Table 5.2-13. There are no ancillary services for this powerhouse.

#### 5.2.4.1.3 New Bullards Bar Minimum Flow Powerhouse

This powerhouse runs continuously at a constant release rate to maintain the required minimum flow below the dam, and therefore produces an almost constant rate of energy generation. The power benefit for this powerhouse is based on multiplying the power purchase agreement power prices broken out into the four time blocks, times the mean-daily modeled generation divided into 24 hours of equal generation. Resulting energy generation for the New Bullards Bar Minimum Flow Powerhouse is listed in Table 5.2-13. There are no ancillary services for this powerhouse.

### **5.2.5 Power Benefits Based on Replacement Power**

Replacing the output of the Project would be accomplished in one of two ways: 1) importing power into the region from an out-of-state facility; or 2) constructing a new generation facility within Northern California.

While importing power into the region to offset Project generation would be possible during some seasons, imports will be impossible during some seasons and hydrologic year types given

the physical limits of the current transmission grid. To the extent that imported generation is available, it would be priced at CAISO market prices and would therefore yield a price consistent with the market rate estimate provided above.

For a new generation facility within Northern California that could provide regulation, ramping and flexibility to actively assist in managing California's load and generation swings in a manner similar to the Project, it is likely that replacement power would be produced by a combined cycle natural gas-fired generating facility. The CPUC's Market Price Referent (MPR) process (2011, California Public Utilities Commission at <http://www.cpuc.ca.gov/PUC/energy/Renewables/mpr>) includes a model and process to estimate long-term price of electricity for a combined cycle natural gas-fired facility. Utilizing the CPUC model and process, with updated assumptions, the MPR methodology yields a levelized power value of \$75.10/MWhr in 2011 dollars (\$80.13/MWhr in 2016 dollars using the U.S. Bureau of Labor Statistics CPI Inflation Calculator, [https://www.bls.gov/data/inflation\\_calculator.htm](https://www.bls.gov/data/inflation_calculator.htm)). A more recent study by the California Energy Commission (<http://www.energy.ca.gov/2014publications/CEC-200-2014-003/>) estimated mid-case levelized costs of development and operation by a public entity at \$102.08 in 2013 dollars (\$105.91/MWhr in 2016 dollars using the U.S. Bureau of Labor Statistics CPI Inflation Calculator).

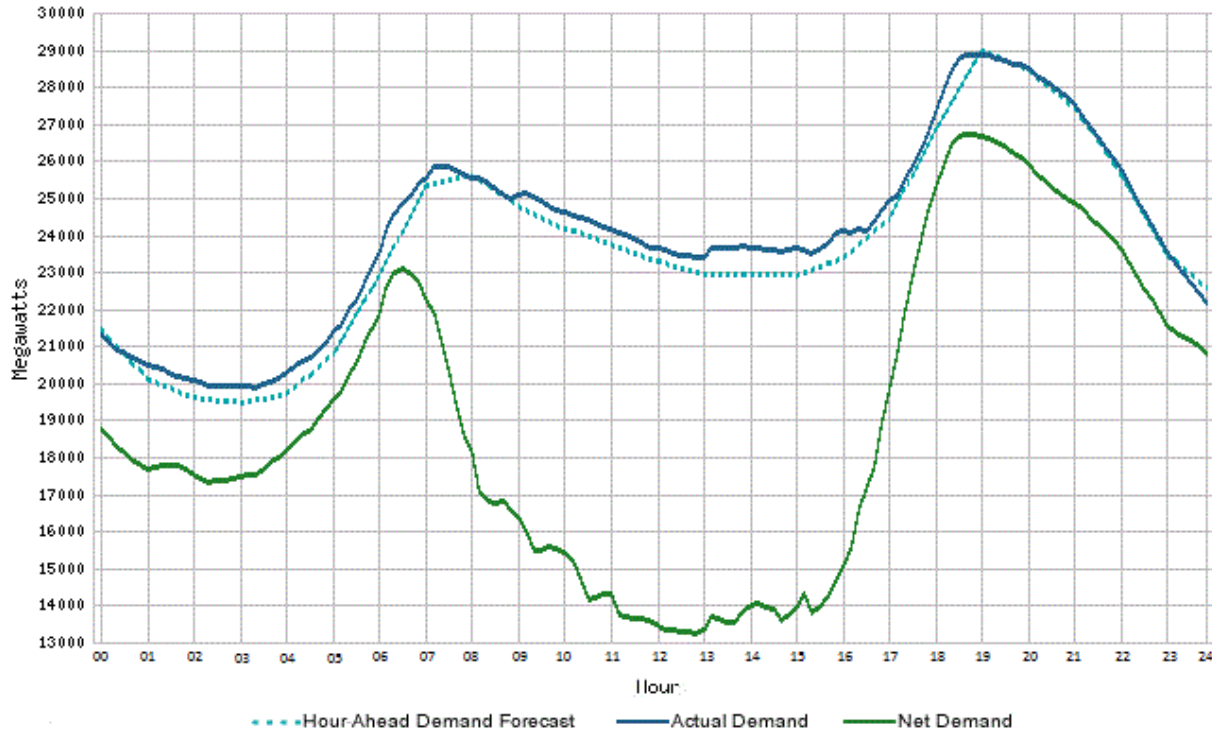
In addition, capital and O&M costs for a new gas pipeline and electric transmission, both of which are unknown at this time since they depend on the location of the new facility, would need to be added to the overall cost of the alternative. Siting a combined cycle natural gas-fired plant in Northern California would be challenging given the limited availability of emission offsets in the region.

If a combined cycle natural gas-fired generating facility were to be sited to replace the power generation of the Project, the annual average cost of replacement power would be \$112,800,000 using the escalated MPR methodology and \$149,100,000 using the escalated CEC methodology.

### **5.2.6 Trend in California Power Market**

California wholesale power prices have been on a downward trend for about 3 years, and low prices are anticipated to persist for at least a decade into the future. This low price trend is based on two basic trends, daily load and long term natural gas prices.

The CAISO tracks the "net" demand. The net demand curve (Figure 5.2-1) depicts the variability in demand and supply that the CAISO must counterbalance to maintain grid reliability. Net demand is calculated by taking the actual demand and subtracting the electricity produced by variable generation resources, wind and solar, which are directly connected to the CAISO grid. Higher levels of variable electricity generation increase the CAISO operational need for resources with the technological flexibility to start and stop quickly, and maintain output for set periods of time, so the CAISO can match supply and demand at all times.



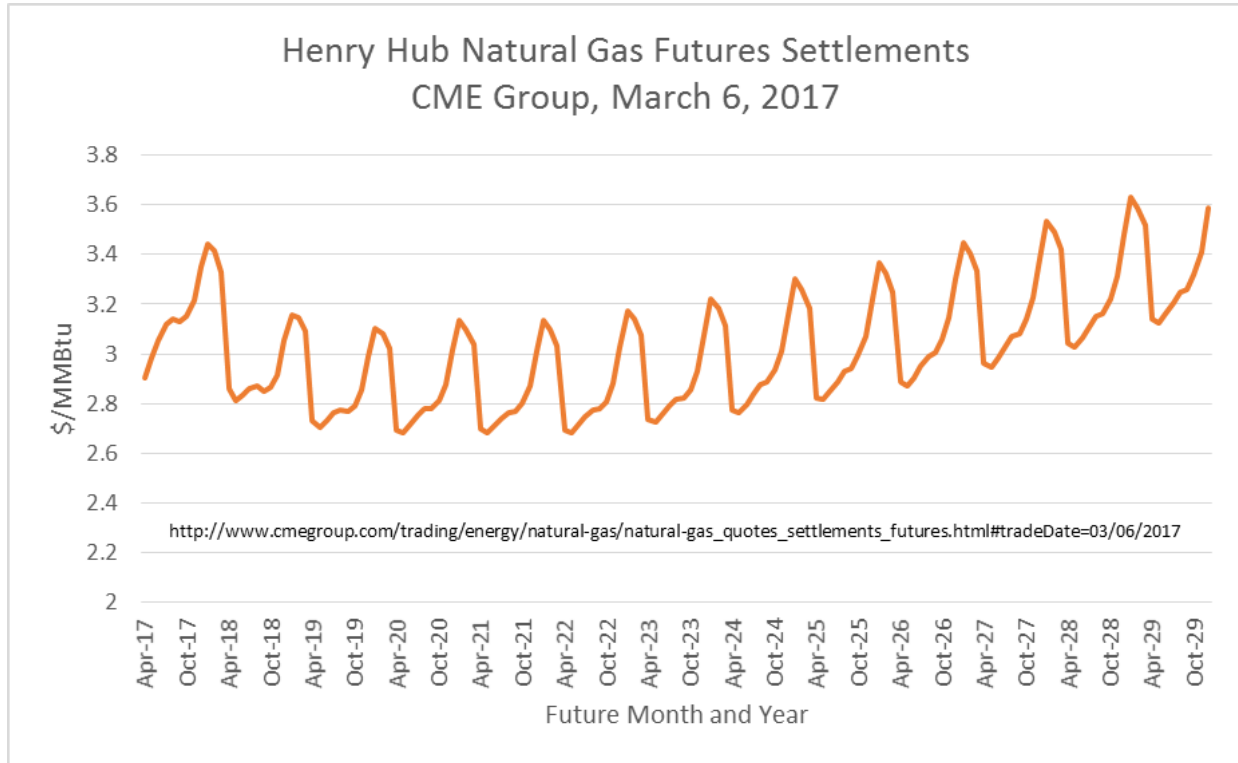
**Figure 5.2-1. CAISO Net Load Curve - Mar 6 2017.**

Source: <http://www.caiso.com/Pages/TodaysOutlook.aspx>

Decrease in net demand is driven by renewables penetration into the California grid. As the state moves towards a 50 percent renewables mandate, the downward pressure on net demand, and thus wholesale energy prices, will continue.

Energy prices in the CAISO market are set by the marginal generation resource, which is typically natural gas fired generation particularly during the net demand peaks between 5 and 8 A.M. and 4 and 10 P.M. Natural gas prices are low, and low prices, as evidenced by natural gas futures prices, are expected to stay low for several years (Figure 5.2-2).

