Appendix 8M
Selenium

This appendix includes a description of the modeling used in the selenium assessment, as well as figures and tables to support the assessment. An addendum to this appendix contains the methodology and results for the bioaccumulation assessment of sturgeon in the western Delta.

8M.1 Selenium Methodology

Project-related changes in waterborne concentrations of selenium in the Delta may result in increased selenium bioaccumulation and/or toxicity to aquatic and semi-aquatic receptors using the Delta. Historical fish tissue data and measured (at Vernalis) or DSM2-modeled (other locations) waterborne selenium concentrations for selected locations in 2000, 2005, and 2007 were used to model water-to-tissue relationships, generally following procedures described by Presser and Luoma (2010).

The output from the DSM2 model (expressed as percent inflow from different sources) was used in combination with the available measured waterborne selenium concentrations to model concentrations of selenium at locations throughout the Delta. These modeled waterborne selenium concentrations were used in the relationship model to estimate bioaccumulation of selenium in whole-body fish and bird eggs. Selenium concentrations in fish fillets were then estimated from those in whole-body fish. Section 8.3.1.3, the selenium discussion under section 8.3.1.7, and the discussion below provide more detailed information regarding the assessment methodology for selenium.

The data and processes used to develop the final models to estimate this selenium bioaccumulation are described in the following sections.

8M.2 Selenium Concentrations in Water

Dissolved selenium data were available for six inflow locations to the Delta (shown in Table 1; all tables are provided at the end of this appendix). Whole-body largemouth bass data for selenium were available from the following DSM2 output locations:

- Big Break
- Cache Slough Ryer
- Franks Tract
- Knights Landing
- Middle River Bullfrog
- Old River Near Paradise Cut
- Sacramento River Mile (RM) 44
- San Joaquin River Potato Slough
- Vernalis

The geometric mean selenium concentrations from the inflow locations were combined with the modeled quarterly average percent inflow for each DSM2 output location to estimate waterborne selenium concentrations at selected DSM2 output locations.

The quarterly average mix of water from the six inflow sources (Table 1) was calculated from daily percent inflows provided by the DSM2 model output for the nine DSM2 output locations for which fish data were available. DSM2 data were not available at or near Veteran's Bridge on the Sacramento River or Vernalis on the San Joaquin River. Historical data of selenium concentrations in water collected near these locations were used to represent quarterly averages. The geometric mean of total selenium concentrations in water collected from years 2003, 2004, 2007, and 2008 (DWR Website 2009) at Knights Landing were used to represent quarterly averages of selenium concentrations in water for all years. The geometric means of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2007 (SWAMP 2009) were used to represent quarterly averages for all years of selenium concentrations in water at Vernalis.

The quarterly waterborne selenium concentrations at DSM2 locations were calculated using the following equation:

$$C_{water\,quarterly} = \frac{(I_1 \bullet C_1) + (I_2 \bullet C_2) + (I_3 \bullet C_3) + (I_4 \bullet C_4) + (I_5 \bullet C_5) + (I_6 \bullet C_6)}{100} \quad \text{[Eq.1]}$$

Where:

$C_{water\ quarterly}$ = quarterly average selenium concentration in water (micrograms/liter [µg/L]) at a DSM2 output location

$I_{1\text{-}6}$ = modeled quarterly inflow from each of the six sources of water to the Delta for each DSM2 output location (percentage)

$C_{1\text{-}6}$ = selenium concentration in water (µg/L) from each of the six inflow sources to the Delta (1-6)

Example Calculation: Modeled Selenium Concentration at Franks Tract Year 2000, First Quarter:

(43.94 [% inflow from Sacramento River water source at Franks Tract] × 0.32 µg/L [Selenium concentration at Sacramento River at Freeport]) + (11.56 [% inflow from East Delta Tributaries water source at Franks Tract] × 0.10 µg/L [Selenium concentration at Mokelumne, Calaveras, and Cosumnes Rivers]) + (15.79 [% inflow from San Joaquin River water source at Franks Tract] × 0.84 µg/L [Selenium concentration at San Joaquin River at Vernalis]) + (0.02 [% inflow from Martinez/Suisun Bay water source at Franks Tract] × 0.09 µg/L [Selenium concentration at San Joaquin River near Mildred Island]) + (0.32 [% inflow from Yolo Bypass water source at Franks Tract] × 0.45 µg/L [Selenium concentration at Sacramento River at Knights Landing]) + (5.06 [% inflow from Delta Agriculture water source at Franks Tract] × 0.11 µg/L [Selenium concentration at Mildred Island, Center])/100 = 0.29 µg/L

The quarterly and average annual waterborne selenium concentrations for the DSM2 output locations are shown in Table 2 (Year 2000), Table 3 (Year 2005), and Table 4 (Year 2007).

8M.3 Bioaccumulation of Selenium into Whole-body Fish and Bird Eggs

Selenium concentrations in whole-body fish and bird eggs were calculated using ecosystem-scale models developed by Presser and Luoma (2010). The models were developed using biogeochemical and physiological factors from laboratory and field studies; information on loading, speciation, and transformation to particulate material; bioavailability; bioaccumulation in invertebrates; and trophic transfer to predators. Important components of the methodology included (1) empirically determined environmental partitioning factors between water and particulate material that quantify the effects of dissolved speciation and phase transformation; (2) concentrations of selenium in living and non-living particulates at the base of the food web that determine selenium bioavailability to invertebrates; and (3) selenium biodynamic food web transfer factors that quantify the physiological potential for bioaccumulation from particulate matter to consumer organisms and prey to their predators.

8M.3.1 Selenium Concentration in Particulates

Phase transformation reactions from dissolved to particulate selenium are the primary form by which selenium enters the food web. Presser and Luoma (2010) used field observations to quantify the relationship between particulate material and dissolved selenium as provided below.

$$C_{particulate} = K_d \bullet C_{water\,column} \quad \text{[Eq. 2]}$$

Where:

$C_{particulate}$ = selenium concentration in particulate material (micrograms/kilogram, dry weight [µg/kg dw])

$C_{water\,column}$ = selenium concentration in water column (µg/L)

K_d = particulate/water ratio

The K_d describes the particulate/water ratio at the moment the sample was taken and should not be interpreted as an equilibrium constant (as it sometimes is). It can vary widely among hydrologic environments and potentially among seasons (Presser and Luoma 2010). In addition, other factors such as speciation, residence time, and particle type affect K_d. Residence time of selenium is usually the most influential factor on the conditions in the receiving water environment. Short water residence times (e.g., streams and rivers) limit partitioning of selenium into particulate material. Conversely, longer residence times (e.g., sloughs, lakes, estuaries) allow greater uptake by plants, algae, and microorganisms. Furthermore, environments in downstream portions of a watershed can receive cumulative contributions of upstream recycling in a hydrologic system. Due to its high variability, K_d is a large source of uncertainty in the model, especially if translation of selenium concentration in the water column is necessary.

8M.3.2 Selenium Concentrations in Invertebrates

Species-specific trophic transfer factors (TTFs) for transfer of selenium from particulates to prey and to predators were developed using data from laboratory experiments and field studies (Presser and Luoma 2010). TTFs are species-specific, but the range of TTFs for freshwater invertebrates was found to be similar to TTFs for marine invertebrates determined in laboratory experiments.

TTFs for estimating selenium concentrations in invertebrates were calculated using the following equation:

$$TTF_{invertebrate} = \frac{C_{invertebrate}}{C_{particulate}} \quad \text{[Eq. 3]}$$

Where:

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

$C_{invertebrate}$ = concentration of selenium in invertebrate (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

A mean aquatic insect TTF was calculated from TTFs for aquatic insect species with similar bioaccumulative potential, including mayfly (Baetidae; Heptageniidae; Ephemerellidae), caddisfly (Rhyacophilidae; Hydropsychidae), crane fly (Tipulidae), stonefly (Perlodidae/Perlidae; Chloroperlidae), damselfly (Coenagrionidae), corixid (*Cenocorixa* sp.), and chironomid (*Chironomus* sp.) aquatic life stages. Species-specific TTFs ranged from 2.14 to 3.2 with a mean TTF of 2.8.

8M.3.3 Selenium Concentrations in Whole-body Fish

The mechanistic equation for modeling of selenium bioaccumulation in fish tissue is similar to that of invertebrates if whole-body concentrations are the endpoint (Presser and Luoma 2010), as follows:

$$TTF_{fish} = \frac{C_{fish}}{C_{invertebrate}}$$

where:

$$C_{invertebrate} = C_{particulate} \bullet TTF_{invertebrate}$$

therefore:

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \quad \text{[Eq. 4]}$$

Where:

C_{fish} = concentration of selenium in fish (µg/g dw)

$C_{invertebrate}$ = concentration of selenium in invertebrate (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

TTF_{fish} = trophic transfer factor from invertebrate to fish

Modeling of bioaccumulation into a particular fish species includes physiology of the organism and its preferred foods. Therefore, variability in fish tissue concentrations of selenium is driven more by dietary choices and their respective levels of bioaccumulation (i.e., $TTF_{invertebrate}$) than by differences in the dietary transfer to the fish (TTF_{fish}). A diet of mixed prey (including invertebrates or other fish) can be modeled as follows:

$$C_{fish} = TTF_{fish} \bullet \left[\left(C_1 \bullet F_1 \right) + \left(C_2 \bullet F_2 \right) + \left(C_3 \bullet F_3 \right) \right] \quad \text{[Eq. 5]}$$

Where:

C_{fish} = concentration of selenium in fish (µg/g dw)

TTF_{fish} = trophic transfer factor for fish species

$C_{1\text{-}3}$ = concentration of selenium in invertebrate or fish prey items 1, 2, and 3 (µg/g dw)

$F_{1\text{-}3}$ = fraction of diet composed of prey items 1, 2, and 3

Modeling of selenium concentrations in longer food webs with higher trophic levels (e.g., forage fish being consumed by predator fish) can be completed by incorporating additional TTFs; for example:

$$C_{predatorfish} = TTF_{invertebrate} \bullet C_{particulate} \bullet TTF_{foragefish} \bullet TTF_{predatorfish} \quad \text{[Eq. 6]}$$

Where:

$C_{predator\ fish}$ = concentration of selenium in fish (µg/g dw)

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{forage\ fish}$ = trophic transfer factor for invertebrates to foraging fish species

$TTF_{predator\ fish}$ = trophic transfer factor for forage fish to predator species

The fish TTFs reported in Presser and Luoma (2010) ranged from 0.5 to 1.6, so the average fish TTF of 1.1 was used for all trophic levels of fish.

Modeled selenium concentrations in whole-body fish were used to estimate selenium concentrations in fish fillets, as described below in Section A.4.

8M.3.4 Selenium Concentrations in Bird Eggs

Selenium concentrations in bird tissues can be estimated, but the transfer of selenium into bird eggs is more meaningful for evaluating reproductive endpoints (Presser and Luoma 2010). Examples of models for selenium transfer to bird eggs are as follows:

$$C_{birdegg} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{birdegg} \quad \text{[Eq. 7]}$$

Or:

$$C_{birdegg} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \bullet TTF_{birdegg} \quad \text{[Eq. 8]}$$

Where:

$C_{bird\ egg}$ = concentration of selenium in bird egg (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

TTF_{fish} = trophic transfer factor from invertebrate to fish

$TTF_{bird\ egg}$ = trophic transfer factor from invertebrate or fish (depending on diet) to bird egg

The only bird TTF presented in Presser and Luoma (2010) was for the mallard ($TTF_{bird\ egg}$ = 1.8). Mallards are considered a sensitive species to selenium based on reproductive endpoints.

8M.4 Refinement of Selenium Bioaccumulation Models for the Delta

Several models were evaluated and refined to estimate selenium uptake in fish and in bird eggs from waters in the Delta. Input parameters to the model (K_ds and TTFs) were varied among the models as refinements were made. A summary of the input parameters is presented in Table 5. Rationale for each refinement is presented below with the discussion of each model. In addition, largemouth bass collected in the Delta from areas near DSM2 output locations were used to calculate the geometric mean selenium concentration in whole-body fish (Foe 2010a). The ratio of the estimated selenium concentration in fish to measured selenium in whole-body bass was used to evaluate each fish model and to focus refinements to the model. The models evaluated are presented in the following subsections.

8M.4.1 Bioaccumulation in Whole-body Fish

Seven models were evaluated for estimating whole-body selenium concentrations in fish. The basic models were refined by dietary fraction and input parameters to provide a model that would most closely represent conditions in the Delta. Each model is described in this section.

Model 1 was a basic representative of uptake by a forage fish, while Models 2 and 3 calculated sequential bioaccumulation in longer food webs representative of predatory fish of increasing complexity as shown below:

- Model 1: Trophic level 3 (TL-3) fish eating invertebrates

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \quad \text{[Eq. 9]}$$

- Model 2: Trophic level 4 (TL-4) fish eating TL-3 fish

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \bullet TTF_{fish} \quad \text{[Eq. 10]}$$

- Model 3: TL-4 fish eating TL-3 fish eating TL-3 and TL-2 invertebrates

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \bullet TTF_{fish} \quad \text{[Eq. 11]}$$

Where:

C_{fish} = concentration of selenium in fish (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{invertebrate}$ = Trophic transfer factor from particulate material to invertebrate

TTF_{fish} = Trophic transfer factor from invertebrate or fish to fish

In each model, the particulate selenium concentration was estimated using Equation 2 and a default K_d of 1,000. The average TTFs for invertebrates (2.8) and fish (1.1) were also used in each model. The outputs of estimated selenium concentrations and the ratios of estimated fish selenium concentration to measured bass selenium concentration for Models 1, 2, and 3 are presented in Table 6 and Figure 1 (all figures are provided at the end of this appendix).

Model 1 tended to underestimate the whole-body selenium concentrations in fish when compared to bass data reported in Foe (2010a). This was most likely because Model 1 was estimating a forage fish (TL-3), whereas bass are a predatory fish with expected higher dietary exposure. Consequently, Model 1 was not further developed as the selenium bioaccumulation model to represent fish in the Delta.

Models 2 and 3 are both representative of predatory fish, but Model 2 was very similar to Model 1 in distribution of data and in underestimating bass data. Conversely, Model 3 had a larger distribution and greater variation in the data and significantly overestimated the bass data. These models were used as the basis for Models 4 and 5.

Models 4 and 5 were developed to represent a mixed diet using prey fractions to characterize the diet of fish in the Delta, as follows:

- Model 4: 50% of Model 2 and 50% of Model 3

$$C_{fish\,Model4} = \left(0.5 \bullet C_{fish\,Model2}\right) + \left(0.5 \bullet C_{fish\,Model3}\right) \quad \text{[Eq. 12]}$$

- Model 5: 75% of Model 2 and 25% of Model 3

$$C_{fish\,Model5} = \left(0.75 \bullet C_{fish\,Model2}\right) + \left(0.25 \bullet C_{fish\,Model3}\right) \quad \text{[Eq. 13]}$$

Models 4 and 5 used the default K_d (1,000), average invertebrate TTF (2.8), and average fish TTF (1.1). The outputs of estimated selenium concentrations and ratios of the estimated selenium concentration in fish to measured selenium concentration in bass data for Models 4 and 5 are presented in Table 6 and Figure 1. Data distribution and variation were comparatively large in Model 4. Model 5 was relatively predictive of bass data, but was not considered representative of the general population of predatory fish in the Delta. Consequently, it was determined that Model 2 was the most representative of the prey base used by fish in the Delta (i.e., number of trophic levels in the model); therefore, further evaluation and refinement of the selenium bioaccumulation model was limited to Model 2.

In addition, review of Models 1 through 5 indicated that the default value of 1,000 for K_d was not representative of the Delta's potentially high variability and uncertainty with regard to residence time. The Delta tends to have a long water residence time and receives upstream contributions of selenium, and greater recycling and higher concentrations of selenium entering the food web are expected. Model 6 was developed using an extrapolated K_d value of 1,400 with Model 2 (Equation 10). The average invertebrate and fish TTFs were used. Model 6 was generally predictive of bass data (ratio median 1.04). The outputs of estimated selenium concentrations and ratios of the estimated selenium concentration in fish to measured selenium concentration in bass data for Model 6 are presented in Table 7 and Figure 1.

Model 7 was a further refinement whereby site-specific data for dissolved selenium in water and selenium in particulate samples collected in the Delta (Lucas and Stewart 2007) were used to calculate a site-specific K_d of 1,760 (geometric mean). Model 7 used the more representative site-specific K_d (1,760) with Model 2 (Equation 10) and the average invertebrate and fish TTFs (2.8 and 1.1, respectively). The outputs from Model 7 slightly overestimated selenium concentrations in fish compared to selenium concentrations in bass (ratio median 1.30), as shown in Table 7 and Figure 1.

Model 8 used the site-specific K_d (1,760) and the average fish TTF (1.1). The invertebrate TTF was revised so that mayflies and stoneflies were not included in the average, because these species would not be readily available in the Delta to contribute to fish or bird diets. The revised invertebrate TTF of 2.1 was used in Model 8. The outputs from Model 8 are presented in Table 8 and Figure 1.

As expected in a large, complex, and diverse ecological habitat such as the Delta, variations in the data distribution and in the outputs of all models including Model 8 (minimum ratio 0.45, maximum ratio 2.21, and median ratio 0.98) were observed. The variation in the models' outputs is primarily influenced by (1) the selenium concentration in water, used to estimate the selenium concentration in fish tissue, and (2) the measured selenium concentration in bass. Variation in selenium concentrations in water among the years was small, so the variation in selenium concentrations in bass was the primary factor determining the temporal variation among the models. One prominent outlier was observed in all models, seasons, and years as shown by the overestimation of selenium concentration in fish to measured selenium in bass collected at Vernalis. The overestimation is likely the result of high selenium concentrations in water calculated during different years (1999–2007) from those when bass were collected (2000, 2005, or 2007).

Data from Year 2000 were the most predictive in estimating selenium concentrations in fish tissue compared to measured selenium concentrations in bass with Model 8 (minimum ratio = 0.53, maximum ratio = 2.21, and median ratio = 0.98; Figure 2). Foe (2010a) reported the water year type for 2000 as "above normal" for both the Sacramento River and San Joaquin River watersheds. It came after "wet" water years and was followed by "dry" water years. Year 2005 selenium concentrations in bass were comparatively lower than those estimated for Year 2000. Year 2005 was wetter than Year 2000 (reported as "above normal" for the Sacramento River watershed and wet for the San Joaquin River watershed), and occurred between periods of wetter water years than reported for Year 2000. As expected in a wet water year, the water residence time is shorter, resulting in less selenium recycling and lower concentrations of selenium entering the food web. Under these influences, Model 8 tended to overestimate selenium concentrations in fish for Year 2005 (minimum ratio = 0.79, maximum ratio = 2.12, and median ratio = 1.21; Figure 2). For Year 2007, the model generally underestimated the comparatively higher measured selenium concentration in bass (minimum ratio = 0.45, maximum ratio = 1.57, and median ratio = 0.62). Water Year 2007 was reported as dry (Sacramento River watershed) and "critically dry" (San Joaquin River watershed). It came after wet water years and was followed by critically dry water years. This dry water year resulted in a longer water residence time, greater selenium recycling, and higher concentrations of selenium entering the food web. Because the influences of a dry water year were not captured in the selenium concentrations in water and were reflected only in bass, Model 8 underestimated selenium concentrations in bass for Year 2007. Therefore, these results illustrate how Model 8 best predicts selenium concentration in fish during normal to wet water years but not dry water years. However, as shown above, Model 8 also can represent selenium bioaccumulation when all water year types were combined (represented by 2000, 2005, and 2007).

Further evaluation of water-year effects on selenium concentration in bass concluded that a more representative model was needed for dry water years. Therefore, Model 9 used an extrapolated K_d of 2,840, the revised invertebrate TTF of 2.1, and the average fish TTF of 1.1 with Model 2 to provide a better fit for the bass data in dry water years. The outputs of estimated selenium concentrations and ratios of the estimated selenium concentration in fish to measured selenium concentration in bass data for Model 9 are presented in Table 9 and Figure 3.

Model 8 is relatively predictive of selenium concentration in whole-body bass during normal to wet water years (ratio median 1.04; Figure 3) or all water years (ratio median 0.98; Figure 1), and Model 9 is considered predictive for dry water years (ratio median 1.00; Figure 3). These models were selected as the selenium bioaccumulative models to estimate selenium concentration in whole-body fish in the Delta and are summarized below for ease of reference; see Table 5 for K_ds and TTFs:

- Model 8: Trophic level 4 (TL-4) fish eating TL-3 fish

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \bullet TTF_{fish}$$
$$where: \qquad \text{[Eq. 14]}$$
$$C_{particulate} = K_d \bullet C_{water}$$

- Model 9: Trophic level 4 (TL-4) fish eating TL-3 fish

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \bullet TTF_{fish}$$
$$where: \qquad \text{[Eq. 15]}$$
$$C_{particulate} = K_d \bullet C_{water}$$

Where:

$C_{particulate}$ = Concentration of selenium in particulate material (µg/g dw)

C_{water} = selenium concentration in water column (µg/L)

K_d = equilibrium constant

$TTF_{invertebrate}$ = Trophic transfer factor from particulate material to invertebrate

TTF_{fish} = Trophic transfer factor from invertebrate to fish

Because all models greatly overestimated selenium bioaccumulation in fish at Vernalis in all seasons and years, Models 8 and 9 were modified by adjusting the K_d downward to reflect the lower rate of bioaccumulation at that location. The adjusted models used K_d values of 850 for Model 8a and 1,130 for Model 9a. With these adjustments, Model 8a produced a ratio of 1.01 for the comparison of modeled fish to the bass data and Model 9a produced a ratio of 1.00.

8M.4.2 Bioaccumulation in Bird Eggs

The K_d, invertebrate TTF, and fish TTFs developed for use in fish bioaccumulation Models 8 and 9 were also used to estimate selenium uptake into bird eggs using the following two bird egg models:

- Bird Egg: Uptake from invertebrates

$$C_{birdegg} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{birdegg}$$
$$where: \qquad \text{[Eq. 16]}$$
$$C_{particulate} = K_d \bullet C_{water}$$

- Bird Egg: Uptake from fish

$$C_{bird\,egg} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \bullet TTF_{bird\,egg}$$

$$where: \qquad \text{[Eq. 17]}$$

$$C_{particulate} = K_d \bullet C_{water}$$

Where:

$C_{bird\,egg}$ = concentration of selenium in bird egg (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

C_{water} = selenium concentration in water column (µg/L)

K_d = equilibrium constant

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

TTF_{fish} = trophic transfer factor from invertebrate to fish

$TTF_{bird\,egg}$ = trophic transfer factor from invertebrate or fish (depending on diet) to bird egg

For normal to wet years, the site-specific K_d value (1,760), revised invertebrate TTF (2.1), average fish TTF (1.1), and mallard bird egg TTF (1.8) were used. For dry years, the revised K_d (2,840), revised invertebrate TTF (2.1), average fish TTF (1.1), and mallard bird egg TTF (1.8) were used. Results of output for bird egg modeling are shown in Table 8 for normal and wet years and in Table 9 for dry years.

8M.5 Bioaccumulation in Fish Fillets

Selenium concentrations in whole-body fish were converted to selenium concentrations in skinless fish fillets. The regression equation provided in Saiki et al. (1991) for largemouth bass from the San Joaquin River system was considered to be the most representative of fish in the Delta and was used for the conversion of these selenium concentrations as follows:

$$SF = -0.388 + 1.322\,WB \qquad \text{[Eq. 18]}$$

Where:

SF = selenium concentration in skinless fish fillet (µg/g dw)

WB = selenium concentration in whole-body fish (µg/g dw)

Fish fillet data will be compared to the advisory tissue level (2.5 µg/g) in wet weight (ww) (OEHHA 2008); therefore, wet-weight concentrations were estimated from dry-weight concentrations using the equation provided by Saiki et al. (1991) as follows:

$$WW = DW \bullet (100 - Moist)/100 \qquad \text{[Eq. 19]}$$

Where:

WW = selenium concentration in wet weight (µg/g ww)

DW = selenium concentration in dry weight (µg/g dw)

Moist = mean moisture content of the species

Because moisture content in fish varies among species, sample handling, and locations, the mean moisture content of 70 percent as used by Foe (2010b) was used as an assumed approximation for fish in the Delta. The final equation used to estimate selenium concentration in skinless fish fillets (wet weight) from selenium concentration in whole-body fish (dry weight) is as follows:

$$SF = (-0.388 + 1.322\,WB) \bullet 0.3 \quad \text{[Eq. 20]}$$

Where:

SF = selenium concentrations in skinless fish fillet (µg/g ww)

WB = selenium concentration in whole-body fish (µg/g dw)

8M.6 References

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ABBREVIATIONS

µg/L	micrograms/liter
µg/g dw	micrograms/gram, dry weight
µg/g ww	micrograms/gram, wet weight
GM	geometric mean (in separate Excel tables)
NA	not available (in separate Excel tables)
OEHHA	Office of Environmental Health Hazard Assessment
RM	River Mile
SFEI	San Francisco Estuary Institute
SWAMP	Central Valley Regional Water Quality Control Board Surface Water Ambient Monitoring Program
TL	trophic level
TTF	trophic transfer factor
USGS	U.S. Geological Survey

TABLES

Table M-1. Selenium Concentrations in Water at Inflow Sources to the Delta

Delta Sources	Representative Inflow Site	GM Se Concentration in Water (µg/L)[a]	Years	Source
Delta Agriculture	Mildred Island, Center	0.11	2000, 2003–2004	Lucas and Stewart 2007
East Delta Tributaries	Mokelumne, Calaveras, and Cosumnes Rivers[b]	0.1	None	None
Martinez/Suisun Bay	San Joaquin River near Mallard Island	0.09	2000–2008	SFEI Website 2010
Sacramento River	Sacramento River at Freeport	0.32	1996–2001, 2007–2010	USGS Website 2010
San Joaquin River	San Joaquin River at Vernalis (Airport Way)[c]	0.84	1999–2007	SWAMP Website 2009
Yolo Bypass	Sacramento River at Knights Landing[d]	0.45	2003, 2004, 2007, 2008	DWR Website 2009

Notes:

[a]Selenium concentrations are in dissolved fraction unless otherwise noted.

[b] Dissolved selenium concentration is assumed to be 0.1 µg/L due to lack of available data and lack of sources that would be expected to result in concentrations greater than 0.1 µg/L.

[c] Not specified whether total or dissolved selenium.

[d] Total selenium concentration in water.

µg/L = microgram(s) per liter

GM = geometric mean

Se = selenium

Table M-2. Calculation of Quarterly Average Selenium Concentrations for DSM2 Output Locations: Year 2000

DSM2 Output Water Location	Inflow Source →	First Quarter Inflow Percentage						Second Quarter Inflow Percentage						Third Quarter Inflow Percentage						Fourth Quarter Inflow Percentage						Estimated Waterborne Selenium Concentrations (µg/L)				
	Inflow Source →	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass					
	Inflow Location →	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*					
	Selenium (µg/L) →	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
	Location ID																													
Big Break	BIGBRK_MID	2.94	6.88	53.15	6.59	0.18	5.70	2.95	6.37	73.59	13.55	0.27	3.12	3.13	0.45	85.63	0.44	4.15	6.12	2.13	0.20	84.85	0.02	8.76	3.96	0.26	0.37	0.31	0.30	0.33
Cache Slough	CACHS_LEN	1.46	0	53.38	0	0	31.91	1.24	1.5E-05	85.07	2.5E-05	0	13.25	1.66	4.7E-07	85.95	4.3E-07	5.9E-07	12.23	1.32	2.8E-06	89.83	1.1E-07	2.3E-05	8.67	0.32	0.33	0.33	0.33	0.33
Cache Slough Ryer	CACHSR_MID	2.88	0	54.86	0	0	20.48	3.36	9.8E-07	79.75	1.9E-06	0	16.25	1.90	9.3E-08	84.53	1.8E-07	9.2E-12	13.38	1.81	1.0E-07	89.45	6.2E-10	3.0E-06	8.54	0.27	0.33	0.33	0.33	0.33
Cosumnes R.	COSR_LEN	8.1E-06	98.82	0	0	0	0	0	100.00	0	0	0	0	0	100.00	0	0	0	0	0	100.00	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Franks Tract	FRANKST_MID	5.06	11.56	43.94	15.79	0.02	0.32	4.17	9.42	61.16	23.89	0.01	1.22	4.04	0.57	90.34	0.41	0.80	3.78	2.76	0.62	91.38	0.12	2.42	2.64	0.29	0.42	0.32	0.31	0.35
Little Holland Tract	LHOLND_L0	72.35	0	5.06	0	0	6.50	23.38	8.2E-07	63.10	1.6E-06	0	13.03	18.48	2.2E-07	68.67	4.2E-07	7.2E-13	12.68	19.63	2.6E-09	72.79	0	0	7.42	0.13	0.29	0.30	0.29	0.29
Middle R Bullfrog	MIDRBULFRG_LEN	10.54	13.07	18.37	32.20	1.9E-03	3.2E-03	5.49	9.19	14.96	70.17	4.2E-04	0.10	7.81	6.43	69.63	14.94	0.12	1.02	4.86	6.31	59.79	27.84	1	0.68	0.35	0.65	0.37	0.44	0.49
Mildred Isl	MILDDRISL_MID	7.47	14.31	22.79	30.23	2.4E-03	1.8E-03	4.77	10.05	18.48	66.48	6.7E-04	0.13	6.57	4.57	83.28	4.14	0.15	1.25	4.50	6.63	71.28	16.13	0.61	0.82	0.35	0.63	0.32	0.38	0.44
Mok. R. below Consum.	MOKBCOS_LEN	2.07	96.19	0	0	0	0	1.65	98.35	0	0	0	0	7.23	92.77	4.7E-09	0	0	0	2.47	97.53	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Mok. R. downstream Consum.	MOKDCOS_MID	2.07	96.43	0	0	0	0	1.68	98.32	0	0	0	0	7.08	92.92	0	0	0	0	2.34	97.66	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Old R. near Paradise Cut	OLDRNPARADSEC_MID	6.24	0	0	87.26	0	0	14.40	1.67	5.21	78.66	1.2E-05	0.04	10.56	3.9E-05	1.3E-04	89.44	8.8E-28	3.0E-07	2.50	1.1E-04	3.5E-04	97.50	2.8E-20	1.7E-07	0.74	0.70	0.76	0.82	0.76
Paradise Cut	PARADSECUT_LEN	4.69	0	0	91.37	0	0	2.62	0.06	0.15	97.16	1.5E-07	1.1E-03	3.43	0	0	96.57	0	0	0.96	0	0	99.04	0	0	0.77	0.82	0.82	0.83	0.82
Port of Stockton	PORTOSTOCK_L0	1.67	0	0	18.85	0	0	2.22	0	0	60.73	0	0	3.09	0	0	81.32	0	0	2.70	0	0	89.89	0	0	0.16	0.51	0.69	0.76	0.65
Sac. R. at Isleton	SACRISLTON_L0	0.33	0	95.77	0	0	0	0.31	0.00	99.60	0	0	5.5E-05	0.44	0	99.55	0	0	1.3E-05	0.28	0	99.72	0	0	1.1E-03	0.31	0.32	0.32	0.32	0.32
Sac. R. RM 44	SACR44_L0	0.14	0	97.93	0	0	0	0.11	0	99.81	0	0	0	0.13	0	99.86	0	0	0	0.05	0	99.94	0	0	0	0.31	0.32	0.32	0.32	0.32
Sandmound Sl.	SANDMND_MID	6.36	10.51	43.82	12.90	0.03	0.57	5.22	8.81	63.78	20.40	0.03	1.63	5.24	0.61	87.78	0.49	1.22	4.59	3.31	0.43	89.58	0.06	3.44	3.11	0.27	0.40	0.31	0.31	0.34
Sherman Island	SHERMNILND_L0	1.64	3.45	52.71	3.93	0.60	12.10	2.48	4.95	76.80	10.96	0.96	3.67	2.60	0.40	81.69	0.46	8.21	6.56	1.77	0.11	77.64	0.01	16.46	3.94	0.26	0.36	0.31	0.28	0.32
SJR Bowman	SJRBOWMN_MID	1.40	0	0	94.03	0	0	1.52	0	0	98.48	0	0	3.00	0	0	97.00	0	0	0.33	0	0	99.67	0	0	0.79	0.83	0.82	0.84	0.83
SJR N Hwy4	SJRNHWY4_MID	3.49	0	0	89.96	0	0	1.87	0	0	98.13	0	0	3.91	0	0	96.09	0	0	0.72	0	0	99.28	0	0	0.76	0.83	0.81	0.83	0.82
SJR Naval st	SJRNAVLST_L0	8.89	12.70	0.00	65.44	0	0	2.69	6.26	0	90.94	0	0	5.98	10.89	0	83.00	0	0	2.02	3.10	0.00	94.84	0	0	0.57	0.77	0.71	0.80	0.76
SJR Potato Slough	SJRPOTSL_MID	3.15	12.62	55.38	12.40	0.01	0.06	3.05	10.32	65.93	19.73	0.01	0.86	2.63	0.35	93.54	0.20	0.45	2.79	2.06	0.80	93.46	0.06	1.47	2.11	0.30	0.39	0.32	0.31	0.34
SJR Turner	SJRTURNR_MID	8.81	9.28	2.55	56.31	5.3E-05	1.0E-05	3.33	5.77	0.41	90.39	6.3E-06	2.4E-03	8.69	13.75	17.87	59.41	0.01	0.16	3.23	4.83	7.34	84.49	0.03	0.05	0.50	0.77	0.58	0.74	0.70
SJR/Pt. Antioch/fish pier	ASRANTFSH_MID	1.92	4.35	55.13	4.50	0.44	10.23	2.45	4.72	77.70	10.28	0.76	3.91	2.64	0.35	83.38	0.38	6.66	6.52	1.82	0.12	80.54	0.01	13.33	4.11	0.27	0.36	0.31	0.29	0.32
Suisun Bay	SUISNB_LEN	0.81	1.22	45.93	1.24	16.49	15.94	0.92	1.66	49.51	3.61	41.10	2.95	0.80	0.23	27.56	0.40	68.55	2.42	0.60	0.03	28.62	0.01	69.16	1.54	0.25	0.24	0.16	0.16	0.19
Sycamore Slough	SYCAMOR_MID	6.50	50.69	15.18	0	0	0	5.89	76.86	16.89	2.8E-07	0	0	5.04	14.29	80.66	1.2E-31	0	0	4.23	31.10	64.66	0	0	0	0.11	0.14	0.28	0.24	0.22
White Slough	WHITESL_L0	22.32	11.88	17.97	25.51	1.7E-08	6.0E-11	16.54	12.10	16.87	54.46	3.7E-09	6.1E-05	9.89	7.76	82.34	3.8E-03	3.0E-05	5.3E-04	11.19	12.92	75.64	0.24	4.2E-04	6.4E-04	0.31	0.54	0.28	0.27	0.36
White Slough DS Disappointment Sl.	WHTSLDISPONT_LEN	14.83	22.63	29.02	22.45	5.4E-08	0	12.45	13.97	21.21	52.32	2.2E-09	2.3E-04	8.74	7.78	83.47	2.4E-03	4.0E-05	5.6E-04	5.28	14.84	79.82	0.05	5.0E-04	7.3E-04	0.32	0.54	0.28	0.28	0.37

Table M-3. Calculation of Quarterly Average Selenium Concentrations for DSM2 Output Locations: Year 2005