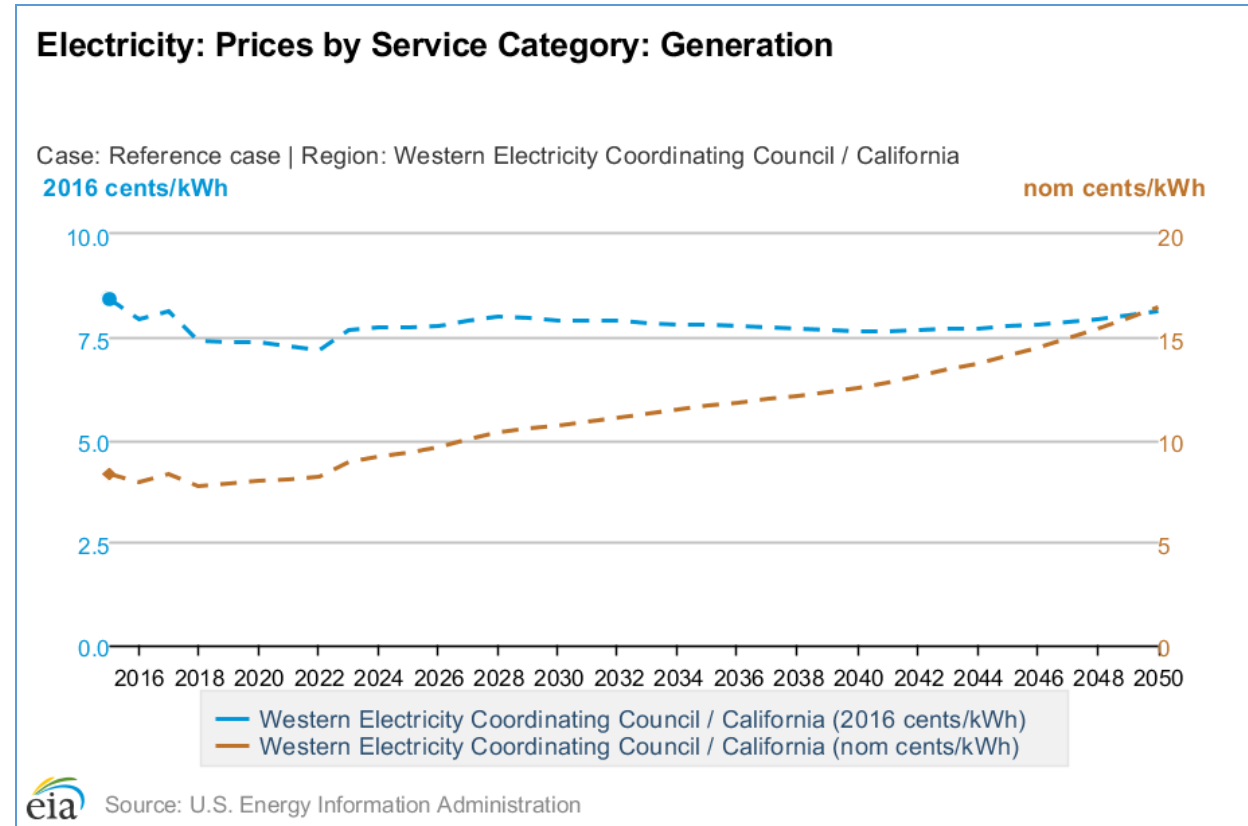




**Figure 5.2-2. Natural gas futures through 2029.**

Source: CME Group Futures Trading Platform, March 6, 2017 at [http://www.cmegroup.com/trading/energy/natural-gas/natural-gas\\_quotes\\_settlements\\_futures.html#tradeDate=03/06/2017](http://www.cmegroup.com/trading/energy/natural-gas/natural-gas_quotes_settlements_futures.html#tradeDate=03/06/2017)

The low price trend is reflected in the Energy Information Administration’s (EIA) Annual Energy Outlook 2017, which includes a reference case forecast of generation prices. The EIA analysis includes contract, regulatory mandated and qualifying facility prices, as well as CAISO market prices, show a weighted average well above current CAISO market prices. However, the overall price trend is declining and flat, with prices declining over the next 5 years, then holding flat for many years into the future. (Figure 5.2-3.)



**Figure 5.2-3. Anticipated relative future generation prices.**

Source: Energy Information Agency, 2017. Annual Energy Outlook 2017. [www.eia.gov/aeo](http://www.eia.gov/aeo).

### 5.3 Summary of No Action Alternative Costs and Power Benefits

Table 5.3-1 summarizes the Project’s costs and power benefits under the No Action Alternative, based on the information provided above.

**Table 5.3-1. YCWA’s estimate of average annual costs and power benefits in 2016 U.S. dollars under the No Action Alternative.**

Value	No Action Alternative
<b>AVERAGE ANNUAL GROSS POWER BENEFITS</b>	
Capacity	--
Installed <sup>1</sup>	361,900 kW
Dependable <sup>2</sup>	230,259 kW
<i>Subtotal - Value in 2016 Dollars</i>	<i>\$0</i>
Energy	--
Peak Energy <sup>3</sup>	171,358 MWh
Partial Peak Energy <sup>3</sup>	501,783 MWh
Off-Peak Energy <sup>3</sup>	616,495 MWh
Super Off-Peak <sup>3</sup>	128,408 MWh
<i>Subtotal - Value in 2016 Dollars<sup>4</sup></i>	<i>\$46,228,930</i>
Ancillary Services	--
Regulation-Up <sup>5</sup>	298,993 MWh
Regulation-Down <sup>5</sup>	232,309 MWh

**Table 5.3-1. (continued)**

Value	No Action Alternative
<b>AVERAGE ANNUAL GROSS POWER BENEFITS (cont'd)</b>	
Spinning Reserve <sup>5</sup>	1,175,158 MWh
<i>Subtotal - Value in 2016 Dollars<sup>4</sup></i>	<i>\$5,159,385</i>
<b>Total - Value in 2016 Dollars<sup>4</sup></b>	<b>\$51,388,315</b>
<b>AVERAGE ANNUAL COSTS</b>	
Non-Environmental/Recreational <sup>6</sup>	\$28,527,848
Environmental/Recreational <sup>6</sup>	\$3,546,000
<b>Total - Value in 2016 Dollars<sup>6</sup></b>	<b>\$32,073,848</b>
<b>AVERAGE ANNUAL NET BENEFIT</b>	
<b>Total 2016 U.S. Dollars<sup>7</sup></b>	<b>\$19,314,467</b>

<sup>1</sup> From Table 5.2-6.

<sup>2</sup> From Table 5.2-8.

<sup>3</sup> From Table 5.2-2.

<sup>4</sup> From Table 5.2-13.

<sup>5</sup> From Table 5.2-5.

<sup>6</sup> From Table 5.1-1.

<sup>7</sup> Calculate by subtracting total for Average Annual Costs from total for Average Annual Gross Power Benefits.

## **6.0 Annual Cost of Operations and Gross Power Benefits Under YCWA's Proposed Project**

Section 6 is divided into four major sections, each of which addresses YCWA's proposed Project. Section 6.1 discusses YCWA's proposed new facilities, Section 6.2 discusses costs, Section 6.3 discusses power benefits, and Section 6.4 provides a summary of costs and benefits.

### **6.1 New Facilities**

YCWA proposes two major additions to the Project: 1) a tailwater depression system (TDS) at the New Colgate Powerhouse; and 2) an auxillary flood control outlet at New Bullards Bar Dam. The costs for each new facility are presented below. In addition, YCWA proposes to: 1) modify the Lohman Ridge Diversion Tunnel intake; 2) modify the fish release outlets at Our House and Log Cabin diversion dams; 3) modify existing recreation facilities and add some new facilities; and 4) add some existing roads to the Project. Costs for these activities are included in Section 6.2.

#### **6.1.1 New Colgate Powerhouse Tailwater Depression System**

As described in Section 5.1.1.1 of Exhibit A, Project Facilities, of this Amended FLA, the TDS will introduce compressed air into the sealed New Colgate Powerhouse turbine discharge chamber to lower the tailwater to a level that does not interfere with turbine operation, which sometimes occurs now, thereby allowing continued turbine operation during high flows. The TDS will thus increase the production of energy, and have an added benefit of enhancing the ability to regulate flood releases from New Bullards Bar Reservoir.

Based on a preliminary design and feasibility study, YCWA estimates construction of the new TDS will cost roughly \$14,453,000. A breakdown of the construction costs is presented in Table 6.1-1. This results in an annualized cost of about \$481,767 assuming a 30-year license term.

**Table 6.1-1. Yuba County Water Agency’s estimated costs in 2016 U.S. dollars for construction of the New Colgate Powerhouse Tailwater Depression System.**

Description	Cost (2016 U.S. Dollars)
Pre-Construction and General	\$239,000
Compressed Air System	\$4,439,000
Turbine Modification	\$834,000
Civil Works	\$1,157,000
Electrical Works	\$1,174,000
Start-up and Testing	\$389,000
<i>Subtotal Base Construction Cost (BCS)</i>	<i>\$8,232,000</i>
Allowance for Unlisted Items / Design Development / Regulatory Requirements	\$258,000
Construction Management & Construction Phase Engineering Services (10% of BCS)	\$823,000
Environmental Compliance / Permitting (3% of BCS) <sup>1</sup>	\$247,000
Environmental Mitigation (3% of BCS) <sup>1</sup>	\$247,000
Legal/Owner Admin (4% of BCS)	\$329,000
Foreign Exchange Contingency (15% of Seal and Compressor Direct Cost)	\$468,000
Contingency, including Schedule and Construction (40% of BCS)	\$3,293,000
<i>Subtotal</i>	<i>\$2,372,000</i>
<i>Subtotal Estimated Cost with Contingency</i>	<i>\$13,897,000</i>
Financing Costs (4% of Subtotal)	\$556,000
<b>Total</b>	<b>\$14,453,000</b>
<b>Total Cost Over 30 Years</b>	<b>\$481,767</b>

<sup>1</sup> Detailed costs for environmental compliance, environmental mitigation, and right-of-way acquisition not developed. Costs shown are considered placeholders pending input from environmental and right-of-way consultants.

### 6.1.2 New Bullards Bar Dam Auxiliary Flood Control Outlet

As described in Section 5.1.2.1 of Exhibit A, Project Facilities, of this Amended FLA, the new Auxiliary Flood Control Outlet will be located south of the existing New Bullards Bar Dam spillway centerline in the upper left abutment area of the dam. The primary benefit of the new outlet is flood control. The outlet has no generation benefits.

Based on a preliminary design and feasibility study, YCWA estimates that construction of the Auxiliary Flood Control Outlet will cost roughly \$158,923,400. A breakdown of the construction costs is presented in Table 6.1-2. This results in an annualized cost of about \$5,297,447 assuming a 30-year license term.