DSM2 Output Water Location	Inflow Source →	First Quarter Inflow Percentage						Second Quarter Inflow Percentage						Third Quarter Inflow Percentage						Fourth Quarter Inflow Percentage						Estimated Waterborne Selenium Concentrations (µg/L)				
		Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass					
	Inflow Location →	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*					
	Selenium (µg/L) →	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
Location ID																														
Big Break	BIGBRK_MID	5.87	7.57	83.73	2.41	0.24	0.18	2.90	17.21	52.77	26.69	1.6E-03	0.43	3.31	2.21	88.77	1.70	3.98	0.03	2.39	0.24	90.17	0.01	6.48	0.70	0.30	0.42	0.31	0.30	0.33
Cache Slough	CACHS_LEN	4.89	2.2E-07	93.64	8.E-07	3.8E-07	1.47	1.48	7.1E-07	94.13	8.0E-07	1.1E-08	4.38	1.94	1.7E-05	98.02	1.0E-05	1.6E-06	0.05	2.30	1.2E-05	92.72	4.6E-07	0.00	4.98	0.31	0.32	0.32	0.32	0.32
Cache Slough Ryer	CACHSR_MID	8.13	3.0E-07	91.14	1.2E-06	1.3E-06	0.73	3.74	2.5E-08	91.89	1.0E-07	2.9E-08	4.38	2.15	5.6E-07	97.77	2.6E-07	4.5E-09	0.08	2.66	8.8E-07	96.37	1.9E-08	7.6E-06	0.97	0.30	0.32	0.32	0.32	0.31
Cosumnes R.	COSR_LEN	0	100.00	0	0	0	0	0.00	100.00	0.00	0	0	0	0	100	0	0	0	0	1.2E-04	100.00	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Franks Tract	FRANKST_MID	8.65	11.65	72.50	7.E+00	0.19	0.05	4.63	16.63	26.97	51.74	1.1E-04	0.03	4.27	3.20	89.93	1.81	0.77	0.02	3.17	0.81	94.16	0.06	1.74	0.05	0.31	0.54	0.31	0.31	0.37
Little Holland Tract	LHOLND_L0	97.11	3.2E-09	2.88	9.E-09	3.9E-09	0.01	44.12	6.5E-09	53.25	2E-08	1.2E-08	2.63	18.61	5.6E-07	81.24	0.00	0.00	0.16	46.22	6.1E-08	53.77	2.8E-08	2.6E-09	0.01	0.12	0.23	0.28	0.22	0.21
Middle R Bullfrog	MIDRBULFRG_LEN	13.67	9.76	28.26	48.24	0.08	0.01	5.55	5.64	2.70	86.11	7.1E-05	8.4E-04	7.43	12.50	53.07	26.88	0.12	3.1E-03	5.54	8.75	65.65	19.67	0.39	1.1E-03	0.52	0.74	0.42	0.39	0.52
Mildred Isl	MILDDRISL_MID	12.36	11.39	32.28	43.87	8.4E-02	0.01	4.81	6.98	2.78	85.43	3.6E-05	6.7E-04	6.73	12.68	65.46	14.98	0.15	3.9E-03	4.81	7.16	77.85	9.71	0.47	1.8E-03	0.50	0.74	0.36	0.34	0.48
Mok. R. below Consum.	MOKBCOS_LEN	2.18	97.82	0	0.00	0	0	0.53	99.47	0	0	0	0	3.05	96.95	0	0	0	0	3.00	97.00	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Mok. R. downstream Consum.	MOKDCOS_MID	2.22	97.78	0	0.00	0	0	0.53	99.47	0	0	0	0	3.05	96.95	0	0	0	0	2.93	97.07	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Old R. near Paradise Cut	OLDRNPARADSEC_MID	8.95	4.7E-05	1.5E-03	91.05	1.4E-05	1.4E-06	1.43	1.7E-07	1.6E-05	98.57	1.7E-08	3.5E-10	6.64	0	5.E-09	93.36	0	0	14.49	0.24	3.16	82.09	0.02	8.1E-05	0.77	0.83	0.79	0.72	0.78
Paradise Cut	PARADSECUT_LEN	10.28	1.6E-07	6.8E-07	89.72	1.6E-11	1.7E-08	0.82	0	0	99.18	0	0	2.39	0	0	97.61	0	0	1.08	0	0	98.92	0	0	0.77	0.83	0.82	0.83	0.81
Port of Stockton	PORTOSTOCK_L0	4.70	0	0	95.30	0	0	2.83	0	0	97.16	0	0	2.20	0	0	97.80	0	0	2.20	0	0	97.79	0	0	0.81	0.82	0.82	0.82	0.82
Sac. R. at Isleton	SACRISLTON_L0	0.55	0	99.45	0.00	0	0	0.18	0	99.82	0.00	0	0	0.45	0	99.55	0.00	0	0	0.41	0	99.59	0	0	8.2E-08	0.32	0.32	0.32	0.32	0.32
Sac. R. RM 44	SACR44_L0	0.21	0	99.79	0.00	0	0	0.07	0	99.93	0.00	0	0	0.14	0	99.86	0.00	0	0	0.17	0	99.83	0	0	0	0.32	0.32	0.32	0.32	0.32
Sandmound Sl.	SANDMND_MID	10.51	10.17	74.35	4.65	0.25	0.07	5.35	18.03	32.15	44.41	1.5E-04	0.06	5.61	3.13	87.97	2.10	1.17	0.02	3.93	0.55	92.97	0.03	2.45	0.07	0.30	0.50	0.31	0.31	0.35
Sherman Island	SHERMNILND_L0	4.89	5.04	87.74	1.52	0.56	0.23	2.43	14.17	61.17	21.31	0.03	0.89	2.76	1.84	86.03	1.72	7.62	0.04	1.95	0.11	84.69	0.01	11.76	1.48	0.31	0.40	0.30	0.29	0.32
SJR Bowman	SJRBOWMN_MID	1.10	0	0.00	98.90	0	0	0.45	0	0	99.55	0	0	2.06	0	0	97.94	0	0	0.80	0	0	99.20	0	0	0.83	0.84	0.83	0.83	0.83
SJR N Hwy4	SJRNHWY4_MID	1.89	0	0.00	98.11	0	0	0.59	0	0	99.41	0	0	2.64	0	0	97.36	0	0	1.94	0.00	0	98.06	0	0	0.83	0.84	0.82	0.83	0.83
SJR Naval st	SJRNAVLST_L0	4.70	5.45	0.00	89.85	0	0	1.06	5.10	0	93.84	0	0	4.11	9.43	0	86.46	0	0	4.97	12.46	0	82.57	0	0	0.77	0.79	0.74	0.71	0.75
SJR Potato Slough	SJRPOTSL_MID	6.24	16.03	71.18	6.45	0.07	0.03	2.65	23.15	38.61	35.59	1.1E-05	0.01	2.75	2.58	93.40	0.83	0.42	0.01	2.16	1.30	95.35	0.02	1.04	0.13	0.31	0.45	0.31	0.31	0.34
SJR Turner	SJRTURNR_MID	6.75	4.55	1.37	87.31	0.01	0	1.49	3.20	0.00	95.31	0	0	6.05	11.77	4.90	77.27	0.01	8.4E-05	5.55	16.96	10.99	66.44	0.06	7.4E-05	0.75	0.81	0.68	0.62	0.71
SJR/Pt. Antioch/fish pier	ASRANTFSH_MID	4.87	5.29	87.53	1.67	0.37	0.27	2.37	13.56	62.61	20.61	0.02	0.84	2.82	1.68	87.76	1.46	6.24	0.03	2.05	0.14	86.70	0.01	9.68	1.42	0.31	0.39	0.30	0.29	0.32
Suisun Bay	SUISNB_LEN	2.63	1.36	66.87	0.33	28.58	0.23	1.35	6.21	59.91	8.33	22.38	1.82	0.83	0.82	31.47	1.16	65.65	0.07	0.68	0.05	32.01	0.03	66.56	0.68	0.25	0.30	0.17	0.17	0.22
Sycamore Slough	SYCAMOR_MID	14.41	68.02	17.57	8.8E-17	0	3.5E-29	3.66	95.02	1.31	1.E-18	0	3.9E-33	4.79	40.41	54.81	2.9E-20	0	1.1E-32	5.24	32.04	62.72	2.6E-18	7.7E-14	1.0E-30	0.14	0.10	0.22	0.24	0.18
White Slough	WHITESL_L0	47.62	12.39	33.06	6.93	8.2E-04	2.7E-06	15.95	8.06	2.95	73.04	1.4E-05	1.5E-07	10.03	26.20	63.17	0.61	3.0E-05	8.1E-08	9.32	12.33	78.34	0.01	4.6E-04	4.6E-08	0.23	0.65	0.24	0.27	0.35
White Slough DS Disappointment Sl.	WHTSLDISPONT_LEN	20.77	29.09	44.03	6.11	2.4E-04	3.6E-06	14.40	8.89	3.00	73.72	7.9E-06	0	9.10	26.19	64.27	0.45	3.1E-05	0	6.26	14.39	79.35	1.9E-03	6.8E-04	0	0.24	0.65	0.25	0.28	0.36

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Table M-4. Calculation of Quarterly Average Selenium Concentrations for DSM2 Output Locations: Year 2007

	Inflow Source →	First Quarter Inflow Percentage						Second Quarter Inflow Percentage						Third Quarter Inflow Percentage						Fourth Quarter Inflow Percentage						Estimated Waterborne Selenium Concentrations (µg/L)				
		Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass					
	Inflow Location →	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*Mallard Island, Center*	*Knights Landing*	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
DSM2 Output Water Location	**Selenium (µg/L) →**	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450	0.113	0.100	0.320	0.840	0.088	0.450					
	Location ID																													
Big Break	BIGBRK_MID	2.66	1.75	93.01	0.07	2.30	0.21	4.40	3.10	84.13	4.24	1.24	2.89	3.58	0.32	81.60	0.79	9.45	4.27	2.60	0.11	84.06	0.04	8.53	4.65	0.31	0.33	0.30	0.30	0.31
Cache Slough	CACHS_LEN	1.86	1.4E-05	97.14	2.2E-07	2.8E-05	1.01	1.99	5.1E-04	88.84	8.8E-04	1.6E-05	9.17	1.92	9.1E-06	89.20	1.9E-05	1.6E-06	8.88	1.64	1.9E-05	91.73	8.5E-06	5.1E-04	6.62	0.32	0.33	0.33	0.33	0.32
Cache Slough Ryer	CACHSR_MID	2.85	1.8E-06	96.46	4.7E-08	1.5E-05	0.68	2.66	1.2E-04	88.76	1.8E-04	1.4E-06	8.58	2.16	1.5E-05	88.35	3.1E-05	3.1E-07	9.49	1.96	4.5E-06	90.83	2.8E-06	1.9E-04	7.21	0.31	0.33	0.33	0.33	0.32
Cosumnes R.	COSR_LEN	0.00	100.00	0	0	0	0.00	0.01	99.99	0	0	0	0	0.09	99.91	0	0	0	0	0	100.00	0	0	0	0.00	0.10	0.10	0.10	0.10	0.10
Franks Tract	FRANKST_MID	3.85	4.08	90.69	0.32	0.94	0.11	6.16	5.35	77.86	9.10	0.16	1.38	4.86	0.34	88.03	0.84	2.96	2.98	3.19	0.32	91.15	0.17	2.23	2.95	0.30	0.34	0.31	0.31	0.32
Little Holland Tract	LHOLND_L0	29.80	0.00	69.38	1.2E-07	5.3E-05	0.81	22.80	8.0E-05	71.18	1.1E-04	5.2E-06	6.02	18.52	2.4E-05	73.18	0.00	4.9E-07	8.30	21.64	5.2E-07	71.72	1.4E-06	4.9E-05	6.64	0.26	0.28	0.29	0.28	0.28
Middle R Bullfrog	MIDRBULFRG_LEN	8.32	10.69	59.08	21.39	0.48	0.04	9.69	10.67	38.75	40.64	0.03	0.22	8.41	3.92	81.16	4.51	0.87	1.14	5.81	4.90	72.42	15.36	0.57	0.94	0.39	0.49	0.32	0.38	0.39
Mildred Isl	MILDDRISL_MID	7.42	11.13	68.24	12.63	0.54	0.04	8.53	10.39	42.57	38.23	0.03	0.25	6.49	1.12	88.25	1.83	1.00	1.30	4.91	4.55	80.81	7.99	0.66	1.08	0.34	0.48	0.31	0.34	0.37
Mok. R. below Consum.	MOKBCOS_LEN	1.46	98.54	0	0	0	0	6.32	93.68	6.5E-04	0	0	0	15.09	84.81	0.10	6.2E-35	0	0	2.30	97.70	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Mok. R. downstream Consum.	MOKDCOS_MID	1.46	98.54	0	0	0	0	6.42	93.58	0	0	0	0	15.19	84.81	3.2E-04	0	0	0	2.27	97.73	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Old R. near Paradise Cut	OLDRNPARADSEC_MID	3.95	5E-12	3E-06	96.05	1.7E-16	2.5E-17	15.73	1.81	12.66	69.68	0.02	0.10	10.18	1.9E-05	1.6E-04	89.82	6.9E-08	6.5E-07	2.31	9.2E-04	0.01	97.68	0	9.7E-05	0.81	0.65	0.77	0.82	0.76
Paradise Cut	PARADSECUT_LEN	1.91	0	0	98.09	0	0	4.98	0.11	0.61	94.29	6.7E-04	3.7E-03	7.14	0	0	92.86	0	0	1.24	4.1E-03	0.05	98.71	4.1E-04	4.5E-04	0.83	0.80	0.79	0.83	0.81
Port of Stockton	PORTOSTOCK_L0	1.48	0	0	98.52	0	0	2.29	0	0	97.71	0	0	6.32	0.04	0	93.64	0	0	7.16	0.05	0	92.78	0	0	0.83	0.82	0.79	0.79	0.81
Sac. R. at Isleton	SACRISLTON_L0	0.45	0	99.55	0	0	2.1E-06	0.63	8.8E-05	99.36	5.7E-08	0	0.01	0.49	0	99.51	0	0	2.9E-04	0.39	1.0E-08	99.61	0	6.7E-07	0.01	0.32	0.32	0.32	0.32	0.32
Sac. R. RM 44	SACR44_L0	0.20	0	99.80	0	0	0	0.30	0	99.70	0	0	0	0.15	0	99.85	0	0	0	0.11	0	99.89	0	0	0	0.32	0.32	0.32	0.32	0.32
Sandmound Sl.	SANDMND_MID	4.47	3.23	90.83	0.17	1.17	0.13	7.20	4.64	79.23	6.98	0.23	1.71	6.15	0.39	84.96	0.98	4.06	3.46	3.79	0.22	89.26	0.10	3.11	3.51	0.30	0.33	0.31	0.31	0.31
Sherman Island	SHERMNILND_L0	2.14	0.95	92.16	0.04	4.49	0.23	3.69	2.31	83.94	2.94	4.01	3.11	2.99	0.32	77.36	0.77	14.22	4.34	2.22	0.06	75.89	0.03	17.11	4.68	0.30	0.32	0.29	0.28	0.30
SJR Bowman	SJRBOWMN_MID	0.88	0	0	99.12	0	0	3.52	0	0	96.48	0	0	8.49	2.5E-04	0	91.51	0	0	0.91	0	0	99.09	0	0	0.83	0.81	0.78	0.83	0.81
SJR N Hwy4	SJRNHWY4_MID	1.82	2.8E-08	0	98.18	0	0	4.35	1.4E-07	0	95.65	0	0	12.54	0.08	4.0E-26	87.39	0	0	1.89	1.3E-04	0	98.11	0	0	0.83	0.81	0.75	0.83	0.80
SJR Naval st	SJRNAVLST_L0	4.83	6.83	0	88.35	0	0	5.86	11.12	1.3E-06	83.02	0	0	12.06	40.15	3.4E-03	47.78	6.2E-07	6.3E-06	4.73	6.37	2.5E-04	88.90	5.4E-09	7.0E-09	0.75	0.72	0.46	0.76	0.67
SJR Potato Slough	SJRPOTSL_MID	2.91	5.22	91.00	0.15	0.61	0.10	4.89	5.67	79.70	8.49	0.10	1.16	3.16	0.19	91.86	0.46	1.88	2.44	2.37	0.33	93.43	0.10	1.44	2.33	0.30	0.34	0.31	0.31	0.32
SJR Turner	SJRTURNR_MID	7.22	10.11	10.82	71.76	0.08	0.01	7.49	11.95	7.23	73.31	2.9E-03	0.02	11.09	11.29	65.50	11.02	0.46	0.63	6.16	6.57	36.18	50.55	0.19	0.35	0.66	0.66	0.33	0.56	0.55
SJR/Pt. Antioch/fish pier	ASRANTFSH_MID	2.17	1.01	92.90	0.04	3.62	0.26	3.74	2.30	84.37	3.04	3.24	3.31	3.00	0.27	79.62	0.65	12.05	4.40	2.27	0.07	78.73	0.03	14.08	4.82	0.31	0.32	0.29	0.29	0.30
Suisun Bay	SUISNB_LEN	0.87	0.23	46.77	0.01	51.97	0.14	0.94	0.51	31.58	0.43	65.55	0.98	0.84	0.16	21.30	0.36	76.08	1.25	0.59	0.02	21.39	0.01	76.63	1.36	0.20	0.17	0.14	0.14	0.16
Sycamore Slough	SYCAMOR_MID	10.20	72.58	17.22	5.1E-10	9.7E-14	4.3E-29	13.62	50.90	35.47	0.01	4.0E-09	1.1E-07	5.33	3.90	90.77	1.9E-16	3.8E-25	1.1E-22	3.69	20.36	75.95	6.0E-19	1.1E-37	2.4E-31	0.14	0.18	0.30	0.27	0.22
White Slough	WHITESL_L0	20.35	16.73	61.67	1.25	4.8E-03	2.4E-04	33.31	13.41	23.49	29.78	3.9E-04	3.2E-03	15.53	1.33	83.05	0.09	1.2E-03	2.0E-03	9.35	8.62	81.98	0.04	3.7E-04	7.1E-04	0.25	0.38	0.29	0.28	0.30
White Slough DS Disappointment Sl.	WHTSLDISPONT_LEN	10.09	24.12	65.07	0.71	4.1E-03	1.9E-04	17.00	13.60	32.29	37.10	1.4E-03	0.01	7.70	1.46	90.83	1.5E-03	1.3E-03	2.2E-03	5.21	9.69	85.06	0.03	9.7E-04	2.1E-03	0.25	0.45	0.30	0.29	0.32

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Table M-5. Summary of Parameter Values Used in Model Calculations

Model	Use	K_d	Trophic Transfer Factors		
			$TTF_{invertebrate}$	TTF_{fish}	$TTF_{bird\ egg}$
1	NA	1,000	2.8	1.1	1.8
2	NA	1,000	2.8	1.1	1.8
3	NA	1,000	2.8	1.1	1.8
4	NA	1,000	2.8	1.1	1.8
5	NA	1,000	2.8	1.1	1.8
6	NA	1,400	2.8	1.1	1.8
7	NA	1,760	2.8	1.1	1.8
8	Normal to Wet Years	1,760	2.1	1.1	1.8
9	Dry Years	2,840	2.1	1.1	1.8

Notes:

NA = not applicable

K_d = water to sediment partition coefficient

TTF = trophic transfer factor

Sources:

K_d 1,000: default value

K_d 1,760: site-specific value calculated from Lucas and Stewart (2007)

K_d 2,840: extrapolated to address dry water years

TTFs: mean of selected species (Presser and Luoma 2010)

Table M-6. Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Models 1 through 5

Year 2000

DSM2 Delta Water Location	Concentration: DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish	Model 3 Fish	Model 4 Fish	Model 5 Fish	Whole-body Bass[a]	Fish-to-Bass Ratio: Model 1	Model 2	Model 3	Model 4	Model 5
First Quarter														
Sacramento River RM 44	0.31	0.31	0.88	0.97	1.06	2.97	2.02	1.54	2.6	0.37	0.40	1.13	0.77	0.58
Cache Slough Ryer[b]	0.27	0.27	0.76	0.83	0.92	2.57	1.74	1.33	1.5	0.56	0.61	1.72	1.17	0.89
San Joaquin River Potato Slough	0.30	0.30	0.83	0.92	1.01	2.83	1.92	1.46	1.4	0.68	0.74	2.08	1.41	1.08
Franks Tract	0.29	0.29	0.82	0.90	0.99	2.77	1.88	1.43	1.6	0.55	0.60	1.68	1.14	0.87
Big Break	0.26	0.26	0.73	0.81	0.89	2.48	1.68	1.28	1.6	0.52	0.57	1.60	1.09	0.83
Middle River Bullfrog	0.35	0.35	0.99	1.09	1.20	3.36	2.28	1.74	NA	NA	NA	NA	NA	NA
Old River near Paradise Cut[c]	0.74	0.74	2.07	2.28	2.51	7.02	4.76	3.64	NA	NA	NA	NA	NA	NA
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	NA	NA	NA	NA	NA	NA
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	1.7	1.52	1.67	4.69	3.18	2.43
Second Quarter														
Sacramento River RM 44	0.32	0.32	0.89	0.98	1.08	3.03	2.06	1.57	2.6	0.37	0.41	1.15	0.78	0.60
Cache Slough Ryer[b]	0.33	0.33	0.93	1.02	1.13	3.15	2.14	1.63	1.5	0.69	0.75	2.11	1.43	1.09
San Joaquin River Potato Slough	0.39	0.39	1.10	1.21	1.34	3.74	2.54	1.94	1.4	0.89	0.98	2.76	1.87	1.43
Franks Tract	0.42	0.42	1.16	1.28	1.41	3.95	2.68	2.04	1.6	0.78	0.86	2.40	1.63	1.24
Big Break	0.37	0.37	1.05	1.15	1.26	3.54	2.40	1.83	1.6	0.74	0.82	2.28	1.55	1.18
Middle River Bullfrog	0.65	0.65	1.83	2.01	2.21	6.20	4.20	3.21	NA	NA	NA	NA	NA	NA
Old River near Paradise Cut[c]	0.70	0.70	1.95	2.14	2.36	6.60	4.48	3.42	NA	NA	NA	NA	NA	NA
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	NA	NA	NA	NA	NA	NA
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	1.7	1.52	1.67	4.69	3.18	2.43
Third Quarter														
Sacramento River RM 44	0.32	0.32	0.90	0.98	1.08	3.03	2.06	1.57	2.6	0.37	0.41	1.15	0.78	0.60
Cache Slough Ryer[b]	0.33	0.33	0.93	1.03	1.13	3.16	2.14	1.64	1.5	0.69	0.76	2.11	1.44	1.10
San Joaquin River Potato Slough	0.32	0.32	0.89	0.98	1.07	3.01	2.04	1.56	1.4	0.72	0.79	2.22	1.50	1.15
Franks Tract	0.32	0.32	0.88	0.97	1.07	2.99	2.03	1.55	1.6	0.59	0.65	1.82	1.23	0.94
Big Break	0.31	0.31	0.88	0.96	1.06	2.97	2.01	1.54	1.6	0.62	0.68	1.91	1.30	0.99
Middle River Bullfrog	0.37	0.37	1.03	1.13	1.25	3.49	2.37	1.81	NA	NA	NA	NA	NA	NA
Old River near Paradise Cut[c]	0.76	0.76	2.14	2.35	2.59	7.24	4.91	3.75	NA	NA	NA	NA	NA	NA

Year 2005

DSM2 Delta Water Location	Concentration: DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish	Model 3 Fish	Model 4 Fish	Model 5 Fish	Whole-body Bass[a]	Fish-to-Bass Ratio: Model 1	Model 2	Model 3	Model 4	Model 5
First Quarter														
Sacramento River RM 44	0.32	0.32	0.89	0.98	1.08	3.03	2.06	1.57	1.5	0.68	0.74	2.08	1.41	1.08
Cache Slough Ryer[b]	0.30	0.30	0.85	0.94	1.03	2.89	1.96	1.49	1.7	0.54	0.60	1.67	1.13	0.86
San Joaquin River Potato Slough	0.31	0.31	0.85	0.94	1.03	2.90	1.96	1.50	1.3	0.72	0.79	2.21	1.50	1.15
Franks Tract	0.31	0.31	0.87	0.96	1.06	2.96	2.01	1.53	1.1	0.84	0.92	2.59	1.76	1.34
Big Break	0.30	0.30	0.85	0.93	1.03	2.88	1.95	1.49	1.0	0.92	1.01	2.82	1.91	1.46
Middle River Bullfrog	0.52	0.52	1.46	1.60	1.76	4.94	3.35	2.56	1.9	0.8	0.9	2.6	1.8	1.3
Old River near Paradise Cut[c]	0.77	0.77	2.17	2.39	2.63	7.35	4.99	3.81	2.4	1.0	1.1	3.1	2.1	1.6
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	2.2	0.6	0.7	1.9	1.3	1.0
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	1.9	1.36	1.50	4.19	2.85	2.17
Second Quarter														
Sacramento River RM 44	0.32	0.32	0.90	0.99	1.08	3.03	2.06	1.57	1.5	0.68	0.74	2.09	1.42	1.08
Cache Slough Ryer[b]	0.32	0.32	0.89	0.98	1.08	3.02	2.05	1.56	1.7	0.57	0.62	1.75	1.18	0.90
San Joaquin River Potato Slough	0.45	0.45	1.26	1.38	1.52	4.26	2.89	2.20	1.3	1.06	1.16	3.25	2.21	1.68
Franks Tract	0.54	0.54	1.52	1.67	1.84	5.15	3.49	2.67	1.1	1.46	1.61	4.50	3.05	2.33
Big Break	0.42	0.42	1.16	1.28	1.41	3.94	2.67	2.04	1.0	1.25	1.38	3.86	2.62	2.00
Middle River Bullfrog	0.74	0.74	2.08	2.29	2.52	7.06	4.79	3.65	1.9	1.2	1.3	3.7	2.5	1.9
Old River near Paradise Cut[c]	0.83	0.83	2.32	2.56	2.81	7.87	5.34	4.08	2.4	1.1	1.2	3.3	2.2	1.7
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	2.2	0.6	0.7	1.9	1.3	1.0
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	1.9	1.36	1.50	4.19	2.85	2.17
Third Quarter														
Sacramento River RM 44	0.32	0.32	0.90	0.98	1.08	3.03	2.06	1.57	1.5	0.68	0.74	2.08	1.41	1.08
Cache Slough Ryer[b]	0.32	0.32	0.88	0.97	1.07	2.99	2.03	1.55	1.7	0.56	0.62	1.73	1.18	0.90
San Joaquin River Potato Slough	0.31	0.31	0.87	0.96	1.06	2.96	2.01	1.53	1.3	0.73	0.81	2.26	1.53	1.17
Franks Tract	0.31	0.31	0.87	0.96	1.06	2.96	2.01	1.53	1.1	0.84	0.92	2.58	1.75	1.34
Big Break	0.31	0.31	0.86	0.95	1.04	2.92	1.98	1.51	1.0	0.93	1.02	2.86	1.94	1.48
Middle River Bullfrog	0.42	0.42	1.17	1.28	1.41	3.95	2.68	2.05	1.9	0.7	0.7	2.1	1.4	1.1
Old River near Paradise Cut[c]	0.79	0.79	2.22	2.44	2.68	7.51	5.10	3.89	2.4	1.0	1.1	3.2	2.1	1.6

Year 2007

DSM2 Delta Water Location	Concentration: DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish	Model 3 Fish	Model 4 Fish	Model 5 Fish	Whole-body Bass[a]	Fish-to-Bass Ratio: Model 1	Model 2	Model 3	Model 4	Model 5
First Quarter														
Sacramento River RM 44	0.32	0.32	0.89	0.98	1.08	3.03	2.06	1.57	1.8	0.53	0.59	1.64	1.12	0.85
Cache Slough Ryer[b]	0.31	0.31	0.88	0.97	1.07	2.99	2.03	1.55	2.5	0.38	0.42	1.17	0.80	0.61
San Joaquin River Potato Slough	0.30	0.30	0.85	0.93	1.02	2.86	1.94	1.48	2.5	0.37	0.41	1.15	0.78	0.60
Franks Tract	0.30	0.30	0.85	0.93	1.03	2.87	1.95	1.49	3.0	0.31	0.34	0.96	0.65	0.50
Big Break	0.31	0.31	0.86	0.94	1.04	2.90	1.97	1.50	2.8	0.33	0.37	1.02	0.69	0.53
Middle River Bullfrog	0.39	0.39	1.09	1.20	1.32	3.69	2.51	1.91	2.1	0.6	0.6	1.7	1.2	0.9
Old River near Paradise Cut[c]	0.81	0.81	2.27	2.50	2.75	7.70	5.22	3.99	NA	NA	NA	NA	NA	NA
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	NA	NA	NA	NA	NA	NA
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	2.4	1.08	1.19	3.32	2.25	1.72
Second Quarter														
Sacramento River RM 44	0.32	0.32	0.89	0.98	1.08	3.03	2.06	1.57	1.8	0.53	0.59	1.64	1.12	0.85
Cache Slough Ryer[b]	0.33	0.33	0.91	1.00	1.10	3.09	2.10	1.60	2.5	0.39	0.43	1.21	0.82	0.63
San Joaquin River Potato Slough	0.34	0.34	0.96	1.06	1.16	3.25	2.21	1.68	2.5	0.43	0.47	1.31	0.89	0.68
Franks Tract	0.34	0.34	0.96	1.06	1.17	3.27	2.22	1.69	3.0	0.35	0.39	1.09	0.74	0.57
Big Break	0.33	0.33	0.92	1.01	1.11	3.10	2.10	1.61	2.8	0.36	0.39	1.09	0.74	0.57
Middle River Bullfrog	0.49	0.49	1.37	1.50	1.65	4.63	3.14	2.40	2.1	0.7	0.8	2.2	1.5	1.1
Old River near Paradise Cut[c]	0.65	0.65	1.81	1.99	2.19	6.13	4.16	3.17	NA	NA	NA	NA	NA	NA
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	NA	NA	NA	NA	NA	NA
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	2.4	1.08	1.19	3.32	2.25	1.72
Third Quarter														
Sacramento River RM 44	0.32	0.32	0.90	0.98	1.08	3.03	2.06	1.57	1.8	0.53	0.59	1.65	1.12	0.85
Cache Slough Ryer[b]	0.33	0.33	0.92	1.01	1.11	3.11	2.11	1.61	2.5	0.40	0.44	1.22	0.83	0.63
San Joaquin River Potato Slough	0.31	0.31	0.88	0.97	1.06	2.98	2.02	1.54	2.5	0.39	0.43	1.20	0.82	0.62
Franks Tract	0.31	0.31	0.87	0.96	1.05	2.95	2.00	1.53	3.0	0.32	0.35	0.99	0.67	0.51
Big Break	0.30	0.30	0.84	0.92	1.02	2.84	1.93	1.47	2.8	0.33	0.36	1.00	0.68	0.52
Middle River Bullfrog	0.32	0.32	0.89	0.98	1.07	3.01	2.04	1.56	2.1	0.5	0.5	1.4	1.0	0.7
Old River near Paradise Cut[c]	0.77	0.77	2.14	2.36	2.60	7.27	4.93	3.76	NA	NA	NA	NA	NA	NA

Table M-6. Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Models 1 through 5

Year 2000

DSM2 Delta Water Location	Concentration: DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish	Model 3 Fish	Model 4 Fish	Model 5 Fish	Whole-body Bass[a]	Fish-to-Bass Ratio: Model 1	Model 2	Model 3	Model 4	Model 5
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	NA	NA	NA	NA	NA	NA
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	1.7	1.52	1.67	4.69	3.18	2.43
Fourth Quarter														
Sacramento River RM 44	0.32	0.32	0.90	0.99	1.08	3.03	2.06	1.57	2.6	0.37	0.41	1.15	0.78	0.60
Cache Slough Ryer[b]	0.33	0.33	0.91	1.01	1.11	3.10	2.10	1.61	1.5	0.67	0.74	2.08	1.41	1.08
San Joaquin River Potato Slough	0.31	0.31	0.88	0.97	1.06	2.97	2.02	1.54	1.4	0.71	0.78	2.19	1.49	1.13
Franks Tract	0.31	0.31	0.87	0.96	1.05	2.95	2.00	1.53	1.6	0.58	0.64	1.79	1.22	0.93
Big Break	0.30	0.30	0.84	0.92	1.02	2.84	1.93	1.47	1.6	0.60	0.66	1.83	1.25	0.95
Middle River Bullfrog	0.44	0.44	1.23	1.36	1.49	4.18	2.84	2.16	NA	NA	NA	NA	NA	NA
Old River near Paradise Cut[c]	0.82	0.82	2.30	2.53	2.78	7.80	5.29	4.04	NA	NA	NA	NA	NA	NA
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	NA	NA	NA	NA	NA	NA
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	1.7	1.52	1.67	4.69	3.18	2.43

Year 2005

DSM2 Delta Water Location	Concentration: DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish	Model 3 Fish	Model 4 Fish	Model 5 Fish	Whole-body Bass[a]	Fish-to-Bass Ratio: Model 1	Model 2	Model 3	Model 4	Model 5
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	2.2	0.6	0.7	1.9	1.3	1.0
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	1.9	1.36	1.50	4.19	2.85	2.17
Fourth Quarter														
Sacramento River RM 44	0.32	0.32	0.90	0.98	1.08	3.03	2.06	1.57	1.5	0.68	0.74	2.08	1.41	1.08
Cache Slough Ryer[b]	0.32	0.32	0.88	0.97	1.07	3.00	2.03	1.55	1.7	0.56	0.62	1.73	1.18	0.90
San Joaquin River Potato Slough	0.31	0.31	0.87	0.96	1.05	2.95	2.00	1.53	1.3	0.73	0.80	2.25	1.53	1.17
Franks Tract	0.31	0.31	0.86	0.95	1.04	2.92	1.98	1.51	1.1	0.83	0.91	2.55	1.73	1.32
Big Break	0.30	0.30	0.84	0.93	1.02	2.85	1.93	1.48	1.0	0.91	1.00	2.79	1.90	1.45
Middle River Bullfrog	0.39	0.39	1.09	1.20	1.32	3.71	2.51	1.92	1.9	0.6	0.7	1.9	1.3	1.0
Old River near Paradise Cut[c]	0.72	0.72	2.01	2.21	2.43	6.80	4.61	3.52	2.4	0.9	1.0	2.9	1.9	1.5
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	2.2	0.6	0.7	1.9	1.3	1.0
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	1.9	1.36	1.50	4.19	2.85	2.17

Year 2007

DSM2 Delta Water Location	Concentration: DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish	Model 3 Fish	Model 4 Fish	Model 5 Fish	Whole-body Bass[a]	Fish-to-Bass Ratio: Model 1	Model 2	Model 3	Model 4	Model 5
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	NA	NA	NA	NA	NA	NA
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	2.4	1.08	1.19	3.32	2.25	1.72
Fourth Quarter														
Sacramento River RM 44	0.32	0.32	0.90	0.98	1.08	3.03	2.06	1.57	1.8	0.53	0.59	1.65	1.12	0.85
Cache Slough Ryer[b]	0.33	0.33	0.91	1.00	1.10	3.09	2.09	1.60	2.5	0.39	0.43	1.21	0.82	0.63
San Joaquin River Potato Slough	0.31	0.31	0.88	0.97	1.07	2.98	2.03	1.55	2.5	0.39	0.43	1.20	0.82	0.62
Franks Tract	0.31	0.31	0.87	0.96	1.06	2.96	2.01	1.53	3.0	0.32	0.35	0.99	0.67	0.51
Big Break	0.30	0.30	0.84	0.93	1.02	2.85	1.94	1.48	2.8	0.33	0.36	1.01	0.68	0.52
Middle River Bullfrog	0.38	0.38	1.06	1.16	1.28	3.58	2.43	1.85	2.1	0.5	0.6	1.7	1.1	0.9
Old River near Paradise Cut[c]	0.82	0.82	2.30	2.54	2.79	7.81	5.30	4.04	NA	NA	NA	NA	NA	NA
Knights Landing[d]	0.45	0.45	1.26	1.39	1.52	4.27	2.90	2.21	NA	NA	NA	NA	NA	NA
Vernalis[e]	0.84	0.84	2.35	2.59	2.85	7.97	5.41	4.13	2.4	1.08	1.19	3.32	2.25	1.72

Notes:

Equations from Presser and Luoma (2010) were used to calculate selenium concentrations for fish (Models 1–5) using the default K_d (1000), the average selenium trophic transfer factors to aquatic insects (2.8), and fish (1.1 for all trophic levels).

Model 1 = TL-3 Fish Eating Invertebrates

Model 2 = TL-4 Fish Eating TL-3 Fish

Model 3 = TL-4 Fish Eating TL-3 Fish Eating TL-3 and TL-2 Invertebrates

Model 4 = 50% of Model 2 + 50% of Model 3

Model 5 = 75% of Model 2 + 25% of Model 3

Invert. = invertebrate

K_d = equilibrium constant

µg/g, dw = micrograms per gram, dry weight

NA = not available; bass not collected here

RM = river mile

TL = trophic level

[a] Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010a).

[b] Fish data collected at Rio Vista (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[c] Fish data collected at Old River near Tracy (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[d] Geometric mean of total selenium concentrations in water collected from years 2003, 2004, 2007, and 2008 (DWR Website 2009) was used to estimate selenium concentrations in particulate and biota (DSM2 data were not available). Fish data collected at Sacramento River at Veterans Bridge (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[e] Geometric mean of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2007 (SWAMP Website 2009) was used to estimate selenium concentrations in particulate and biota (DSM2 data were not available).

Table M-7. Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Models 6 and 7

DSM2 Delta Water Location	Year 2000										Year 2005										Year 2007									
	Concentration							Whole-body Bass [a]	Fish-to-Bass Ratio		Concentration							Whole-body Bass [a]	Fish-to-Bass Ratio		Concentration							Whole-body Bass [a]	Fish-to-Bass Ratio	
		Model 6			Model 7							Model 6			Model 7							Model 6			Model 7					
	DSM2 Water	Particulate From Water	Invert. From Particulate	Fish	Particulate From Water	Invert. From Particulate	Fish		Model 6	Model 7	DSM2 Water	Particulate From Water	Invert. From Particulate	Fish	Particulate From Water	Invert. From Particulate	Fish		Model 6	Model 7	DSM2 Water	Particulate From Water	Invert. From Particulate	Fish	Particulate From Water	Invert. From Particulate	Fish		Model 6	Model 7
	First Quarter										First Quarter										First Quarter									
Sacramento River RM 44	0.31	0.44	1.23	1.49	0.55	1.55	1.87	2.6	0.56	0.71	0.32	0.45	1.25	1.52	0.56	1.57	1.91	1.5	1.04	1.31	0.32	0.45	1.25	1.52	0.56	1.57	1.91	1.8	0.82	1.03
Cache Slough Ryer [b]	0.27	0.38	1.06	1.29	0.48	1.34	1.62	1.5	0.86	1.08	0.30	0.43	1.19	1.44	0.54	1.50	1.81	1.7	0.84	1.05	0.31	0.44	1.23	1.49	0.55	1.55	1.88	2.5	0.59	0.74
San Joaquin River Potato Slough	0.30	0.42	1.17	1.41	0.52	1.47	1.78	1.4	1.04	1.31	0.31	0.43	1.20	1.45	0.54	1.50	1.82	1.3	1.11	1.39	0.30	0.42	1.18	1.43	0.53	1.49	1.80	2.5	0.58	0.73
Franks Tract	0.29	0.41	1.14	1.38	0.51	1.44	1.74	1.6	0.84	1.06	0.31	0.44	1.22	1.48	0.55	1.54	1.86	1.1	1.29	1.63	0.30	0.42	1.19	1.44	0.53	1.49	1.80	3.0	0.48	0.60
Big Break	0.26	0.37	1.02	1.24	0.46	1.29	1.56	1.6	0.80	1.01	0.30	0.42	1.19	1.44	0.53	1.50	1.81	1.0	1.41	1.77	0.31	0.43	1.20	1.45	0.54	1.51	1.82	2.8	0.51	0.64
Middle River Bullfrog	0.35	0.50	1.39	1.68	0.62	1.75	2.11	NA	NA	NA	0.52	0.73	2.04	2.47	0.92	2.57	3.11	1.9	1.3	1.6	0.39	0.55	1.53	1.85	0.69	1.92	2.32	2.1	0.9	1.1
Old River near Paradise Cut [c]	0.74	1.04	2.90	3.51	1.30	3.65	4.41	NA	NA	NA	0.77	1.08	3.04	3.68	1.36	3.82	4.62	2.4	1.5	1.9	0.81	1.14	3.18	3.85	1.43	4.00	4.84	NA	NA	NA
Knights Landing [d]	0.45	0.63	1.76	2.13	0.79	2.22	2.68	NA	NA	NA	0.45	0.63	1.76	2.13	0.79	2.22	2.68	2.2	1.0	1.2	0.45	0.63	1.76	2.13	0.79	2.22	2.68	NA	NA	NA
Vernalis [e]	0.84	1.18	3.29	3.98	1.48	4.14	5.01	1.7	2.34	2.95	0.84	1.18	3.29	3.98	1.48	4.14	5.01	1.9	2.10	2.64	0.84	1.18	3.29	3.98	1.48	4.14	5.01	2.4	1.66	2.09
	Second Quarter										Second Quarter										Second Quarter									
Sacramento River RM 44	0.32	0.45	1.25	1.52	0.56	1.57	1.91	2.6	0.58	0.72	0.32	0.45	1.25	1.52	0.56	1.58	1.91	1.5	1.04	1.31	0.32	0.45	1.25	1.51	0.56	1.57	1.90	1.8	0.82	1.03
Cache Slough Ryer [b]	0.33	0.46	1.30	1.58	0.58	1.64	1.98	1.5	1.06	1.33	0.32	0.45	1.25	1.51	0.56	1.57	1.90	1.7	0.87	1.10	0.33	0.46	1.28	1.54	0.57	1.60	1.94	2.5	0.61	0.76
San Joaquin River Potato Slough	0.39	0.55	1.55	1.87	0.69	1.94	2.35	1.4	1.38	1.73	0.45	0.63	1.76	2.13	0.79	2.21	2.68	1.3	1.63	2.04	0.34	0.48	1.34	1.63	0.60	1.69	2.04	2.5	0.66	0.82
Franks Tract	0.42	0.58	1.63	1.97	0.73	2.05	2.48	1.6	1.20	1.51	0.54	0.76	2.13	2.58	0.96	2.68	3.24	1.1	2.25	2.83	0.34	0.48	1.35	1.63	0.61	1.70	2.05	3.0	0.55	0.69
Big Break	0.37	0.52	1.46	1.77	0.66	1.84	2.23	1.6	1.14	1.44	0.42	0.58	1.63	1.97	0.73	2.05	2.48	1.0	1.93	2.43	0.33	0.46	1.28	1.55	0.58	1.61	1.95	2.8	0.55	0.69
Middle River Bullfrog	0.65	0.91	2.56	3.10	1.15	3.22	3.89	NA	NA	NA	0.74	1.04	2.92	3.53	1.31	3.67	4.44	1.9	1.8	2.3	0.49	0.68	1.91	2.31	0.86	2.41	2.91	2.1	1.1	1.4
Old River near Paradise Cut [c]	0.70	0.97	2.73	3.30	1.22	3.43	4.15	NA	NA	NA	0.83	1.16	3.25	3.94	1.46	4.09	4.95	2.4	1.7	2.1	0.65	0.90	2.53	3.06	1.14	3.18	3.85	NA	NA	NA
Knights Landing [d]	0.45	0.63	1.76	2.13	0.79	2.22	2.68	NA	NA	NA	0.45	0.63	1.76	2.13	0.79	2.22	2.68	2.2	1.0	1.2	0.45	0.63	1.76	2.13	0.79	2.22	2.68	NA	NA	NA
Vernalis [e]	0.84	1.18	3.29	3.98	1.48	4.14	5.01	1.7	2.34	2.95	0.84	1.18	3.29	3.98	1.48	4.14	5.01	1.9	2.10	2.64	0.84	1.18	3.29	3.98	1.48	4.14	5.01	2.4	1.66	2.09
	Third Quarter										Third Quarter										Third Quarter									
Sacramento River RM 44	0.32	0.45	1.25	1.52	0.56	1.58	1.91	2.6	0.58	0.72	0.32	0.45	1.25	1.52	0.56	1.58	1.91	1.5	1.04	1.31	0.32	0.45	1.25	1.52	0.56	1.58	1.91	1.8	0.82	1.03
Cache Slough Ryer [b]	0.33	0.47	1.30	1.58	0.59	1.64	1.98	1.5	1.06	1.33	0.32	0.44	1.24	1.50	0.56	1.56	1.88	1.7	0.87	1.09	0.33	0.46	1.29	1.56	0.58	1.62	1.96	2.5	0.61	0.77
San Joaquin River Potato Slough	0.32	0.44	1.24	1.50	0.56	1.56	1.89	1.4	1.11	1.39	0.31	0.44	1.22	1.48	0.55	1.54	1.86	1.3	1.13	1.42	0.31	0.44	1.23	1.49	0.55	1.55	1.87	2.5	0.60	0.76
Franks Tract	0.32	0.44	1.24	1.50	0.56	1.55	1.88	1.6	0.91	1.14	0.31	0.44	1.22	1.48	0.55	1.54	1.86	1.1	1.29	1.62	0.31	0.43	1.22	1.47	0.55	1.53	1.85	3.0	0.49	0.62
Big Break	0.31	0.44	1.23	1.48	0.55	1.54	1.87	1.6	0.96	1.20	0.31	0.43	1.21	1.46	0.54	1.52	1.84	1.0	1.43	1.80	0.30	0.42	1.17	1.42	0.53	1.48	1.79	2.8	0.50	0.63
Middle River Bullfrog	0.37	0.52	1.44	1.75	0.65	1.81	2.20	NA	NA	NA	0.42	0.58	1.63	1.98	0.73	2.05	2.48	1.9	1.0	1.3	0.32	0.44	1.24	1.50	0.56	1.56	1.89	2.1	0.7	0.9
Old River near Paradise Cut [c]	0.76	1.07	2.99	3.62	1.34	3.76	4.55	NA	NA	NA	0.79	1.11	3.10	3.76	1.39	3.90	4.72	2.4	1.6	2.0	0.77	1.07	3.00	3.63	1.35	3.77	4.57	NA	NA	NA
Knights Landing [d]	0.45	0.63	1.76	2.13	0.79	2.22	2.68	NA	NA	NA	0.45	0.63	1.76	2.13	0.79	2.22	2.68	2.2	1.0	1.2	0.45	0.63	1.76	2.13	0.79	2.22	2.68	NA	NA	NA
Vernalis [e]	0.84	1.18	3.29	3.98	1.48	4.14	5.01	1.7	2.34	2.95	0.84	1.18	3.29	3.98	1.48	4.14	5.01	1.9	2.10	2.64	0.84	1.18	3.29	3.98	1.48	4.14	5.01	2.4	1.66	2.09