**Table 6.1-2. Yuba County Water Agency’s estimated costs in 2016 U.S. dollars for construction of the New Bullards Bar Dam Auxiliary Flood Control Outlet.**

Description	Cost (2016 U.S. Dollars)
PRE-CONSTRUCTION AND GENERAL	
Mobilization/Demobilization & General Conditions	\$5,838,300
Site Works, Including Access Roads, Disposal/Laydown Areas, Utility Relocation	\$1,781,400
Clearing and Grubbing	\$62,000
<i>Subtotal</i>	<i>\$7,681,700</i>

**Table 6.1-2. (continued)**

Description	Cost (2016 U.S. Dollars)
<b>INTAKE STRUCTURE</b>	
Excavation	\$975,900
Intake Structure Grouting	\$1,118,900
Rock Anchors	\$337,500
Reinforced Concrete	\$11,608,800
Structural Backfill	\$140,200
Dewatering and Care of Water	\$1,488,500
Temporary Support at Intake	\$1,077,800
<i>Subtotal</i>	<i>\$16,747,600</i>
<b>CONVEYANCE TUNNEL</b>	
Outlet Portal Excavation	\$465,600
Structural Backfill	\$38,800
Tunnel Excavation	\$6,984,400
Shotcrete w/Wire Mesh	\$452,700
Rock Anchors, Including Tunnel Roof Anchors	\$1,243,500
Reinforced Concrete, Including Tunnel Lining and Tunnel Outlet	\$8,835,000
Tunnel Grouting	\$807,200
<i>Subtotal</i>	<i>\$18,827,200</i>
<b>APPROACH CHANNEL</b>	
Approach Channel Excavation	\$1,862,500
Reinforced Concrete	\$5,240,800
Rock Anchors	\$347,100
Structural Backfill	\$203,700
Riprap	\$74,500
Temporary Support at Approach Channel	\$1,212,600
<i>Subtotal</i>	<i>\$8,941,200</i>
<b>GATES</b>	
Gates, Including Miscellaneous Embedded Steel	\$10,425,900
<i>Subtotal</i>	<i>\$10,425,900</i>
<b>ELECTRICAL &amp; INSTRUMENTATION</b>	
Electrical (Allowance)	\$808,400
<i>Subtotal</i>	<i>\$808,400</i>
Subtotal Construction Cost	\$63,432,000
Allowance for Unlisted Items / Design Development / Regulatory Requirements (25% of Subtotal)	\$15,858,000
Base Construction Subtotal (BCS)	\$79,290,000
Engineering for Detailed Design (10% of BCS)	\$7,929,000
Construction Management & Construction Phase Engineering Services (10% of BCS)	\$7,929,000
Environmental Compliance / Permitting (5% of BCS) (Note 3)	\$3,964,500
Environmental Mitigation (10% of BCS) (Note 3)	\$7,929,000
Right-of-Way Acquisition (Allowance) (Note 3)	\$1,077,800
Legal/Owner Admin (4% of BCS)	\$3,171,600
<i>Subtotal Estimated Cost</i>	<i>\$111,291,000</i>
Project Contingency @ 40% (Including Construction Changes)	\$44,516,400
<i>Subtotal Estimated Cost with Contingency</i>	<i>\$155,807,400</i>
Financing Costs (2% of Subtotal)	\$3,116,000
<b>Total</b>	<b>\$158,923,400</b>
<b>Total Cost Over 30 Years</b>	<b>\$5,297,447</b>

<sup>1</sup> Detailed costs for environmental compliance, environmental mitigation, and right-of-way acquisition not developed. Costs shown are considered placeholders pending input from environmental and right-of-way consultants.

## 6.2 Annual Cost of Operations

### 6.2.1 O&M Costs Unrelated to Environmental and Recreation Conditions

The Depreciated Plant In-Service Costs related to Non-Environmental/Recreational Costs would increase from \$4,000,000 per year under the No Action Alternative to \$9,000,000 per year under YCWA's proposed Project related to operations of the new TDS and new Auxiliary Flood

Control Outlet. Otherwise, the estimated annual cost to operate the Project under YCWA’s proposed Project will not change, as compared to the No Action Alternative. As shown in Table 6.2-1, the estimated annual cost of Project operation under the proposed Project is \$36,873,848.

**Table 6.2-1. YCWA’s estimated average annual costs over 30 years in 2016 U.S. dollars for the proposed Project Alternative.**

Item	Total Capital, One-Time, or Repeating Costs Over 30 Years (2016 U.S. Dollars)	Average Annual Expenses (2016 U.S. Dollars)	Average Annual Cost <sup>1</sup> (2016 U.S. Dollars)
<b>COSTS UNRELATED TO EXISTING ENVIRONMENTAL AND RECREATION CONDITIONS</b>			
Depreciated Plant In-Service Costs <sup>2</sup>	--	\$9,000,000	\$9,000,000
Power Purchase Contract Management Costs <sup>3</sup>	--	\$3,300,000	\$3,300,000
Local, State and Federal Fees and Payments <sup>4</sup>	--	\$1,500,000	\$1,500,000
Capital Additions Costs <sup>5</sup>	\$150,000,000	--	\$5,000,000
Normal O&M Costs <sup>6</sup>	--	\$11,500,000	\$11,500,000
FERC License Application Costs <sup>7</sup>	--	\$1,266,667	\$1,266,667
Operating Reserve <sup>8</sup>	--	\$1,953,333	\$1,953,333
Transmission Costs <sup>9</sup>	--	\$7,848	\$7,848
<i>Subtotal</i>	<i>\$150,000,000</i>	<i>\$28,527,848</i>	<i>\$33,527,848</i>
<b>COSTS RELATED TO EXISTING ENVIRONMENTAL AND RECREATION CONDITIONS</b>			
Normal O&M Costs Related to Environmental and Recreation Conditions <sup>10</sup>	--	\$3,346,000	\$3,346,000
<i>Subtotal</i>	<i>--</i>	<i>\$3,346,000</i>	<i>\$3,346,000</i>
<b>Total</b>	<b>\$150,000,000</b>	<b>\$31,873,848</b>	<b>\$36,873,848</b>

<sup>1</sup> Average Annual Cost is calculated by summing Total Capital, One-Time or Repeating Costs over 30 years and the total of Annual Expenses over 30 years, and dividing the sum by 30 years.

<sup>2</sup> As described in Section 6.2.1.

<sup>3</sup> As described in Section 5.1.2.

<sup>4</sup> As described in Section 5.1.3.

<sup>5</sup> As described in Section 5.1.4.

<sup>6</sup> As described in Section 5.1.5.

<sup>7</sup> As described in Section 5.1.6.

<sup>8</sup> As described in Section 5.1.7.

<sup>9</sup> As described in Section 5.1.8.

<sup>10</sup> As described in Section 5.1.9.

## 6.2.2 O&M Costs Related to Environmental and Recreation Conditions

YCWA’s proposed Project includes 41 Project-specific environmental/recreational resource management conditions, which are provided in Appendix E2 of Exhibit E. YCWA’s estimate costs, including assumptions related to the costs for each of these measures is provided by condition in Table 6.2-2. YCWA’s estimated annual cost to implement the conditions is \$4,666,739.

**Table 6.2-2. Yuba County Water Agency’s estimated costs in 2016 dollars related to implementation of YCWA’s proposed conditions as part of continued operation of the Yuba River Development Project.**

YCWA’s Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
GEN1	Organize Ecological Group and Host Meetings	\$0	\$525,000	\$17,500	Assumes preparation, participation and follow-up on (i.e., file letter summary with FERC) one 1-day-long meeting each year at YCWA’s office (no cost for meeting room). Assumes greater effort (\$35,000) in first 5 years of license, which includes consultant costs and more than one meeting; routine effort (\$15,000) in middle years; and reduced effort (\$10,000) in last 5 years. Assumes material for meetings provided to Ecological Group when material filed with FERC, as required by that condition (not included in this cost).
GEN2	Annual Review of Special-Status Species Lists and Assessment of New Species on NFS Lands	\$0	\$540,000	\$18,000	Assumes gathering/ reviewing special-status species lists each year at cost of \$3,000 per year, and assume six studies over 30 years at cost of \$75,000 per study, which includes consultation and reporting. Assumes reporting occurs in Ecological Group’s April meeting at no cost to this condition.
GEN3	Provide Environmental Training to Employees	\$0	\$215,000	\$7,167	Assumes preparation and participation in 1 environmental (including cultural) training meeting (~4 hrs long) each year with 20 YCWA O&M staff at a cost of \$6,000 per meeting (assumes training for newly hired staff occurs as part of overall employment indoctrination). Also, assumes preparation of training material in License Year 1 at added cost of \$15,000, and updating training material in License Years 10 and 20 at additional cost of \$10,000 each year.
GEN4	Develop and Implement a Coordinated Operations Plan to Assure Licensee’s Compliance with the Yuba River Development Project New License	\$0	\$330,000	\$11,000	Assumes existing Yuba River Development Project/ Narrows Project Coordinated Operations Plan updated in License Year 1 at a cost of \$15,000, and average cost of coordinating of \$10,000 per year. Assumes update of plan at additional cost of \$15,000 when new Narrows Project license is issued (assumed to be in License Year 15). Assumes no new equipment (capital cost) needed.
GEN5	Special-Status Species on NFS Lands	\$0	\$500,000	\$16,667	Assumes on average one new project every three years on NFS lands that triggers preparation of a biological evaluation, and each evaluation, including consultation with FS, costs \$50,000.

**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
GEN6	Review of Improvements on NFS Lands	\$0	\$240,000	\$8,000	Assumes six Project-specific special use permits (SUP) required for Project-specific work outside of FERC Project Boundary over 30 years at a cost of \$40,000 per SUP. Assumes these permit activities occur in first part of new license when recreation construction work more common.
GS1	Implement Erosion and Sediment Control Plan	\$0	\$0	\$0	Assumes this condition implemented for a specific project, and the cost for implementation, which may include the development of site-specific plan for the work based on this condition, included at the time in the cost of the specific work.
GS2	Implement Our House and Log Cabin Diversion Dams Sediment Management Plan	\$750,000	\$8,050,100	\$293,337	Assumes for each sediment-pass-through on average one O&M staff at Our House Diversion Dam for three half days three times once every other year (\$2,700 per event) starting in License Year 1, and two O&M staff at Log Cabin Diversion Dam for two half days twice every 4 <sup>th</sup> year (\$1,200 per event) starting in License Year 1. Also, assumes \$250,000 in capital costs in License Years 10, 20 and 30 for repair of each low-level outlet due to sediment passing through the outlet.  Assumes sediment removal would occur at Log Cabin Diversion Dam twice over a 30-year period at a cost of \$1,000,000 per event, and at Our House Diversion Dam twice over a 30-year period at a cost of \$3,000,000 per event. Assumes existing permits are extended each time, so no additional permitting/environmental study cost.



**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
GS3	Implement Our House and Log Cabin Diversion Dams and New Bullards Bar Reservoir Woody Material Management Plan	\$1,100,000	\$3,716,400	\$160,547	Assumes each year, two O&M staff at Our House Diversion Dam for four days four times each year (\$19,200 per event), and two O&M staff at Log Cabin Diversion Dam for two days four times each year (\$9,600 per event). Assumes \$500,000 capital cost for improvements to roads for placing LWM downstream of the dams. Assumes no new equipment (capital cost) or permits needed.  Assumes at New Bullards Bar Reservoir, eight O&M staff each year for 15 days in the spring to collect floating material and place it in coves for burning (\$72,000/yr); four O&M staff each year for five days in the fall to burn the material (\$12,000/yr); two O&M staff each year for five days to open and close the skid roads to the burn areas and stabilize the burn areas (\$6,000/yr); and \$300,000 to replace boats/tugs/booms used to collect material twice over the term of the new license (License Years 12 and 24). Cost for burn permits included in costs.  Assumes surveys for nesting birds will need to be conducted at both sites when New Bullards Bar LWM work occurs (\$5,000/yr).
WR1	Implement Hazardous Materials Management Plan	\$0	\$0	\$0	Assumes this condition implemented for a specific project, and the cost for implementation, which may include the development of site-specific plan for the work based on this condition, included at the time in the cost of the specific work.
WR2	Determine Water Year Types for Conditions Pertaining to Our House Diversion Dam, Log Cabin Diversion Dam and New Bullards Bar Dam	\$0	\$30,000	\$1,000	Assumes gathering appropriate information and determining Water Year type each year at cost of \$1,000 per year. Assumes information filed with FERC only at end of calendar year.
WR3	Determine Water Year Types for Conditions Pertaining to Narrows 2 Powerhouse and Narrows 2 Full Bypass	\$0	\$30,000	\$1,000	Assumes gathering appropriate information and determining Water Year type each year at cost of \$1,000 per year. Assumes information filed with FERC only at end of calendar year.
WR4	Implement Streamflow and Reservoir Level Compliance Monitoring Plan	\$1,650,000	\$300,000	\$65,000	Assumes maintaining and operate all gages at a cost of \$10,000 per year, and replacing all gages twice at a cost of \$300,000 over 30 years. Assumes increasing the compliance-level measurement capacity of the weirs below New Bullards Bar Dam, Our House Diversion Dam, and Log Cabin Diversion Dam at a capital cost of \$350,000 each, which includes permitting costs.

**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
WR5	Maintain New Bullards Bar Reservoir Minimum Pool	\$0	\$0	\$0	Assumes cost include in normal Project O&M and no new equipment (capital cost) or permits needed.
WR6	Operate New Bullards Bar Reservoir for Flood Control	\$0	\$300,000	\$10,000	Assumes cost include in normal Project O&M and no new equipment (capital cost) or permits needed.
WR7	Implement Water Temperature Monitoring Plan	\$60,000	\$1,314,000	\$43,867	Assumes total labor cost for monitoring over 30 years of \$1,314,000; equipment cost (i.e., loggers or similar device) of \$2,000 per year; and reporting covered in Condition 2.13 above. Assumes no cost for boats (use YCWA O&M boats).
WR8	Implement Water Quality Monitoring Plan	\$15,000	\$925,020	\$31,334	Assumes total labor cost for monitoring over 30 years of \$935,000; equipment cost (i.e., Hydrolab or similar device) of \$500 per year; and reporting covered in Condition 2.13 above. Assumes no cost for boats (use YCWA O&M boats).
WR9	Implement Drought Management Plan	\$0	\$45,000	\$1,500	Assumes drought plan implemented 3 times over 30 years at \$15,000 per event.
AR1	Maintain Minimum Streamflows below Our House Diversion Dam and Log Cabin Diversion Dam	\$2,587,500	\$475,200	\$102,090	Assumes one O&M staff person visit to Our House and Log Cabin diversion dams once each month for a day to adjust valves for minimum flows, for a total of \$7,200 per year. Assumes capital costs to modify valves for increased flow requirements of \$962,000 at Our House, \$825,500 at Log Cabin, and \$500,000 at New Bullards Bar; and \$300,000 for permitting to be spent over the first four years of the new license.
AR2	Control Project Spills at Our House Diversion Dam	\$0	\$45,000	\$1,500	Assumes a spill cessation event will occur every other year, and on average twice each year when they occur, and one staff will be on site a half day for five days for each event (\$3,000 every other year). Assumes no new equipment (capital cost) is needed for low-level outlet other than that already included in Condition 2.4 above, and no permits are required.
AR3	Maintain Minimum Streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass	\$0	\$360,000	\$12,000	Assumes one-staff-person visit to Narrows 2 Powerhouse once each month to make adjustments for minimum flows, for a total of \$12,000 per year. Assumes no new equipment needed to implement condition.
AR4	Control Project Spills at New Bullards Bar Dam	\$0	\$0	\$0	Assumes adjustments made automatically, cost included in normal Project O&M, and no new equipment (capital cost) or permits needed.

**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
AR5	Implement Aquatic Invasive Species Management Plan	\$50,000	\$407,000	\$15,523	<p>Assumes annual artificial substrate sampling at New Bullards Bar Reservoir and at Our House and Log Cabin two diversion dams and veliger sampling at New Bullards Bar Reservoir each year and reporting at \$6,500/yr. Assumes fabrication, installation and maintenance of informational signs at New Bullards Bar Reservoir and the two diversion dams at a total of \$20,000 in License Year 1 and then replaced three times at a cost of \$10,000 each time. Assumes annual Asian clam monitoring for License Years 1 through 10 at 7 locations and additional monitoring every 5 years thereafter for a total of 14 years at \$10,000 for each event. Bullfrog suppression for License Years 1 through 5 at \$12,000 for each event, with reporting. Assumes three changes to the Vulnerability Assessment over the course of the license at \$3,000 each.</p> <p>Assumes inspection of houseboats done by Emerald Cove Marina under its lease (no cost in this condition).</p> <p>Assumes BMPs for specific projects would be developed for the specific project, and the cost for development and implementation included at the time in the cost of the specific project.</p>
AR6	Implement New Bullards Bar Reservoir Fish Stocking Plan	\$0	\$591,500	\$19,717	<p>Assumes two plantings per year in New Bullards Bar Reservoir by a private hatchery contracted to YCWA, one planting for each fish species. Total of 1,500 pounds of rainbow trout (2 fish per pound) at \$5.00 per pound and 325 pounds of kokanee (200 fish per pound) at \$30 per pound. One delivery of each per year to the Cottage Creek Boat Ramp (delivery costs included above). Assumes no fish stocking in the diversion dam pools, and reporting to occur at annual meeting.</p>

**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
AR7	Implement Upper Yuba River Aquatic Monitoring Plan	\$0	\$5,765,400	\$192,180	Assumes total labor cost and expenses, including monitoring equipment, over 30-year license term as follows: fish - \$2,010,000; benthic macroinvertebrates - \$180,000; FYLF – \$921,600; WPT - \$748,800; channel morphology in Our House and Log Cabin diversion dams - \$230,000; and channel morphology, riparian and large woody material - \$1,225,000, for a total of \$5,315,400. Assumes one report prepared each year for all of the resource areas at a cost of \$15,000 per year (report will include the resources in this condition as well as water temperature and quality (Conditions 2.14 and 2.15 below). Assumes no cost for boats (use YCWA O&M boats).
AR8	Implement Lower Yuba River Aquatic Monitoring Plan	\$0	\$9,434,000	\$314,467	<p>Assumes total labor cost and expenses, including monitoring equipment, vehicles and boats over 30-year license term as follows.</p> <p>In each year that substrate, LWM, riparian/cottonwood and BMI is performed, the cost is \$42,000, \$19,000, \$30,000 and \$15,000, respectively. Therefore, since substrate, LWM, riparian/cottonwood would occur in 4 years over a 30-year term, the respective total cost over 30 years is \$168,000 for substrate, \$76,000 for LWM and \$120,000 for riparian/cottonwood. Costs for BMI over 30 years would be \$90,000 (4 years monitoring and assumed 2 years of conditional monitoring for dry year conditions). Assumes one report prepared each year for all of the resource monitoring in that year with costs included in above estimates.</p> <p>In each year that mark-recapture and biometric surveys of Chinook salmon carcasses downstream of Daguerre Point Dam occurs, the cost would be \$50,000. Mark-recapture and biometric surveys would occur during the first 10 years after license issuance, and subsequently during 3 years of each 10-year block through the term of the license. Therefore, over a 30-year license term, the total cost would be \$800,000.</p> <p>In each year that biometric surveys of Chinook salmon carcasses upstream of Daguerre Point Dam occurs, the cost would be \$10,000. Biometric surveys would occur during the first 10 years after license issuance, and subsequently during 3 years of each 10-year block</p>

**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
AR8 (cont'd)	Implement Lower Yuba River Aquatic Monitoring Plan (cont'd)				<p>through the term of the license. Therefore, over a 30-year license term, the total cost would be \$160,000.</p> <p>In each year that the VAKI Riverwatcher™ monitoring occurs, the cost would be \$120,000. VAKI Riverwatcher™ monitoring would occur each year over a 30-year license term. The total cost would be \$3,600,000.</p> <p>In each year that steelhead redd surveys occur, the cost would be \$55,000. Steelhead redd surveys would occur during the first 5 years after license issuance, and subsequently during 3 years of each 10-year block through the term of the license. For cost estimation purposes, 14 annual surveys are assumed. Therefore, over a 30-year license term, the total cost would be \$770,000.</p> <p>In each year that rotary screw trapping occurs, the cost would be \$250,000. Rotary screw trapping would occur during the first 5 years after license issuance, and subsequently during 3 years of each 10-year block through the term of the license. For cost estimation purposes, 14 annual surveys are assumed. Therefore, over a 30-year license term, the total cost would be \$3,500,000.</p> <p>Assumes cost of monitoring for stranded fish is \$5,000 per event and one event per year over a 30-year term.</p> <p>Report preparation for each year of monitoring is included in the above cost estimates for each monitoring component.</p>
AR9	Control Project Ramping and Flow Fluctuations Downstream of Englebright Dam	\$0	\$2,340,000	\$78,000	<p>For ramping, coordination requires four senior staff for 2 hours each week year round (\$52,000/yr). For flow fluctuation, coordination requires four senior staff 2 hours a week from September 1 through March 31 each year (\$26,000/yr). O&amp;M staff time not included and assumes no new equipment needed.</p>
AR10	Maintain Minimum Streamflow Below New Bullards Bar Dam	\$0	\$0	\$0	<p>Assumes all adjustments for minimum flows are made remotely (no cost), and no new equipment needed to implement condition.</p>