Table M-7. Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Models 6 and 7

DSM2 Delta Water Location	Year 2000										Year 2005										Year 2007									
	Concentration							Whole-body Bass[a]	Fish-to-Bass Ratio		Concentration							Whole-body Bass[a]	Fish-to-Bass Ratio		Concentration							Whole-body Bass[a]	Fish-to-Bass Ratio	
	DSM2 Water	Model 6			Model 7				Model 6	Model 7	DSM2 Water	Model 6			Model 7				Model 6	Model 7	DSM2 Water	Model 6			Model 7				Model 6	Model 7
		Particulate From Water	Invert. From Particulate	Fish	Particulate From Water	Invert. From Particulate	Fish					Particulate From Water	Invert. From Particulate	Fish	Particulate From Water	Invert. From Particulate	Fish					Particulate From Water	Invert. From Particulate	Fish	Particulate From Water	Invert. From Particulate	Fish			
	Fourth Quarter										Fourth Quarter										Fourth Quarter									
Sacramento River RM 44	0.32	0.45	1.25	1.52	0.56	1.58	1.91	2.6	0.58	0.72	0.32	0.45	1.25	1.52	0.56	1.58	1.91	1.5	1.04	1.31	0.32	0.45	1.25	1.52	0.56	1.58	1.91	1.8	0.82	1.03
Cache Slough Ryer[b]	0.33	0.46	1.28	1.55	0.58	1.61	1.95	1.5	1.04	1.30	0.32	0.44	1.24	1.50	0.56	1.56	1.88	1.7	0.87	1.09	0.33	0.46	1.28	1.54	0.57	1.60	1.94	2.5	0.61	0.76
San Joaquin River Potato Slough	0.31	0.44	1.23	1.49	0.55	1.54	1.87	1.4	1.10	1.38	0.31	0.43	1.22	1.47	0.55	1.53	1.85	1.3	1.13	1.42	0.31	0.44	1.23	1.49	0.55	1.55	1.88	2.5	0.60	0.76
Franks Tract	0.31	0.44	1.22	1.48	0.55	1.53	1.86	1.6	0.90	1.13	0.31	0.43	1.21	1.46	0.54	1.52	1.84	1.1	1.28	1.60	0.31	0.44	1.22	1.48	0.55	1.54	1.86	3.0	0.50	0.62
Big Break	0.30	0.42	1.18	1.42	0.53	1.48	1.79	1.6	0.92	1.15	0.30	0.42	1.18	1.43	0.53	1.48	1.79	1.0	1.40	1.76	0.30	0.42	1.18	1.43	0.53	1.48	1.79	2.8	0.50	0.63
Middle River Bullfrog	0.44	0.62	1.73	2.09	0.78	2.17	2.63	NA	NA	NA	0.39	0.55	1.53	1.85	0.69	1.93	2.33	1.9	1.0	1.2	0.38	0.53	1.48	1.79	0.66	1.86	2.25	2.1	0.8	1.1
Old River near Paradise Cut[c]	0.82	1.15	3.22	3.90	1.45	4.05	4.90	NA	NA	NA	0.72	1.00	2.81	3.40	1.26	3.53	4.27	2.4	1.4	1.8	0.82	1.15	3.23	3.90	1.45	4.06	4.91	NA	NA	NA
Knights Landing[d]	0.45	0.63	1.76	2.13	0.79	2.22	2.68	NA	NA	NA	0.45	0.63	1.76	2.13	0.79	2.22	2.68	2.2	1.0	1.2	0.45	0.63	1.76	2.13	0.79	2.22	2.68	NA	NA	NA
Vernalis[e]	0.84	1.18	3.29	3.98	1.48	4.14	5.01	1.7	2.34	2.95	0.84	1.18	3.29	3.98	1.48	4.14	5.01	1.9	2.10	2.64	0.84	1.18	3.29	3.98	1.48	4.14	5.01	2.4	1.66	2.09

Notes:

Model 6 = Equations from Presser and Luoma (2010) were used to calculate selenium concentrations in Trophic Level 4 (TL-4) Fish eating TL-3 Fish using an extrapolated K_d (1400), the average selenium trophic transfer factors to aquatic insects (2.8), and fish (1.1 for TL-4 and TL-3 fish).

Model 7 = Equations from Presser and Luoma (2010) were used to calculate selenium concentrations in Trophic Level 4 (TL-4) Fish eating TL-3 Fish using a K_d of 1760 (calculated from data reported in Lucas and Stewart [2007]), the average selenium trophic transfer factors to aquatic insects (2.8), and fish (1.1, for TL-3 and TL-4).

Invert. = invertebrate

K_d = equilibrium constant

µg/g, dw = micrograms per gram, dry weight

NA = not available; bass not collected here

RM = river mile

TL = trophic level

[a] Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010a).

[b] Fish data collected at Rio Vista (Foe 2010a) were used to calculate geometric whole-body largemouth bass and ratios.

[c] Fish data collected at Old River near Tracy (Foe 2010a) were used to calculate geometric whole-body largemouth bass and ratios.

[d] Geometric mean of total selenium concentrations in water collected from years 2003, 2004, 2007, and 2008 (DWR Website 2009) was used to estimate selenium concentrations in particulate and biota (DSM2 data were not available). Fish data collected at Sacramento River at Veterans Bridge (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[e] Geometric mean of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2007 (SWAMP Website 2009) was used to estimate selenium concentrations in particulate and biota (DSM2 data were not available).

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Table M-8. Selenium Bioaccumulation from Water (µg/L) to Particulates, Whole-body Fish, and Bird Eggs (µg/g, dw) Using Model 8 (Normal to Wet Years)

DSM2 Delta Water Location	Year 2000								Year 2005								Year 2007							
	Concentration				Whole-body Bass[a]	Model 8-to-Bass Ratio	Bird Egg		Concentration				Whole-body Bass[a]	Model 8-to-Bass Ratio	Bird Egg		Concentration				Whole-body Bass[a]	Model 8-to-Bass Ratio	Bird Egg	
	DSM2 Water	Particulate From Water	Invert. From Particulate	Model 8 Fish			From Invert.	From Fish	DSM2 Water	Particulate From Water	Invert. From Particulate	Model 8 Fish			From Invert.	From Fish	DSM2 Water	Particulate From Water	Invert. From Particulate	Model 8 Fish			From Invert.	From Fish
First Quarter																								
Sacramento River RM 44	0.31	0.55	1.16	1.40	2.6	0.53	2.09	2.29	0.32	0.56	1.18	1.43	1.5	0.98	2.13	2.34	0.32	0.56	1.18	1.43	1.8	0.78	2.13	2.34
Cache Slough Ryer[b]	0.27	0.48	1.00	1.21	1.5	0.81	1.80	1.98	0.30	0.54	1.12	1.36	1.7	0.79	2.02	2.23	0.31	0.55	1.16	1.41	2.5	0.55	2.10	2.31
San Joaquin River Potato Slough	0.30	0.52	1.10	1.33	1.4	0.98	1.98	2.18	0.31	0.54	1.13	1.37	1.3	1.04	2.03	2.23	0.30	0.53	1.12	1.35	2.5	0.54	2.01	2.21
Franks Tract	0.29	0.51	1.08	1.31	1.6	0.79	1.94	2.14	0.31	0.55	1.15	1.40	1.1	1.22	2.08	2.29	0.30	0.53	1.12	1.35	3.0	0.45	2.01	2.21
Big Break	0.26	0.46	0.97	1.17	1.6	0.75	1.74	1.91	0.30	0.53	1.12	1.36	1.0	1.33	2.02	2.22	0.31	0.54	1.13	1.37	2.2	0.62	2.04	2.24
Middle River Bullfrog	0.35	0.62	1.31	1.58	NA	NA	2.36	2.59	0.52	0.92	1.93	2.33	1.9	1.2	3.47	3.81	0.39	0.69	1.44	1.74	2.1	0.8	2.59	2.85
Old River near Paradise Cut[c]	0.74	1.30	2.74	3.31	NA	NA	4.92	5.42	0.77	1.36	2.86	3.47	2.4	1.5	5.16	5.67	0.81	1.43	3.00	3.63	NA	NA	5.40	5.94
Knights Landing[d]	0.45	0.79	1.66	2.01	NA	NA	2.99	3.29	0.45	0.79	1.66	2.01	2.2	0.9	2.99	3.29	0.45	0.79	1.66	2.01	NA	NA	2.99	3.29
Vernalis[e]	0.84	1.48	3.10	3.76	1.7	2.21	5.59	6.15	0.84	1.48	3.10	3.76	1.9	1.98	5.59	6.15	0.84	1.48	3.10	3.76	2.4	1.57	5.59	6.15
Second Quarter																								
Sacramento River RM 44	0.32	0.56	1.18	1.43	2.6	0.54	2.13	2.34	0.32	0.56	1.18	1.43	1.5	0.98	2.13	2.34	0.32	0.56	1.18	1.43	1.8	0.77	2.12	2.34
Cache Slough Ryer[b]	0.33	0.58	1.23	1.49	1.5	0.99	2.21	2.43	0.32	0.56	1.18	1.42	1.7	0.82	2.12	2.33	0.33	0.57	1.20	1.46	2.5	0.57	2.17	2.38
San Joaquin River Potato Slough	0.39	0.69	1.46	1.76	1.4	1.30	2.62	2.89	0.45	0.79	1.66	2.01	1.3	1.53	2.98	3.28	0.34	0.60	1.27	1.53	2.5	0.62	2.28	2.51
Franks Tract	0.42	0.73	1.54	1.86	1.6	1.13	2.77	3.04	0.54	0.96	2.01	2.43	1.1	2.12	3.61	3.97	0.34	0.61	1.27	1.54	3.0	0.51	2.29	2.52
Big Break	0.37	0.66	1.38	1.67	1.6	1.08	2.48	2.73	0.42	0.73	1.54	1.86	1.0	1.82	2.76	3.04	0.33	0.58	1.21	1.46	2.2	0.66	2.18	2.39
Middle River Bullfrog	0.65	1.15	2.41	2.92	NA	NA	4.34	4.78	0.74	1.31	2.75	3.33	1.9	1.7	4.95	5.44	0.49	0.86	1.80	2.18	2.1	1.0	3.25	3.57
Old River near Paradise Cut[c]	0.70	1.22	2.57	3.11	NA	NA	4.63	5.09	0.83	1.46	3.07	3.71	2.4	1.6	5.52	6.07	0.65	1.14	2.39	2.89	NA	NA	4.30	4.73
Knights Landing[d]	0.45	0.79	1.66	2.01	NA	NA	2.99	3.29	0.45	0.79	1.66	2.01	2.2	0.9	2.99	3.29	0.45	0.79	1.66	2.01	NA	NA	2.99	3.29
Vernalis[e]	0.84	1.48	3.10	3.76	1.7	2.21	5.59	6.15	0.84	1.48	3.10	3.76	1.9	1.98	5.59	6.15	0.84	1.48	3.10	3.76	2.4	1.57	5.59	6.15
Third Quarter Selenium									**Third Quarter**								**Third Quarter**							
Sacramento River RM 44	0.32	0.56	1.18	1.43	2.6	0.54	2.13	2.34	0.32	0.56	1.18	1.43	1.5	0.98	2.13	2.34	0.32	0.56	1.18	1.43	1.8	0.78	2.13	2.34
Cache Slough Ryer[b]	0.33	0.59	1.23	1.49	1.5	1.00	2.21	2.44	0.32	0.56	1.17	1.41	1.7	0.82	2.10	2.31	0.33	0.58	1.21	1.47	2.5	0.58	2.18	2.40
San Joaquin River Potato Slough	0.32	0.56	1.17	1.42	1.4	1.05	2.11	2.32	0.31	0.55	1.15	1.40	1.3	1.07	2.08	2.28	0.31	0.55	1.16	1.41	2.5	0.57	2.09	2.30
Franks Tract	0.32	0.56	1.17	1.41	1.6	0.86	2.10	2.31	0.31	0.55	1.15	1.39	1.1	1.22	2.07	2.28	0.31	0.55	1.15	1.39	3.0	0.46	2.07	2.27
Big Break	0.31	0.55	1.16	1.40	1.6	0.90	2.08	2.29	0.31	0.54	1.14	1.38	1.0	1.35	2.05	2.25	0.30	0.53	1.11	1.34	2.2	0.61	1.99	2.19
Middle River Bullfrog	0.37	0.65	1.36	1.65	NA	NA	2.45	2.70	0.42	0.73	1.54	1.86	1.9	1.0	2.77	3.05	0.32	0.56	1.17	1.42	2.1	0.7	2.11	2.32
Old River near Paradise Cut[c]	0.76	1.34	2.82	3.41	NA	NA	5.08	5.59	0.79	1.39	2.93	3.54	2.4	1.5	5.27	5.79	0.77	1.35	2.83	3.43	NA	NA	5.10	5.61
Knights Landing[d]	0.45	0.79	1.66	2.01	NA	NA	2.99	3.29	0.45	0.79	1.66	2.01	2.2	0.9	2.99	3.29	0.45	0.79	1.66	2.01	NA	NA	2.99	3.29
Vernalis[e]	0.84	1.48	3.10	3.76	1.7	2.21	5.59	6.15	0.84	1.48	3.10	3.76	1.9	1.98	5.59	6.15	0.84	1.48	3.10	3.76	2.4	1.57	5.59	6.15
Fourth Quarter									**Fourth Quarter**								**Fourth Quarter**							
Sacramento River RM 44	0.32	0.56	1.18	1.43	2.6	0.54	2.13	2.34	0.32	0.56	1.18	1.43	1.5	0.98	2.13	2.34	0.32	0.56	1.18	1.43	1.8	0.78	2.13	2.34
Cache Slough Ryer[b]	0.33	0.58	1.21	1.46	1.5	0.98	2.17	2.39	0.32	0.56	1.17	1.41	1.7	0.82	2.10	2.31	0.33	0.57	1.20	1.45	2.5	0.57	2.16	2.38
San Joaquin River Potato Slough	0.31	0.55	1.16	1.40	1.4	1.03	2.09	2.29	0.31	0.55	1.15	1.39	1.3	1.06	2.07	2.27	0.31	0.55	1.16	1.41	2.5	0.57	2.09	2.30
Franks Tract	0.31	0.55	1.15	1.39	1.6	0.85	2.07	2.28	0.31	0.54	1.14	1.38	1.1	1.20	2.05	2.25	0.31	0.55	1.15	1.40	3.0	0.47	2.08	2.29

Table M-8. Selenium Bioaccumulation from Water (µg/L) to Particulates, Whole-body Fish, and Bird Eggs (µg/g, dw) Using Model 8 (Normal to Wet Years)

DSM2 Delta Water Location	Year 2000								Year 2005								Year 2007							
	Concentration				Whole-body Bass[a]	Model 8-to-Bass Ratio	Bird Egg		Concentration				Whole-body Bass[a]	Model 8-to-Bass Ratio	Bird Egg		Concentration				Whole-body Bass[a]	Model 8-to-Bass Ratio	Bird Egg	
	DSM2 Water	Particulate From Water	Invert. From Particulate	Model 8 Fish			From Invert.	From Fish	DSM2 Water	Particulate From Water	Invert. From Particulate	Model 8 Fish			From Invert.	From Fish	DSM2 Water	Particulate From Water	Invert. From Particulate	Model 8 Fish			From Invert.	From Fish
Big Break	0.30	0.53	1.11	1.34	1.6	0.86	1.99	2.19	0.30	0.53	1.11	1.34	1.0	1.32	2.00	2.20	0.30	0.53	1.11	1.35	2.2	0.61	2.00	2.20
Middle River Bullfrog	0.44	0.78	1.63	1.97	NA	NA	2.93	3.22	0.39	0.69	1.44	1.75	1.9	0.9	2.60	2.86	0.38	0.66	1.39	1.69	2.1	0.8	2.51	2.76
Old River near Paradise Cut[c]	0.82	1.45	3.04	3.68	NA	NA	5.47	6.01	0.72	1.26	2.65	3.20	2.4	1.3	4.77	5.24	0.82	1.45	3.04	3.68	NA	NA	5.48	6.02
Knights Landing[d]	0.45	0.79	1.66	2.01	NA	NA	2.99	3.29	0.45	0.79	1.66	2.01	2.2	0.9	2.99	3.29	0.45	0.79	1.66	2.01	NA	NA	2.99	3.29
Vernalis[e]	0.84	1.48	3.10	3.76	1.7	2.21	5.59	6.15	0.84	1.48	3.10	3.76	1.9	1.98	5.59	6.15	0.84	1.48	3.10	3.76	2.4	1.57	5.59	6.15

Notes:

Model 8 = Equations from Presser and Luoma (2010) were used to calculate selenium concentrations in Trophic Level 4 (TL-4) Fish eating TL-3 Fish (Model 8) using a K_d of 1760 (calculated from data reported in Lucas and Stewart [2007]), a revised selenium trophic transfer factor to aquatic insects (2.1), and the average selenium trophic transfer factors to fish (1.1 for TL-3 and TL-4).

Bird Egg from Invertebrate Model 8 = Equations from Presser and Luoma (2010) were used to calculate selenium concentrations in bird eggs using a K_d of 1760 (calculated from data reported in Lucas and Stewart [2007]), the revised selenium trophic transfer factor to aquatic insects (2.1), and the average selenium trophic transfer factor to mallard bird egg (1.8).

Bird Egg from Fish Model 8 = Equations from Presser and Luoma (2010) were used to calculate selenium concentrations in bird eggs using a K_d of 1760 (calculated from data reported in Lucas and Stewart [2007]), the revised selenium trophic transfer factor to aquatic insects (2.1), and the average selenium trophic transfer factors to fish (1.1) and mallard bird egg trophic transfer factor (1.8).

Invert. = invertebrate

K_d = equilibrium constant

µg/g, dw = micrograms per gram, dry weight

NA = not available; bass not collected here

RM = River Mile

TL = Trophic Level

[a] Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010a).

[b] Fish data collected at Rio Vista (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[c] Fish data collected at Old River near Tracy (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[d] Geometric mean of total selenium concentrations in water collected from years 2003, 2004, 2007, and 2008 (DWR Website 2009) was used to estimate selenium concentrations in particulate and biota (DSM2 data were not available). Fish data collected at Sacramento River at Veterans Bridge (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[e] Geometric mean of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2007 (SWAMP Website 2009) was used to estimate selenium concentrations in particulate and biota (DSM2 data were not available). Note that the model over-predicts selenium concentrations in whole-body fish by 50 percent at this location, so selenium concentrations in bird eggs likely are similarly overestimated.

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Table M-9. Selenium Bioaccumulation from Water (µg/L) to Particulates, Whole-body Fish, and Bird Eggs (µg/g, dw) Using Model 9 (Dry Years)

	Year 2007							
	Concentration						Bird Egg	
DSM2 Delta Water Location	DSM2 Water	Particulate From Water	Invert. From Particulate	Model 9 Fish	Whole-body Bass[a]	Model 9-to-Bass Ratio	From Invert.	From Fish
First Quarter								
Sacramento River RM 44	0.32	0.91	1.91	2.31	1.8	1.25	3.43	3.77
Cache Slough Ryer[b]	0.31	0.89	1.88	2.27	2.5	0.89	3.38	3.72
San Joaquin River Potato Slough	0.30	0.86	1.80	2.18	2.5	0.88	3.24	3.57
Franks Tract	0.30	0.86	1.81	2.18	3.0	0.73	3.25	3.57
Big Break	0.31	0.87	1.82	2.21	2.2	1.00	3.28	3.61
Middle River Bullfrog	0.39	1.11	2.32	2.81	2.1	1.3	4.18	4.60
Old River near Paradise Cut[c]	0.81	2.30	4.84	5.85	NA	NA	8.71	9.58
Knights Landing[d]	0.45	1.28	2.68	3.25	NA	NA	4.83	5.31
Vernalis[e]	0.84	2.39	5.01	6.06	2.4	2.53	9.02	9.92
Second Quarter								
Sacramento River RM 44	0.32	0.91	1.90	2.30	1.8	1.25	3.43	3.77
Cache Slough Ryer[b]	0.33	0.92	1.94	2.35	2.5	0.92	3.50	3.85
San Joaquin River Potato Slough	0.34	0.97	2.04	2.47	2.5	1.00	3.68	4.05
Franks Tract	0.34	0.98	2.05	2.48	3.0	0.83	3.70	4.07
Big Break	0.33	0.93	1.95	2.36	2.2	1.07	3.51	3.86
Middle River Bullfrog	0.49	1.39	2.91	3.52	2.1	1.7	5.24	5.76
Old River near Paradise Cut[c]	0.65	1.83	3.85	4.66	NA	NA	6.93	7.63
Knights Landing[d]	0.45	1.28	2.68	3.25	NA	NA	4.83	5.31
Vernalis[e]	0.84	2.39	5.01	6.06	2.4	2.53	9.02	9.92
Third Quarter								
Sacramento River RM 44	0.32	0.91	1.91	2.31	1.8	1.25	3.43	3.78
Cache Slough Ryer[b]	0.33	0.93	1.96	2.37	2.5	0.93	3.52	3.87
San Joaquin River Potato Slough	0.31	0.89	1.87	2.27	2.5	0.91	3.37	3.71
Franks Tract	0.31	0.88	1.85	2.24	3.0	0.75	3.33	3.67
Big Break	0.30	0.85	1.79	2.16	2.2	0.98	3.22	3.54
Middle River Bullfrog	0.32	0.90	1.89	2.29	2.1	1.1	3.40	3.74
Old River near Paradise Cut[c]	0.77	2.18	4.57	5.53	NA	NA	8.22	9.05
Knights Landing[d]	0.45	1.28	2.68	3.25	NA	NA	4.83	5.31
Vernalis[e]	0.84	2.39	5.01	6.06	2.4	2.53	9.02	9.92

Table M-9. Selenium Bioaccumulation from Water (µg/L) to Particulates, Whole-body Fish, and Bird Eggs (µg/g, dw) Using Model 9 (Dry Years)

DSM2 Delta Water Location	Year 2007							
	Concentration						Bird Egg	
	DSM2 Water	Particulate From Water	Invert. From Particulate	Model 9 Fish	Whole-body Bass[a]	Model 9-to-Bass Ratio	From Invert.	From Fish
	Fourth Quarter							
Sacramento River RM 44	0.32	0.91	1.91	2.31	1.8	1.25	3.43	3.78
Cache Slough Ryer[b]	0.33	0.92	1.94	2.35	2.5	0.92	3.49	3.84
San Joaquin River Potato Slough	0.31	0.89	1.88	2.27	2.5	0.91	3.38	3.71
Franks Tract	0.31	0.89	1.86	2.25	3.0	0.75	3.35	3.69
Big Break	0.30	0.85	1.79	2.17	2.2	0.99	3.23	3.55
Middle River Bullfrog	0.38	1.07	2.25	2.72	2.1	1.3	4.05	4.45
Old River near Paradise Cut[c]	0.82	2.34	4.91	5.94	NA	NA	8.84	9.72
Knights Landing[d]	0.45	1.28	2.68	3.25	NA	NA	4.83	5.31
Vernalis[e]	0.84	2.39	5.01	6.06	2.4	2.53	9.02	9.92

Notes:
Model 9 = Equations from Presser and Luoma (2010) were used to calculate selenium concentrations in Trophic Level 4 (TL-4) Fish eating TL-3 Fish (Model 8) using a K_d of 2840 (calculated from data reported in Lucas and Stewart [2007]), an extrapolated selenium trophic transfer factor to aquatic insects (2.1), and the average selenium trophic transfer factors to fish (1.1 for TL-3 and TL-4).
Bird Egg from Invertebrate Model 9 = Equations from Presser and Luoma (2010) were used to calculate selenium concentrations in bird eggs using a K_d of 2840 (calculated from data reported in Lucas and Stewart [2007]), an extrapolated selenium trophic transfer factor to aquatic insects (2.1), and the average selenium trophic transfer factor to mallard bird egg (1.8).
Bird Egg from Fish Model 9 = Equations from Presser and Luoma (2010) were used to calculate selenium concentrations in bird eggs using a K_d of 2840 (calculated from data reported in Lucas and Stewart [2007]), an extrapolated selenium trophic transfer factor to aquatic insects (2.1), and the average selenium trophic transfer factors to fish (1.1) and mallard bird egg (1.8).
K_d = equilibrium constant

µg/g, dw = micrograms per gram, dry weight

NA = not available; bass not collected here

RM = river mile

TL = trophic level

[a] Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010).

[b] Fish data collected at Rio Vista (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[c] Fish data collected at Old River near Tracy (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[d] Geometric mean of total selenium concentrations in water collected from years 2003, 2004, 2007, and 2008 (DWR Website 2009) was used to estimate selenium concentrations in particulate and biota (DSM2 data were not available). Fish data collected at Sacramento River at Veterans Bridge (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[e] Geometric mean of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2007 (SWAMP Website 2009) was used to estimate selenium concentrations in particulate and biota (DSM2 data were not available). Note that the model overpredicts selenium concentrations in whole-body fish by more than twofold at this location, so selenium concentrations in bird eggs likely are similarly overestimated.

Table M-10A. Modeled Selenium Concentrations in Water for Existing Conditions, No Action Alternative Late Long Term and Alternatives 1-3 and 5-9.

		Period Average Concentration (µg/L)									
Location	**Period ***	**Existing Conditions**	**No Action Alternative-LLT**	**Alternative 1-LLT**	**Alternative 2-LLT**	**Alternative 3-LLT**	**Alternative 5-LLT**	**Alternative 6-LLT**	**Alternative 7-LLT**	**Alternative 8-LLT**	**Alternative 9-LLT**
Delta Interior											
Mokelumne River (SF) at Staten Island	ALL	0.26	0.26	0.25	0.25	0.25	0.26	0.24	0.25	0.25	0.28
	DROUGHT	0.29	0.29	0.28	0.28	0.28	0.28	0.27	0.28	0.28	0.30
San Joaquin River at Buckley Cove	ALL	0.76	0.69	0.70	0.74	0.70	0.73	0.74	0.71	0.72	0.36
	DROUGHT	0.72	0.62	0.64	0.71	0.64	0.68	0.70	0.65	0.67	0.28
Franks Tract	ALL	0.36	0.36	0.39	0.41	0.37	0.38	0.48	0.45	0.45	0.58
	DROUGHT	0.31	0.31	0.31	0.33	0.31	0.31	0.38	0.37	0.37	0.49
Old River at Rock Slough	ALL	0.39	0.39	0.41	0.45	0.39	0.40	0.63	0.58	0.59	0.70
	DROUGHT	0.31	0.32	0.31	0.34	0.31	0.32	0.53	0.51	0.51	0.63
Western Delta											
Sacramento River at Emmaton	ALL	0.32	0.32	0.32	0.33	0.32	0.32	0.34	0.34	0.33	0.33
	DROUGHT	0.30	0.30	0.30	0.30	0.30	0.30	0.32	0.31	0.31	0.31
San Joaquin River at Antioch	ALL	0.31	0.31	0.33	0.34	0.32	0.32	0.38	0.37	0.37	0.38
	DROUGHT	0.27	0.27	0.27	0.28	0.27	0.28	0.31	0.31	0.31	0.32
Sacramento River at Mallard Island	ALL	0.25	0.25	0.26	0.27	0.25	0.26	0.30	0.29	0.29	0.28
	DROUGHT	0.21	0.21	0.21	0.22	0.21	0.21	0.24	0.24	0.24	0.23
Major Diversions (Pumping Stations)											
North Bay Aqueduct at Barker Slough Pumping Plant	ALL	0.31	0.31	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
	DROUGHT	0.30	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Contra Costa Pumping Plant #1	ALL	0.35	0.36	0.38	0.41	0.36	0.37	0.61	0.55	0.56	0.65
	DROUGHT	0.30	0.31	0.31	0.33	0.31	0.31	0.54	0.50	0.51	0.60
Banks Pumping Plant	ALL	0.47	0.46	0.38	0.38	0.41	0.43	0.32	0.34	0.36	0.39
	DROUGHT	0.37	0.37	0.37	0.37	0.37	0.37	0.32	0.32	0.32	0.32
Jones Pumping Plant	ALL	0.58	0.59	0.49	0.45	0.52	0.53	0.32	0.37	0.37	0.40
	DROUGHT	0.51	0.53	0.50	0.45	0.49	0.49	0.32	0.34	0.34	0.32

* All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

Notes:

LLT - late long term

µg/L - microgram per liter

SF - south fork

Table M-10B. Modeled Selenium Concentrations in Water for Existing Conditions, No Action Alternative and All Scenarios Under Alternative 4

		Period Average Concentration (µg/L)					
Location	**Period ***	**Existing Conditions**	**No Action Alternative**	**Alternative 4H1**	**Alternative 4H2**	**Alternative 4H3**	**Alternative 4H4**
Delta Interior							
Mokelumne River (SF) at Staten Island	ALL	0.26	0.26	0.25	0.25	0.25	0.25
	DROUGHT	0.29	0.29	0.28	0.28	0.28	0.28
San Joaquin River at Buckley Cove	ALL	0.76	0.69	0.74	0.74	0.74	0.74
	DROUGHT	0.72	0.62	0.71	0.71	0.71	0.71
Franks Tract	ALL	0.36	0.36	0.40	0.40	0.41	0.41
	DROUGHT	0.31	0.31	0.32	0.32	0.33	0.33
Old River at Rock Slough	ALL	0.39	0.39	0.42	0.43	0.44	0.45
	DROUGHT	0.31	0.32	0.33	0.33	0.34	0.35
Western Delta							
Sacramento River at Emmaton	ALL	0.32	0.32	0.32	0.32	0.33	0.33
	DROUGHT	0.30	0.30	0.30	0.30	0.30	0.30
San Joaquin River at Antioch	ALL	0.31	0.31	0.33	0.33	0.34	0.34
	DROUGHT	0.27	0.27	0.28	0.28	0.28	0.28
Sacramento River at Mallard Island	ALL	0.25	0.25	0.26	0.26	0.27	0.27
	DROUGHT	0.21	0.21	0.21	0.21	0.22	0.22
Major Diversions (Pumping Stations)							
North Bay Aqueduct at Barker Slough Pumping Plant	ALL	0.31	0.31	0.33	0.33	0.33	0.33
	DROUGHT	0.30	0.31	0.32	0.32	0.32	0.32
Contra Costa Pumping Plant #1	ALL	0.35	0.36	0.39	0.40	0.41	0.42
	DROUGHT	0.30	0.31	0.32	0.33	0.33	0.34
Banks Pumping Plant	ALL	0.47	0.46	0.39	0.40	0.40	0.40
	DROUGHT	0.37	0.37	0.37	0.37	0.37	0.37
Jones Pumping Plant	ALL	0.58	0.59	0.47	0.46	0.47	0.46
	DROUGHT	0.51	0.53	0.47	0.45	0.46	0.44

* All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

Notes:

µg/L - microgram per liter

SF - south fork

Table M-11. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions and No Action Alternative Late Long Term

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])							
		Whole-body Fish		Bird Eggs (Invertebrate Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)	
		EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT
Delta Interior									
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.74	1.75	1.91	1.93	0.35	0.35
	Drought	2.06	2.07	3.07	3.08	3.38	3.38	0.70	0.70
San Joaquin River at Buckley Cove	All	3.38	3.10	5.03	4.61	5.53	5.07	1.22	1.11
	Drought	5.21	4.50	7.75	6.69	8.53	7.36	1.95	1.67
Franks Tract	All	1.61	1.60	2.40	2.39	2.64	2.63	0.52	0.52
	Drought	2.21	2.24	3.29	3.33	3.62	3.66	0.76	0.77
Old River at Rock Slough	All	1.75	1.74	2.60	2.58	2.86	2.84	0.58	0.57
	Drought	2.26	2.30	3.36	3.43	3.70	3.77	0.78	0.80
Western Delta									
Sacramento River at Emmaton	All	1.41	1.42	2.10	2.11	2.31	2.32	0.44	0.45
	Drought	2.16	2.15	3.22	3.20	3.54	3.52	0.74	0.74
SJR at Antioch	All	1.39	1.39	2.06	2.07	2.27	2.28	0.43	0.44
	Drought	1.96	1.97	2.91	2.93	3.20	3.22	0.66	0.66
Sacramento River at Mallard Island	All	1.13	1.14	1.68	1.70	1.84	1.87	0.33	0.34
	Drought	1.52	1.54	2.26	2.29	2.49	2.52	0.49	0.49
Major Diversions (Pumping Stations)									
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	2.08	2.08	2.29	2.29	0.44	0.44
	Drought	2.20	2.20	3.27	3.28	3.59	3.60	0.75	0.76
Contra Costa Pumping Plant #1	All	1.56	1.59	2.32	2.37	2.55	2.61	0.50	0.52
	Drought	2.20	2.25	3.27	3.35	3.59	3.68	0.75	0.78
Banks Pumping Plant	All	2.09	2.07	3.11	3.08	3.42	3.39	0.71	0.71
	Drought	2.67	2.68	3.98	3.98	4.37	4.38	0.94	0.94
Jones Pumping Plant	All	2.58	2.64	3.84	3.92	4.23	4.31	0.91	0.93
	Drought	3.70	3.83	5.50	5.70	6.05	6.27	1.35	1.40

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-12. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 1

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
		Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
		EX	NAA-LLT	Alt. 1	EX	NAA-LLT	Alt. 1	EX	NAA-LLT	Alt. 1	EX	NAA-LLT	Alt. 1
Delta Interior													
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.12	1.74	1.75	1.67	1.91	1.93	1.83	0.35	0.35	0.33
	Drought	2.06	2.07	2.01	3.07	3.08	2.99	3.38	3.38	2.88	0.70	0.70	0.68
San Joaquin River at Buckley Cove	All	3.38	3.10	3.13	5.03	4.61	4.66	5.53	5.07	5.12	1.22	1.11	1.12
	Drought	5.21	4.50	4.64	7.75	6.69	6.91	8.53	7.36	6.63	1.95	1.67	1.72
Franks Tract	All	1.61	1.60	1.73	2.40	2.39	2.57	2.64	2.63	2.82	0.52	0.52	0.57
	Drought	2.21	2.24	2.21	3.29	3.33	3.29	3.62	3.66	3.16	0.76	0.77	0.76
Old River at Rock Slough	All	1.75	1.74	1.84	2.60	2.58	2.74	2.86	2.84	3.02	0.58	0.57	0.61
	Drought	2.26	2.30	2.25	3.36	3.43	3.35	3.70	3.77	3.22	0.78	0.80	0.78
Western Delta													
Sacramento River at Emmaton	All	1.41	1.42	1.43	2.10	2.11	2.13	2.31	2.32	2.34	0.44	0.45	0.45
	Drought	2.16	2.15	2.16	3.22	3.20	3.22	3.54	3.52	3.09	0.74	0.74	0.74
SJR at Antioch	All	1.39	1.39	1.46	2.06	2.07	2.17	2.27	2.28	2.39	0.43	0.44	0.46
	Drought	1.96	1.97	1.97	2.91	2.93	2.94	3.20	3.22	2.82	0.66	0.66	0.67
Sacramento River at Mallard Island	All	1.13	1.14	1.15	1.68	1.70	1.71	1.84	1.87	1.88	0.33	0.34	0.34
	Drought	1.52	1.54	1.52	2.26	2.29	2.27	2.49	2.52	2.18	0.49	0.49	0.49
Major Diversions (Pumping Stations)													
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.47	2.08	2.08	2.19	2.29	2.29	2.41	0.44	0.44	0.47
	Drought	2.20	2.20	2.31	3.27	3.28	3.44	3.59	3.60	3.30	0.75	0.76	0.80
Contra Costa Pumping Plant #1	All	1.56	1.59	1.69	2.32	2.37	2.52	2.55	2.61	2.77	0.50	0.52	0.55
	Drought	2.20	2.25	2.20	3.27	3.35	3.28	3.59	3.68	3.15	0.75	0.78	0.76
Banks Pumping Plant	All	2.09	2.07	1.71	3.11	3.08	2.54	3.42	3.39	2.80	0.71	0.71	0.56
	Drought	2.67	2.68	2.65	3.98	3.98	3.94	4.37	4.38	3.78	0.94	0.94	0.93
Jones Pumping Plant	All	2.58	2.64	2.19	3.84	3.92	3.26	4.23	4.31	3.59	0.91	0.93	0.75
	Drought	3.70	3.83	3.60	5.50	5.70	5.36	6.05	6.27	5.15	1.35	1.40	1.31