**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
AR11	Periodically Close Lohman Ridge Diversion Tunnel	\$5,500,000	\$198,000	\$189,933	Assumes two O&M staff visit Our House Dam one day when tunnel closed and two staff for two days when tunnel opened (related to preparing to close and open tunnel gate), at a cost of about \$3,600 per event, and events occur every year. Assumes one time capital costs to modify Lohman Ridge Tunnel intake of \$4,500,000, with additional \$500,000 for related environmental studies, permitting and intertie connections over License Years 1 through 5. Assumes \$500,000 for equipment replacement costs in License Year 15. Also assumes \$3,000 per year in reporting costs.
AR12	Control Project Spills at Log Cabin Diversion Dam	\$0	\$13,500	\$450	Assumes a spill cessation event will occur every other year, and on average once each year when they occur, and one staff will be on site a half day for three days for each event (\$900 every other year). Assumes no new equipment (capital cost) is needed for low-level outlet other than that already included in Condition 2.4 above, and no permits are required.
TR1	Implement Integrated Vegetation Management Plan	\$0	\$1,400,040	\$46,668	Assumes three surveys of all areas at \$150,000 at License Years 1, 11 and 21, and three surveys of just high use areas at \$100,000 every five years on NFS lands for NNIPs and special-status plants. Treatment of NNIP on NFS lands (currently known weeds at \$10,000 a year for each occurrence for five years and an assumed additional 10 occurrences at \$10,000 a year for each occurrence for five years). Re-vegetation of areas of Project-related ground-disturbing activities at \$100,000 (non-routine) (assume four projects at \$50,000 each for revegetation needs). Implementation of LOPs and other protection measures for sensitive areas (assume assorted costs of \$50,000 for this implementation and other general support).
TR2	Implement Bald Eagle and American Peregrine Falcon Management Plan	\$0	\$750,000	\$25,000	Assumes Peregrine falcon surveys in License Year 1 and every 5 <sup>th</sup> year thereafter (\$5,000 per survey). Bald eagle surveys to be conducted annually include a single day winter survey (one visit at a cost of \$3,500 annually) and nesting surveys (three visits at a cost of \$15,000 annually). A winter roosting survey conducted once (one time cost of \$10,000) and consultation will determine need for additional (assumes four additional surveys over license term for a cost of \$40,000 over 30 years). Maintenance of special-status raptor map and LOPs, including installation of buoys for one nest buffer is assumed at \$3,000 annually or \$90,000 over 30 years.

**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
TR3	Implement Ringtail Management Plan	\$0	\$65,000	\$2,167	Assumes initial cost for purchasing and installing protective device is \$30,000 in License Year 1, and bi-annual inspection of exclusion measures and replacements assumed at \$2,500 every other year.
TR4	Implement Bat Management Plan	\$15,000	\$65,000	\$2,667	Assumes installation and annual inspection of exclusion devices at \$2,000 per year, with an equipment cost of \$10,000 in License Year 1 and replacement once.
RR1	Implement Recreation Facilities Plan				The cost breakdown is provided by major facility, as requested by FERC in previous relicensings. Assumes the recreation road, parking area and camping spur costs are included in the Transportation System Management Plan and not the Recreation Plan. The O&M costs: 1) include YCWA staff time to operate facilities on YCWA land; 2) assumes the facilities on NFS land would be operated by the Forest Service. In addition, O&M costs include annualized monitoring costs of \$44,000/year, which includes annual campground occupancy, boat ramp parking and reservoir boating reports, 6-year observation and reservoir capacity surveys and reports, West Shoreline Trail, and 12-year visitor surveys and reports. Note: About 54% of the total Condition RR1 cost is for the rehabilitation and operation of existing recreation facilities (no upgrades) over the term of the new license. The remaining 46% is for new facilities and improvements to the existing facilities, including rehabilitation, operation and monitoring.
	Schoolhouse Campground	\$3,459,000	\$2,526,040	\$199,501	
	Dark Day Campground	\$498,000	\$778,820	\$42,561	
	Hornswoggle Campground	\$3,071,000	\$2,041,840	\$170,428	
	Kelly Ridge Campground (new)	\$4,930,000	\$2,169,455	\$236,649	
	Cottage Creek Campground	\$887,000	\$899,870	\$59,562	
	Shadow Ridge Campground (new)	\$2,370,000	\$952,390	\$110,746	
	Garden Point Boat-in Campground	\$689,000	\$1,007,790	\$56,560	
	Madrone Cove Boat-in Campground	\$534,000	\$523,590	\$35,253	
	Frenchy Point Boat-in Campground	\$25,000	\$0	\$833	
	Dark Day Picnic Site	\$608,000	\$657,770	\$42,192	
	Sunset Vista Observation Site	\$406,000	\$536,720	\$31,424	
	Dam Overlook Observation Site	\$24,000	\$160,440	\$6,148	
	Moran Road Boating Site	\$217,000	\$415,670	\$21,089	
	Cottage Creek Picnic Site (new)	\$495,000	\$899,870	\$46,496	
	Dark Day Boat Launch	\$5,958,000	\$2,617,950	\$285,865	
	Cottage Creek Boat Launch	\$1,714,000	\$2,617,950	\$144,398	
	Dark Day RV Dump Station (new)	\$357,000	\$968,400	\$44,180	
Recreational Trails	\$71,000	\$739,430	\$27,014		
Recreational Trails (new)	\$1,031,000	\$739,430	\$59,014		
Water Supply System	\$5,536,000	\$1,815,750	\$245,058		
Electrical System (new)	\$2,620,000	\$726,300	\$111,543		
Floating Restrooms	\$948,000	\$363,150	\$43,705		
Our House Diversion Dam	\$506,000	\$1,109,145	\$53,838		
Colgate Powerhouse (new)	\$110,000	\$255,230	\$12,174		
RR2	Provide Recreation Flow Information	\$0	\$150,000	\$5,000	Assumes no new equipment needed to implement condition, and information provided on CDEC with some QA/QC at \$5,000/year.
RR3	Provide Whitewater Boating Below Our House Diversion Dam	\$0	\$54,000	\$1,800	Assumes providing flows every other License Year for three weekends on average, each of those years (45 events). Assume two YCWA staff trips to dam for each event (\$1,200 per event). Assumes YCWA will use Lohman Ridge Diversion Tunnel gate covered under Condition #2.9 above (no cost in this condition).

**Table 6.2-2. (continued)**

YCWA's Proposed Condition		Total Capital Cost Over 30 Years <sup>1</sup> (2016 U.S. Dollars)	Total O&M Cost Over 30 Years (2016 U.S. Dollars)	Annualized Cost Over 30 Years <sup>2</sup> Excluding Energy (2016 U.S. Dollars)	Assumptions Over 30 Years <sup>3</sup>
Designation in This Amended FLA	Description				
LU1	Implement Transportation System Management Plan	\$0	\$24,464,500	\$815,483	Assumes cost/yr of \$200,000 for annual O&M (includes annual roads O&M at Project recreation facilities on NFS lands). Other costs in a given year include a range of projects, such as periodic maintenance (e.g., culvert replacements, landslide and gully repairs), long-term maintenance (repaving Project roads every 20 yrs), and road development/upgrades at seven post-FLA recreation facility improvement sites.
LU2	Implement Fire Prevention and Response Plan	\$0	\$30,000	\$1,000	Assumes \$5,000/fire and six fires over term of license (years selected randomly for cash flow purposes).
CR1	Implement Historic Properties Management Plan	\$0	\$1,956,000	\$65,200	Assumes NRHP evaluation of 22 archeological sites at \$25,000/site; NRHP of ten built resources at \$7,500/resource; and data recovery at six sites at \$100,000/site. Assumes annual costs of \$5,000/yr for compliance report and \$4,000/yr for meetings with tribes and agencies; and once every 10 years meeting with tribes and agencies to review HPMP at a cost of \$10,000/meeting. Assumes \$2,000/yr for employee training. Assumes public education signage (one time cost of \$18,000). Also, assumes if New Bullards Bar Reservoir drawn down so that inundated sites are exposed, NRHP evaluation of the 11 inundated archeological sites and survey for cultural resources in areas not surveyed during relicensing study (below El. 1,805 ft) (\$325,000), with an additional \$50,000 for analysis of collections at University of California, Sacramento from two of the submerged sites.
VR1	Implement Visual Resource Management Plan	\$0	\$63,000	\$2,100	Assumes initial implementation (e.g., vegetation planting and clearing and painting) is \$35,000 in License Years 1 and 2. Follow up maintenance and or replacement is estimated at \$28,000 over the course of 30 years. Assumes visual resource plans and work associated with any specific project are included in the cost of the specific project.
<b>Total</b>		<b>\$48,791,500</b>	<b>\$91,210,660</b>	<b>\$4,666,739</b>	<b>41 Conditions</b>
<b>Annualized Over 30 Years</b>		<b>\$1,626,383</b>	<b>\$3,040,355</b>		

<sup>1</sup> Capital cost include new facilities or equipment or replacement of existing facilities or equipment with facilities or equipment that extend the life expectancy of the existing facilities or equipment.

<sup>2</sup> Total annualized costs are calculated by summing Capital Cost and Total O&M Cost, and dividing the sum by 30.

<sup>3</sup> Assumes cost of O&M staff is \$600 per day.



This estimate does not include costs related to implementation of potential measures that could be contained in “mandatory conditions” from: Forest Service’s FPA Section 4(e) “standard” administrative conditions; USACE’s FPA Section 4(e) conditions; United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) FPA Section 18 fishway prescriptions; NMFS’s and United States Department of the Interior, Fish and Wildlife Service’s (USFWS) measures that may be included in an Endangered Species Act Biological Opinion for the Project; the State Water Resources Control Board’s (SWRCB) Clean Water Act Section 401 Water Quality Certificate, and FERC’s Standard Articles. These potential conditions have not been provided to YCWA as yet. Implementation of these additional measures will likely result in significant increases to YCWA’s estimate of costs to implement YCWA’s proposed Project.

### 6.3 Annual Gross Power Benefits

#### 6.3.1 Modeled Energy Generation

Table 6.3-1 provides a summary of annual generation by powerhouse for YCWA’s proposed Project based on a run of YCWA’s Operations Model.

**Table 6.3-1. Yuba County Water Agency’s estimated average annual generation in megawatt-hours for WYs 1970 through 2010 at each powerhouse in the Yuba River Development Project for the proposed Project.**

Powerhouse	Average Annual Generation Under Proposed Project (MWh/yr)					Maximum Average Annual Generation (MWh/yr) <sup>1</sup>
	Peak	Partial-Peak	Off-Peak	Super Off-Peak	Total	
New Colgate Powerhouse	146,130	423,734	495,135	82,852	1,147,851	2,052,358
New Bullards Bar Minimum Flow	113	371	558	208	1,251	1,291
Narrows 2 Powerhouse	20,191	66,770	100,457	37,484	224,901	381,163
<b>Total</b>	<b>166,434</b>	<b>490,875</b>	<b>596,150</b>	<b>120,544</b>	<b>1,374,003</b>	<b>2,434,812</b>

Source: YCWA’s proposed Project Operations Model run of Yuba River Development Water Balance/Operations Model, which is in Exhibit E, Appendix E6, of YCWA’s Amended FLA, and post-processing.