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-13. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 2

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
		Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
		EX	NAA-LLT	Alt. 2	EX	NAA-LLT	Alt. 2	EX	NAA-LLT	Alt. 2	EX	NAA-LLT	Alt. 2
Delta Interior													
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.11	1.74	1.75	1.66	1.91	1.93	1.82	0.35	0.35	0.32
	Drought	2.06	2.07	2.00	3.07	3.08	2.98	3.38	3.38	2.86	0.70	0.70	0.68
San Joaquin River at Buckley Cove	All	3.38	3.10	3.32	5.03	4.61	4.94	5.53	5.07	5.44	1.22	1.11	1.20
	Drought	5.21	4.50	5.13	7.75	6.69	7.63	8.53	7.36	7.33	1.95	1.67	1.92
Franks Tract	All	1.61	1.60	1.84	2.40	2.39	2.74	2.64	2.63	3.01	0.52	0.52	0.61
	Drought	2.21	2.24	2.35	3.29	3.33	3.50	3.62	3.66	3.36	0.76	0.77	0.82
Old River at Rock Slough	All	1.75	1.74	2.00	2.60	2.58	2.97	2.86	2.84	3.26	0.58	0.57	0.67
	Drought	2.26	2.30	2.46	3.36	3.43	3.66	3.70	3.77	3.51	0.78	0.80	0.86
Western Delta													
Sacramento River at Emmaton	All	1.41	1.42	1.46	2.10	2.11	2.18	2.31	2.32	2.39	0.44	0.45	0.46
	Drought	2.16	2.15	2.19	3.22	3.20	3.26	3.54	3.52	3.13	0.74	0.74	0.75
SJR at Antioch	All	1.39	1.39	1.53	2.06	2.07	2.28	2.27	2.28	2.51	0.43	0.44	0.49
	Drought	1.96	1.97	2.04	2.91	2.93	3.03	3.20	3.22	2.91	0.66	0.66	0.69
Sacramento River at Mallard Island	All	1.13	1.14	1.20	1.68	1.70	1.79	1.84	1.87	1.97	0.33	0.34	0.36
	Drought	1.52	1.54	1.57	2.26	2.29	2.34	2.49	2.52	2.24	0.49	0.49	0.51
Major Diversions (Pumping Stations)													
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.47	2.08	2.08	2.19	2.29	2.29	2.41	0.44	0.44	0.47
	Drought	2.20	2.20	2.32	3.27	3.28	3.45	3.59	3.60	3.31	0.75	0.76	0.80
Contra Costa Pumping Plant #1	All	1.56	1.59	1.85	2.32	2.37	2.75	2.55	2.61	3.03	0.50	0.52	0.62
	Drought	2.20	2.25	2.41	3.27	3.35	3.59	3.59	3.68	3.44	0.75	0.78	0.84
Banks Pumping Plant	All	2.09	2.07	1.72	3.11	3.08	2.56	3.42	3.39	2.82	0.71	0.71	0.57
	Drought	2.67	2.68	2.69	3.98	3.98	4.00	4.37	4.38	3.84	0.94	0.94	0.95
Jones Pumping Plant	All	2.58	2.64	2.01	3.84	3.92	2.98	4.23	4.31	3.28	0.91	0.93	0.68
	Drought	3.70	3.83	3.25	5.50	5.70	4.84	6.05	6.27	4.65	1.35	1.40	1.17

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-14. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 3

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
		Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
		EX	NAA-LLT	Alt. 3	EX	NAA-LLT	Alt. 3	EX	NAA-LLT	Alt. 3	EX	NAA-LLT	Alt. 3
Delta Interior													
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.13	1.74	1.75	1.68	1.91	1.93	1.85	0.35	0.35	0.33
	Drought	2.06	2.07	2.01	3.07	3.08	3.00	3.38	3.38	2.88	0.70	0.70	0.68
San Joaquin River at Buckley Cove	All	3.38	3.10	3.12	5.03	4.61	4.64	5.53	5.07	5.10	1.22	1.11	1.12
	Drought	5.21	4.50	4.60	7.75	6.69	6.84	8.53	7.36	6.57	1.95	1.67	1.71
Franks Tract	All	1.61	1.60	1.66	2.40	2.39	2.47	2.64	2.63	2.72	0.52	0.52	0.54
	Drought	2.21	2.24	2.21	3.29	3.33	3.29	3.62	3.66	3.16	0.76	0.77	0.76
Old River at Rock Slough	All	1.75	1.74	1.76	2.60	2.58	2.62	2.86	2.84	2.88	0.58	0.57	0.58
	Drought	2.26	2.30	2.27	3.36	3.43	3.37	3.70	3.77	3.24	0.78	0.80	0.78
Western Delta													
Sacramento River at Emmaton	All	1.41	1.42	1.42	2.10	2.11	2.11	2.31	2.32	2.32	0.44	0.45	0.45
	Drought	2.16	2.15	2.17	3.22	3.20	3.22	3.54	3.52	3.10	0.74	0.74	0.74
SJR at Antioch	All	1.39	1.39	1.42	2.06	2.07	2.12	2.27	2.28	2.33	0.43	0.44	0.45
	Drought	1.96	1.97	1.98	2.91	2.93	2.94	3.20	3.22	2.83	0.66	0.66	0.67
Sacramento River at Mallard Island	All	1.13	1.14	1.13	1.68	1.70	1.68	1.84	1.87	1.84	0.33	0.34	0.33
	Drought	1.52	1.54	1.53	2.26	2.29	2.28	2.49	2.52	2.19	0.49	0.49	0.49
Major Diversions (Pumping Stations)													
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.47	2.08	2.08	2.19	2.29	2.29	2.41	0.44	0.44	0.47
	Drought	2.20	2.20	2.31	3.27	3.28	3.44	3.59	3.60	3.30	0.75	0.76	0.80
Contra Costa Pumping Plant #1	All	1.56	1.59	1.62	2.32	2.37	2.40	2.55	2.61	2.64	0.50	0.52	0.52
	Drought	2.20	2.25	2.21	3.27	3.35	3.29	3.59	3.68	3.16	0.75	0.78	0.76
Banks Pumping Plant	All	2.09	2.07	1.84	3.11	3.08	2.74	3.42	3.39	3.02	0.71	0.71	0.62
	Drought	2.67	2.68	2.67	3.98	3.98	3.97	4.37	4.38	3.81	0.94	0.94	0.94
Jones Pumping Plant	All	2.58	2.64	2.33	3.84	3.92	3.47	4.23	4.31	3.81	0.91	0.93	0.81
	Drought	3.70	3.83	3.51	5.50	5.70	5.22	6.05	6.27	5.02	1.35	1.40	1.28

Notes:
[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)
[b] Dry weight, except as noted for fish fillets
Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA-LLT - No Action Alternative Late Long Term
ww - wet weight

Table M-15A. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 4 H1

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs(Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 4H1	EX	NAA	Alt. 4H1	EX	NAA	Alt. 4H1	EX	NAA	Alt. 4H1
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.12	1.74	1.75	1.66	1.91	1.93	1.83	0.35	0.35	0.33
		Drought	2.06	2.07	2.01	3.07	3.08	2.99	3.38	3.38	2.87	0.70	0.70	0.68
	San Joaquin River at Buckley Cove	All	3.38	3.10	3.32	5.03	4.61	4.93	5.53	5.07	5.43	1.22	1.11	1.20
		Drought	5.21	4.50	5.12	7.75	6.69	7.62	8.53	7.36	7.32	1.95	1.67	1.92
	Franks Tract	All	1.61	1.60	1.77	2.40	2.39	2.64	2.64	2.63	2.90	0.52	0.52	0.59
		Drought	2.21	2.24	2.30	3.29	3.33	3.42	3.62	3.66	3.28	0.76	0.77	0.79
	Old River at Rock Slough	All	1.75	1.74	1.89	2.60	2.58	2.81	2.86	2.84	3.09	0.58	0.57	0.63
		Drought	2.26	2.30	2.38	3.36	3.43	3.55	3.70	3.77	3.41	0.78	0.80	0.83
Western Delta	Sacramento River at Emmaton	All	1.41	1.42	1.45	2.10	2.11	2.15	2.31	2.32	2.37	0.44	0.45	0.46
		Drought	2.16	2.15	2.18	3.22	3.20	3.24	3.54	3.52	3.11	0.74	0.74	0.75
	SJR at Antioch	All	1.39	1.39	1.49	2.06	2.07	2.21	2.27	2.28	2.43	0.43	0.44	0.47
		Drought	1.96	1.97	2.00	2.91	2.93	2.98	3.20	3.22	2.86	0.66	0.66	0.68
	Sacramento River at Mallard Island	All	1.13	1.14	1.17	1.68	1.70	1.74	1.84	1.87	1.91	0.33	0.34	0.35
		Drought	1.52	1.54	1.54	2.26	2.29	2.29	2.49	2.52	2.20	0.49	0.49	0.49
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.47	2.08	2.08	2.19	2.29	2.29	2.41	0.44	0.44	0.47
		Drought	2.20	2.20	2.31	3.27	3.28	3.44	3.59	3.60	3.31	0.75	0.76	0.80
	Contra Costa Pumping Plant #1	All	1.56	1.59	1.75	2.32	2.37	2.61	2.55	2.61	2.87	0.50	0.52	0.58
		Drought	2.20	2.25	2.32	3.27	3.35	3.46	3.59	3.68	3.32	0.75	0.78	0.81
	Banks Pumping Plant	All	2.09	2.07	1.76	3.11	3.08	2.61	3.42	3.39	2.87	0.71	0.71	0.58
		Drought	2.67	2.68	2.67	3.98	3.98	3.98	4.37	4.38	3.82	0.94	0.94	0.94
	Jones Pumping Plant	All	2.58	2.64	2.12	3.84	3.92	3.15	4.23	4.31	3.47	0.91	0.93	0.72
		Drought	3.70	3.83	3.37	5.50	5.70	5.01	6.05	6.27	4.81	1.35	1.40	1.22

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-15B. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 4 H2

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs(Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 4H2	EX	NAA	Alt. 4H2	EX	NAA	Alt. 4H2	EX	NAA	Alt. 4H2
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.12	1.74	1.75	1.66	1.91	1.93	1.83	0.35	0.35	0.33
		Drought	2.06	2.07	2.01	3.07	3.08	2.98	3.38	3.38	2.87	0.70	0.70	0.68
	San Joaquin River at Buckley Cove	All	3.38	3.10	3.33	5.03	4.61	4.95	5.53	5.07	5.44	1.22	1.11	1.20
		Drought	5.21	4.50	5.13	7.75	6.69	7.63	8.53	7.36	7.33	1.95	1.67	1.92
	Franks Tract	All	1.61	1.60	1.79	2.40	2.39	2.67	2.64	2.63	2.93	0.52	0.52	0.59
		Drought	2.21	2.24	2.32	3.29	3.33	3.45	3.62	3.66	3.31	0.76	0.77	0.80
	Old River at Rock Slough	All	1.75	1.74	1.92	2.60	2.58	2.85	2.86	2.84	3.14	0.58	0.57	0.64
		Drought	2.26	2.30	2.41	3.36	3.43	3.59	3.70	3.77	3.45	0.78	0.80	0.84
Western Delta	Sacramento River at Emmaton	All	1.41	1.42	1.44	2.10	2.11	2.15	2.31	2.32	2.36	0.44	0.45	0.46
		Drought	2.16	2.15	2.18	3.22	3.20	3.24	3.54	3.52	3.11	0.74	0.74	0.75
	SJR at Antioch	All	1.39	1.39	1.50	2.06	2.07	2.22	2.27	2.28	2.45	0.43	0.44	0.48
		Drought	1.96	1.97	2.01	2.91	2.93	2.99	3.20	3.22	2.88	0.66	0.66	0.68
	Sacramento River at Mallard Island	All	1.13	1.14	1.17	1.68	1.70	1.74	1.84	1.87	1.92	0.33	0.34	0.35
		Drought	1.52	1.54	1.55	2.26	2.29	2.30	2.49	2.52	2.21	0.49	0.49	0.50
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.48	2.08	2.08	2.19	2.29	2.29	2.41	0.44	0.44	0.47
		Drought	2.20	2.20	2.31	3.27	3.28	3.44	3.59	3.60	3.30	0.75	0.76	0.80
	Contra Costa Pumping Plant #1	All	1.56	1.59	1.77	2.32	2.37	2.64	2.55	2.61	2.90	0.50	0.52	0.59
		Drought	2.20	2.25	2.36	3.27	3.35	3.51	3.59	3.68	3.37	0.75	0.78	0.82
	Banks Pumping Plant	All	2.09	2.07	1.79	3.11	3.08	2.66	3.42	3.39	2.93	0.71	0.71	0.59
		Drought	2.67	2.68	2.64	3.98	3.98	3.93	4.37	4.38	3.78	0.94	0.94	0.93
	Jones Pumping Plant	All	2.58	2.64	2.07	3.84	3.92	3.08	4.23	4.31	3.39	0.91	0.93	0.71
		Drought	3.70	3.83	3.27	5.50	5.70	4.86	6.05	6.27	4.67	1.35	1.40	1.18

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-15C. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 4 H3

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs(Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 4H3	EX	NAA	Alt. 4H3	EX	NAA	Alt. 4H3	EX	NAA	Alt. 4H3
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.12	1.74	1.75	1.66	1.91	1.93	1.83	0.35	0.35	0.33
		Drought	2.06	2.07	2.01	3.07	3.08	2.99	3.38	3.38	2.87	0.70	0.70	0.68
	San Joaquin River at Buckley Cove	All	3.38	3.10	3.32	5.03	4.61	4.95	5.53	5.07	5.44	1.22	1.11	1.20
		Drought	5.21	4.50	5.13	7.75	6.69	7.64	8.53	7.36	7.34	1.95	1.67	1.92
	Franks Tract	All	1.61	1.60	1.82	2.40	2.39	2.70	2.64	2.63	2.97	0.52	0.52	0.60
		Drought	2.21	2.24	2.35	3.29	3.33	3.50	3.62	3.66	3.36	0.76	0.77	0.82
	Old River at Rock Slough	All	1.75	1.74	1.96	2.60	2.58	2.92	2.86	2.84	3.21	0.58	0.57	0.66
		Drought	2.26	2.30	2.46	3.36	3.43	3.66	3.70	3.77	3.52	0.78	0.80	0.86
Western Delta	Sacramento River at Emmaton	All	1.41	1.42	1.46	2.10	2.11	2.17	2.31	2.32	2.39	0.44	0.45	0.46
		Drought	2.16	2.15	2.19	3.22	3.20	3.26	3.54	3.52	3.13	0.74	0.74	0.75
	SJR at Antioch	All	1.39	1.39	1.52	2.06	2.07	2.26	2.27	2.28	2.49	0.43	0.44	0.49
		Drought	1.96	1.97	2.04	2.91	2.93	3.04	3.20	3.22	2.92	0.66	0.66	0.69
	Sacramento River at Mallard Island	All	1.13	1.14	1.20	1.68	1.70	1.78	1.84	1.87	1.96	0.33	0.34	0.36
		Drought	1.52	1.54	1.57	2.26	2.29	2.34	2.49	2.52	2.24	0.49	0.49	0.51
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.48	2.08	2.08	2.19	2.29	2.29	2.41	0.44	0.44	0.47
		Drought	2.20	2.20	2.32	3.27	3.28	3.45	3.59	3.60	3.31	0.75	0.76	0.80
	Contra Costa Pumping Plant #1	All	1.56	1.59	1.84	2.32	2.37	2.73	2.55	2.61	3.00	0.50	0.52	0.61
		Drought	2.20	2.25	2.41	3.27	3.35	3.59	3.59	3.68	3.44	0.75	0.78	0.84
	Banks Pumping Plant	All	2.09	2.07	1.77	3.11	3.08	2.63	3.42	3.39	2.89	0.71	0.71	0.58
		Drought	2.67	2.68	2.67	3.98	3.98	3.97	4.37	4.38	3.81	0.94	0.94	0.94
	Jones Pumping Plant	All	2.58	2.64	2.09	3.84	3.92	3.11	4.23	4.31	3.42	0.91	0.93	0.71
		Drought	3.70	3.83	3.33	5.50	5.70	4.95	6.05	6.27	4.75	1.35	1.40	1.20

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-15D. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 4 H4

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs(Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 4H4	EX	NAA	Alt. 4H4	EX	NAA	Alt. 4H4	EX	NAA	Alt. 4H4
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.12	1.74	1.75	1.66	1.91	1.93	1.83	0.35	0.35	0.33
		Drought	2.06	2.07	2.01	3.07	3.08	2.98	3.38	3.38	2.87	0.70	0.70	0.68
	San Joaquin River at Buckley Cove	All	3.38	3.10	3.33	5.03	4.61	4.95	5.53	5.07	5.45	1.22	1.11	1.20
		Drought	5.21	4.50	5.14	7.75	6.69	7.64	8.53	7.36	7.34	1.95	1.67	1.92
	Franks Tract	All	1.61	1.60	1.84	2.40	2.39	2.74	2.64	2.63	3.01	0.52	0.52	0.61
		Drought	2.21	2.24	2.38	3.29	3.33	3.54	3.62	3.66	3.40	0.76	0.77	0.83
	Old River at Rock Slough	All	1.75	1.74	2.00	2.60	2.58	2.98	2.86	2.84	3.28	0.58	0.57	0.68
		Drought	2.26	2.30	2.50	3.36	3.43	3.72	3.70	3.77	3.57	0.78	0.80	0.88
Western Delta	Sacramento River at Emmaton	All	1.41	1.42	1.46	2.10	2.11	2.17	2.31	2.32	2.39	0.44	0.45	0.46
		Drought	2.16	2.15	2.20	3.22	3.20	3.27	3.54	3.52	3.14	0.74	0.74	0.76
	SJR at Antioch	All	1.39	1.39	1.53	2.06	2.07	2.27	2.27	2.28	2.50	0.43	0.44	0.49
		Drought	1.96	1.97	2.05	2.91	2.93	3.05	3.20	3.22	2.93	0.66	0.66	0.70
	Sacramento River at Mallard Island	All	1.13	1.14	1.20	1.68	1.70	1.79	1.84	1.87	1.97	0.33	0.34	0.36
		Drought	1.52	1.54	1.57	2.26	2.29	2.34	2.49	2.52	2.25	0.49	0.49	0.51
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.47	2.08	2.08	2.19	2.29	2.29	2.41	0.44	0.44	0.47
		Drought	2.20	2.20	2.32	3.27	3.28	3.44	3.59	3.60	3.31	0.75	0.76	0.80
	Contra Costa Pumping Plant #1	All	1.56	1.59	1.86	2.32	2.37	2.77	2.55	2.61	3.05	0.50	0.52	0.62
		Drought	2.20	2.25	2.45	3.27	3.35	3.64	3.59	3.68	3.50	0.75	0.78	0.86
	Banks Pumping Plant	All	2.09	2.07	1.79	3.11	3.08	2.66	3.42	3.39	2.92	0.71	0.71	0.59
		Drought	2.67	2.68	2.65	3.98	3.98	3.94	4.37	4.38	3.78	0.94	0.94	0.93
	Jones Pumping Plant	All	2.58	2.64	2.05	3.84	3.92	3.05	4.23	4.31	3.36	0.91	0.93	0.70
		Drought	3.70	3.83	3.21	5.50	5.70	4.77	6.05	6.27	4.58	1.35	1.40	1.16

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-16. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 5

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
		Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
		EX	NAA-LLT	Alt. 5	EX	NAA-LLT	Alt. 5	EX	NAA-LLT	Alt. 5	EX	NAA-LLT	Alt. 5
Delta Interior													
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.14	1.74	1.75	1.70	1.91	1.93	1.87	0.35	0.35	0.34
	Drought	2.06	2.07	2.01	3.07	3.08	3.00	3.38	3.38	2.88	0.70	0.70	0.68
San Joaquin River at Buckley Cove	All	3.38	3.10	3.24	5.03	4.61	4.82	5.53	5.07	5.31	1.22	1.11	1.17
	Drought	5.21	4.50	4.93	7.75	6.69	7.33	8.53	7.36	7.04	1.95	1.67	1.84
Franks Tract	All	1.61	1.60	1.68	2.40	2.39	2.50	2.64	2.63	2.75	0.52	0.52	0.55
	Drought	2.21	2.24	2.27	3.29	3.33	3.38	3.62	3.66	3.24	0.76	0.77	0.78
Old River at Rock Slough	All	1.75	1.74	1.81	2.60	2.58	2.69	2.86	2.84	2.96	0.58	0.57	0.60
	Drought	2.26	2.30	2.33	3.36	3.43	3.47	3.70	3.77	3.33	0.78	0.80	0.81
Western Delta													
Sacramento River at Emmaton	All	1.41	1.42	1.43	2.10	2.11	2.13	2.31	2.32	2.34	0.44	0.45	0.45
	Drought	2.16	2.15	2.18	3.22	3.20	3.24	3.54	3.52	3.11	0.74	0.74	0.75
SJR at Antioch	All	1.39	1.39	1.44	2.06	2.07	2.14	2.27	2.28	2.35	0.43	0.44	0.45
	Drought	1.96	1.97	2.01	2.91	2.93	2.98	3.20	3.22	2.87	0.66	0.66	0.68
Sacramento River at Mallard Island	All	1.13	1.14	1.15	1.68	1.70	1.71	1.84	1.87	1.88	0.33	0.34	0.34
	Drought	1.52	1.54	1.55	2.26	2.29	2.31	2.49	2.52	2.22	0.49	0.49	0.50
Major Diversions (Pumping Stations)													
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.47	2.08	2.08	2.19	2.29	2.29	2.41	0.44	0.44	0.47
	Drought	2.20	2.20	2.31	3.27	3.28	3.44	3.59	3.60	3.30	0.75	0.76	0.80
Contra Costa Pumping Plant #1	All	1.56	1.59	1.66	2.32	2.37	2.48	2.55	2.61	2.72	0.50	0.52	0.54
	Drought	2.20	2.25	2.26	3.27	3.35	3.37	3.59	3.68	3.23	0.75	0.78	0.78
Banks Pumping Plant	All	2.09	2.07	1.92	3.11	3.08	2.86	3.42	3.39	3.14	0.71	0.71	0.65
	Drought	2.67	2.68	2.68	3.98	3.98	3.99	4.37	4.38	3.83	0.94	0.94	0.95
Jones Pumping Plant	All	2.58	2.64	2.37	3.84	3.92	3.53	4.23	4.31	3.88	0.91	0.93	0.82
	Drought	3.70	3.83	3.51	5.50	5.70	5.23	6.05	6.27	5.02	1.35	1.40	1.28

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-17. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 6

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
		Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
		EX	NAA-LLT	Alt. 6	EX	NAA-LLT	Alt. 6	EX	NAA-LLT	Alt. 6	EX	NAA-LLT	Alt. 6
Delta Interior													
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.09	1.74	1.75	1.62	1.91	1.93	1.78	0.35	0.35	0.31
	Drought	2.06	2.07	1.97	3.07	3.08	2.94	3.38	3.38	2.82	0.70	0.70	0.67
San Joaquin River at Buckley Cove	All	3.38	3.10	3.29	5.03	4.61	4.90	5.53	5.07	5.39	1.22	1.11	1.19
	Drought	5.21	4.50	5.05	7.75	6.69	7.52	8.53	7.36	7.22	1.95	1.67	1.89
Franks Tract	All	1.61	1.60	2.16	2.40	2.39	3.21	2.64	2.63	3.53	0.52	0.52	0.74
	Drought	2.21	2.24	2.77	3.29	3.33	4.11	3.62	3.66	3.95	0.76	0.77	0.98
Old River at Rock Slough	All	1.75	1.74	2.82	2.60	2.58	4.20	2.86	2.84	4.62	0.58	0.57	1.00
	Drought	2.26	2.30	3.82	3.36	3.43	5.68	3.70	3.77	5.46	0.78	0.80	1.40
Western Delta													
Sacramento River at Emmaton	All	1.41	1.42	1.54	2.10	2.11	2.28	2.31	2.32	2.51	0.44	0.45	0.49
	Drought	2.16	2.15	2.28	3.22	3.20	3.39	3.54	3.52	3.25	0.74	0.74	0.79
SJR at Antioch	All	1.39	1.39	1.72	2.06	2.07	2.55	2.27	2.28	2.81	0.43	0.44	0.56
	Drought	1.96	1.97	2.27	2.91	2.93	3.38	3.20	3.22	3.25	0.66	0.66	0.78
Sacramento River at Mallard Island	All	1.13	1.14	1.33	1.68	1.70	1.97	1.84	1.87	2.17	0.33	0.34	0.41
	Drought	1.52	1.54	1.72	2.26	2.29	2.56	2.49	2.52	2.46	0.49	0.49	0.57
Major Diversions (Pumping Stations)													
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.48	2.08	2.08	2.20	2.29	2.29	2.42	0.44	0.44	0.47
	Drought	2.20	2.20	2.32	3.27	3.28	3.45	3.59	3.60	3.32	0.75	0.76	0.80
Contra Costa Pumping Plant #1	All	1.56	1.59	2.72	2.32	2.37	4.05	2.55	2.61	4.45	0.50	0.52	0.96
	Drought	2.20	2.25	3.89	3.27	3.35	5.79	3.59	3.68	5.57	0.75	0.78	1.43
Banks Pumping Plant	All	2.09	2.07	1.43	3.11	3.08	2.12	3.42	3.39	2.34	0.71	0.71	0.45
	Drought	2.67	2.68	2.30	3.98	3.98	3.43	4.37	4.38	3.29	0.94	0.94	0.80
Jones Pumping Plant	All	2.58	2.64	1.43	3.84	3.92	2.12	4.23	4.31	2.34	0.91	0.93	0.45
	Drought	3.70	3.83	2.30	5.50	5.70	3.43	6.05	6.27	3.29	1.35	1.40	0.80

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-18. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 7

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
		Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
		EX	NAA-LLT	Alt. 7	EX	NAA-LLT	Alt. 7	EX	NAA-LLT	Alt. 7	EX	NAA-LLT	Alt. 7
Delta Interior													
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.11	1.74	1.75	1.65	1.91	1.93	1.82	0.35	0.35	0.32
	Drought	2.06	2.07	2.00	3.07	3.08	2.97	3.38	3.38	2.85	0.70	0.70	0.68
San Joaquin River at Buckley Cove	All	3.38	3.10	3.17	5.03	4.61	4.71	5.53	5.07	5.18	1.22	1.11	1.14
	Drought	5.21	4.50	4.72	7.75	6.69	7.03	8.53	7.36	6.75	1.95	1.67	1.76
Franks Tract	All	1.61	1.60	2.03	2.40	2.39	3.02	2.64	2.63	3.32	0.52	0.52	0.69
	Drought	2.21	2.24	2.69	3.29	3.33	4.00	3.62	3.66	3.84	0.76	0.77	0.95
Old River at Rock Slough	All	1.75	1.74	2.62	2.60	2.58	3.89	2.86	2.84	4.28	0.58	0.57	0.92
	Drought	2.26	2.30	3.65	3.36	3.43	5.42	3.70	3.77	5.21	0.78	0.80	1.33
Western Delta													
Sacramento River at Emmaton	All	1.41	1.42	1.50	2.10	2.11	2.23	2.31	2.32	2.46	0.44	0.45	0.48
	Drought	2.16	2.15	2.26	3.22	3.20	3.37	3.54	3.52	3.23	0.74	0.74	0.78
SJR at Antioch	All	1.39	1.39	1.63	2.06	2.07	2.43	2.27	2.28	2.67	0.43	0.44	0.53
	Drought	1.96	1.97	2.23	2.91	2.93	3.31	3.20	3.22	3.18	0.66	0.66	0.77
Sacramento River at Mallard Island	All	1.13	1.14	1.28	1.68	1.70	1.90	1.84	1.87	2.09	0.33	0.34	0.39
	Drought	1.52	1.54	1.71	2.26	2.29	2.54	2.49	2.52	2.44	0.49	0.49	0.56
Major Diversions (Pumping Stations)													
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.48	2.08	2.08	2.20	2.29	2.29	2.42	0.44	0.44	0.47
	Drought	2.20	2.20	2.32	3.27	3.28	3.45	3.59	3.60	3.31	0.75	0.76	0.80
Contra Costa Pumping Plant #1	All	1.56	1.59	2.47	2.32	2.37	3.68	2.55	2.61	4.05	0.50	0.52	0.86
	Drought	2.20	2.25	3.63	3.27	3.35	5.40	3.59	3.68	5.19	0.75	0.78	1.32
Banks Pumping Plant	All	2.09	2.07	1.54	3.11	3.08	2.29	3.42	3.39	2.52	0.71	0.71	0.49
	Drought	2.67	2.68	2.30	3.98	3.98	3.41	4.37	4.38	3.28	0.94	0.94	0.79
Jones Pumping Plant	All	2.58	2.64	1.67	3.84	3.92	2.48	4.23	4.31	2.73	0.91	0.93	0.54
	Drought	3.70	3.83	2.46	5.50	5.70	3.67	6.05	6.27	3.52	1.35	1.40	0.86

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-19. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 8

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
		Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
		EX	NAA-LLT	Alt. 8	EX	NAA-LLT	Alt. 8	EX	NAA-LLT	Alt. 8	EX	NAA-LLT	Alt. 8
Delta Interior													
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.11	1.74	1.75	1.66	1.91	1.93	1.82	0.35	0.35	0.33
	Drought	2.06	2.07	2.00	3.07	3.08	2.98	3.38	3.38	2.86	0.70	0.70	0.68
San Joaquin River at Buckley Cove	All	3.38	3.10	3.22	5.03	4.61	4.79	5.53	5.07	5.27	1.22	1.11	1.16
	Drought	5.21	4.50	4.85	7.75	6.69	7.21	8.53	7.36	6.93	1.95	1.67	1.81
Franks Tract	All	1.61	1.60	2.03	2.40	2.39	3.02	2.64	2.63	3.32	0.52	0.52	0.69
	Drought	2.21	2.24	2.69	3.29	3.33	4.01	3.62	3.66	3.85	0.76	0.77	0.95
Old River at Rock Slough	All	1.75	1.74	2.63	2.60	2.58	3.92	2.86	2.84	4.31	0.58	0.57	0.93
	Drought	2.26	2.30	3.66	3.36	3.43	5.44	3.70	3.77	5.23	0.78	0.80	1.33
Western Delta													
Sacramento River at Emmaton	All	1.41	1.42	1.50	2.10	2.11	2.23	2.31	2.32	2.45	0.44	0.45	0.48
	Drought	2.16	2.15	2.26	3.22	3.20	3.36	3.54	3.52	3.23	0.74	0.74	0.78
SJR at Antioch	All	1.39	1.39	1.63	2.06	2.07	2.43	2.27	2.28	2.67	0.43	0.44	0.53
	Drought	1.96	1.97	2.23	2.91	2.93	3.32	3.20	3.22	3.19	0.66	0.66	0.77
Sacramento River at Mallard Island	All	1.13	1.14	1.28	1.68	1.70	1.91	1.84	1.87	2.10	0.33	0.34	0.39
	Drought	1.52	1.54	1.73	2.26	2.29	2.57	2.49	2.52	2.47	0.49	0.49	0.57
Major Diversions (Pumping Stations)													
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.49	2.08	2.08	2.22	2.29	2.29	2.44	0.44	0.44	0.47
	Drought	2.20	2.20	2.33	3.27	3.28	3.47	3.59	3.60	3.33	0.75	0.76	0.81
Contra Costa Pumping Plant #1	All	1.56	1.59	2.49	2.32	2.37	3.70	2.55	2.61	4.07	0.50	0.52	0.87
	Drought	2.20	2.25	3.66	3.27	3.35	5.44	3.59	3.68	5.22	0.75	0.78	1.33
Banks Pumping Plant	All	2.09	2.07	1.60	3.11	3.08	2.37	3.42	3.39	2.61	0.71	0.71	0.52
	Drought	2.67	2.68	2.33	3.98	3.98	3.46	4.37	4.38	3.33	0.94	0.94	0.81
Jones Pumping Plant	All	2.58	2.64	1.67	3.84	3.92	2.49	4.23	4.31	2.74	0.91	0.93	0.55
	Drought	3.70	3.83	2.42	5.50	5.70	3.60	6.05	6.27	3.46	1.35	1.40	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-20. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative Late Long Term, and Alternative 9

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
		Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
		EX	NAA-LLT	Alt. 9	EX	NAA-LLT	Alt. 9	EX	NAA-LLT	Alt. 9	EX	NAA-LLT	Alt. 9
Delta Interior													
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.23	1.74	1.75	1.84	1.91	1.93	2.02	0.35	0.35	0.37
	Drought	2.06	2.07	2.14	3.07	3.08	3.19	3.38	3.38	3.06	0.70	0.70	0.73
San Joaquin River at Buckley Cove	All	3.38	3.10	1.60	5.03	4.61	2.38	5.53	5.07	2.62	1.22	1.11	0.52
	Drought	5.21	4.50	2.06	7.75	6.69	3.06	8.53	7.36	2.94	1.95	1.67	0.70
Franks Tract	All	1.61	1.60	2.58	2.40	2.39	3.84	2.64	2.63	4.22	0.52	0.52	0.91
	Drought	2.21	2.24	3.54	3.29	3.33	5.26	3.62	3.66	5.06	0.76	0.77	1.29
Old River at Rock Slough	All	1.75	1.74	3.13	2.60	2.58	4.66	2.86	2.84	5.12	0.58	0.57	1.13
	Drought	2.26	2.30	4.54	3.36	3.43	6.76	3.70	3.77	6.49	0.78	0.80	1.69
Western Delta													
Sacramento River at Emmaton	All	1.41	1.42	1.47	2.10	2.11	2.18	2.31	2.32	2.40	0.44	0.45	0.46
	Drought	2.16	2.15	2.24	3.22	3.20	3.34	3.54	3.52	3.21	0.74	0.74	0.77
SJR at Antioch	All	1.39	1.39	1.68	2.06	2.07	2.49	2.27	2.28	2.74	0.43	0.44	0.55
	Drought	1.96	1.97	2.33	2.91	2.93	3.47	3.20	3.22	3.33	0.66	0.66	0.81
Sacramento River at Mallard Island	All	1.13	1.14	1.24	1.68	1.70	1.85	1.84	1.87	2.04	0.33	0.34	0.38
	Drought	1.52	1.54	1.67	2.26	2.29	2.49	2.49	2.52	2.39	0.49	0.49	0.55
Major Diversions (Pumping Stations)													
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	1.46	2.08	2.08	2.18	2.29	2.29	2.39	0.44	0.44	0.46
	Drought	2.20	2.20	2.31	3.27	3.28	3.43	3.59	3.60	3.30	0.75	0.76	0.80
Contra Costa Pumping Plant #1	All	1.56	1.59	2.91	2.32	2.37	4.32	2.55	2.61	4.76	0.50	0.52	1.04
	Drought	2.20	2.25	4.31	3.27	3.35	6.41	3.59	3.68	6.16	0.75	0.78	1.59
Banks Pumping Plant	All	2.09	2.07	1.76	3.11	3.08	2.61	3.42	3.39	2.87	0.71	0.71	0.58
	Drought	2.67	2.68	2.32	3.98	3.98	3.46	4.37	4.38	3.32	0.94	0.94	0.80
Jones Pumping Plant	All	2.58	2.64	1.80	3.84	3.92	2.68	4.23	4.31	2.95	0.91	0.93	0.60
	Drought	3.70	3.83	2.32	5.50	5.70	3.46	6.05	6.27	3.32	1.35	1.40	0.80

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-21. Summary Table for Selenium Concentrations in Biota and Comparisons to Benchmarks for Existing Conditions and No Action Alternative Late Long Term.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])								Exceedance Quotients [c]													
		Whole-body Fish		Bird Eggs (Invert Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish				Bird Eggs (Invert Diet)				Bird Eggs (Fish Diet)				Fish Fillets (ww)	
										Level of Concern [d]		Toxicity Level [e]		Level of Concern [f]		Toxicity Level [g]		Level of Concern [f]		Toxicity Level [g]		Advisory Tissue Level [h]	
		EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT
Delta Interior																							
Mokelumne River (South Fork) at Staten Island	All	1.17	1.18	1.74	1.75	1.91	1.93	0.35	0.35	0.29	0.29	0.13	0.13	0.29	0.29	0.17	0.18	0.32	0.32	0.19	0.19	0.14	0.14
	Drought	2.06	2.07	3.07	3.08	3.38	3.38	0.70	0.70	0.52	0.52	0.23	0.23	0.51	0.51	0.31	0.31	0.56	0.56	0.34	0.34	0.28	0.28
San Joaquin River at Buckley Cove	All	3.38	3.10	5.03	4.61	5.53	5.07	1.22	1.11	0.85	0.77	0.38	0.34	0.84	0.77	0.50	0.46	0.92	0.84	0.55	0.51	0.49	0.44
	Drought	5.21	4.50	7.75	6.69	8.53	7.36	1.95	1.67	**1.30**	**1.12**	0.58	0.50	**1.29**	**1.12**	0.78	0.67	**1.42**	**1.23**	0.85	0.74	0.78	0.67
Franks Tract	All	1.61	1.60	2.40	2.39	2.64	2.63	0.52	0.52	0.40	0.40	0.18	0.18	0.40	0.40	0.24	0.24	0.44	0.44	0.26	0.26	0.21	0.21
	Drought	2.21	2.24	3.29	3.33	3.62	3.66	0.76	0.77	0.55	0.56	0.25	0.25	0.55	0.55	0.33	0.33	0.60	0.61	0.36	0.37	0.30	0.31
Old River at Rock Slough	All	1.75	1.74	2.60	2.58	2.86	2.84	0.58	0.57	0.44	0.43	0.19	0.19	0.43	0.43	0.26	0.26	0.48	0.47	0.29	0.28	0.23	0.23
	Drought	2.26	2.30	3.36	3.43	3.70	3.77	0.78	0.80	0.56	0.58	0.25	0.26	0.56	0.57	0.34	0.34	0.62	0.63	0.37	0.38	0.31	0.32
Western Delta																							
Sacramento River at Emmaton	All	1.41	1.42	2.10	2.11	2.31	2.32	0.44	0.45	0.35	0.35	0.16	0.16	0.35	0.35	0.21	0.21	0.38	0.39	0.23	0.23	0.18	0.18
	Drought	2.16	2.15	3.22	3.20	3.54	3.52	0.74	0.74	0.54	0.54	0.24	0.24	0.54	0.53	0.32	0.32	0.59	0.59	0.35	0.35	0.30	0.30
SJR at Antioch	All	1.39	1.39	2.06	2.07	2.27	2.28	0.43	0.44	0.35	0.35	0.15	0.15	0.34	0.35	0.21	0.21	0.38	0.38	0.23	0.23	0.17	0.17
	Drought	1.96	1.97	2.91	2.93	3.20	3.22	0.66	0.66	0.49	0.49	0.22	0.22	0.48	0.49	0.29	0.29	0.53	0.54	0.32	0.32	0.26	0.27
Sacramento River at Mallard Island	All	1.13	1.14	1.68	1.70	1.84	1.87	0.33	0.34	0.28	0.29	0.13	0.13	0.28	0.28	0.17	0.17	0.31	0.31	0.18	0.19	0.13	0.13
	Drought	1.52	1.54	2.26	2.29	2.49	2.52	0.49	0.49	0.38	0.38	0.17	0.17	0.38	0.38	0.23	0.23	0.41	0.42	0.25	0.25	0.19	0.20
Major Diversions (Pumping Stations)																							
North Bay Aqueduct at Barker Slough PP	All	1.40	1.40	2.08	2.08	2.29	2.29	0.44	0.44	0.35	0.35	0.16	0.16	0.35	0.35	0.21	0.21	0.38	0.38	0.23	0.23	0.18	0.18
	Drought	2.20	2.20	3.27	3.28	3.59	3.60	0.75	0.76	0.55	0.55	0.24	0.24	0.54	0.55	0.33	0.33	0.60	0.60	0.36	0.36	0.30	0.30
Contra Costa Pumping Plant #1	All	1.56	1.59	2.32	2.37	2.55	2.61	0.50	0.52	0.39	0.40	0.17	0.18	0.39	0.40	0.23	0.24	0.43	0.43	0.26	0.26	0.20	0.21
	Drought	2.20	2.25	3.27	3.35	3.59	3.68	0.75	0.78	0.55	0.56	0.24	0.25	0.54	0.56	0.33	0.33	0.60	0.61	0.36	0.37	0.30	0.31
Banks Pumping Plant	All	2.09	2.07	3.11	3.08	3.42	3.39	0.71	0.71	0.52	0.52	0.23	0.23	0.52	0.51	0.31	0.31	0.57	0.57	0.34	0.34	0.28	0.28
	Drought	2.67	2.68	3.98	3.98	4.37	4.38	0.94	0.94	0.67	0.67	0.30	0.30	0.66	0.66	0.40	0.40	0.73	0.73	0.44	0.44	0.38	0.38
Jones Pumping Plant	All	2.58	2.64	3.84	3.92	4.23	4.31	0.91	0.93	0.65	0.66	0.29	0.29	0.64	0.65	0.38	0.39	0.70	0.72	0.42	0.43	0.36	0.37
	Drought	3.70	3.83	5.50	5.70	6.05	6.27	1.35	1.40	0.92	0.96	0.41	0.43	0.92	0.95	0.55	0.57	**1.01**	**1.04**	0.61	0.63	0.54	0.56