<sup>1</sup> The maximum powerhouse capability is the maximum average annual generation for that powerhouse from WY 1970 through WY 2010 under YCWA’s proposed Project. The maximum annual New Colgate and Narrows 2 powerhouse generation as well as the maximum total generation, occurred in 1983 and the maximum annual generation at the New Bullards Bar Minimum Flow Powerhouse occurred in 1984.

YCWA estimates that approximately 7,350 MWh/yr of the New Colgate Powerhouse average annual power generation is a result of YCWA’s proposed TDS. As stated above, YCWA’s proposed new Auxiliary Flood Control Outlet has no related generation benefits.

Table 5.2-3 shows definitions of time blocks for peak, partial-peak, off-peak and super off-peak.

Table 6.3-2 shows the estimated monthly average generation in MWh for WYs 1970 through 2010 by time block for the three Project powerhouses and the Project overall under the proposed Project, based on results of the Operations Model.

**Table 6.3-2. Estimated average monthly generation in megawatt-hours for WYs 1970 through 2010 by time block for the three Project powerhouses and the Project overall under YCWA’s proposed Project.**

Month	Peak (MWh)	Partial-Peak (MWh)	Off-Peak (MWh)	Super Off Peak (MWh)	Total (MWh)
<b>NEW COLGATE POWERHOUSE</b>					
January	0	39,998	42,574	8,181	90,752
February	0	43,180	46,914	11,613	101,707
March	0	47,853	54,585	12,897	115,335
April	0	39,613	50,321	7,679	97,613
May	26,753	40,286	66,510	14,218	147,767
June	36,863	39,856	63,995	13,636	154,350
July	37,903	35,777	53,066	7,719	134,466
August	32,854	30,423	36,623	2,371	102,270
September	10,107	25,320	14,953	7	50,388
October	1,649	26,005	20,678	0	48,332
November	0	25,777	20,860	1,127	47,764
December	0	29,645	24,057	3,403	57,105
<i>Subtotal</i>	<i>146,130</i>	<i>423,734</i>	<i>495,135</i>	<i>82,852</i>	<i>1,147,851</i>
<b>NEW BULLARDS BAR MINIMUM FLOW POWERHOUSE</b>					
January	0	41	47	18	106
February	0	38	43	16	97
March	0	41	47	18	106
April	0	40	46	17	103
May	19	22	48	18	106
June	18	21	46	17	103
July	19	22	47	18	106
August	19	22	47	18	106
September	18	21	46	17	103
October	19	22	47	18	106
November	0	39	46	17	102
December	0	41	47	18	106
<i>Subtotal</i>	<i>113</i>	<i>371</i>	<i>558</i>	<i>208</i>	<i>1,251</i>
<b>NARROWS 2 POWERHOUSE</b>					
January	0	7,392	8,583	3,195	19,169
February	0	8,300	9,573	3,575	21,448
March	0	9,833	11,295	4,226	25,354
April	0	9,113	10,571	3,937	23,621
May	5,262	6,139	13,187	4,918	29,505
June	4,901	5,718	12,200	4,564	27,384
July	4,137	4,826	10,371	3,867	23,201
August	3,185	3,716	7,992	2,979	17,873
September	1,336	1,559	3,308	1,241	7,444
October	1,370	1,598	3,493	1,292	7,753
November	0	3,852	4,452	1,661	9,965
December	0	4,723	5,432	2,031	12,185
<i>Subtotal</i>	<i>20,191</i>	<i>66,770</i>	<i>100,457</i>	<i>37,484</i>	<i>224,901</i>
<b>TOTAL PROJECT</b>					
January	0	47,431	51,204	11,393	110,028
February	0	51,518	56,530	15,204	123,252
March	0	57,727	65,927	17,141	140,795
April	0	48,766	60,938	11,633	121,336
May	32,034	46,447	79,744	19,153	177,379
June	41,783	45,596	76,241	18,217	181,837
July	42,059	40,626	63,485	11,604	157,773
August	36,058	34,161	44,663	5,367	120,249
September	11,462	26,901	18,308	1,265	57,935
October	3,038	27,625	24,218	1,310	56,191
November	0	29,669	25,357	2,805	57,831
December	0	34,409	29,536	5,452	69,396
<b>Total</b>	<b>166,434</b>	<b>490,875</b>	<b>596,150</b>	<b>120,544</b>	<b>1,374,003</b>

Source: YCWA’s proposed Project Operations Model run of Yuba River Development Water Balance/Operations Model, which is in Exhibit E, Appendix E6, of YCWA’s Amended FLA, and post-processing.

### 6.3.2 Project Capacity

YCWA does not propose any changes to the Project that would affect the Project’s installed capacity, described in Section 5.2.2.1.

The methods described in Section 5.2.2.3 were used to determine the dependable capacity under the YCWA proposed Project, as shown in Table 6.3-3.

**Table 6.3-3. Modeled dependable capacity in kilowatts for New Colgate, Narrows 2 and New Bullards Bar Minimum Flow powerhouses for the proposed Project.**

Powerhouse	WY of Lowest Available Capacity	Dependable Capacity in that WY (kW)
Narrows 2 Powerhouse	1977	0
New Bullards Bar Minimum Flow	1977	102
New Colgate Powerhouse	1977	230,208
<b>Total</b>	--	<b>230,310</b>

Source: YCWA’s proposed Project Operations Model run of Yuba River Development Water Balance/Operations Model, which is in Exhibit E, Appendix E6, of YCWA’s Amended FLA, post-processing.

YCWA’s proposed new TDS and proposed new Auxiliary Flood Control Outlet do not affect installed or dependable capacity.

### 6.3.3 Modeled Ancillary Services

The methods described in Section 5.2.1.3 were used to determine the ancillary services opportunities under the YCWA proposed Project. The resulting monthly opportunities are shown in Table 6.3-4.

**Table 6.3-4. Estimated average monthly ancillary services opportunities in megawatt-hours for WYs 1970 through 2010 by market for the New Colgate Powerhouse under the proposed Project.**

Month	Regulation-Up (MWh)	Regulation-Down (MWh)	Spinning Reserve (MWh)
January	25,209	17,955	96,895
February	20,468	19,893	78,978
March	21,728	22,226	86,698
April	25,337	18,755	104,842
May	18,228	27,666	75,513
June	15,578	28,696	63,648
July	20,200	25,727	81,515
August	25,685	20,333	101,756
September	34,025	10,581	133,440
October	35,583	10,399	138,001
November	33,405	10,248	127,837
December	32,081	11,791	122,561
<b>Total</b>	<b>307,526</b>	<b>224,270</b>	<b>1,211,686</b>

Source: No Action Alternative Model Run of Yuba River Development Water Balance/Operations Model, which is in Exhibit E, Appendix E6, of YCWA’s Amended FLA, and post-processing.

YCWA’s proposed new TDS and proposed new Auxiliary Flood Control Outlet do not significantly affect ancillary services opportunities.

### 6.3.4 Gross Power Benefits

Based on the above estimation of capacity and energy and unit values for each of these, as defined in Section 5.2.3, Table 6.3-5 provides annual gross power benefits by powerhouse for YCWA’s proposed Project.

**Table 6.3-5. Average annual gross power benefits in 2016 U.S. dollars by powerhouse for YCWA’s proposed Project.**

Powerhouse	Average Annual Gross Power Benefits (2016 U.S. Dollars)					Total
	Energy					
	Peak	Partial Peak	Off Peak	Super Off Peak	Ancillary Services	
New Colgate	\$5,286,866	\$15,651,811	\$15,377,413	\$1,901,117	\$5,287,806	\$43,505,013
Narrows 2	\$689,939	\$2,076,076	\$2,834,957	\$865,459	\$0	\$6,466,431
New Bullards Bar Minimum Flow	\$10,372	\$33,018	\$46,439	\$18,365	\$0	\$108,194
<i>subtotal</i>	<i>\$5,987,177</i>	<i>\$17,760,905</i>	<i>\$18,258,809</i>	<i>\$2,784,941</i>	<i>\$5,287,806</i>	<i>--</i>
<b>Total</b>	<b>\$44,791,832</b>				<b>\$5,287,806</b>	<b>\$50,079,638</b>

YCWA estimates that approximately \$99,000 of the New Colgate Powerhouse off-peak average annual power value, and \$201,000 of the total average annual power value, is a result of YCWA’s proposed New Colgate Powerhouse TDS. YCWA’s proposed New Bullards Bar Auxiliary Flood Control Outlet does not significantly affect power benefits.

### 6.4 Summary of YCWA’s Proposed Project Costs and Power Benefits

Table 6.4-1 summarizes the Project’s costs and power benefits under YCWA’s proposed Project, based on the information provided above.

**Table 6.4-1. Yuba County Water Agency’s estimate of annual costs and power benefits in 2016 U.S. dollars under the YCWA proposed Project.**

Value	YCWA’s Proposed Project
<b>AVERAGE ANNUAL GROSS POWER BENEFITS</b>	
Capacity	--
Installed <sup>1</sup>	361,900 kW
Dependable <sup>2</sup>	230,310 kW
<i>Subtotal - Value in 2016 Dollars</i>	<i>\$0</i>
Energy	--
Peak Energy <sup>3</sup>	166,434 MWh
Partial Peak Energy <sup>3</sup>	490,875 MWh
Off-Peak Energy <sup>3</sup>	596,150 MWh
Super Off-Peak <sup>3</sup>	120,544 MWh
<i>Subtotal - Value in 2016 Dollars<sup>4</sup></i>	<i>\$44,791,832</i>
Ancillary Services	--
Regulation-Up <sup>5</sup>	307,526 MWh
Regulation-Down <sup>5</sup>	224,270 MWh
Spinning Reserve <sup>5</sup>	1,211,686 MWh
<i>Subtotal - Value in 2016 Dollars<sup>4</sup></i>	<i>\$5,287,806</i>
<b>Total – Value in 2016 Dollars<sup>4</sup></b>	<b>\$50,079,638</b>

**Table 6.4-1. (continued)**

Value	YCWA's Proposed Project
<b>AVERAGE ANNUAL COSTS</b>	
Non-Environmental/Recreational <sup>6</sup>	\$33,527,848
Addition of New Colgate Powerhouse Tailwater Depression System <sup>7</sup>	\$481,767
Addition of New Bullards Bar Reservoir Flood Control Outlet <sup>8</sup>	\$5,297,447
Environmental/Recreational <sup>9</sup>	\$4,666,739
<b>Total - Value in 2016 Dollars</b>	<b>\$43,973,801</b>
<b>AVERAGE ANNUAL NET BENEFIT</b>	
<b>Total 2016 U.S. Dollars<sup>10</sup></b>	<b>\$6,105,837</b>

<sup>1</sup> From Table 5.2-6.

<sup>2</sup> From Table 6.3.3.

<sup>3</sup> From Table 6.3-1.

<sup>4</sup> From Table 6.3-5.

<sup>5</sup> From Table 6.3-4.

<sup>6</sup> From Table 6.2.1.

<sup>7</sup> From Table 6.1.1.

<sup>8</sup> From Table 6.1.2.

<sup>9</sup> From Table 6.2.2.

<sup>10</sup> Calculate by subtracting total for Average Annual Costs from total for Average Annual Gross Power Benefits.

## 7.0 Changes in Project Power and Value

Table 7.0-1 compares the annual cost and power benefits of the No Action Alternative and YCWA's proposed Project.

**Table 7.0-1. Comparison of annual power benefits, costs net benefits between No Action Alternative and YCWA' proposed Project.**

Value	No Action Alternative <sup>1</sup>	YCWA's Proposed Project <sup>2</sup>	Change <sup>3</sup>
<b>AVERAGE ANNUAL GROSS POWER BENEFITS</b>			
Capacity	--	--	--
Installed	361,900 kW	361,900 kW	None
Dependable	230,259 kW	230,310 kW	51 kW (<0.1%)
<i>Subtotal - Value in 2016 Dollars</i>	<i>\$0</i>	<i>\$0</i>	<i>None</i>
Energy	--	--	--
Peak Energy	171,358 MWh	166,434 MWh	-4,924 MWh (-2.9%)
Partial Peak Energy	501,783 MWh	490,875 MWh	-10,908 MWh (-2.2%)
Off-Peak Energy	616,495 MWh	596,150 MWh	-20,345 MWh (-3.3%)
Super Off-Peak	128,408 MWh	120,544 MWh	-7,864 MWh (-6.1%)
<i>Subtotal Energy</i>	<i>1,418,044 MWh</i>	<i>1,374,003 MWh</i>	<i>-44,041 MWh (-3.1%)</i>
<i>Subtotal - Value in 2016 Dollars</i>	<i>\$46,228,930</i>	<i>\$44,791,832</i>	<i>-\$1,437,098 (-3.1%)</i>
Ancillary Services Opportunities	--	--	--
Regulation Up	298,993 MWh	307,526 MWh	8,533 MWh (2.9%)
Regulation Down	232,309 MWh	224,270 MWh	-8,039 MWh (-3.5%)
Spinning Reserve	1,175,158 MWh	1,211,686 MWh	36,529 MWh (3.1%)
<i>Subtotal - Value in 2016 Dollars</i>	<i>\$5,159,385</i>	<i>\$5,287,806</i>	<i>\$128,421(2.5%)</i>
<b>Total - Value in 2016 Dollars</b>	<b>\$51,388,315</b>	<b>\$50,079,638</b>	<b>-\$1,308,677 (-2.5%)</b>
<b>AVERAGE ANNUAL COSTS</b>			
Non-Environmental/Recreational	\$28,527,848	\$33,527,848	-\$5,000,000 <sup>4</sup> (42.0% <sup>5</sup> )
Addition of New Colgate Powerhouse Tailwater Depression System	--	\$481,767	-\$481,767 (4.0% <sup>5</sup> )
Addition of New Bullards Bar Reservoir Auxiliary Flood Control Outlet	--	\$5,297,447	-\$5,297,447 (44.5% <sup>5</sup> )
Environmental/Recreational	\$3,546,000	\$4,666,739	-\$1,120,739 (9.4% <sup>5</sup> )
<b>Total - Costs in 2016 Dollars</b>	<b>\$32,073,848</b>	<b>\$43,973,801</b>	<b>-\$11,899,953 (-37.1%)</b>

**Table 7.0-1. (continued)**

Value	No Action Alternative <sup>1</sup>	YCWA's Proposed Project <sup>2</sup>	Change <sup>3</sup>
<b>AVERAGE ANNUAL NET BENEFIT</b>			
<b>Total – Net Benefit in 2016 U.S. Dollars</b>	<b>\$19,314,467</b>	<b>\$6,105,837</b>	<b>-\$13,208,630 (-68.4%)</b>

<sup>1</sup> From Table 5.3-1.

<sup>2</sup> From Table 6.4-1.

<sup>3</sup> Calculate by subtracting YCWA's proposed Project value from the No Action Alternative value.

<sup>4</sup> As described in Section 6.2.1, this change in cost is due to the Depreciated Plant In-Service Costs and operations primarily related to the new Auxiliary Flood Control Outlet.

<sup>5</sup> Expressed as percent of change in total cost (e.g., value divided by \$11,899,953).

Under YCWA's proposed Project as compared to the No Action Alternative, no change in installed capacity would occur and dependable capacity would be increased by less than 0.1 percent from 230,259 kW to 230,310 kW. Average annual energy generation would be reduced by 3.1 percent from 1,418,044 MWh to 1,374,003 MWh, with the greatest loss to super off-peak (6.1%). Average annual ancillary services opportunities would increase by \$128,421 (2.5%). Average annual energy benefits would be reduced by \$1,308,677, or 2.5 percent. (Table 7.0-1.)

Under YCWA's proposed Project as compared to the No Action Alternative, average annual Project costs would increase by \$11,899,953 or 37.1 percent, with 4.0 percent of the increased cost related to the new TDS, 86.5 percent related to the new Auxiliary Flood Control Outlet, and 9.4 percent related to the new environmental and recreation conditions (Table 7.0-1).

The overall average annual Project net benefit would decrease by \$13,208,630 from \$19,314,467 to \$6,105,837, or 68.4 percent (Table 7.0-1).

YCWA's proposed Project would maintain the current installed capacity value of the Project, enhance flood control and continue to provide a source of high-quality consumptive water to the region. YCWA's proposed Project would also provide numerous environmental benefits, some of which include: enhancing fish habitat, which already supports robust and healthy anadromous fish populations; and providing the optimum development of recreational opportunity in the Project area consistent with the purpose of the Project.

## **8.0 Sources of Financing and Annual Revenues to Meet Project Costs**

With the exception of the New Bullards Bar new Auxiliary Flood Control Outlet, YCWA anticipates financing Project O&M, the New Colgate Powerhouse TDS and all other components of the proposed Project with YCWA power sales. YCWA is financially able to do this. In support of this statement, YCWA refers to its history of operating the Project and the continued need for power and the many energy market opportunities in California. Historically, the power output was contracted to PG&E where PG&E paid all the bond repayment costs and the Project O&M and capital costs. This contract expired on April 30, 2016, and YCWA is operating under a new power purchase contract with an independent energy marketing firm where YCWA receives the vast majority of the electric revenues.

YCWA anticipates financing the new Auxiliary Flood Control Outlet with a combination of funds, including YCWA power and water sales, and YCWA will seek state funds and federal financing for the new Auxiliary Flood Control Outlet.

## **9.0 Need for Power**

The Project is located in the California-Mexico Power area of the WECC. According to the California Energy Commission (CEC), electricity consumption statewide is projected to grow at an annual average compound rate of 1.2 percent from 2010 through 2020 (CEC 2009). YCWA's proposed Project would continue to meet part of existing load requirements within the system, which is in need of resources.

In particular, New Colgate Powerhouse is a source of firm, dispatchable generation, which is useful for providing both peak summertime regional demands for energy and for providing ancillary services to the regional grid (e.g., spinning reserve). These ancillary services will likely have increasing importance as other non-dispatchable sources of power generation (e.g., wind and photovoltaic solar generation) are incorporated into the regional grid to help meet renewable generation portfolio requirements.

Power from the Project could help to meet a need for power in the WECC region in both the short-term and long-term. The Project would provide low-cost power that may displace non-renewable, fossil-fired generation and contribute to a diversified generation mix. Displacing the operation of fossil-fired facilities avoids some power plant emissions and creates an environmental benefit.

## **10.0 Other Developmental and Non-Developmental Benefits**

This section describes other developmental and non-development benefits.

### **10.1 Flood Management**

The need for flood control on the Yuba River was the principle reason for the creation of the YCWA and the construction of New Bullards Bar Dam. Historically, the Marysville-Yuba City area experienced the ravages of a major flood about once every 10 years. The historic discharge of debris from placer mines in Nevada County compounded the flooding problems because it raised the river beds by many feet (ft). Levees began providing flood control protection for Yuba City and Marysville as early as 1875, and are still heavily relied on for flood protection. This is primarily because there is no significant flood protection from the South Yuba and Middle Yuba rivers.

New Bullards Bar Dam and Reservoir are used to control about one half of the flood flows of the Yuba River, with the remainder of the runoff essentially un-controlled. The Project provides essential flood management by reducing the peak flood flow on the lower Yuba River and the Feather River in the Marysville-Yuba City area downstream to the Sacramento River.

In the 1997 flood, the major levee break was on the Feather River on the Yuba County side in the Arboga area, resulting in the flooding of the local residences and the surrounding rural/agricultural areas. In this flood, 1,000 acres of residential land, 15,500 acres of agricultural land and 1,700 acres of industrial lands were flooded; 322 homes were destroyed; and 407 homes suffered major damage. The economic cost of this flood was estimated at \$300,000,000. Only 11 years before, in 1986 a massive flood in Linda and Olivehurst, which resulted from a levee break on the Yuba River, flooded more than 3,000 homes and destroyed 895 homes, with an estimated cost of \$450,000,000.

Without New Bullards Bar Dam, the estimated peak flow for the 1 in 100 year flood is 260,000 cfs on the Yuba River at Marysville, and would result in approaching the crest of the levee in this area. With New Bullards Bar Dam, the peak flow for this flood event would be 153,000 cfs, which is well below the levee crest. Without the Project, floods greater than the 1 in 100 unregulated conditions would overtop the levee, while the Project reduces the flood peak to below the levee top for floods even larger than the 1 in 200 year event.

The reduction in flood flows by the Project primarily protects the urban areas of Marysville, Yuba City and reclamation District 784 as well as surrounding rural areas. The value of structures and contents in the Yuba City and Reclamation District 784, which includes the communities of Linda and Olivehurst, total more than \$8,500,000,000, and these areas have a combined population of about 110,000.

YCWA's proposed Project would not only continue this valuable flood protection, but enhance it with the addition of the new Auxiliary Flood Control Outlet at New Bullards Bar Dam and new TDS at New Colgate Powerhouse.

The Auxiliary Flood Control Outlet would increase operational flexibility during storm events, which would result in lower flood stages downstream and provide flood system resiliency. Specifically, these benefits would include:

- Provide up to an additional 100,000 ac-ft of flood reservation that is currently not available because of the existing spillway elevation.<sup>17</sup>
- Increase the outlet capacity to 45,000 cfs at elevation 1,918 ft, the elevation of the bottom of current flood reservation space, and to 66,000 cfs at elevation 1,956 ft, the elevation at the top of flood reservation space.
- The outlet would be an integral part of operating the New Bullards Bar Reservoir under the Forecast-Based Operation<sup>18</sup> during major flood events by creating additional storage space in the reservoir in advance of major floods.