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

d Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

e Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

f Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

g Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

h Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-22. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 1.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 1	Alt. 1	Alt. 1	Alt. 1	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Delta Interior																				
Mokelumne River (South Fork) at Staten Island	All	1.12	1.67	1.83	0.33	-4	-5	-4	-5	-4	-5	-5	-6	0.28	0.12	0.28	0.17	0.31	0.18	0.13
	Drought	2.01	2.99	2.88	0.68	-3	-3	-3	-3	-15	-15	-3	-3	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.13	4.66	5.12	1.12	-7	1	-7	1	-7	1	-8	1	0.78	0.35	0.78	0.47	0.85	0.51	0.45
	Drought	4.64	6.91	6.63	1.72	-11	3	-11	3	-22	-10	-12	3	**1.16**	0.52	**1.15**	0.69	**1.11**	0.66	0.69
Franks Tract	All	1.73	2.57	2.82	0.57	7	8	7	8	7	8	8	9	0.43	0.19	0.43	0.26	0.47	0.28	0.23
	Drought	2.21	3.29	3.16	0.76	0	-1	0	-1	-13	-14	0	-1	0.55	0.25	0.55	0.33	0.53	0.32	0.30
Old River at Rock Slough	All	1.84	2.74	3.02	0.61	6	6	6	6	6	6	7	7	0.46	0.20	0.46	0.27	0.50	0.30	0.25
	Drought	2.25	3.35	3.22	0.78	0	-2	0	-2	-13	-15	0	-2	0.56	0.25	0.56	0.34	0.54	0.32	0.31
Western Delta																				
Sacramento River at Emmaton	All	1.43	2.13	2.34	0.45	1	1	1	1	1	1	2	1	0.36	0.16	0.35	0.21	0.39	0.23	0.18
	Drought	2.16	3.22	3.09	0.74	0	0	0	0	-13	-12	0	0	0.54	0.24	0.54	0.32	0.51	0.31	0.30
SJR at Antioch	All	1.46	2.17	2.39	0.46	5	5	5	5	5	5	7	6	0.37	0.16	0.36	0.22	0.40	0.24	0.19
	Drought	1.97	2.94	2.82	0.67	1	0	1	0	-12	-12	1	0	0.49	0.22	0.49	0.29	0.47	0.28	0.27
Sacramento River at Mallard Island	All	1.15	1.71	1.88	0.34	2	1	2	1	2	1	3	1	0.29	0.13	0.28	0.17	0.31	0.19	0.14
	Drought	1.52	2.27	2.18	0.49	0	-1	0	-1	-13	-14	0	-1	0.38	0.17	0.38	0.23	0.36	0.22	0.20
Major Diversions (Pumping Stations)																				
North Bay Aqueduct at Barker Slough PP	All	1.47	2.19	2.41	0.47	5	5	5	5	5	5	7	7	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.31	3.44	3.30	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	1.69	2.52	2.77	0.55	8	6	8	6	8	6	10	8	0.42	0.19	0.42	0.25	0.46	0.28	0.22
	Drought	2.20	3.28	3.15	0.76	0	-2	0	-2	-12	-14	0	-2	0.55	0.24	0.55	0.33	0.52	0.31	0.30
Banks Pumping Plant	All	1.71	2.54	2.80	0.56	-18	-17	-18	-17	-18	-17	-21	-20	0.43	0.19	0.42	0.25	0.47	0.28	0.22
	Drought	2.65	3.94	3.78	0.93	-1	-1	-1	-1	-14	-14	-1	-1	0.66	0.29	0.66	0.39	0.63	0.38	0.37
Jones Pumping Plant	All	2.19	3.26	3.59	0.75	-15	-17	-15	-17	-15	-17	-17	-19	0.55	0.24	0.54	0.33	0.60	0.36	0.30
	Drought	3.60	5.36	5.15	1.31	-3	-6	-3	-6	-15	-18	-3	-6	0.90	0.40	0.89	0.54	0.86	0.51	0.53

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

d Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-23. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 2.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 2	Alt. 2	Alt. 2	Alt. 2	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior																				
Mokelumne River (South Fork) at Staten Island	All	1.11	1.66	1.82	0.32	-5	-5	-5	-5	-5	-5	-6	-7	0.28	0.12	0.28	0.17	0.30	0.18	0.13
	Drought	2.00	2.98	2.86	0.68	-3	-3	-3	-3	-15	-15	-3	-4	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.32	4.94	5.44	1.20	-2	7	-2	7	-2	7	-2	8	0.83	0.37	0.82	0.49	0.91	0.54	0.48
	Drought	5.13	7.63	7.33	1.92	-2	14	-2	14	-14	0	-2	15	**1.28**	0.57	**1.27**	0.76	**1.22**	0.73	0.77
Franks Tract	All	1.84	2.74	3.01	0.61	14	15	14	15	14	15	17	18	0.46	0.20	0.46	0.27	0.50	0.30	0.25
	Drought	2.35	3.50	3.36	0.82	6	5	6	5	-7	-8	7	6	0.59	0.26	0.58	0.35	0.56	0.34	0.33
Old River at Rock Slough	All	2.00	2.97	3.26	0.67	14	15	14	15	14	15	17	18	0.50	0.22	0.49	0.30	0.54	0.33	0.27
	Drought	2.46	3.66	3.51	0.86	9	7	9	7	-5	-7	10	8	0.61	0.27	0.61	0.37	0.59	0.35	0.34
Western Delta																				
Sacramento River at Emmaton	All	1.46	2.18	2.39	0.46	4	3	4	3	4	3	5	4	0.37	0.16	0.36	0.22	0.40	0.24	0.19
	Drought	2.19	3.26	3.13	0.75	1	2	1	2	-11	-11	2	2	0.55	0.24	0.54	0.33	0.52	0.31	0.30
SJR at Antioch	All	1.53	2.28	2.51	0.49	11	10	11	10	11	10	13	13	0.38	0.17	0.38	0.23	0.42	0.25	0.20
	Drought	2.04	3.03	2.91	0.69	4	4	4	4	-9	-9	5	4	0.51	0.23	0.51	0.30	0.49	0.29	0.28
Sacramento River at Mallard Island	All	1.20	1.79	1.97	0.36	7	6	7	6	7	6	9	8	0.30	0.13	0.30	0.18	0.33	0.20	0.14
	Drought	1.57	2.34	2.24	0.51	3	2	3	2	-10	-11	4	2	0.39	0.17	0.39	0.23	0.37	0.22	0.20
Major Diversions (Pumping Stations)																				
North Bay Aqueduct at Barker Slough PP	All	1.47	2.19	2.41	0.47	6	6	6	6	6	6	7	7	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.32	3.45	3.31	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	1.85	2.75	3.03	0.62	19	16	19	16	19	16	23	20	0.46	0.21	0.46	0.28	0.51	0.30	0.25
	Drought	2.41	3.59	3.44	0.84	10	7	10	7	-4	-7	11	8	0.60	0.27	0.60	0.36	0.57	0.34	0.34
Banks Pumping Plant	All	1.72	2.56	2.82	0.57	-18	-17	-18	-17	-18	-17	-20	-20	0.43	0.19	0.43	0.26	0.47	0.28	0.23
	Drought	2.69	4.00	3.84	0.95	0	0	0	0	-12	-12	1	0	0.67	0.30	0.67	0.40	0.64	0.38	0.38
Jones Pumping Plant	All	2.01	2.98	3.28	0.68	-22	-24	-22	-24	-22	-24	-25	-27	0.50	0.22	0.50	0.30	0.55	0.33	0.27
	Drought	3.25	4.84	4.65	1.17	-12	-15	-12	-15	-23	-26	-13	-16	0.81	0.36	0.81	0.48	0.77	0.46	0.47

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

d Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA-LLT - No Action Alternative Late Long Term
ww - wet weight

Table M-24. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 3.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 3	Alt. 3	Alt. 3	Alt. 3	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Delta Interior																				
Mokelumne River (South Fork) at Staten Island	All	1.13	1.68	1.85	0.33	-3	-4	-3	-4	-3	-4	-4	-5	0.28	0.13	0.28	0.17	0.31	0.19	0.13
	Drought	2.01	3.00	2.88	0.68	-2	-3	-2	-3	-15	-15	-3	-3	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.12	4.64	5.10	1.12	-8	1	-8	1	-8	1	-9	1	0.78	0.35	0.77	0.46	0.85	0.51	0.45
	Drought	4.60	6.84	6.57	1.71	-12	2	-12	2	-23	-11	-12	2	**1.15**	0.51	**1.14**	0.68	**1.10**	0.66	0.68
Franks Tract	All	1.66	2.47	2.72	0.54	3	3	3	3	3	3	3	4	0.42	0.18	0.41	0.25	0.45	0.27	0.22
	Drought	2.21	3.29	3.16	0.76	0	-1	0	-1	-13	-14	0	-1	0.55	0.25	0.55	0.33	0.53	0.32	0.30
Old River at Rock Slough	All	1.76	2.62	2.88	0.58	1	2	1	2	1	2	1	2	0.44	0.20	0.44	0.26	0.48	0.29	0.23
	Drought	2.27	3.37	3.24	0.78	0	-2	0	-2	-12	-14	0	-2	0.57	0.25	0.56	0.34	0.54	0.32	0.31
Western Delta																				
Sacramento River at Emmaton	All	1.42	2.11	2.32	0.45	1	0	1	0	1	0	1	0	0.35	0.16	0.35	0.21	0.39	0.23	0.18
	Drought	2.17	3.22	3.10	0.74	0	1	0	1	-13	-12	0	1	0.54	0.24	0.54	0.32	0.52	0.31	0.30
SJR at Antioch	All	1.42	2.12	2.33	0.45	3	2	3	2	3	2	3	3	0.36	0.16	0.35	0.21	0.39	0.23	0.18
	Drought	1.98	2.94	2.83	0.67	1	1	1	1	-12	-12	1	1	0.49	0.22	0.49	0.29	0.47	0.28	0.27
Sacramento River at Mallard Island	All	1.13	1.68	1.84	0.33	0	-1	0	-1	0	-1	0	-2	0.28	0.13	0.28	0.17	0.31	0.18	0.13
	Drought	1.53	2.28	2.19	0.49	1	0	1	0	-12	-13	1	0	0.38	0.17	0.38	0.23	0.37	0.22	0.20
Major Diversions (Pumping Stations)																				
North Bay Aqueduct at Barker Slough PP	All	1.47	2.19	2.41	0.47	5	5	5	5	5	5	7	7	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.31	3.44	3.30	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	1.62	2.40	2.64	0.52	3	1	3	1	3	1	4	2	0.40	0.18	0.40	0.24	0.44	0.26	0.21
	Drought	2.21	3.29	3.16	0.76	1	-2	1	-2	-12	-14	1	-2	0.55	0.25	0.55	0.33	0.53	0.32	0.30
Banks Pumping Plant	All	1.84	2.74	3.02	0.62	-12	-11	-12	-11	-12	-11	-14	-13	0.46	0.20	0.46	0.27	0.50	0.30	0.25
	Drought	2.67	3.97	3.81	0.94	0	0	0	0	-13	-13	0	0	0.67	0.30	0.66	0.40	0.63	0.38	0.38
Jones Pumping Plant	All	2.33	3.47	3.81	0.81	-10	-12	-10	-12	-10	-12	-11	-13	0.58	0.26	0.58	0.35	0.64	0.38	0.32
	Drought	3.51	5.22	5.02	1.28	-5	-8	-5	-8	-17	-20	-5	-9	0.88	0.39	0.87	0.52	0.84	0.50	0.51

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

d Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA-LLT - No Action Alternative Late Long Term
ww - wet weight

Table M-25A. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 4H1

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 4H1	Alt. 4H1	Alt. 4H1	Alt. 4H1	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Mokelumne River (South Fork) at Staten Island	All	1.12	1.66	1.83	0.33	-4	-5	-4	-5	-4	-5	-6	-7	0.28	0.12	0.28	0.17	0.30	0.18	0.13
	Drought	2.01	2.99	2.87	0.68	-3	-3	-3	-3	-15	-15	-3	-3	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.32	4.93	5.43	1.20	-2	7	-2	7	-2	7	-2	8	0.83	0.37	0.82	0.49	0.90	0.54	0.48
	Drought	5.12	7.62	7.32	1.92	-2	14	-2	14	-14	-1	-2	15	**1.28**	0.57	**1.27**	0.76	**1.22**	0.73	0.77
Franks Tract	All	1.77	2.64	2.90	0.59	10	11	10	11	10	11	12	13	0.44	0.20	0.44	0.26	0.48	0.29	0.23
	Drought	2.30	3.42	3.28	0.79	4	3	4	3	-9	-10	4	3	0.57	0.26	0.57	0.34	0.55	0.33	0.32
Old River at Rock Slough	All	1.89	2.81	3.09	0.63	8	9	8	9	8	9	10	11	0.47	0.21	0.47	0.28	0.52	0.31	0.25
	Drought	2.38	3.55	3.41	0.83	6	3	6	3	-8	-10	6	4	0.60	0.26	0.59	0.35	0.57	0.34	0.33
Sacramento River at Emmaton	All	1.45	2.15	2.37	0.46	3	2	3	2	3	2	3	3	0.36	0.16	0.36	0.22	0.39	0.24	0.18
	Drought	2.18	3.24	3.11	0.75	1	1	1	1	-12	-12	1	1	0.54	0.24	0.54	0.32	0.52	0.31	0.30
SJR at Antioch	All	1.49	2.21	2.43	0.47	7	7	7	7	7	7	9	9	0.37	0.17	0.37	0.22	0.41	0.24	0.19
	Drought	2.00	2.98	2.86	0.68	2	2	2	2	-11	-11	3	2	0.50	0.22	0.50	0.30	0.48	0.29	0.27
Sacramento River at Mallard Island	All	1.17	1.74	1.91	0.35	4	3	4	3	4	3	5	3	0.29	0.13	0.29	0.17	0.32	0.19	0.14
	Drought	1.54	2.29	2.20	0.49	1	0	1	0	-12	-13	2	0	0.39	0.17	0.38	0.23	0.37	0.22	0.20
North Bay Aqueduct at Barker Slough PP	All	1.47	2.19	2.41	0.47	6	6	6	6	6	6	7	7	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.31	3.44	3.31	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	1.75	2.61	2.87	0.58	12	10	12	10	12	10	15	12	0.44	0.19	0.43	0.26	0.48	0.29	0.23
	Drought	2.32	3.46	3.32	0.81	6	3	6	3	-8	-10	7	4	0.58	0.26	0.58	0.35	0.55	0.33	0.32
Banks Pumping Plant	All	1.76	2.61	2.87	0.58	-16	-15	-16	-15	-16	-15	-19	-18	0.44	0.20	0.44	0.26	0.48	0.29	0.23
	Drought	2.67	3.98	3.82	0.94	0	0	0	0	-13	-13	0	0	0.67	0.30	0.66	0.40	0.64	0.38	0.38
Jones Pumping Plant	All	2.12	3.15	3.47	0.72	-18	-20	-18	-20	-18	-20	-20	-22	0.53	0.24	0.53	0.32	0.58	0.35	0.29
	Drought	3.37	5.01	4.81	1.22	-9	-12	-9	-12	-21	-23	-10	-13	0.84	0.37	0.83	0.50	0.80	0.48	0.49

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

b Dry weight, except as noted for fish fillets

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative.

d Exceedance Quotient = tissue concentration/benchmark

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative
ww - wet weight

Table M-25B. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 4H2

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 4H2	Alt. 4H2	Alt. 4H2	Alt. 4H2	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Mokelumne River (South Fork) at Staten Island	All	1.12	1.66	1.83	0.33	-4	-5	-4	-5	-4	-5	-6	-7	0.28	0.12	0.28	0.17	0.30	0.18	0.13
	Drought	2.01	2.98	2.87	0.68	-3	-3	-3	-3	-15	-15	-3	-4	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.33	4.95	5.44	1.20	-2	7	-2	7	-2	7	-2	8	0.83	0.37	0.82	0.49	0.91	0.54	0.48
	Drought	5.13	7.63	7.33	1.92	-2	14	-2	14	-14	0	-2	15	**1.28**	0.57	**1.27**	0.76	**1.22**	0.73	0.77
Franks Tract	All	1.79	2.67	2.93	0.59	11	12	11	12	11	12	13	14	0.45	0.20	0.44	0.27	0.49	0.29	0.24
	Drought	2.32	3.45	3.31	0.80	5	4	5	4	-8	-9	6	4	0.58	0.26	0.58	0.35	0.55	0.33	0.32
Old River at Rock Slough	All	1.92	2.85	3.14	0.64	10	10	10	10	10	10	12	13	0.48	0.21	0.48	0.29	0.52	0.31	0.26
	Drought	2.41	3.59	3.45	0.84	7	5	7	5	-7	-9	8	5	0.60	0.27	0.60	0.36	0.57	0.34	0.34
Sacramento River at Emmaton	All	1.44	2.15	2.36	0.46	3	2	3	2	3	2	3	3	0.36	0.16	0.36	0.21	0.39	0.24	0.18
	Drought	2.18	3.24	3.11	0.75	1	1	1	1	-12	-12	1	1	0.54	0.24	0.54	0.32	0.52	0.31	0.30
SJR at Antioch	All	1.50	2.22	2.45	0.48	8	7	8	7	8	7	10	9	0.37	0.17	0.37	0.22	0.41	0.24	0.19
	Drought	2.01	2.99	2.88	0.68	3	2	3	2	-10	-11	3	3	0.50	0.22	0.50	0.30	0.48	0.29	0.27
Sacramento River at Mallard Island	All	1.17	1.74	1.92	0.35	4	3	4	3	4	3	6	4	0.29	0.13	0.29	0.17	0.32	0.19	0.14
	Drought	1.55	2.30	2.21	0.50	2	0	2	0	-11	-12	2	1	0.39	0.17	0.38	0.23	0.37	0.22	0.20
North Bay Aqueduct at Barker Slough PP	All	1.48	2.19	2.41	0.47	6	6	6	6	6	6	7	7	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.31	3.44	3.30	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	1.77	2.64	2.90	0.59	13	11	13	11	13	11	17	14	0.44	0.20	0.44	0.26	0.48	0.29	0.23
	Drought	2.36	3.51	3.37	0.82	7	5	7	5	-6	-8	9	6	0.59	0.26	0.58	0.35	0.56	0.34	0.33
Banks Pumping Plant	All	1.79	2.66	2.93	0.59	-14	-14	-14	-14	-14	-14	-17	-16	0.45	0.20	0.44	0.27	0.49	0.29	0.24
	Drought	2.64	3.93	3.78	0.93	-1	-1	-1	-1	-14	-14	-1	-1	0.66	0.29	0.66	0.39	0.63	0.38	0.37
Jones Pumping Plant	All	2.07	3.08	3.39	0.71	-20	-21	-20	-21	-20	-21	-22	-24	0.52	0.23	0.51	0.31	0.57	0.34	0.28
	Drought	3.27	4.86	4.67	1.18	-12	-15	-12	-15	-23	-26	-13	-16	0.82	0.36	0.81	0.49	0.78	0.47	0.47

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

b Dry weight, except as noted for fish fillets

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative.

d Exceedance Quotient = tissue concentration/benchmark

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative
ww - wet weight

Table M-25C. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 4 H3

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 4H3	Alt. 4H3	Alt. 4H3	Alt. 4H3	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Mokelumne River (South Fork) at Staten Island	All	1.12	1.66	1.83	0.33	-4	-5	-4	-5	-4	-5	-6	-7	0.28	0.12	0.28	0.17	0.30	0.18	0.13
	Drought	2.01	2.99	2.87	0.68	-3	-3	-3	-3	-15	-15	-3	-3	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.32	4.95	5.44	1.20	-2	7	-2	7	-2	7	-2	8	0.83	0.37	0.82	0.49	0.91	0.54	0.48
	Drought	5.13	7.64	7.34	1.92	-1	14	-1	14	-14	0	-2	15	**1.28**	0.57	**1.27**	0.76	**1.22**	0.73	0.77
Franks Tract	All	1.82	2.70	2.97	0.60	12	13	12	13	12	13	15	16	0.45	0.20	0.45	0.27	0.50	0.30	0.24
	Drought	2.35	3.50	3.36	0.82	6	5	6	5	-7	-8	7	6	0.59	0.26	0.58	0.35	0.56	0.34	0.33
Old River at Rock Slough	All	1.96	2.92	3.21	0.66	12	13	12	13	12	13	15	16	0.49	0.22	0.49	0.29	0.54	0.32	0.26
	Drought	2.46	3.66	3.52	0.86	9	7	9	7	-5	-7	10	8	0.62	0.27	0.61	0.37	0.59	0.35	0.34
Sacramento River at Emmaton	All	1.46	2.17	2.39	0.46	4	3	4	3	4	3	4	4	0.36	0.16	0.36	0.22	0.40	0.24	0.18
	Drought	2.19	3.26	3.13	0.75	1	2	1	2	-11	-11	2	2	0.55	0.24	0.54	0.33	0.52	0.31	0.30
SJR at Antioch	All	1.52	2.26	2.49	0.49	10	9	10	9	10	9	12	12	0.38	0.17	0.38	0.23	0.41	0.25	0.19
	Drought	2.04	3.04	2.92	0.69	4	4	4	4	-9	-9	5	4	0.51	0.23	0.51	0.30	0.49	0.29	0.28
Sacramento River at Mallard Island	All	1.20	1.78	1.96	0.36	6	5	6	5	6	5	8	7	0.30	0.13	0.30	0.18	0.33	0.20	0.14
	Drought	1.57	2.34	2.24	0.51	3	2	3	2	-10	-11	4	3	0.39	0.17	0.39	0.23	0.37	0.22	0.20
North Bay Aqueduct at Barker Slough PP	All	1.48	2.19	2.41	0.47	6	6	6	6	6	6	7	7	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.32	3.45	3.31	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	1.84	2.73	3.00	0.61	18	15	18	15	18	15	22	19	0.46	0.20	0.46	0.27	0.50	0.30	0.24
	Drought	2.41	3.59	3.44	0.84	10	7	10	7	-4	-7	11	8	0.60	0.27	0.60	0.36	0.57	0.34	0.34
Banks Pumping Plant	All	1.77	2.63	2.89	0.58	-15	-15	-15	-15	-15	-15	-18	-17	0.44	0.20	0.44	0.26	0.48	0.29	0.23
	Drought	2.67	3.97	3.81	0.94	0	0	0	0	-13	-13	0	0	0.67	0.30	0.66	0.40	0.64	0.38	0.38
Jones Pumping Plant	All	2.09	3.11	3.42	0.71	-19	-21	-19	-21	-19	-21	-22	-23	0.52	0.23	0.52	0.31	0.57	0.34	0.28
	Drought	3.33	4.95	4.75	1.20	-10	-13	-10	-13	-21	-24	-11	-14	0.83	0.37	0.82	0.49	0.79	0.48	0.48

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

b Dry weight, except as noted for fish fillets

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative.

d Exceedance Quotient = tissue concentration/benchmark

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative
ww - wet weight

Table M-25D. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 4 H4

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 4H4	Alt. 4H4	Alt. 4H4	Alt. 4H4	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Mokelumne River (South Fork) at Staten Island	All	1.12	1.66	1.83	0.33	-4	-5	-4	-5	-4	-5	-6	-7	0.28	0.12	0.28	0.17	0.30	0.18	0.13
	Drought	2.01	2.98	2.87	0.68	-3	-3	-3	-3	-15	-15	-3	-3	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.33	4.95	5.45	1.20	-2	7	-2	7	-2	7	-2	8	0.83	0.37	0.83	0.50	0.91	0.54	0.48
	Drought	5.14	7.64	7.34	1.92	-1	14	-1	14	-14	0	-1	15	**1.28**	0.57	**1.27**	0.76	**1.22**	0.73	0.77
Franks Tract	All	1.84	2.74	3.01	0.61	14	15	14	15	14	15	17	18	0.46	0.20	0.46	0.27	0.50	0.30	0.25
	Drought	2.38	3.54	3.40	0.83	7	6	7	6	-6	-7	9	7	0.59	0.26	0.59	0.35	0.57	0.34	0.33
Old River at Rock Slough	All	2.00	2.98	3.28	0.68	15	15	15	15	15	15	18	19	0.50	0.22	0.50	0.30	0.55	0.33	0.27
	Drought	2.50	3.72	3.57	0.88	11	8	11	8	-3	-5	12	10	0.63	0.28	0.62	0.37	0.60	0.36	0.35
Sacramento River at Emmaton	All	1.46	2.17	2.39	0.46	4	3	4	3	4	3	5	4	0.37	0.16	0.36	0.22	0.40	0.24	0.19
	Drought	2.20	3.27	3.14	0.76	2	2	2	2	-11	-11	2	2	0.55	0.24	0.54	0.33	0.52	0.31	0.30
SJR at Antioch	All	1.53	2.27	2.50	0.49	10	10	10	10	10	10	13	12	0.38	0.17	0.38	0.23	0.42	0.25	0.20
	Drought	2.05	3.05	2.93	0.70	5	4	5	4	-8	-9	6	5	0.51	0.23	0.51	0.30	0.49	0.29	0.28
Sacramento River at Mallard Island	All	1.20	1.79	1.97	0.36	7	5	7	5	7	5	9	7	0.30	0.13	0.30	0.18	0.33	0.20	0.14
	Drought	1.57	2.34	2.25	0.51	3	2	3	2	-10	-11	4	3	0.39	0.17	0.39	0.23	0.37	0.22	0.20
North Bay Aqueduct at Barker Slough PP	All	1.47	2.19	2.41	0.47	6	6	6	6	6	6	7	7	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.32	3.44	3.31	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	1.86	2.77	3.05	0.62	19	17	19	17	19	17	24	21	0.47	0.21	0.46	0.28	0.51	0.30	0.25
	Drought	2.45	3.64	3.50	0.86	12	9	12	9	-3	-5	13	10	0.61	0.27	0.61	0.36	0.58	0.35	0.34
Banks Pumping Plant	All	1.79	2.66	2.92	0.59	-14	-14	-14	-14	-14	-14	-17	-16	0.45	0.20	0.44	0.27	0.49	0.29	0.24
	Drought	2.65	3.94	3.78	0.93	-1	-1	-1	-1	-14	-14	-1	-1	0.66	0.29	0.66	0.39	0.63	0.38	0.37
Jones Pumping Plant	All	2.05	3.05	3.36	0.70	-21	-22	-21	-22	-21	-22	-23	-25	0.51	0.23	0.51	0.31	0.56	0.34	0.28
	Drought	3.21	4.77	4.58	1.16	-13	-16	-13	-16	-24	-27	-14	-18	0.80	0.36	0.79	0.48	0.76	0.46	0.46

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

b Dry weight, except as noted for fish fillets

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative.

d Exceedance Quotient = tissue concentration/benchmark

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative
ww - wet weight

Table M-26. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 5.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 5	Alt. 5	Alt. 5	Alt. 5	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Delta Interior																				
Mokelumne River (South Fork) at Staten Island	All	1.14	1.70	1.87	0.34	-2	-3	-2	-3	-2	-3	-3	-4	0.29	0.13	0.28	0.17	0.31	0.19	0.13
	Drought	2.01	3.00	2.88	0.68	-2	-3	-2	-3	-15	-15	-3	-3	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.24	4.82	5.31	1.17	-4	5	-4	5	-4	5	-5	5	0.81	0.36	0.80	0.48	0.88	0.53	0.47
	Drought	4.93	7.33	7.04	1.84	-5	10	-5	10	-17	-4	-6	10	**1.23**	0.55	**1.22**	0.73	**1.17**	0.70	0.73
Franks Tract	All	1.68	2.50	2.75	0.55	4	5	4	5	4	5	5	6	0.42	0.19	0.42	0.25	0.46	0.28	0.22
	Drought	2.27	3.38	3.24	0.78	3	1	3	1	-10	-11	3	2	0.57	0.25	0.56	0.34	0.54	0.32	0.31
Old River at Rock Slough	All	1.81	2.69	2.96	0.60	4	4	4	4	4	4	4	5	0.45	0.20	0.45	0.27	0.49	0.30	0.24
	Drought	2.33	3.47	3.33	0.81	3	1	3	1	-10	-12	4	1	0.58	0.26	0.58	0.35	0.56	0.33	0.32
Western Delta																				
Sacramento River at Emmaton	All	1.43	2.13	2.34	0.45	1	1	1	1	1	1	2	1	0.36	0.16	0.35	0.21	0.39	0.23	0.18
	Drought	2.18	3.24	3.11	0.75	1	1	1	1	-12	-12	1	1	0.54	0.24	0.54	0.32	0.52	0.31	0.30
SJR at Antioch	All	1.44	2.14	2.35	0.45	4	3	4	3	4	3	5	4	0.36	0.16	0.36	0.21	0.39	0.24	0.18
	Drought	2.01	2.98	2.87	0.68	3	2	3	2	-10	-11	3	2	0.50	0.22	0.50	0.30	0.48	0.29	0.27
Sacramento River at Mallard Island	All	1.15	1.71	1.88	0.34	2	1	2	1	2	1	2	1	0.29	0.13	0.28	0.17	0.31	0.19	0.14
	Drought	1.55	2.31	2.22	0.50	2	1	2	1	-11	-12	2	1	0.39	0.17	0.38	0.23	0.37	0.22	0.20
Major Diversions (Pumping Stations)																				
North Bay Aqueduct at Barker Slough PP	All	1.47	2.19	2.41	0.47	5	5	5	5	5	5	7	7	0.37	0.16	0.36	0.22	0.40	0.24	0.19
	Drought	2.31	3.44	3.30	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	1.66	2.48	2.72	0.54	7	4	7	4	7	4	8	5	0.42	0.18	0.41	0.25	0.45	0.27	0.22
	Drought	2.26	3.37	3.23	0.78	3	1	3	1	-10	-12	4	1	0.57	0.25	0.56	0.34	0.54	0.32	0.31
Banks Pumping Plant	All	1.92	2.86	3.14	0.65	-8	-7	-8	-7	-8	-7	-9	-9	0.48	0.21	0.48	0.29	0.52	0.31	0.26
	Drought	2.68	3.99	3.83	0.95	0	0	0	0	-12	-13	0	0	0.67	0.30	0.66	0.40	0.64	0.38	0.38
Jones Pumping Plant	All	2.37	3.53	3.88	0.82	-8	-10	-8	-10	-8	-10	-9	-11	0.59	0.26	0.59	0.35	0.65	0.39	0.33
	Drought	3.51	5.23	5.02	1.28	-5	-8	-5	-8	-17	-20	-5	-9	0.88	0.39	0.87	0.52	0.84	0.50	0.51

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

d Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA-LLT - No Action Alternative Late Long Term
ww - wet weight

Table M-27. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 6.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 6	Alt. 6	Alt. 6	Alt. 6	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Delta Interior																				
Mokelumne River (South Fork) at Staten Island	All	1.09	1.62	1.78	0.31	-7	-8	-7	-8	-7	-8	-9	-10	0.27	0.12	0.27	0.16	0.30	0.18	0.13
	Drought	1.97	2.94	2.82	0.67	-4	-5	-4	-5	-17	-17	-5	-5	0.49	0.22	0.49	0.29	0.47	0.28	0.27
San Joaquin River at Buckley Cove	All	3.29	4.90	5.39	1.19	-3	6	-3	6	-3	6	-3	7	0.82	0.37	0.82	0.49	0.90	0.54	0.48
	Drought	5.05	7.52	7.22	1.89	-3	12	-3	12	-15	-2	-3	13	**1.26**	0.56	**1.25**	0.75	**1.20**	0.72	0.75
Franks Tract	All	2.16	3.21	3.53	0.74	34	34	34	34	34	34	41	42	0.54	0.24	0.53	0.32	0.59	0.35	0.30
	Drought	2.77	4.11	3.95	0.98	25	24	25	24	9	8	29	27	0.69	0.31	0.69	0.41	0.66	0.40	0.39
Old River at Rock Slough	All	2.82	4.20	4.62	1.00	62	63	62	63	62	63	74	75	0.71	0.31	0.70	0.42	0.77	0.46	0.40
	Drought	3.82	5.68	5.46	1.40	69	66	69	66	48	45	79	75	0.96	0.42	0.95	0.57	0.91	0.55	0.56
Western Delta																				
Sacramento River at Emmaton	All	1.54	2.28	2.51	0.49	9	8	9	8	9	8	11	11	0.38	0.17	0.38	0.23	0.42	0.25	0.20
	Drought	2.28	3.39	3.25	0.79	5	6	5	6	-8	-8	6	7	0.57	0.25	0.56	0.34	0.54	0.33	0.31
SJR at Antioch	All	1.72	2.55	2.81	0.56	24	23	24	23	24	23	30	29	0.43	0.19	0.43	0.26	0.47	0.28	0.23
	Drought	2.27	3.38	3.25	0.78	16	15	16	15	1	1	19	18	0.57	0.25	0.56	0.34	0.54	0.32	0.31
Sacramento River at Mallard Island	All	1.33	1.97	2.17	0.41	18	16	18	16	18	16	24	22	0.33	0.15	0.33	0.20	0.36	0.22	0.16
	Drought	1.72	2.56	2.46	0.57	13	12	13	12	-1	-2	16	15	0.43	0.19	0.43	0.26	0.41	0.25	0.23
Major Diversions (Pumping Stations)																				
North Bay Aqueduct at Barker Slough PP	All	1.48	2.20	2.42	0.47	6	6	6	6	6	6	8	8	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.32	3.45	3.32	0.80	6	5	6	5	-8	-8	7	6	0.58	0.26	0.58	0.35	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	2.72	4.05	4.45	0.96	74	71	74	71	74	71	91	87	0.68	0.30	0.67	0.40	0.74	0.44	0.38
	Drought	3.89	5.79	5.57	1.43	77	73	77	73	55	51	89	84	0.97	0.43	0.97	0.58	0.93	0.56	0.57
Banks Pumping Plant	All	1.43	2.12	2.34	0.45	-32	-31	-32	-31	-32	-31	-37	-36	0.36	0.16	0.35	0.21	0.39	0.23	0.18
	Drought	2.30	3.43	3.29	0.80	-14	-14	-14	-14	-25	-25	-15	-16	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Jones Pumping Plant	All	1.43	2.12	2.34	0.45	-45	-46	-45	-46	-45	-46	-50	-52	0.36	0.16	0.35	0.21	0.39	0.23	0.18
	Drought	2.30	3.43	3.29	0.80	-38	-40	-38	-40	-46	-47	-41	-43	0.58	0.26	0.57	0.34	0.55	0.33	0.32

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

d Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-28. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 7.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 7	Alt. 7	Alt. 7	Alt. 7	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Delta Interior																				
Mokelumne River (South Fork) at Staten Island	All	1.11	1.65	1.82	0.32	-5	-6	-5	-6	-5	-6	-6	-7	0.28	0.12	0.28	0.17	0.30	0.18	0.13
	Drought	2.00	2.97	2.85	0.68	-3	-3	-3	-3	-16	-16	-4	-4	0.50	0.22	0.49	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.17	4.71	5.18	1.14	-6	2	-6	2	-6	2	-7	2	0.79	0.35	0.79	0.47	0.86	0.52	0.46
	Drought	4.72	7.03	6.75	1.76	-9	5	-9	5	-21	-8	-10	5	**1.18**	0.52	**1.17**	0.70	**1.12**	0.67	0.70
Franks Tract	All	2.03	3.02	3.32	0.69	26	26	26	26	26	26	31	32	0.51	0.23	0.50	0.30	0.55	0.33	0.28
	Drought	2.69	4.00	3.84	0.95	22	20	22	20	6	5	25	23	0.67	0.30	0.67	0.40	0.64	0.38	0.38
Old River at Rock Slough	All	2.62	3.89	4.28	0.92	50	51	50	51	50	51	60	61	0.65	0.29	0.65	0.39	0.71	0.43	0.37
	Drought	3.65	5.42	5.21	1.33	61	58	61	58	41	38	71	67	0.91	0.41	0.90	0.54	0.87	0.52	0.53
Western Delta																				
Sacramento River at Emmaton	All	1.50	2.23	2.46	0.48	7	6	7	6	7	6	8	8	0.38	0.17	0.37	0.22	0.41	0.25	0.19
	Drought	2.26	3.37	3.23	0.78	5	5	5	5	-9	-8	5	6	0.57	0.25	0.56	0.34	0.54	0.32	0.31
SJR at Antioch	All	1.63	2.43	2.67	0.53	18	17	18	17	18	17	23	22	0.41	0.18	0.40	0.24	0.45	0.27	0.21
	Drought	2.23	3.31	3.18	0.77	14	13	14	13	0	-1	16	16	0.56	0.25	0.55	0.33	0.53	0.32	0.31
Sacramento River at Mallard Island	All	1.28	1.90	2.09	0.39	13	12	13	12	13	12	18	16	0.32	0.14	0.32	0.19	0.35	0.21	0.16
	Drought	1.71	2.54	2.44	0.56	12	11	12	11	-2	-3	15	13	0.43	0.19	0.42	0.25	0.41	0.24	0.22
Major Diversions (Pumping Stations)																				
North Bay Aqueduct at Barker Slough PP	All	1.48	2.20	2.42	0.47	6	6	6	6	6	6	7	7	0.37	0.16	0.37	0.22	0.40	0.24	0.19
	Drought	2.32	3.45	3.31	0.80	6	5	6	5	-8	-8	6	6	0.58	0.26	0.58	0.35	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	2.47	3.68	4.05	0.86	58	55	58	55	58	55	72	68	0.62	0.27	0.61	0.37	0.67	0.40	0.35
	Drought	3.63	5.40	5.19	1.32	65	61	65	61	44	41	75	71	0.91	0.40	0.90	0.54	0.87	0.52	0.53
Banks Pumping Plant	All	1.54	2.29	2.52	0.49	-26	-26	-26	-26	-26	-26	-31	-30	0.38	0.17	0.38	0.23	0.42	0.25	0.20
	Drought	2.30	3.41	3.28	0.79	-14	-14	-14	-14	-25	-25	-16	-16	0.57	0.26	0.57	0.34	0.55	0.33	0.32
Jones Pumping Plant	All	1.67	2.48	2.73	0.54	-35	-37	-35	-37	-35	-37	-40	-41	0.42	0.19	0.41	0.25	0.45	0.27	0.22
	Drought	2.46	3.67	3.52	0.86	-33	-36	-33	-36	-42	-44	-36	-39	0.62	0.27	0.61	0.37	0.59	0.35	0.34

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

d Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA-LLT - No Action Alternative Late Long Term
ww - wet weight

Table M-29. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 8.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 8	Alt. 8	Alt. 8	Alt. 8	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Delta Interior																				
Mokelumne River (South Fork) at Staten Island	All	1.11	1.66	1.82	0.33	-4	-5	-4	-5	-4	-5	-6	-7	0.28	0.12	0.28	0.17	0.30	0.18	0.13
	Drought	2.00	2.98	2.86	0.68	-3	-3	-3	-3	-15	-15	-4	-4	0.50	0.22	0.50	0.30	0.48	0.29	0.27
San Joaquin River at Buckley Cove	All	3.22	4.79	5.27	1.16	-5	4	-5	4	-5	4	-5	4	0.81	0.36	0.80	0.48	0.88	0.53	0.46
	Drought	4.85	7.21	6.93	1.81	-7	8	-7	8	-19	-6	-7	8	**1.21**	0.54	**1.20**	0.72	**1.15**	0.69	0.72
Franks Tract	All	2.03	3.02	3.32	0.69	26	27	26	27	26	27	32	33	0.51	0.23	0.50	0.30	0.55	0.33	0.28
	Drought	2.69	4.01	3.85	0.95	22	20	22	20	6	5	25	23	0.67	0.30	0.67	0.40	0.64	0.38	0.38
Old River at Rock Slough	All	2.63	3.92	4.31	0.93	51	52	51	52	51	52	61	62	0.66	0.29	0.65	0.39	0.72	0.43	0.37
	Drought	3.66	5.44	5.23	1.33	62	59	62	59	41	39	71	67	0.91	0.41	0.91	0.54	0.87	0.52	0.53
Western Delta																				
Sacramento River at Emmaton	All	1.50	2.23	2.45	0.48	6	6	6	6	6	6	8	7	0.37	0.17	0.37	0.22	0.41	0.24	0.19
	Drought	2.26	3.36	3.23	0.78	5	5	5	5	-9	-8	5	6	0.57	0.25	0.56	0.34	0.54	0.32	0.31
SJR at Antioch	All	1.63	2.43	2.67	0.53	18	17	18	17	18	17	23	22	0.41	0.18	0.40	0.24	0.45	0.27	0.21
	Drought	2.23	3.32	3.19	0.77	14	14	14	14	0	-1	17	16	0.56	0.25	0.55	0.33	0.53	0.32	0.31
Sacramento River at Mallard Island	All	1.28	1.91	2.10	0.39	14	12	14	12	14	12	19	17	0.32	0.14	0.32	0.19	0.35	0.21	0.16
	Drought	1.73	2.57	2.47	0.57	13	12	13	12	-1	-2	17	15	0.43	0.19	0.43	0.26	0.41	0.25	0.23
Major Diversions (Pumping Stations)																				
North Bay Aqueduct at Barker Slough PP	All	1.49	2.22	2.44	0.47	7	7	7	7	7	7	8	8	0.37	0.17	0.37	0.22	0.41	0.24	0.19
	Drought	2.33	3.47	3.33	0.81	6	6	6	6	-7	-7	7	7	0.58	0.26	0.58	0.35	0.56	0.33	0.32
Contra Costa Pumping Plant #1	All	2.49	3.70	4.07	0.87	59	56	59	56	59	56	73	69	0.62	0.28	0.62	0.37	0.68	0.41	0.35
	Drought	3.66	5.44	5.22	1.33	66	62	66	62	45	42	77	72	0.91	0.41	0.91	0.54	0.87	0.52	0.53
Banks Pumping Plant	All	1.60	2.37	2.61	0.52	-24	-23	-24	-23	-24	-23	-27	-27	0.40	0.18	0.40	0.24	0.44	0.26	0.21
	Drought	2.33	3.46	3.33	0.81	-13	-13	-13	-13	-24	-24	-14	-15	0.58	0.26	0.58	0.35	0.55	0.33	0.32
Jones Pumping Plant	All	1.67	2.49	2.74	0.55	-35	-37	-35	-37	-35	-37	-40	-41	0.42	0.19	0.41	0.25	0.46	0.27	0.22
	Drought	2.42	3.60	3.46	0.84	-35	-37	-35	-37	-43	-45	-38	-40	0.61	0.27	0.60	0.36	0.58	0.35	0.34

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

d Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

Table M-30. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 9.

Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw [b])				% Change In Selenium Concentrations Compared to Baseline [c]								Exceedance Quotients [d]						
		Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
		Alt. 9	Alt. 9	Alt. 9	Alt. 9	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	EX	NAA-LLT	LOC [e]	TL [f]	LOC [g]	TL [h]	LOC [g]	TL [h]	ATL [i]
Delta Interior																				
Mokelumne River (South Fork) at Staten Island	All	1.23	1.84	2.02	0.37	6	5	6	5	6	5	8	6	0.31	0.14	0.31	0.18	0.34	0.20	0.15
	Drought	2.14	3.19	3.06	0.73	4	4	4	4	-9	-10	4	4	0.54	0.24	0.53	0.32	0.51	0.31	0.29
San Joaquin River at Buckley Cove	All	1.60	2.38	2.62	0.52	-53	-48	-53	-48	-53	-48	-58	-53	0.40	0.18	0.40	0.24	0.44	0.26	0.21
	Drought	2.06	3.06	2.94	0.70	-61	-54	-61	-54	-66	-60	-64	-58	0.51	0.23	0.51	0.31	0.49	0.29	0.28
Franks Tract	All	2.58	3.84	4.22	0.91	60	61	60	61	60	61	73	74	0.64	0.29	0.64	0.38	0.70	0.42	0.36
	Drought	3.54	5.26	5.06	1.29	60	58	60	58	40	38	69	67	0.88	0.39	0.88	0.53	0.84	0.51	0.51
Old River at Rock Slough	All	3.13	4.66	5.12	1.13	79	80	79	80	79	80	95	97	0.78	0.35	0.78	0.47	0.85	0.51	0.45
	Drought	4.54	6.76	6.49	1.69	**101**	97	**101**	97	76	72	**116**	**111**	**1.14**	0.50	**1.13**	0.68	**1.08**	0.65	0.67
Western Delta																				
Sacramento River at Emmaton	All	1.47	2.18	2.40	0.46	4	3	4	3	4	3	5	4	0.37	0.16	0.36	0.22	0.40	0.24	0.19
	Drought	2.24	3.34	3.21	0.77	4	4	4	4	-9	-9	4	5	0.56	0.25	0.56	0.33	0.53	0.32	0.31
SJR at Antioch	All	1.68	2.49	2.74	0.55	21	20	21	20	21	20	27	26	0.42	0.19	0.42	0.25	0.46	0.27	0.22
	Drought	2.33	3.47	3.33	0.81	19	19	19	19	4	4	23	22	0.58	0.26	0.58	0.35	0.56	0.33	0.32
Sacramento River at Mallard Island	All	1.24	1.85	2.04	0.38	10	9	10	9	10	9	14	12	0.31	0.14	0.31	0.19	0.34	0.20	0.15
	Drought	1.67	2.49	2.39	0.55	10	9	10	9	-4	-5	13	11	0.42	0.19	0.42	0.25	0.40	0.24	0.22
Major Diversions (Pumping Stations)																				
North Bay Aqueduct at Barker Slough PP	All	1.46	2.18	2.39	0.46	5	5	5	5	5	5	6	6	0.37	0.16	0.36	0.22	0.40	0.24	0.19
	Drought	2.31	3.43	3.30	0.80	5	5	5	5	-8	-8	6	6	0.58	0.26	0.57	0.34	0.55	0.33	0.32
Contra Costa Pumping Plant #1	All	2.91	4.32	4.76	1.04	86	82	86	82	86	82	**106**	**101**	0.73	0.32	0.72	0.43	0.79	0.48	0.41
	Drought	4.31	6.41	6.16	1.59	96	92	96	92	71	67	**111**	**105**	**1.08**	0.48	**1.07**	0.64	**1.03**	0.62	0.64
Banks Pumping Plant	All	1.76	2.61	2.87	0.58	-16	-15	-16	-15	-16	-15	-19	-18	0.44	0.20	0.44	0.26	0.48	0.29	0.23
	Drought	2.32	3.46	3.32	0.80	-13	-13	-13	-13	-24	-24	-15	-15	0.58	0.26	0.58	0.35	0.55	0.33	0.32
Jones Pumping Plant	All	1.80	2.68	2.95	0.60	-30	-32	-30	-32	-30	-32	-34	-36	0.45	0.20	0.45	0.27	0.49	0.29	0.24
	Drought	2.32	3.46	3.32	0.80	-37	-39	-37	-39	-45	-47	-40	-43	0.58	0.26	0.58	0.35	0.55	0.33	0.32

Notes:

a All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

b Dry weight, except as noted for fish fillets.

c % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted and changes of 100% or more are in bold red font.

d Exceedance Quotient = tissue concentration/benchmark; quotients of 1.0 or more are highlighted.

e Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

f Toxicity Level for fish tissue = 9 mg/kg dw (Beckon et al. 2008)

g Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

h Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

i Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA-LLT - No Action Alternative Late Long Term

ww - wet weight

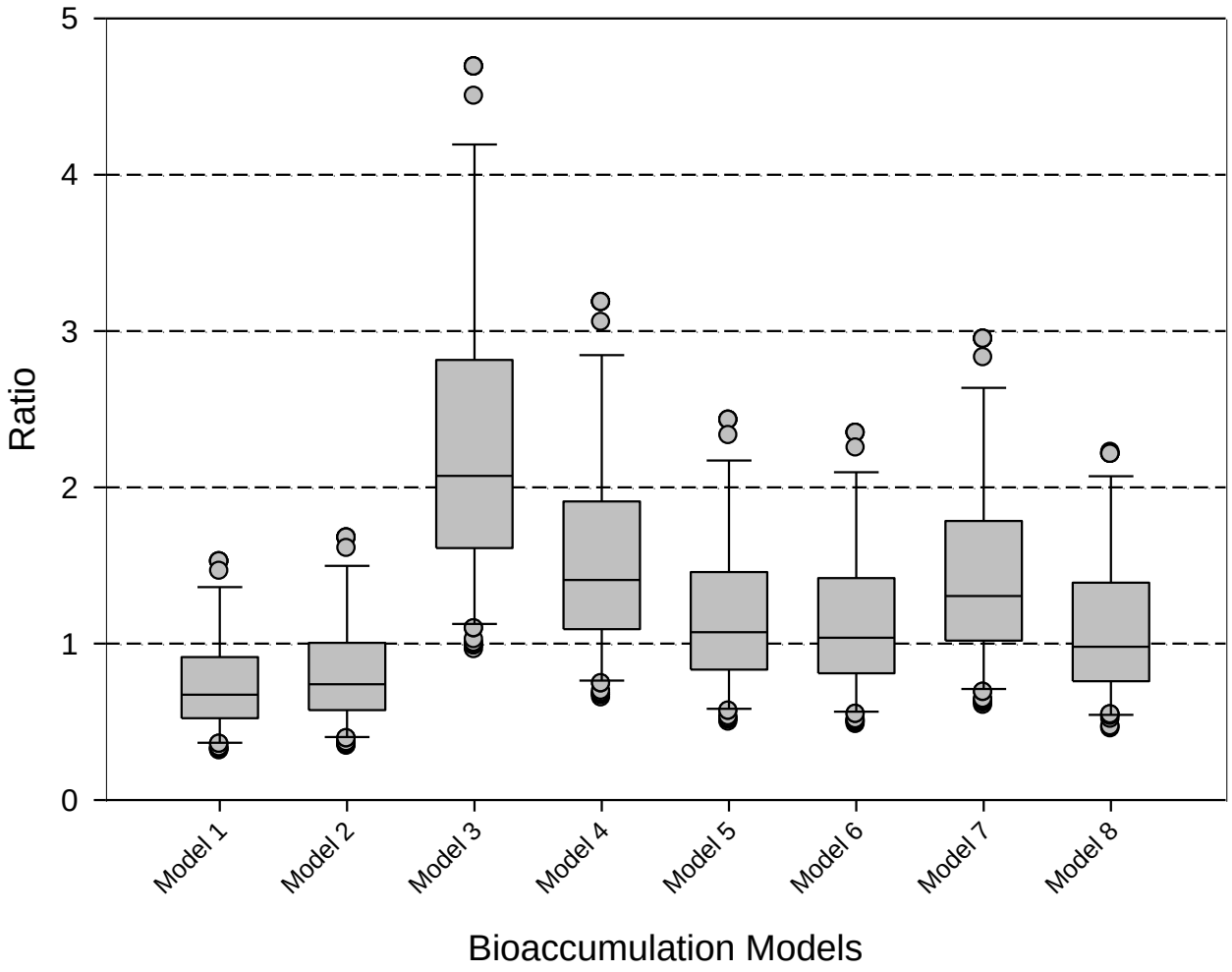
Table M-31. Monthly Average Concentrations of Selenium in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

Year	Average Selenium Concentration (µg/L)	Average Flow (cfs)	Average Selenium Concentration (µg/L)	Average Flow (cfs)	Average Selenium Concentration (µg/L)	Average Flow (cfs)	Average Selenium Concentration (µg/L)	Average Flow (cfs)	Average Selenium Concentration (µg/L)	Average Flow (cfs)	Average Selenium Concentration (µg/L)	Average Flow (cfs)
	January		February		March		April		May		June	
1999	0.6	4730	0.5	11700	0.84	8332	0.65	6437	0.675	5551	0.825	3016
2000	1	2136	1.1	7559	0.84	12100	0.9	5013	0.825	4814	1.18	2772
2001	1.025	2442	1.65	3092	1.92	3430	1.55	3008	0.86	3527	1.4	1549
2002	1.06	2662	1.95	1898	2.275	2134	1.025	2598	0.68	2739	1.075	1407
2003	0.98	1913	2.075	1879	2.325	2193	1.15	2668	0.88	2625	0.55	2034
2004	1.4	1792	1.975	2201	1.675	3361	0.875	2751	0.75	2647	0.967	1404
2005	0.825	4918	0.925	5303	1.1	8065	0.5	10060	0.425	10410	0.44	9979
2006	0.425	13170	0.5	6458	0.42	11700	0.4	27940	0.4	26050	0.44	15690
2007	0.85	2587	1.4	2534	0.86	2555	1.025	2225	0.6	2898	0.625	1745
	July		August		September		October		November		December	
1999	1.06	2094	1	1969	0.96	2037	No Data	2532	1	2158	1.1	1688
2000	1.35	1898	0.84	2171	0.6	2330	0.625	2826	0.975	2526	1.08	2238
2001	1.35	1400	1.18	1330	0.9	1376	0.625	2003	0.78	2096	1.3	2064
2002	1.35	1227	1.3	1116	1.15	1175	0.6	1705	0.64	1715	0.825	1988
2003	1	1321	0.8	1281	0.725	1308	1	1999	1.025	1647	1.125	1503
2004	0.92	1147	0.875	1125	0.82	1121	0.88	1753	1	1632	1.36	1578
2005	0.675	4155	0.85	2615	0.78	2412	0.55	2619	1	2038	0.9	3521
2006	0.55	5547	0.56	3697	0.425	3316	0.45	3851	0.825	2538	0.64	2354
2007	0.625	1138	0.58	1008	0.5	1014	0.4	1570	0.84	1711	0.7	1503

Notes:
µg/L = micrograms/liter
cfs = cubic feet/second

FIGURES

Figure M-1. Ratios of Estimated Selenium Concentrations in Fish Models 1 through 8 to Measured Selenium Concentrations in Largemouth Bass



For Models 1 through 5, K_d (1000), $TTF_{invertebrate}$ (2.8), and TTF_{fish} (1.1) were used in calculations.

Model 1 = Trophic Level 3 (TL-3) fish eating invertebrates

Model 2 = TL-4 fish eating TL-3 fish

Model 3 = TL-4 fish eating TL-3 fish eating two insect TLs

Model 4 = 50% Model 2 + 50% Model 3

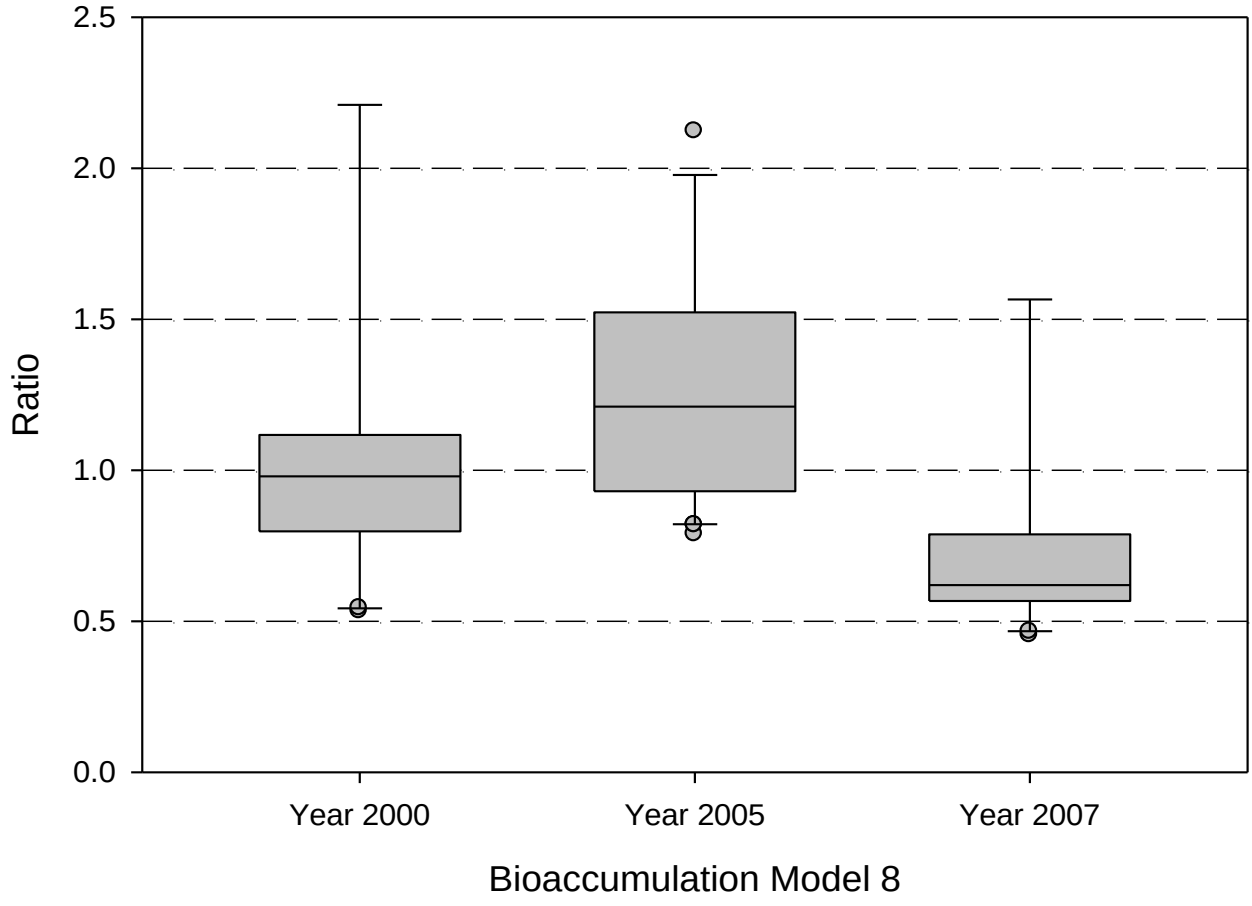
Model 5 = 75% Model 2 + 25% Model 3

Model 6 = Model 2 using K_d (1400), $TTF_{invertebrate}$ (2.8), and TTF_{fish} (1.1)

Model 7 = Model 2 using K_d (1760), $TTF_{invertebrate}$ (2.8), and TTF_{fish} (1.1)

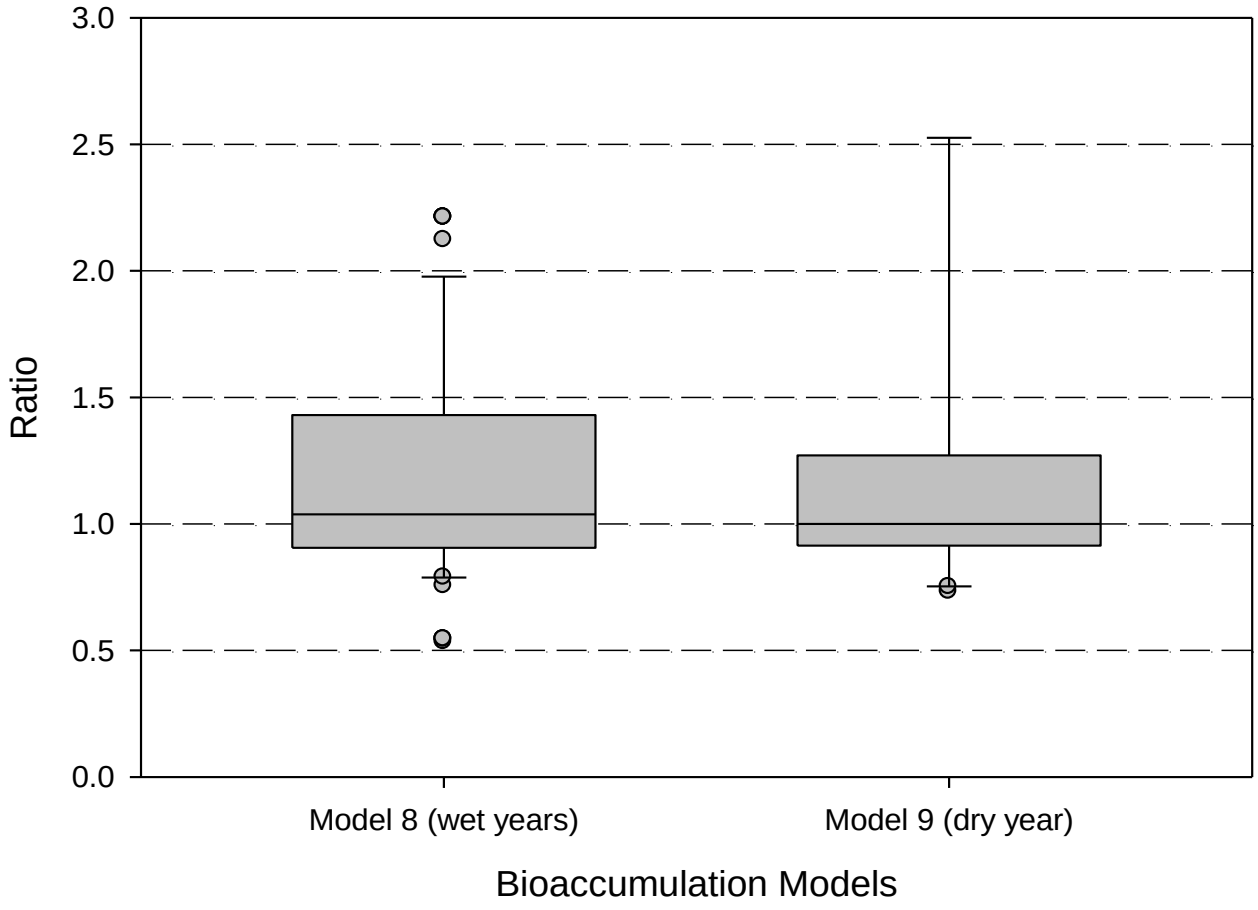
Model 8 = Model 2 using K_d (1760), $TTF_{invertebrate}$ (2.1), and TTF_{fish} (1.1)

Figure M-2. Ratios of Estimated Selenium Concentrations in Fish Model 8 to Measured Selenium Concentrations in Largemouth Bass for Years 2000, 2005, and 2007



Model 8 = K_d (1760), $TTF_{invertebrate}$ (2.1), and TTF_{fish} (1.1)

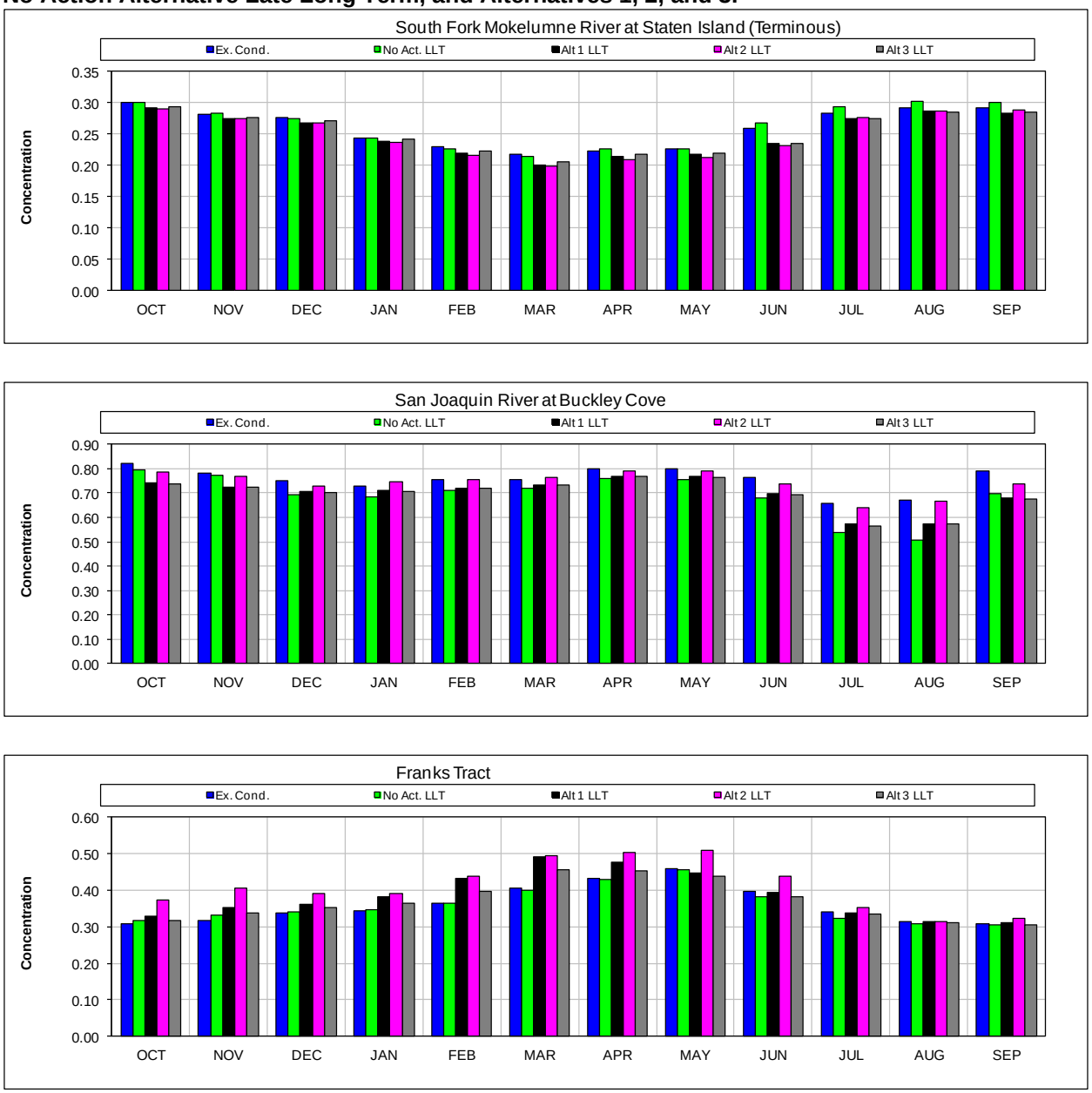
Figure M-3. Ratios of Estimated Selenium Concentrations in Fish Model 8 (2000 and 2005 Wet Years) and Model 9 (2007 Dry Year) to Measured Selenium Concentrations in Largemouth Bass

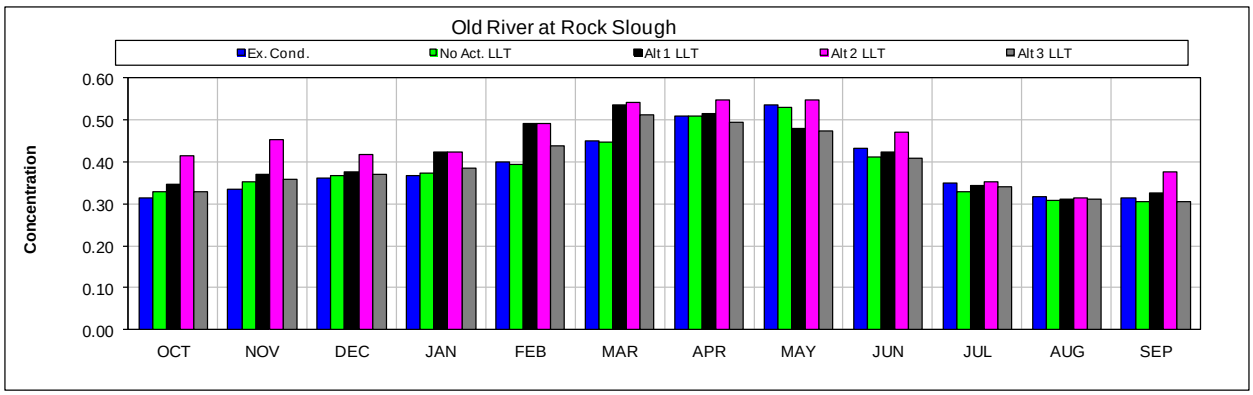


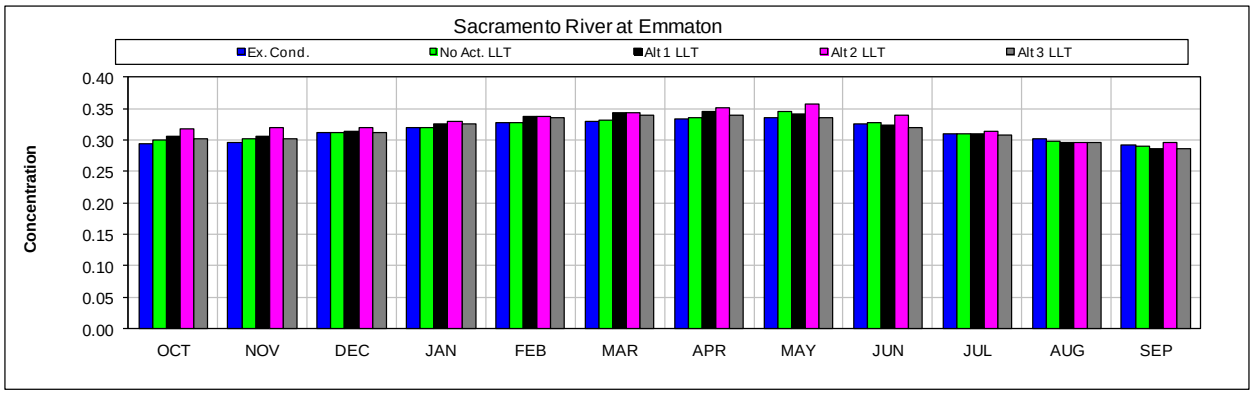
Model 8 = K_d (1760), $TTF_{invertebrate}$ (2.1), and TTF_{fish} (1.1)

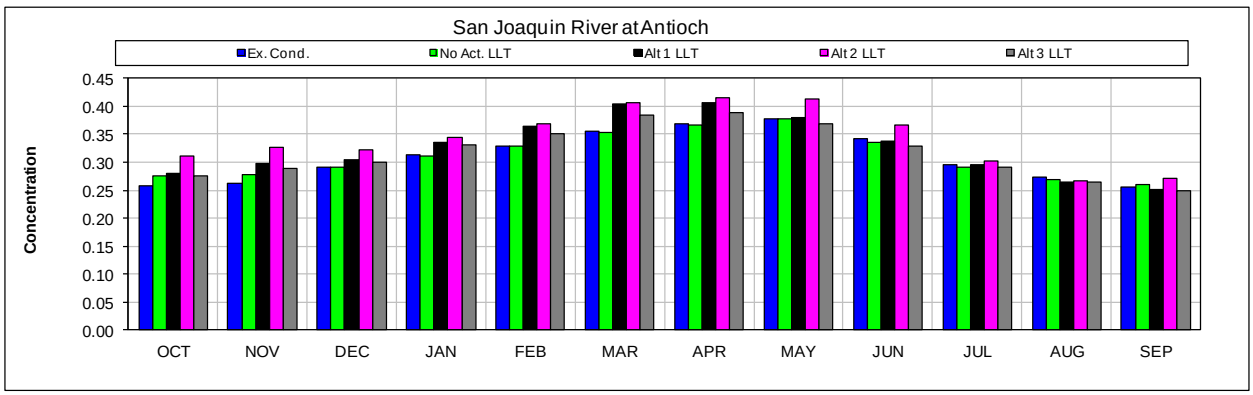
Model 9 = K_d (2840), $TTF_{invertebrate}$ (2.1), and TTF_{fish} (1.1)

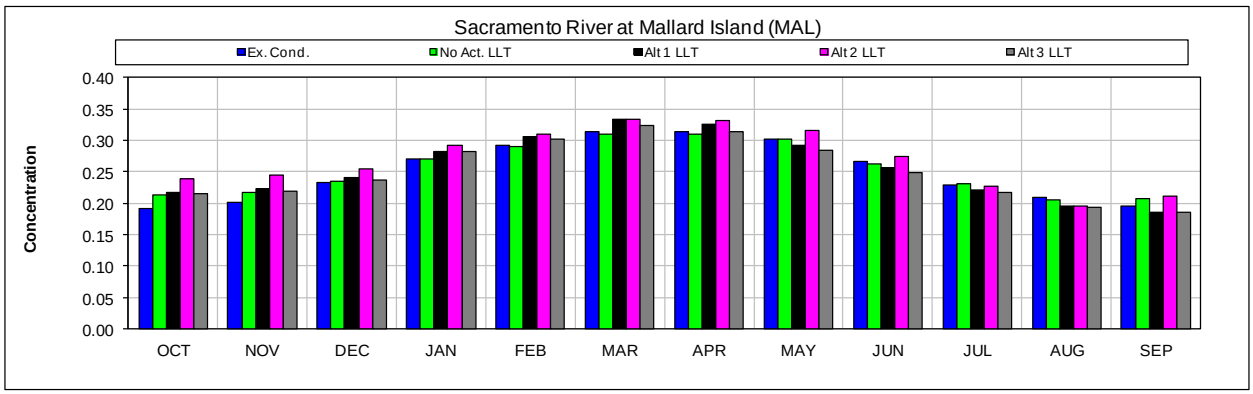
Figure M-4. Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative Late Long Term, and Alternatives 1, 2, and 3.

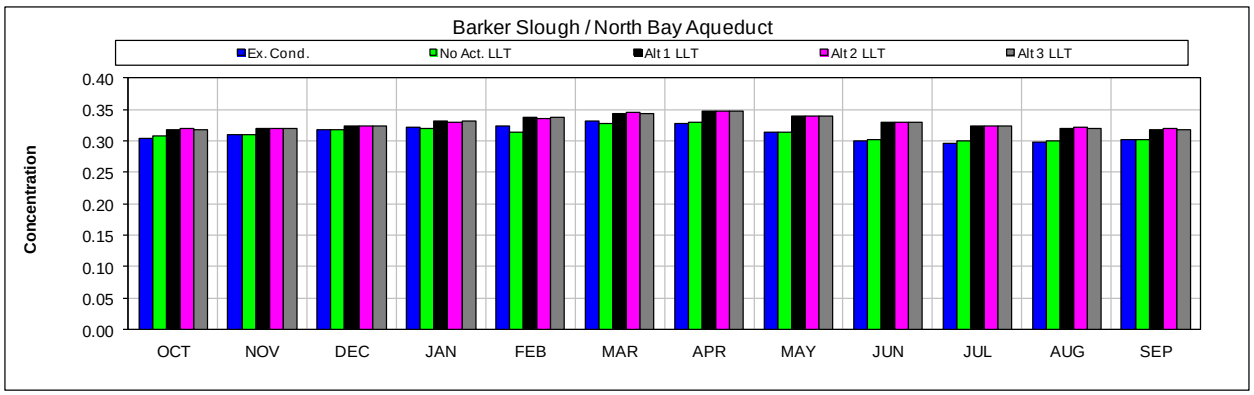


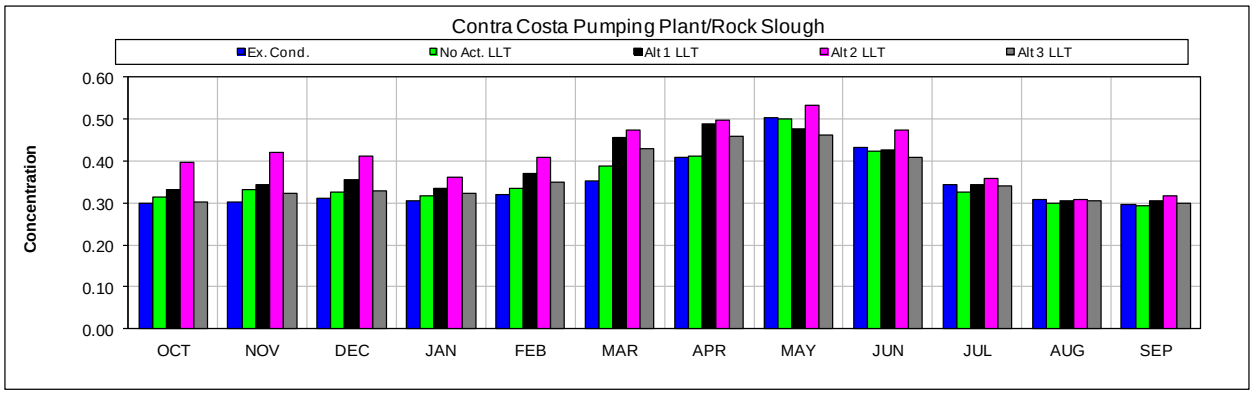

Old River at Rock Slough
Ex. Cond.
No Act. LLT
Alt 1 LLT
Alt 2 LLT
Alt 3 LLT
Concentration
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

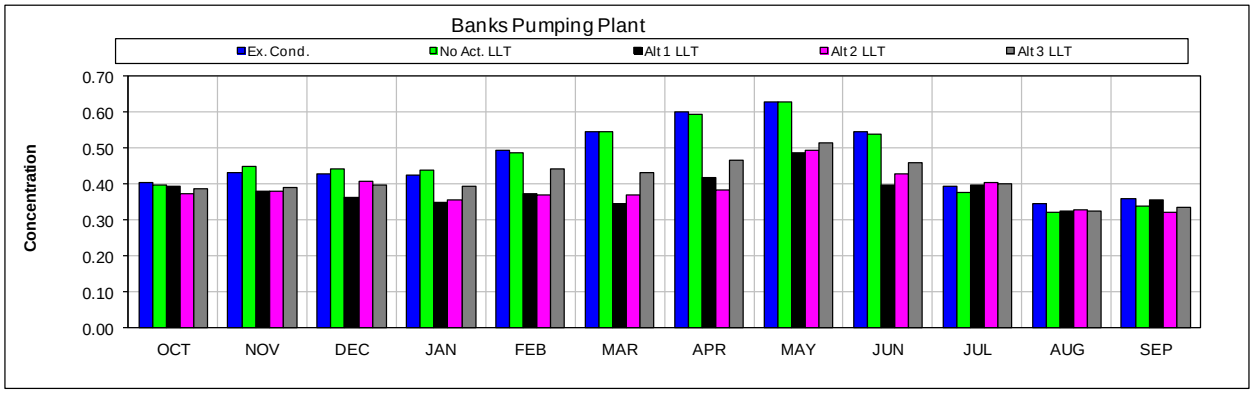

Sacramento River at Emmaton
Ex. Cond.
No Act. LLT
Alt 1 LLT
Alt 2 LLT
Alt 3 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


San Joaquin River at Antioch
Ex. Cond.
No Act. LLT
Alt 1 LLT
Alt 2 LLT
Alt 3 LLT
Concentration
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Sacramento River at Mallard Island (MAL)
Ex. Cond.
No Act. LLT
Alt 1 LLT
Alt 2 LLT
Alt 3 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Barker Slough / North Bay Aqueduct
Ex. Cond.
No Act. LLT
Alt 1 LLT
Alt 2 LLT
Alt 3 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Contra Costa Pumping Plant/Rock Slough
Ex. Cond.
No Act. LLT
Alt 1 LLT
Alt 2 LLT
Alt 3 LLT
Concentration
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Banks Pumping Plant
Ex. Cond.
No Act. LLT
Alt 1 LLT
Alt 2 LLT
Alt 3 LLT
Concentration
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

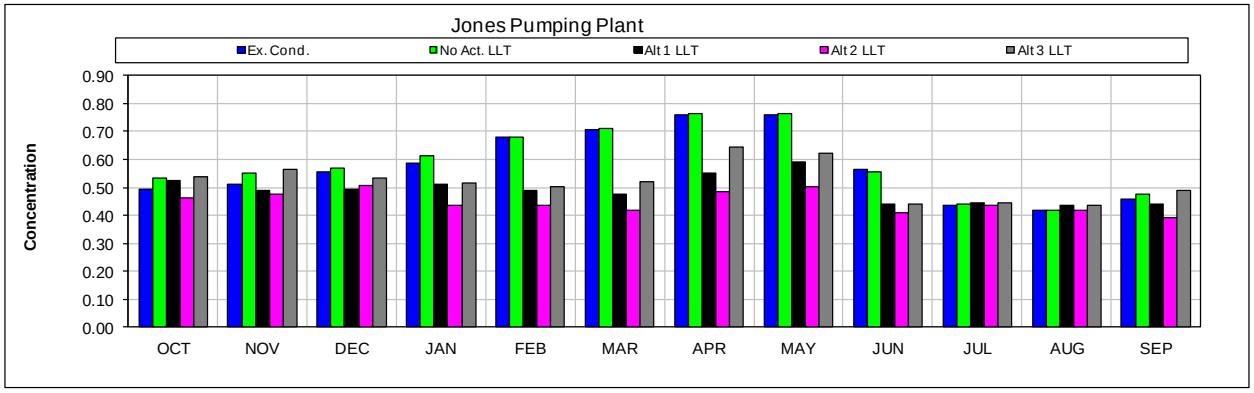
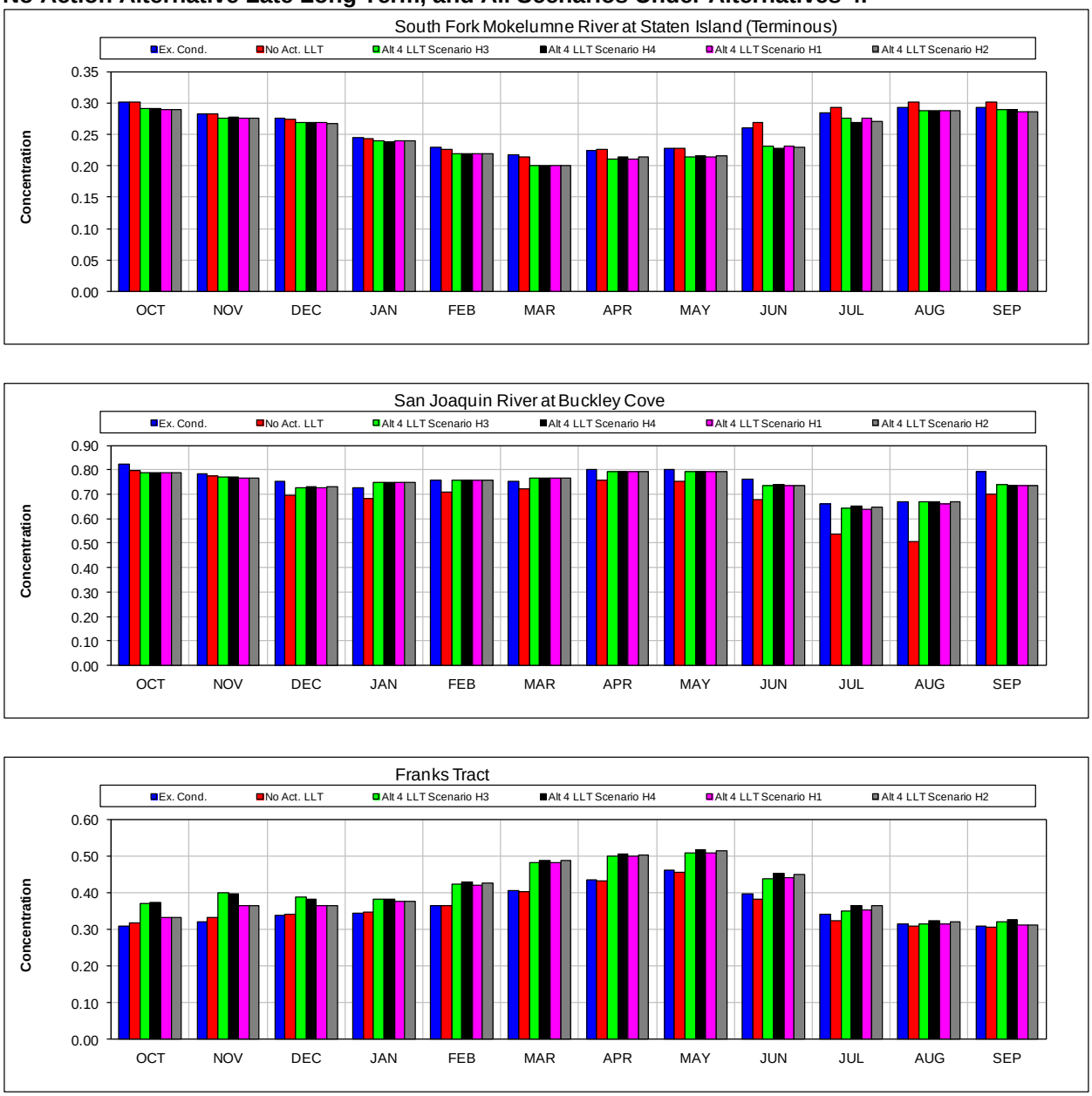
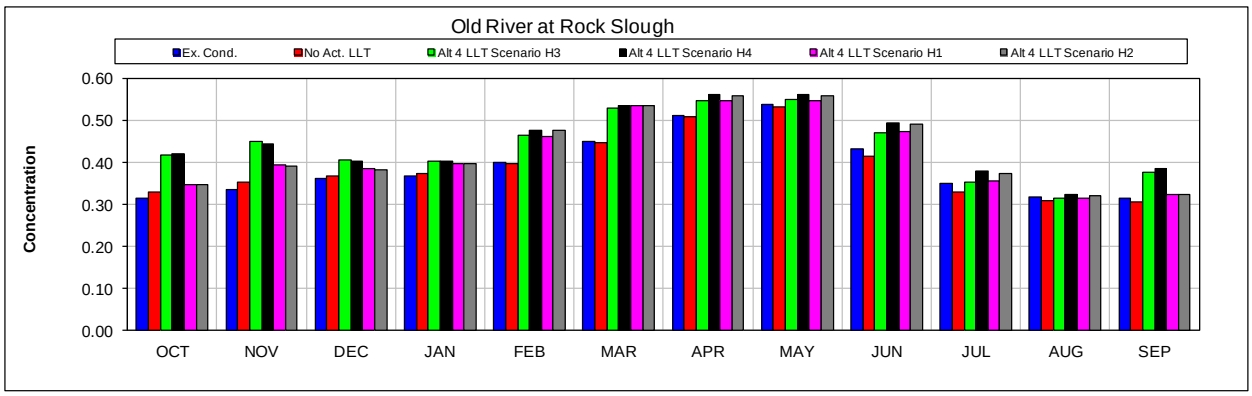
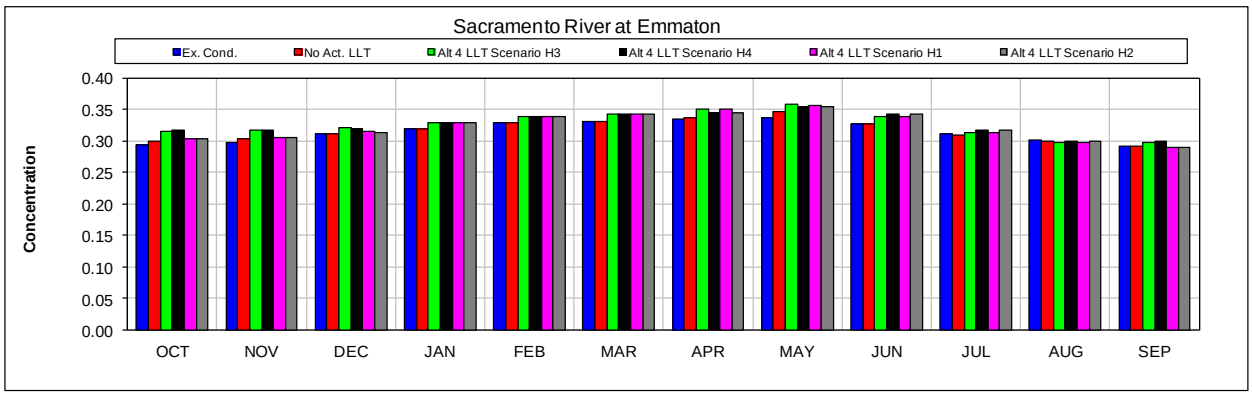
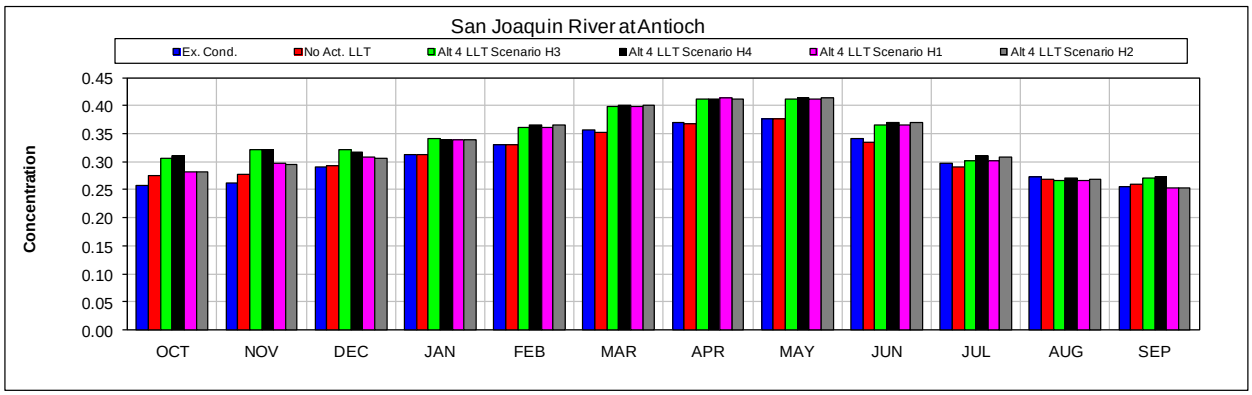

Jones Pumping Plant
Ex. Cond.
No Act. LLT
Alt 1 LLT
Alt 2 LLT
Alt 3 LLT
Concentration
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

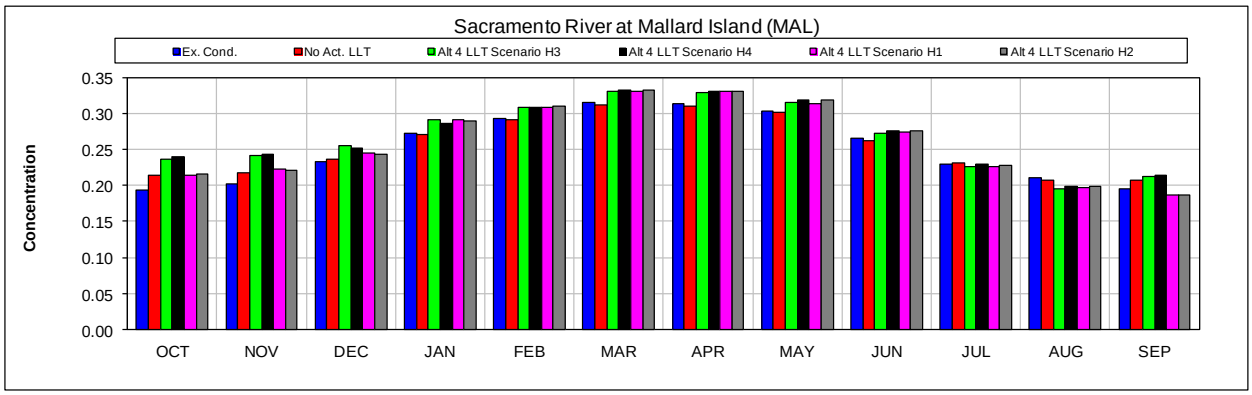
Figure M-5. Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative Late Long Term, and All Scenarios Under Alternatives 4.

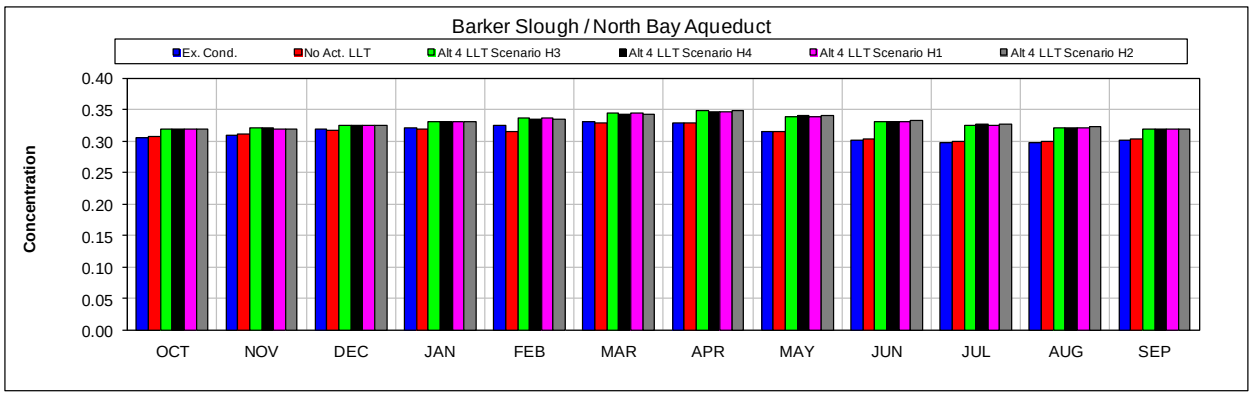


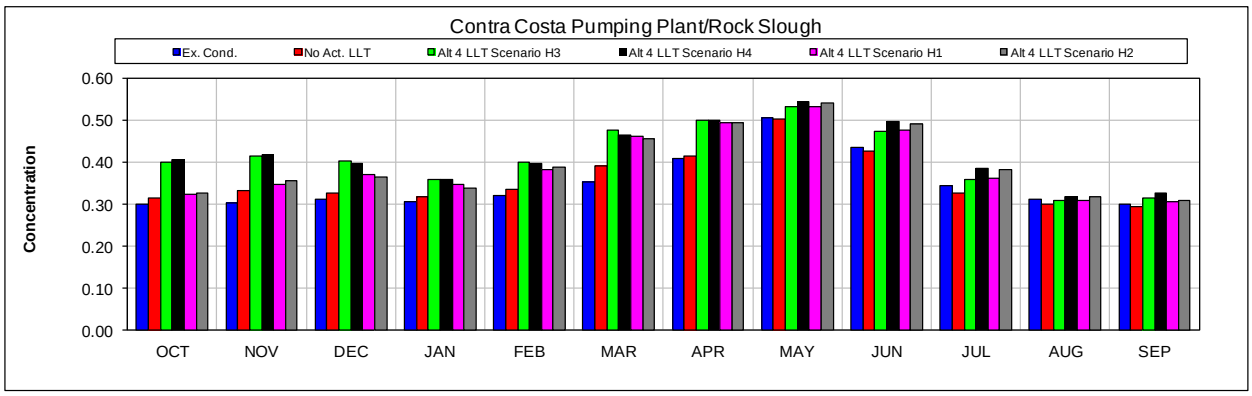

Old River at Rock Slough
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Concentration
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

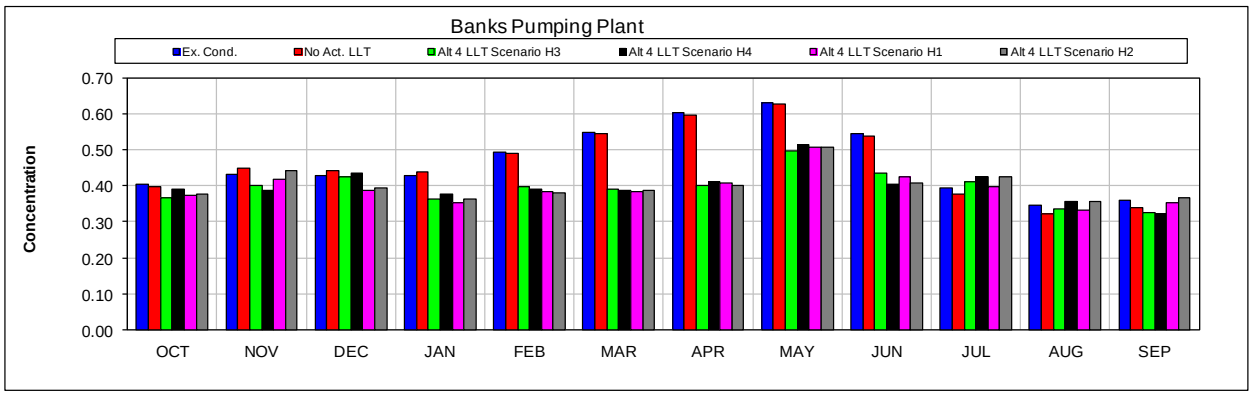

Sacramento River at Emmaton
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


San Joaquin River at Antioch
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Concentration
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Sacramento River at Mallard Island (MAL)
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Concentration
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Barker Slough / North Bay Aqueduct
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Contra Costa Pumping Plant/Rock Slough
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Concentration
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Banks Pumping Plant
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Concentration
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

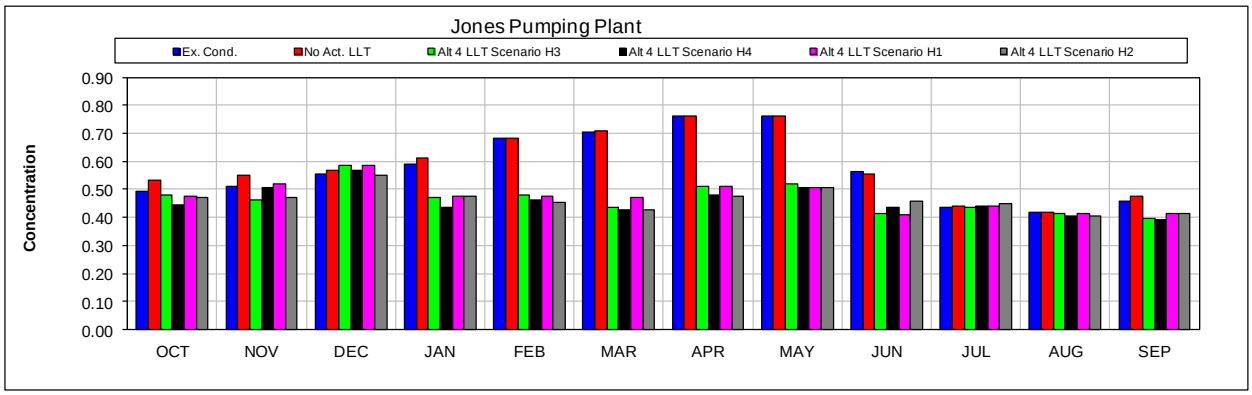
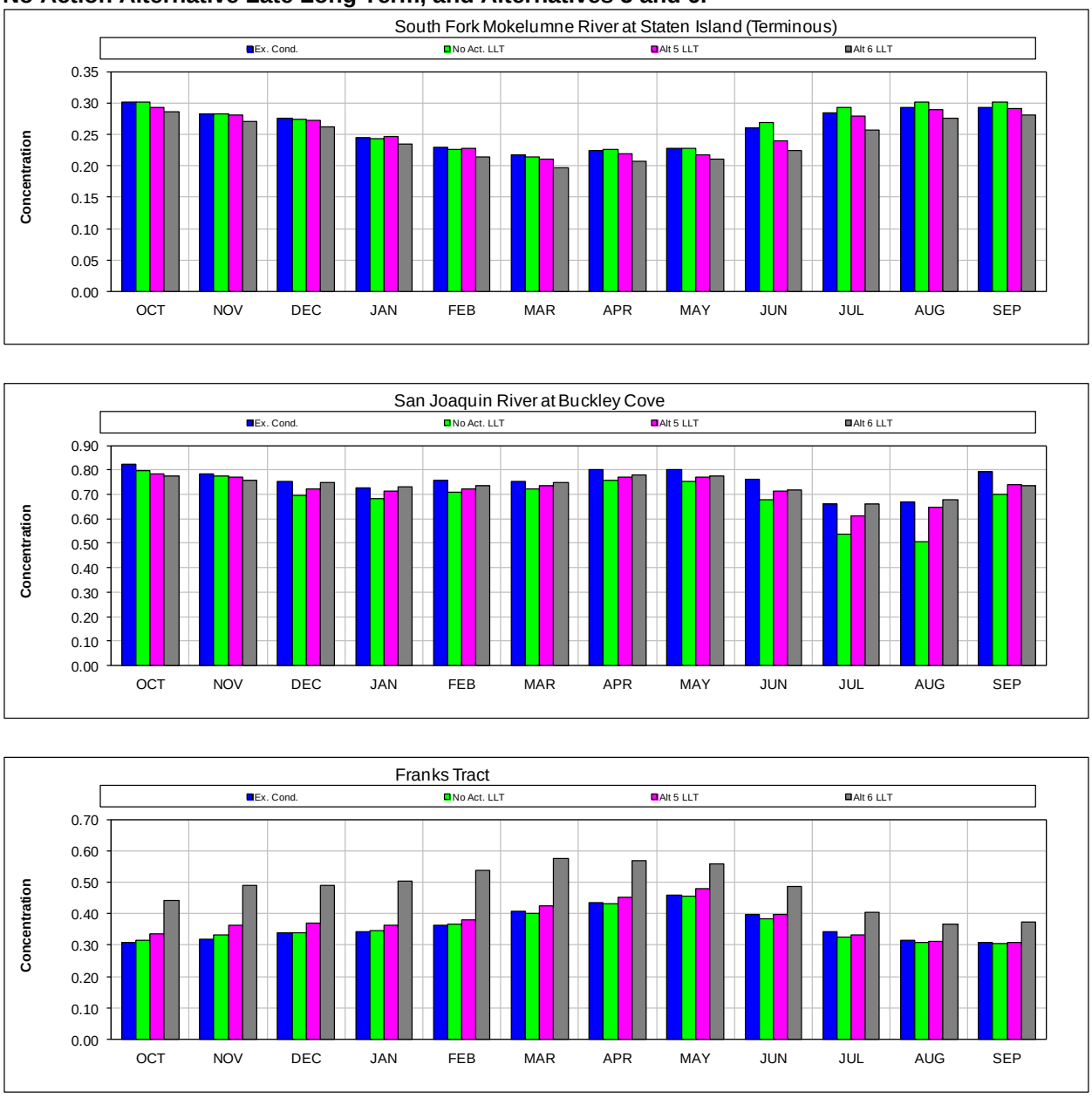
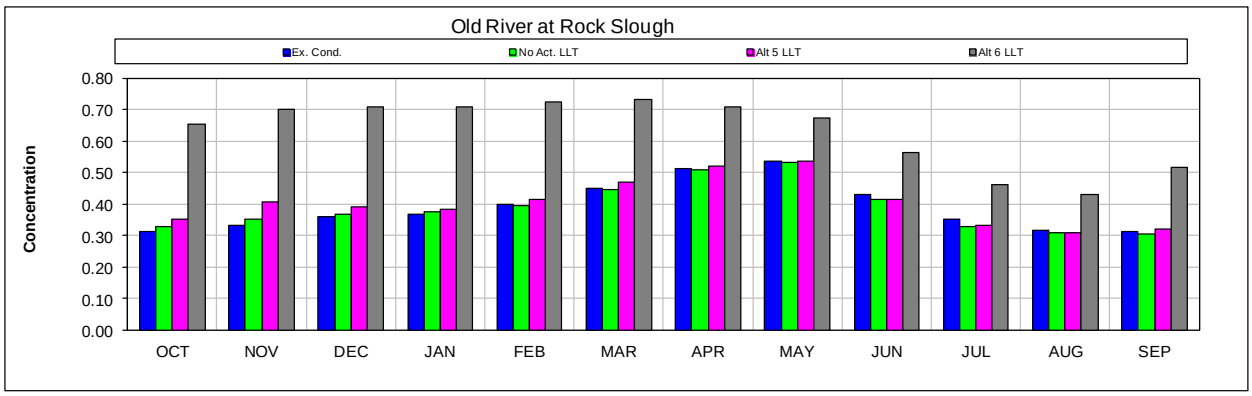
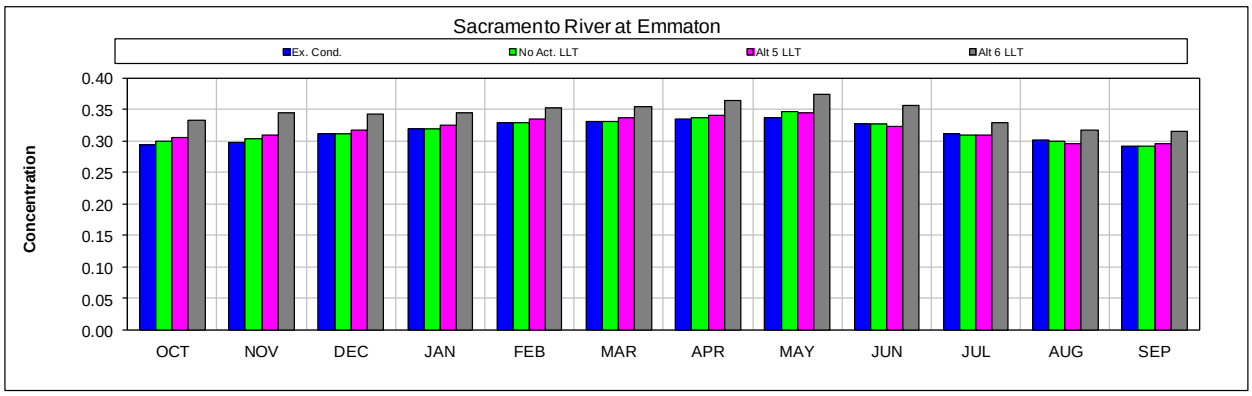
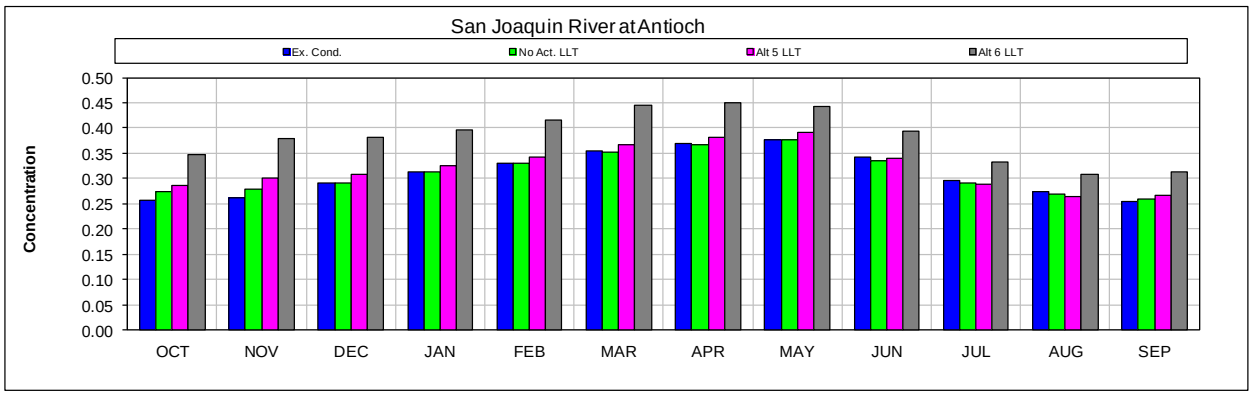

Jones Pumping Plant
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Concentration
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

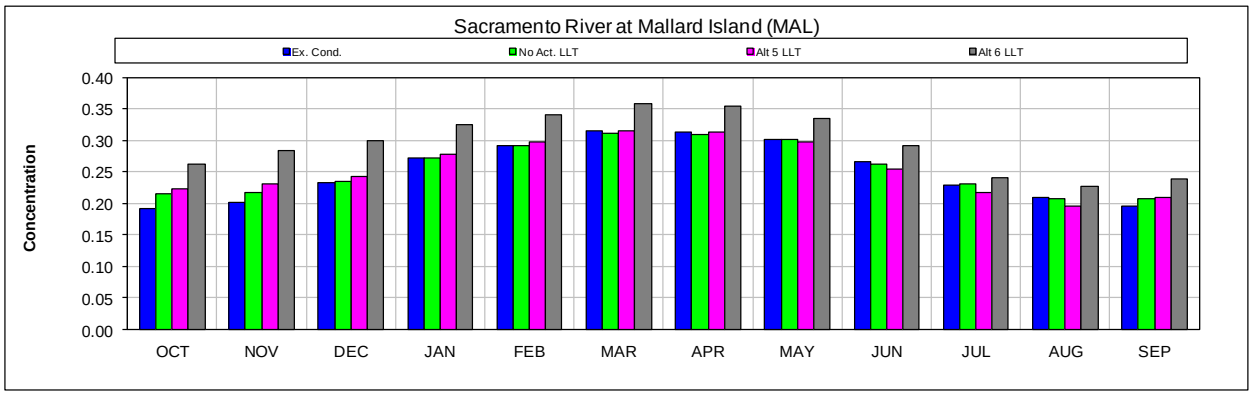
Figure M-6. Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative Late Long Term, and Alternatives 5 and 6.

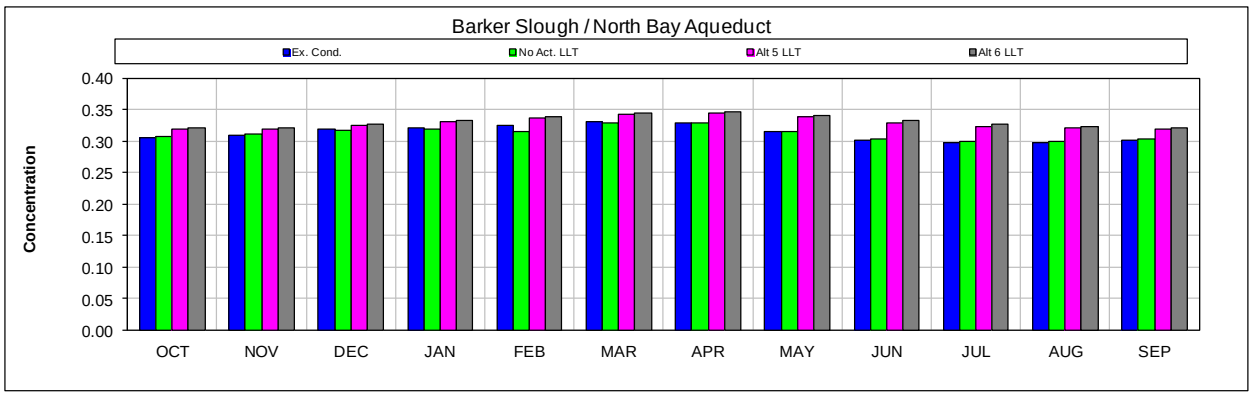


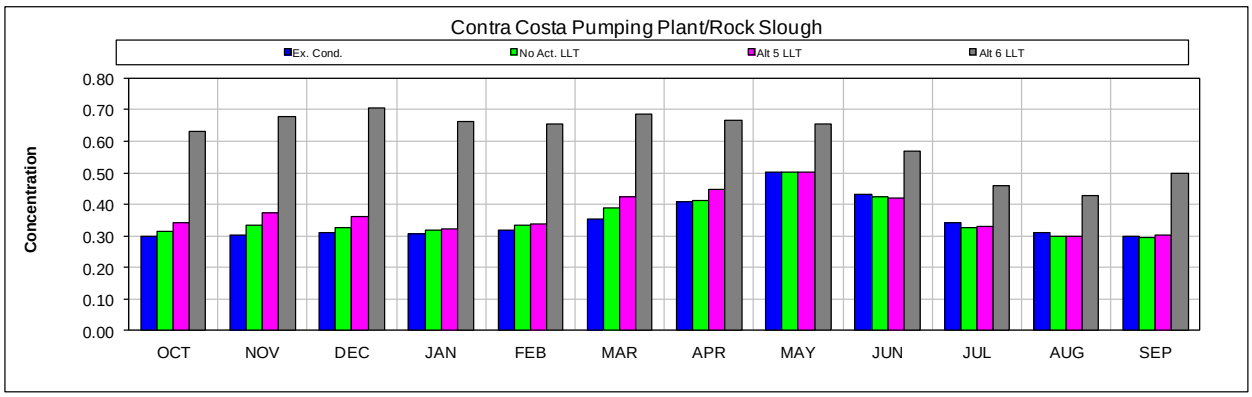

Old River at Rock Slough
Ex. Cond.
No Act. LLT
Alt 5 LLT
Alt 6 LLT
Concentration
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

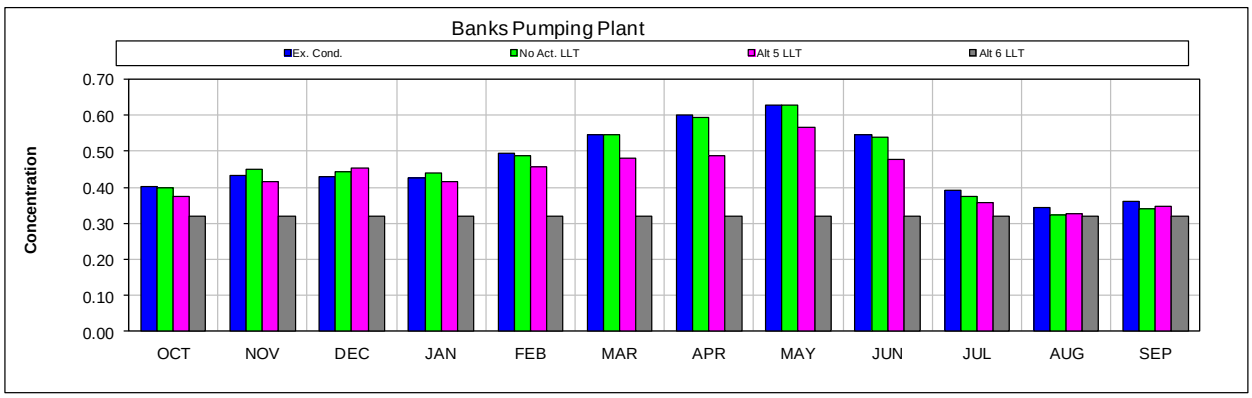

Sacramento River at Emmaton
Ex. Cond.
No Act. LLT
Alt 5 LLT
Alt 6 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


San Joaquin River at Antioch
Ex. Cond.
No Act. LLT
Alt 5 LLT
Alt 6 LLT
Concentration
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Sacramento River at Mallard Island (MAL)
Ex. Cond.
No Act. LLT
Alt 5 LLT
Alt 6 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Barker Slough / North Bay Aqueduct
Ex. Cond.
No Act. LLT
Alt 5 LLT
Alt 6 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Contra Costa Pumping Plant/Rock Slough
Ex. Cond.
No Act. LLT
Alt 5 LLT
Alt 6 LLT
Concentration
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Banks Pumping Plant
Ex. Cond.
No Act. LLT
Alt 5 LLT
Alt 6 LLT
Concentration
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