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<sup>17</sup> Additional flood space storage associated with a new flood control outlet would only result from pre-emptive releases as part of Forecast-Based Operations in anticipation of very large storms. This magnitude of storm would be very infrequent, occurring less than once every 10 years.

<sup>18</sup> Forecast-Based Operations is a program of coordinated reservoir operations between YCWA, the California Department of Water Resources, National Weather Service and the USACE, utilizing weather forecasts to inform coordinated operations for flood management between New Bullards Bar and Oroville reservoirs.



- Provide greater flexibility in flood management operations in larger flood events along the Yuba, Feather and Sacramento river systems by allowing larger and earlier pre-storm releases at lower reservoir elevations from New Bullards Bar Reservoir, which will increase the ability of reservoir operators to maintain the objective flows in the Feather River for larger flood events (i.e., lower downstream flows).

Several outlet configurations have been studied and this option provides the greatest opportunity to provide system-wide benefits as identified in the California Department of Water Resources Central Valley Flood Protection Plan - State System-wide Investment Approach (SSIA).<sup>19</sup>

The new TDS would introduce compressed air into the sealed New Colgate Powerhouse turbine discharge chamber to lower the tailwater to a level that does not interfere with turbine operation, thereby allowing continued turbine operation during high flows. The TDS will thus enhance the ability to regulate flood releases from New Bullards Bar Reservoir and increase the production of energy. The TDS was planned for, but not included in initial Project construction.

## 10.2 Irrigation

One of YCWA’s primary purposes is to provide a reliable water supply to farmers in Yuba County. Yuba River water is supplied through direct diversion of natural flow and by storage releases from New Bullards Bar Reservoir. Irrigation water is diverted under YCWA’s water right permits and delivered to Brophy Water District (BWD), Browns Valley Irrigation District (BVID), Cordua Irrigation District (CID), Dry Creek Mutual Water Company (DCMWC), Hallwood Irrigation Company (HIC), Ramirez Water District (RWD), South Yuba Water District (SYWD), and Wheatland Water District (WWD). In addition to YCWA water right permits, several of the Member Units have their own water rights.

BVID receives water at the Pumpline Diversion Facility, located 1 mile upstream from Daguerre Point Dam. CID, HIC, and RWD receive water through the Hallwood-Cordua Canal (North Canal), located on the north abutment of Daguerre Point Dam. BWD, SYWD, DCMWC, and WWD receive water through the South Yuba Canal (South Canal), located on the south side of the Yuba River slightly upstream of the south abutment of Daguerre Point Dam. Contract allocations for each of the Member Units are summarized in Table 10.0-1.

**Table 10.0-1. Yuba County Water Agency annual contract amounts.**

Member Unit	Water Right Based Supply (ac-ft)	Project Based Supply (ac-ft)	Total Contract (ac-ft)
<b>BROWNS VALLEY IRRIGATION DISTRICT PUMPLINE DIVERSION FACILITY</b>			
Browns Valley Irrigation District	23,469	9,500	32,969

<sup>19</sup> The State System-wide Investment Approach (SSIA) reflects the state of California’s strategy for modernizing the State Plan of Flood Control to address current challenges and affordably meet the 2012 Central Valley Flood Protection Project goals. The preliminary approaches suggested a broad range of physical and institutional flood damage reduction actions to improve public safety and achieve economic, environmental, and social sustainability. The SSIA is an assembly of the most promising, affordable, and timely elements of the three preliminary approaches.

**Table 10.0-1. (continued)**

Member Unit	Water Right Based Supply (ac-ft)	Project Based Supply (ac-ft)	Total Contract (ac-ft)
<b>SOUTH YUBA CANAL</b>			
Brophy Water District	--	86,870	86,870
South Yuba Water District	--	54,307	54,307
Dry Creek Mutual Water Company	--	17,751	17,751
Wheatland Water District	--	40,230	40,230
<b>HALLWOOD-CORDUA CANAL</b>			
Cordua Irrigation District	60,000	24,000	84,000
Hallwood Irrigation Company	78,000	11,208	89,208
Ramirez Water District	--	30,389	30,389
<b>Total</b>	<b>161,469</b>	<b>274,255</b>	<b>435,724</b>

BVID, CID, and HIC have water rights on the lower Yuba River. Under YCWA water right settlement contracts, BVID, CID and HIC receive surface water supplies as part of Project operations that are based on these Member Units water rights. All eight of the Member Units receive contracted Project supplies that are not water right based.

The total irrigated farmland acreage served from operations of the Project is about 90,000 acres. Yuba Counties productive farmland has an annual economic output of \$213,000,000 in 2011, with the top three crops being rice, walnuts and dried plums (prunes) accounting for 70 percent of the total farmland production value (Yuba County Agricultural Commission 2012). This production in turn provides over \$866,000,000 to the local economy from processing, transportation, marketing and other farm related services directly or indirectly tied to agriculture.

YCWA’s proposed Project would provide for the continued delivery of water to YCWA’s Member Units. Under both the No Action and YCWA’s proposed Project – Existing Water Deliveries alternatives Operation Model Runs, YCWA Member Units have very high reliability of water supplies; the only deficit under the model run occurred in 1977, when total delivery to the Member Units was 50 percent of demand (i.e., total demand under existing conditions is approximately 300,000 ac-ft/yr).

Under YCWA’s proposed Project – 2062 Water Deliveries Operations Model Run - changes to Project inflows due to changes in upstream projects operations and water supply deliveries reflected a 2062-level of development, and YCWA Member Unit demand reached a full-build out - the Project was able to maintain the same level of water supply reliability that the Member Units experience under existing operations and demands (i.e., total demand under future conditions is approximately 320,000 ac-ft/yr).

### **10.3 Benefits of Yuba Accord**

#### **10.3.1 Anadromous Fish in the Yuba River Downstream of Englebright Dam**

New Bullards Bar Reservoir stores a deep pool of cold water behind the 645-ft dam, and water from this pool ultimately is released to the Yuba River downstream of Englebright Dam. The New Bullards Bar Reservoir primary release point is through the New Colgate Powerhouse just upstream of Englebright Reservoir. Flow transit time through Englebright Reservoir is typically

less than 1.5 days. Also, Englebright Dam is over 240 ft tall. As a result of the configuration of these Project and non-Project facilities, water released through the Narrows 2 Powerhouse typically has temperatures of 48 to 54 degrees Fahrenheit year-round. Spring-run Chinook salmon reportedly were extirpated from the Yuba River in 1959 and, as reported by California Department of Fish and Game (1991), a population of spring-run Chinook salmon became re-established in the 1970s due to improved habitat conditions that resulted from Project operations, fish stocking from the Feather River Fish Hatchery, and fish straying from the Feather River. Improved cold water conditions and higher and more-stable summer flows resulting from the Project contributed to, and possibly were fundamental to, this reestablishment.

YCWA has diligently pursued safeguarding flows in the Yuba River downstream of Englebright Dam. In 2002 through 2005, representatives of YCWA, Cal Fish and Wildlife, NMFS, USFWS, and several non-governmental organizations negotiated a set of minimum flow requirements (flow schedules) for the Yuba River downstream of Englebright Dam. These flow schedules were designed to provide the maximum possible benefit for the aquatic resources of the Yuba River, using available water supplies. The flow schedules settled a contested SWRCB water rights hearing and related litigation regarding lower Yuba River minimum flow requirements that had been pending for many years. The flow schedules developed by this group were included in the Yuba Accord Fisheries Agreement, which was one of three related agreements that together are known as the “Lower Yuba River Accord.” The second agreement, the Water Purchase Agreement, provided a long-term pathway for continued water transfers to help support statewide water supply needs. The third agreement, the Conjunctive Use Agreements, put in place a conjunctive use program to help ensure the local water supply and sustainably manage the local groundwater basins.

During 2005-2007, YCWA conducted comprehensive California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) processes to analyze the environmental effects of the Yuba Accord, and, in late 2007, YCWA certified its final Environmental Impact Statement (EIR) for the Yuba Accord. On May 20, 2008 the SWRCB adopted its Corrected Order WR 2008-0014, which amended YCWA’s water right permits to incorporate the Yuba Accord flow schedules. In total, YCWA expended more than \$8,000,000 through the crafting of the Yuba Accord and completion of the CEQA/NEPA process.

As a requirement of the Fisheries Agreement, YCWA also has established the Yuba Accord River Management Team (RMT), which is comprised of representatives of YCWA, Cal Fish and Wildlife, NMFS, USFWS, and NGO’s. The primary purpose of the RMT is to evaluate the effects of implementation of the Yuba Accord on anadromous fish in the lower Yuba River. YCWA has funded a monitoring plan since 2007. YCWA’s direct expenditure on studies and science is over \$5,000,000, and YCWA’s expenditures including participation in the RMT and in-kind contributions total another \$2,000,000. YCWA’s commitment to direct and indirect funding of the RMT continues until the issuance of a new Project license.

YCWA’s proposed Project will preserve the numerous benefits developed through the Yuba Accord.

### **10.3.2 Statewide Water Supply and Funding for Local Flood Control Projects**

Since 1989, YCWA has completed stored-water transfers by operating New Bullards Bar Reservoir to make additional releases as a way to provide needed supplemental water supplies for water-short areas of the State, and to provide a revenue stream that is used to fund flood control projects in Yuba County. With the implementation of the Yuba Accord, YCWA has been able to continue that practice and to make water available for transfer while providing environmental benefits. A portion of the Yuba Accord instream flows that are above an accounting baseline is available for transfer if the water can be successfully diverted by a downstream buyer. The transfer water provides the multiple benefits of water supply to downstream entities, inflow to the Delta and fishery habitat improvements on the Yuba River. Revenues received by YCWA for transfer water are used to fund local flood control projects or provide the local cost share for projects funded by the State and Federal government. An example of this is the Feather River Setback Levee Project where YCWA is guaranteeing \$78,000,000 in bond sales repayment.

Since 2006, the first pilot year for the Yuba Accord in which YCWA operated to meet the Accord instream flows through 2016, YCWA has transferred 825,000 ac-ft of surface water to other areas of the State under the Yuba Accord. About half of the transfer volume was supplied to the Environmental Water Account and successor programs to replaced water supplies that were reduced due to environmental programs and regulatory actions in the Delta. The current agreement between YCWA and the California Department of Water Resources for Yuba Accord transfer water supplies extends until 2025.

## **11.0 Consequences of Denial of New License**

If YCWA were not to receive a new license for the Project, YCWA would retain most Project facilities because they are used to provide flood management, consumptive water to YCWA's service territory and because YCWA holds the consumptive water rights for use of the Project facilities. However, YCWA would not receive the energy revenue from the Project, which would result in higher costs to its customers for consumptive water, and since Project revenues are used primarily to fund flood control projects in Yuba County, these flood control projects would not occur. In addition, the environmental and recreational benefits described above would not be realized.

## **12.0 Literature Cited**

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