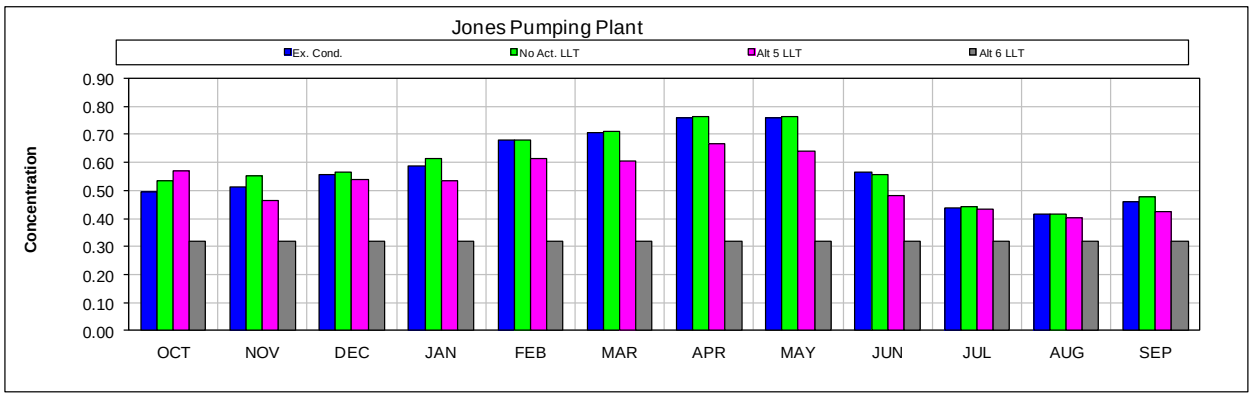
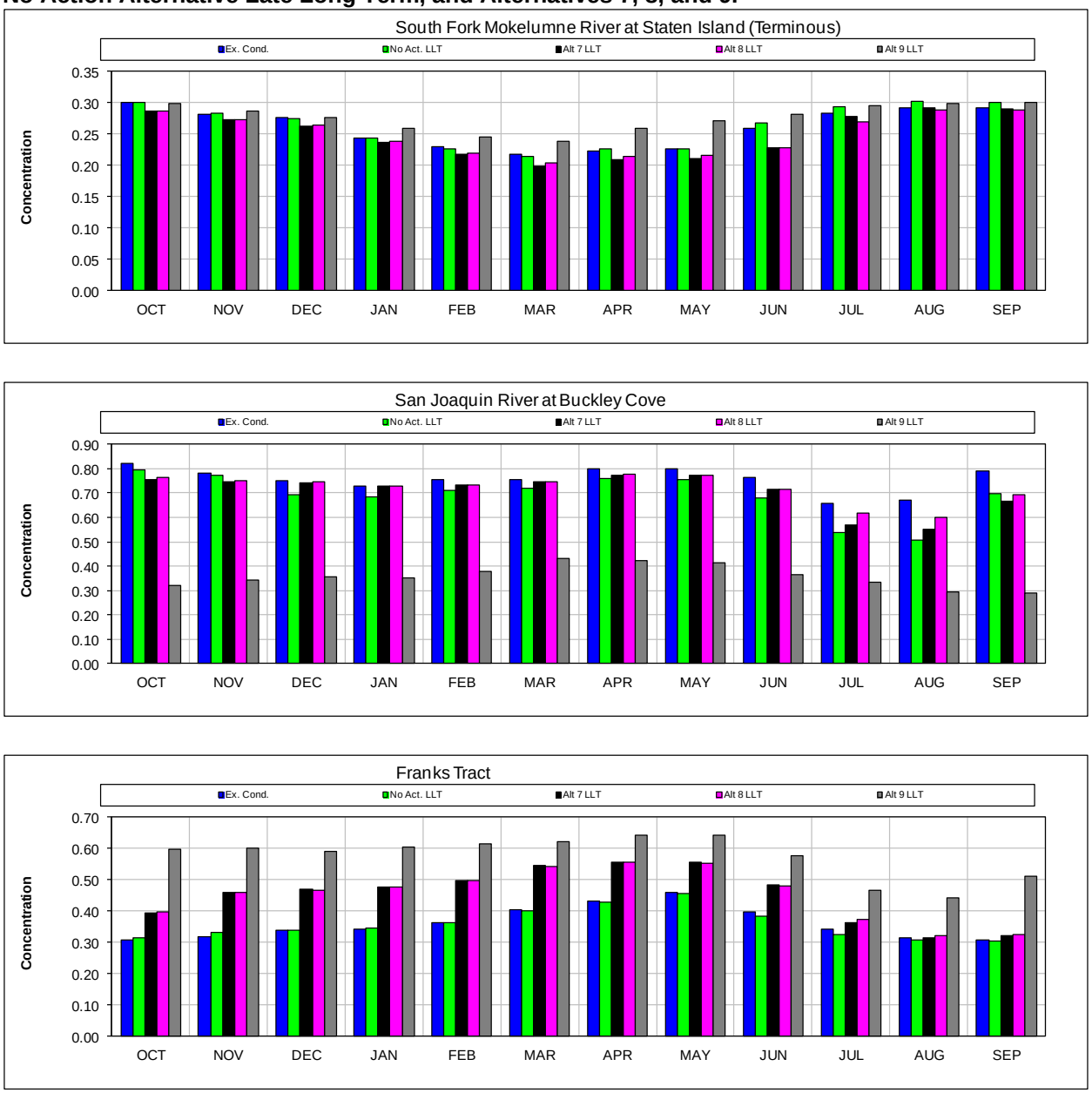
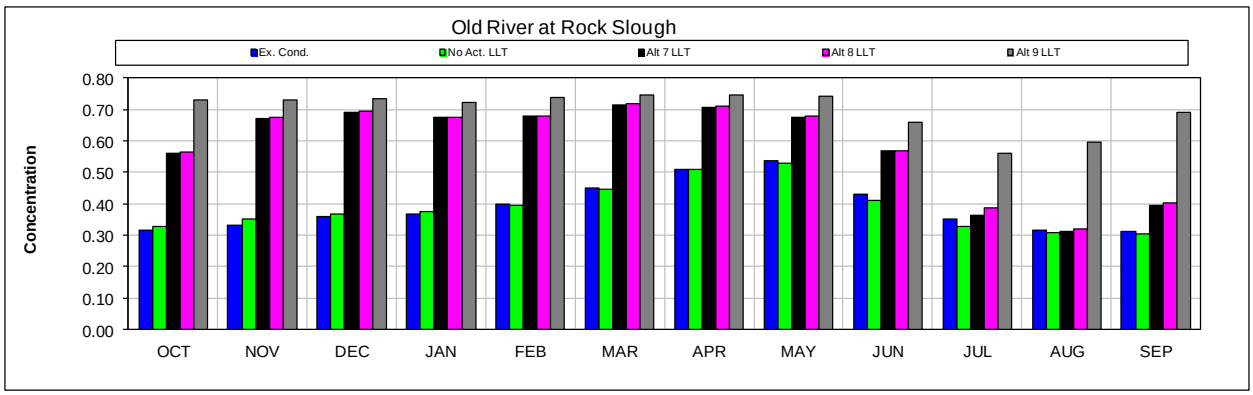
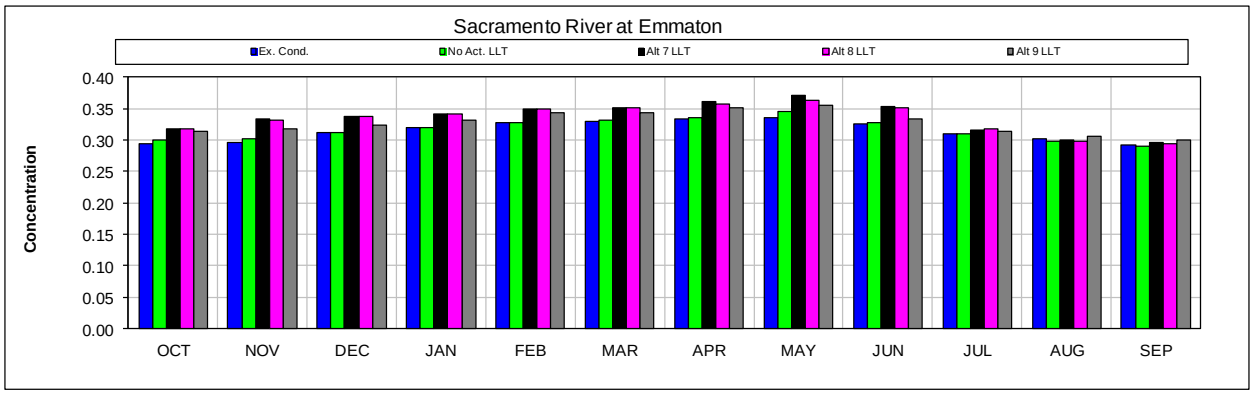
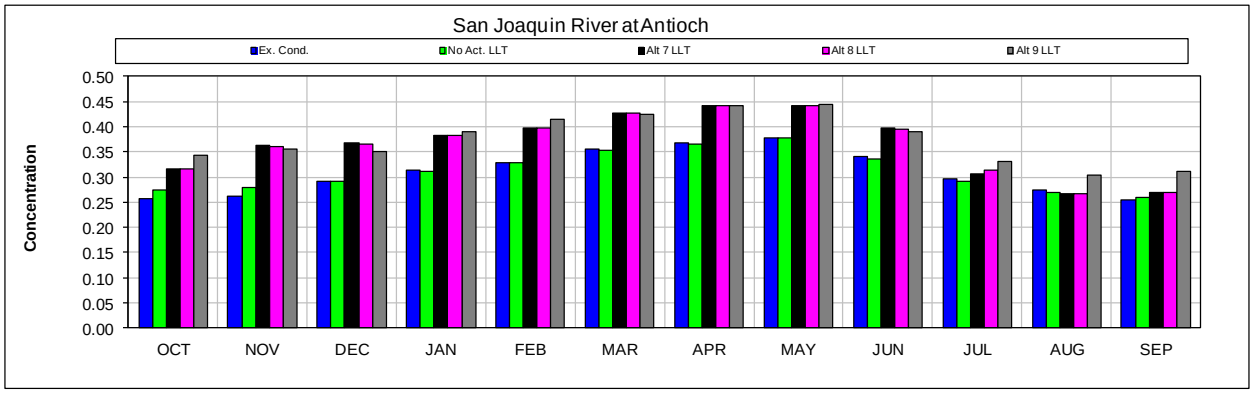

Jones Pumping Plant
Ex. Cond.
No Act. LLT
Alt 5 LLT
Alt 6 LLT
Concentration
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

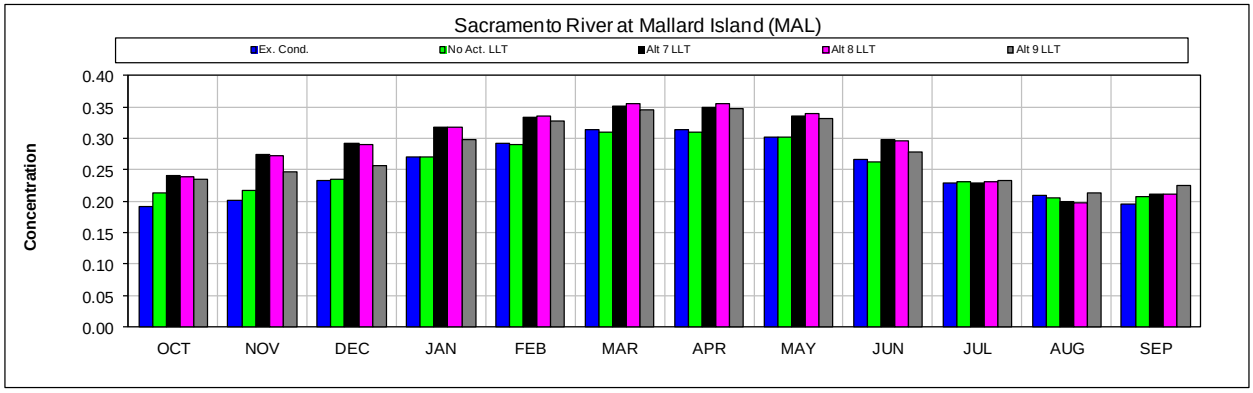
Figure M-7. Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative Late Long Term, and Alternatives 7, 8, and 9.

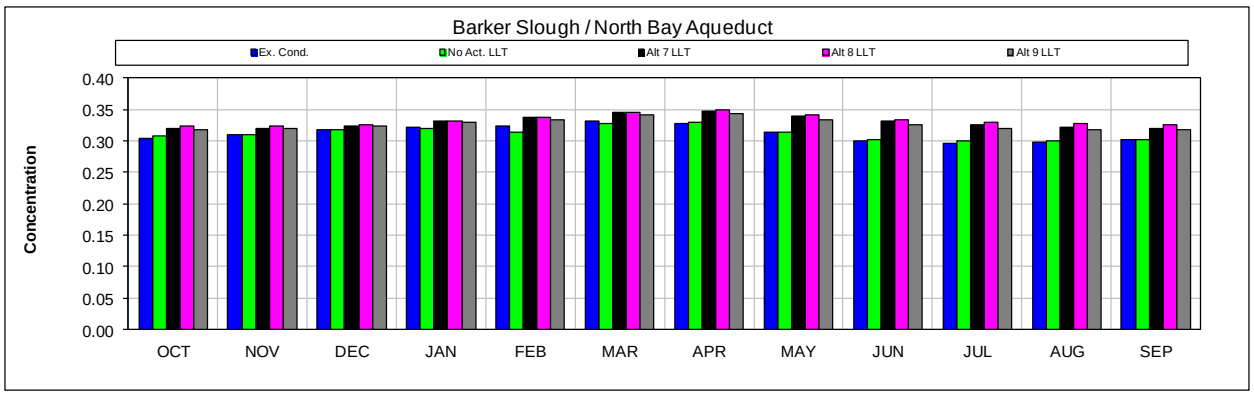



Old River at Rock Slough
Ex. Cond.
No Act. LLT
Alt 7 LLT
Alt 8 LLT
Alt 9 LLT
Concentration
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

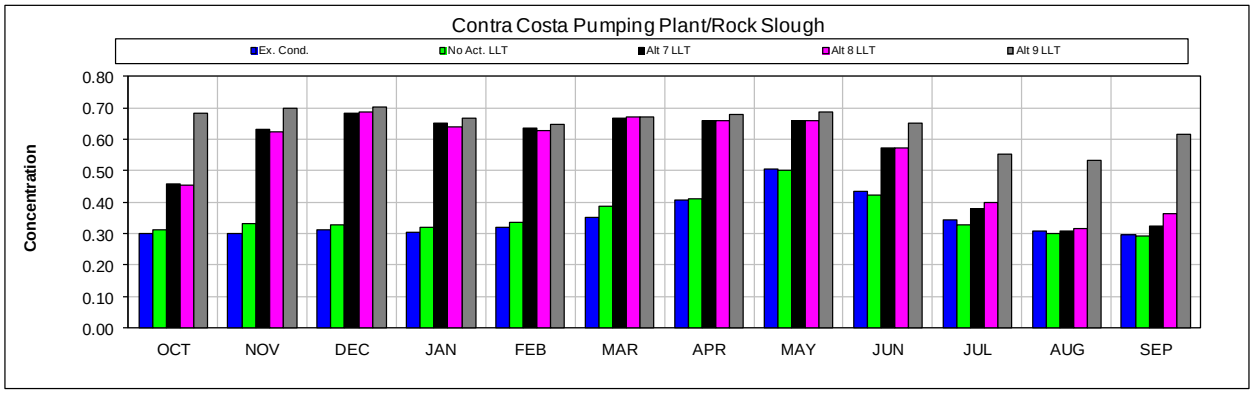

Sacramento River at Emmaton
Ex. Cond.
No Act. LLT
Alt 7 LLT
Alt 8 LLT
Alt 9 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


San Joaquin River at Antioch
Ex. Cond.
No Act. LLT
Alt 7 LLT
Alt 8 LLT
Alt 9 LLT
Concentration
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

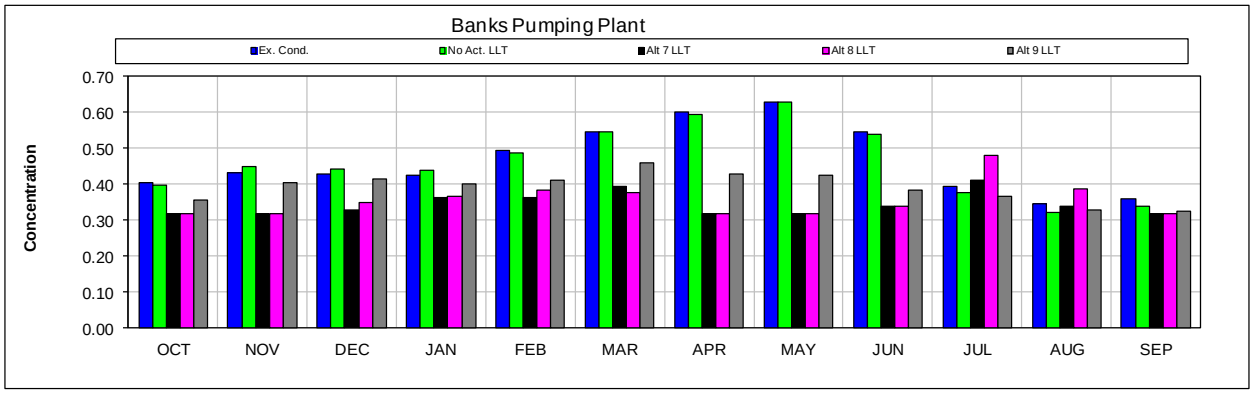

Sacramento River at Mallard Island (MAL)
Ex. Cond.
No Act. LLT
Alt 7 LLT
Alt 8 LLT
Alt 9 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP


Barker Slough / North Bay Aqueduct
Ex. Cond.
No Act. LLT
Alt 7 LLT
Alt 8 LLT
Alt 9 LLT
Concentration
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

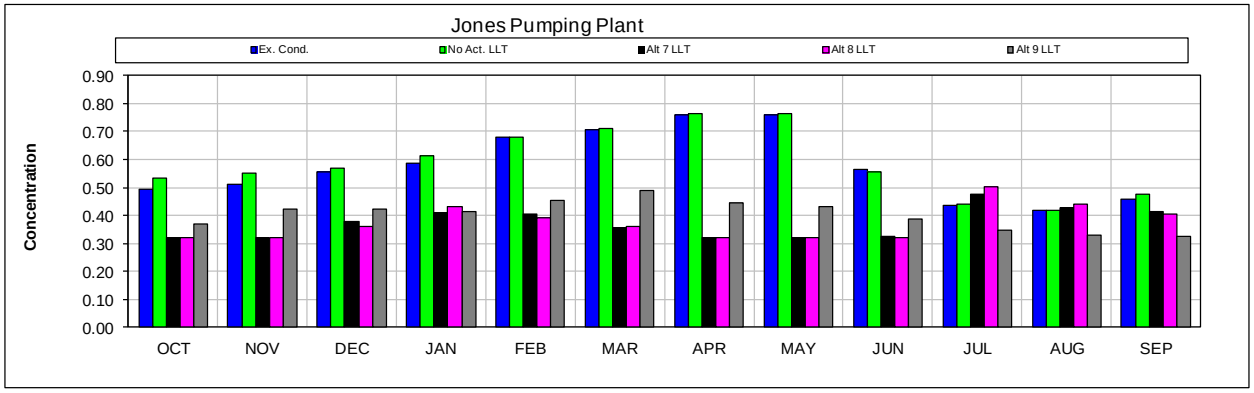
1


Contra Costa Pumping Plant/Rock Slough
Ex. Cond.
No Act. LLT
Alt 7 LLT
Alt 8 LLT
Alt 9 LLT
Concentration
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

2
3


Banks Pumping Plant
Ex. Cond.
No Act. LLT
Alt 7 LLT
Alt 8 LLT
Alt 9 LLT
Concentration
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

4
5


Jones Pumping Plant
Ex. Cond.
No Act. LLT
Alt 7 LLT
Alt 8 LLT
Alt 9 LLT
Concentration
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

6
7

Figure M-8. Yearly Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

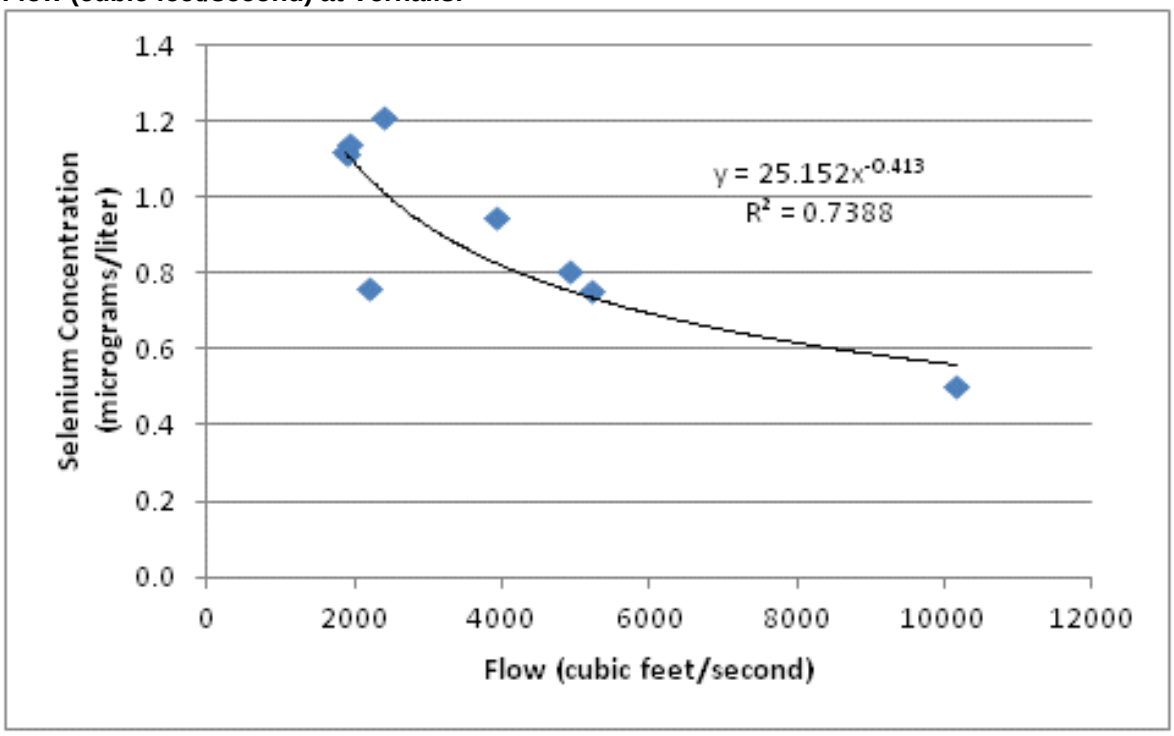


Figure M-9. Monthly Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

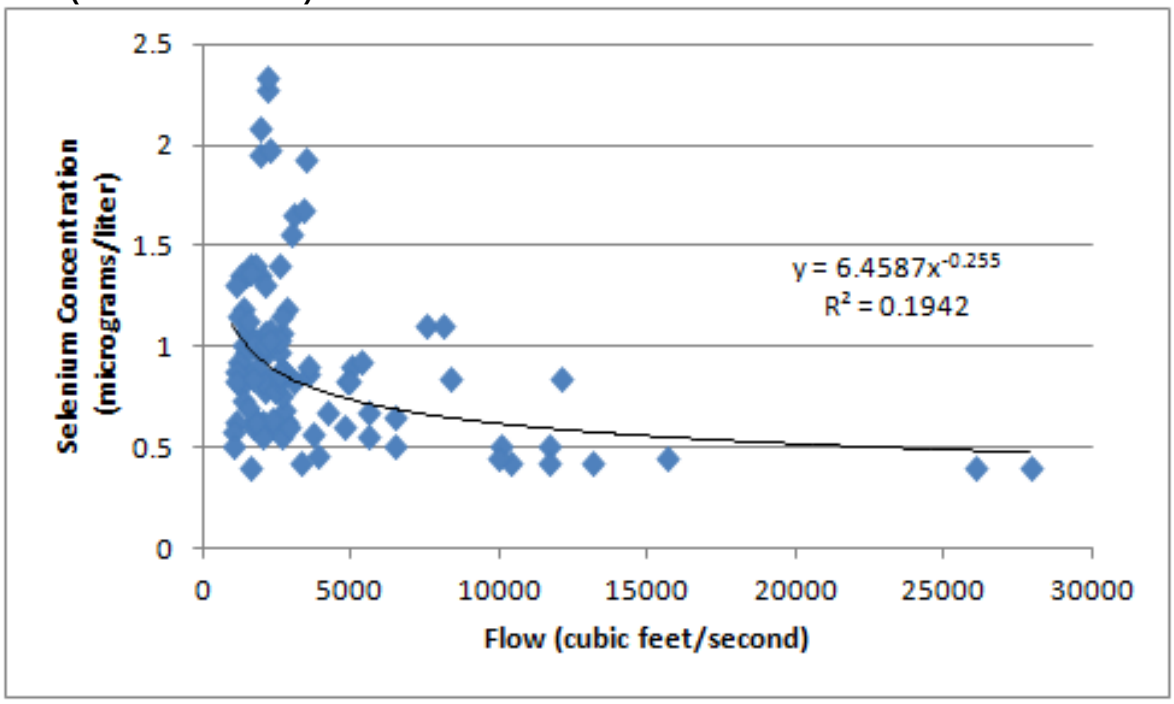


Figure M-10. January Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

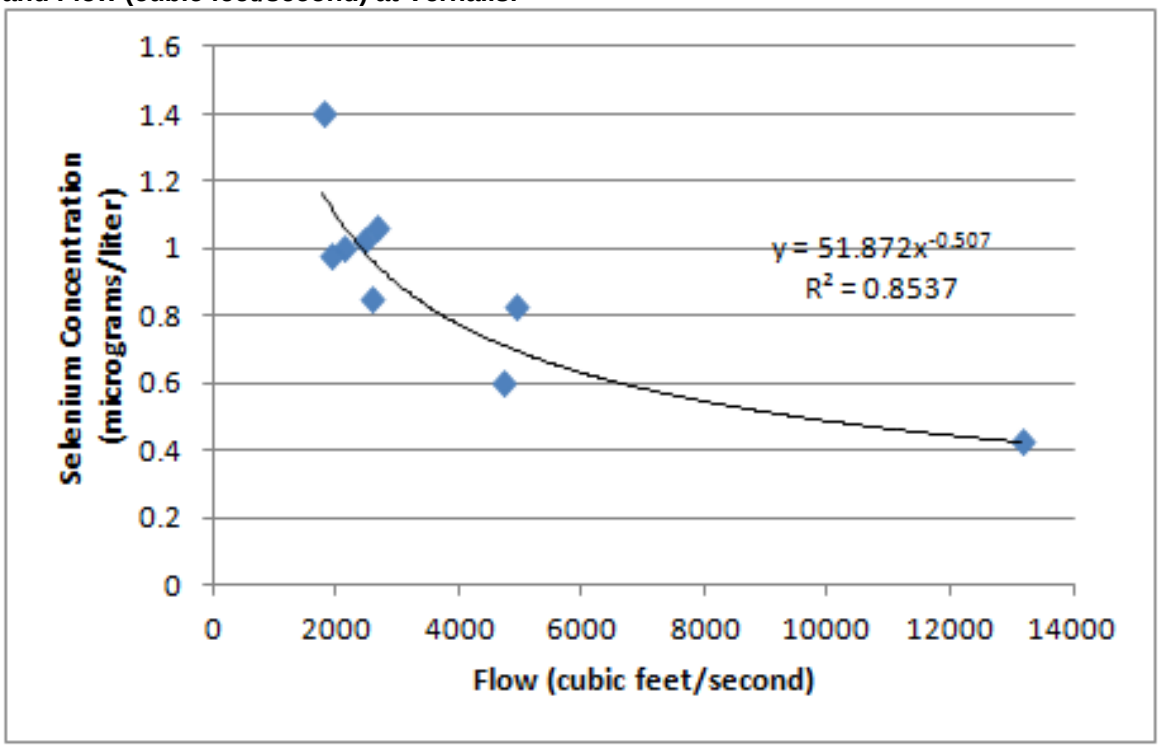


Figure M-11. February Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

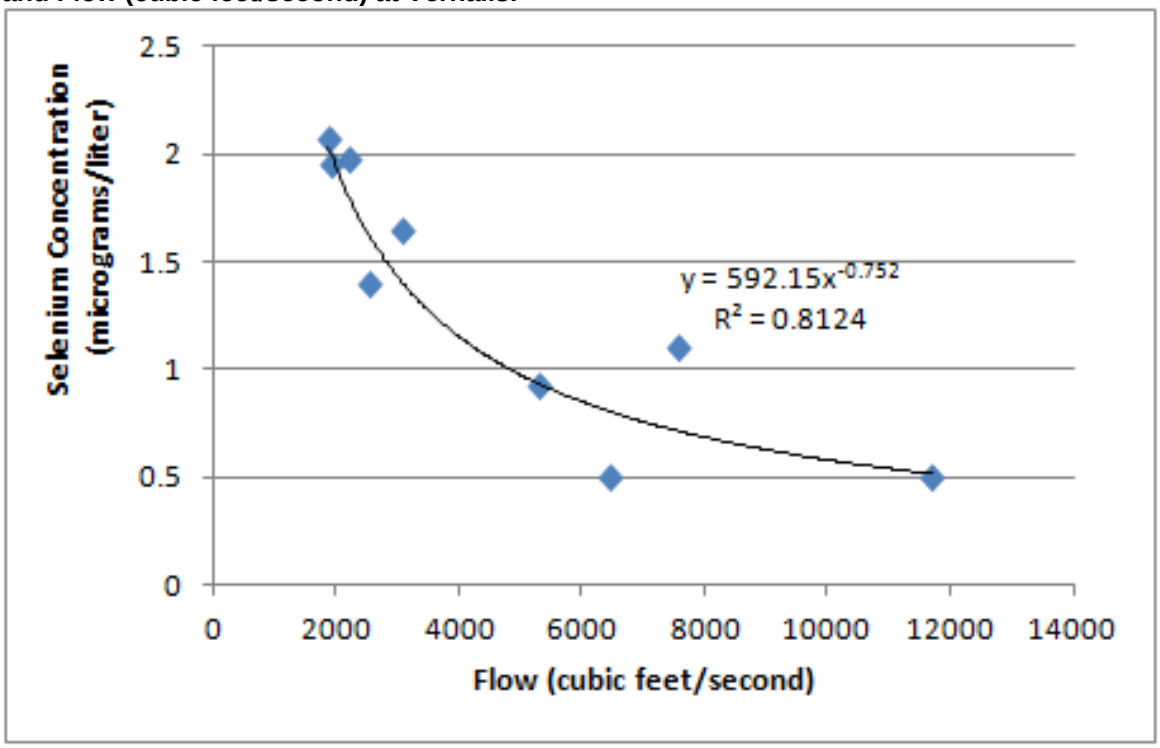


Figure M-12. March Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

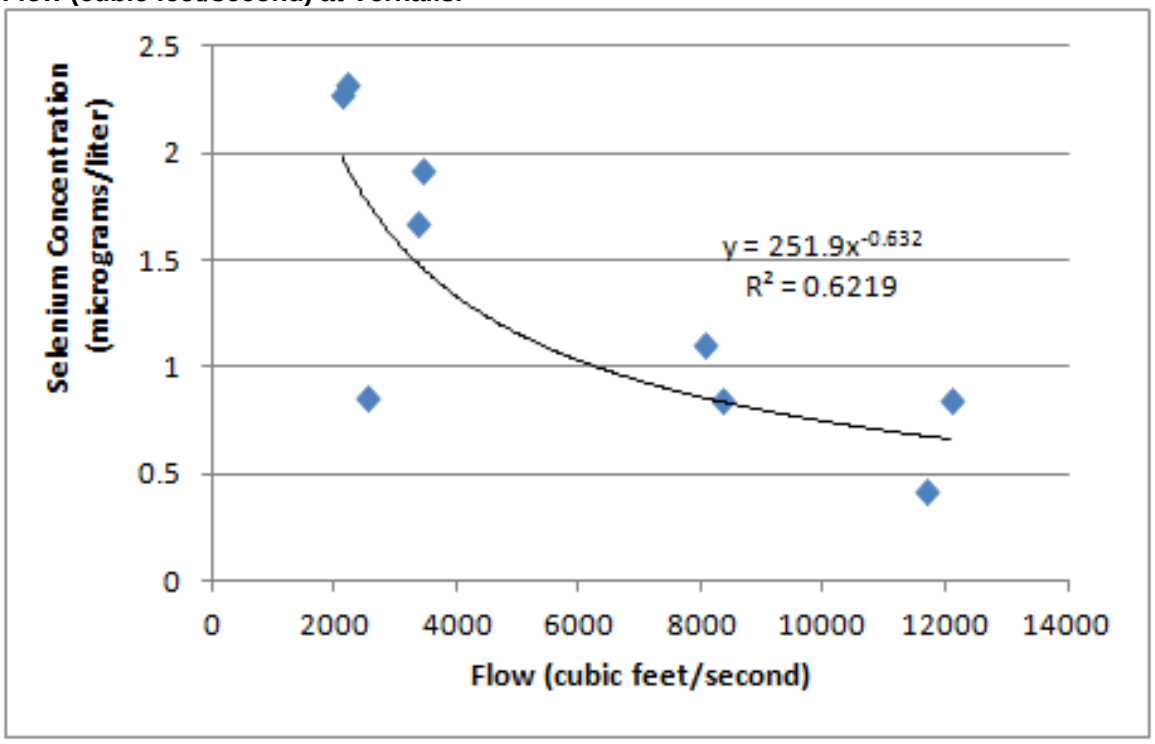


Figure M-13. April Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

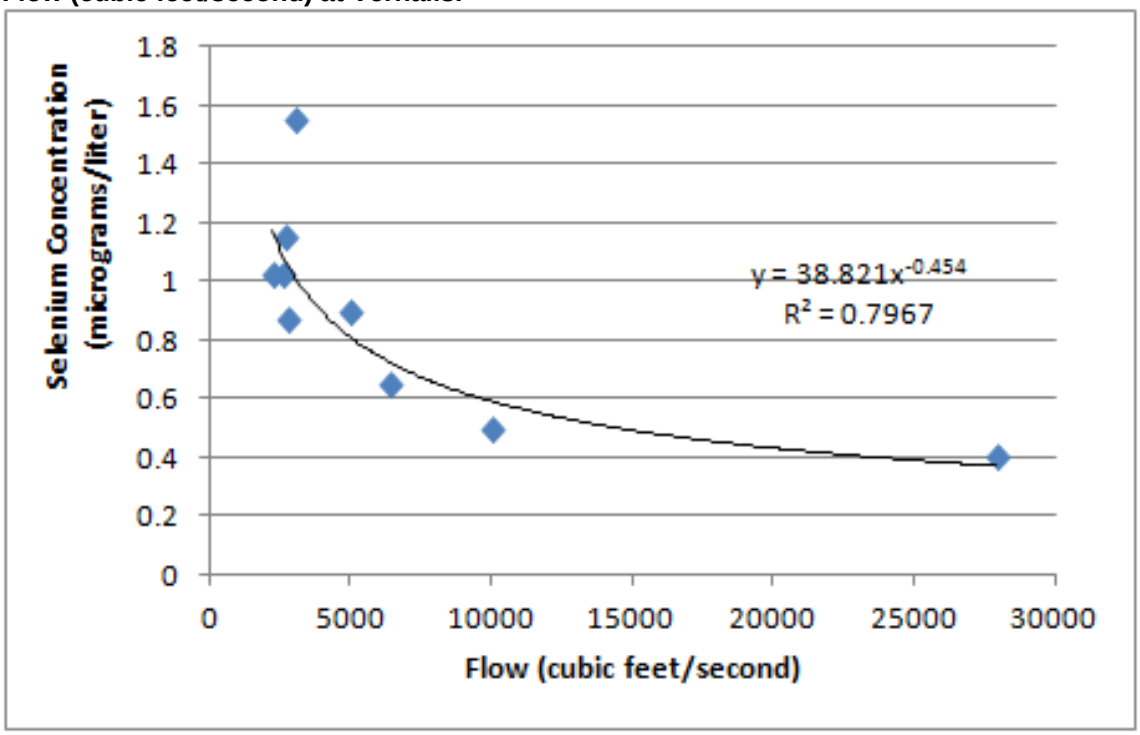


Figure M-14. May Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

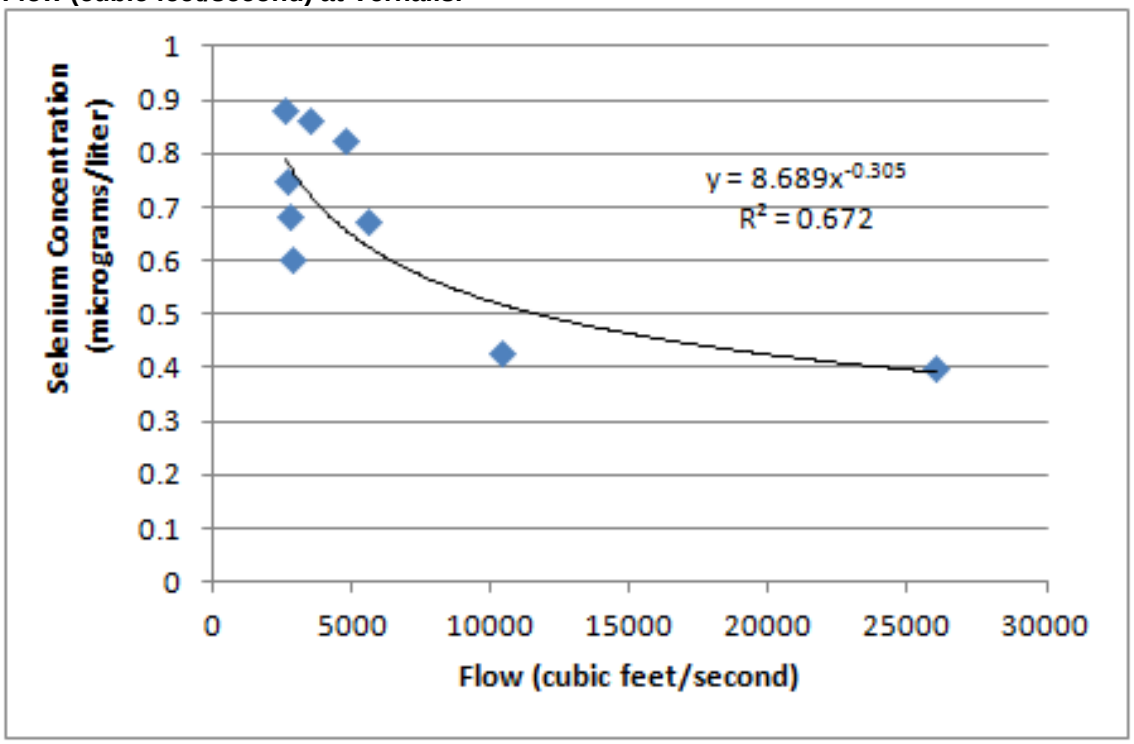


Figure M-15. June Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

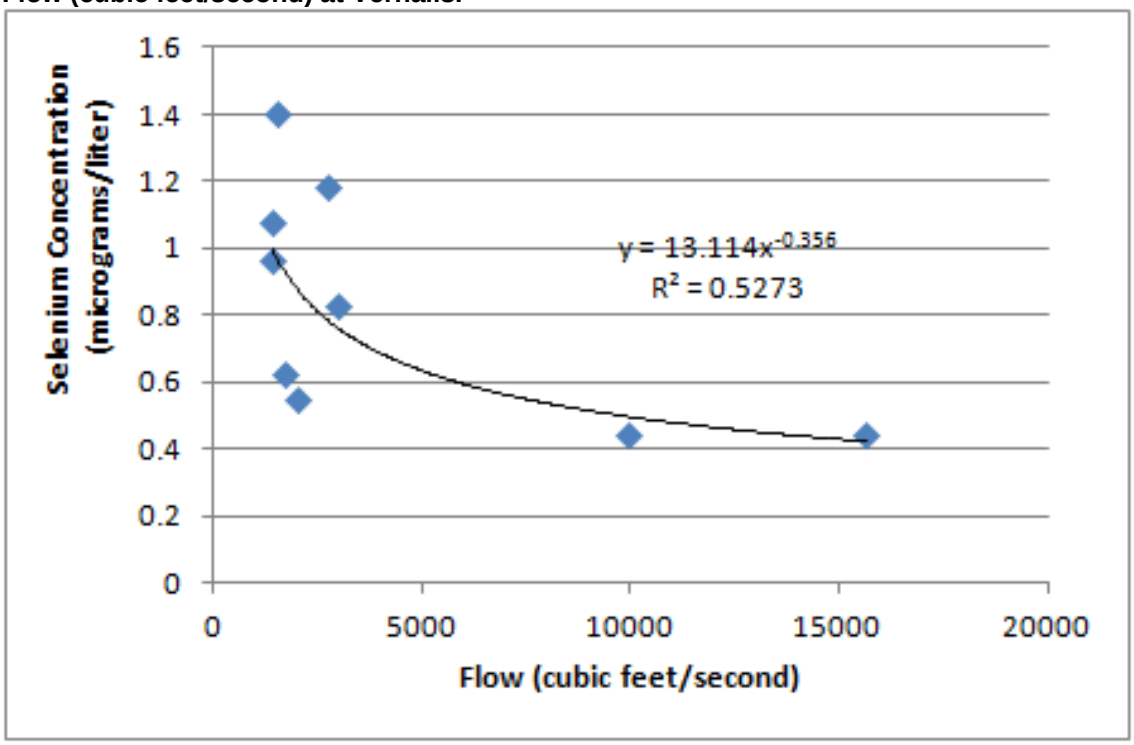


Figure M-16. July Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

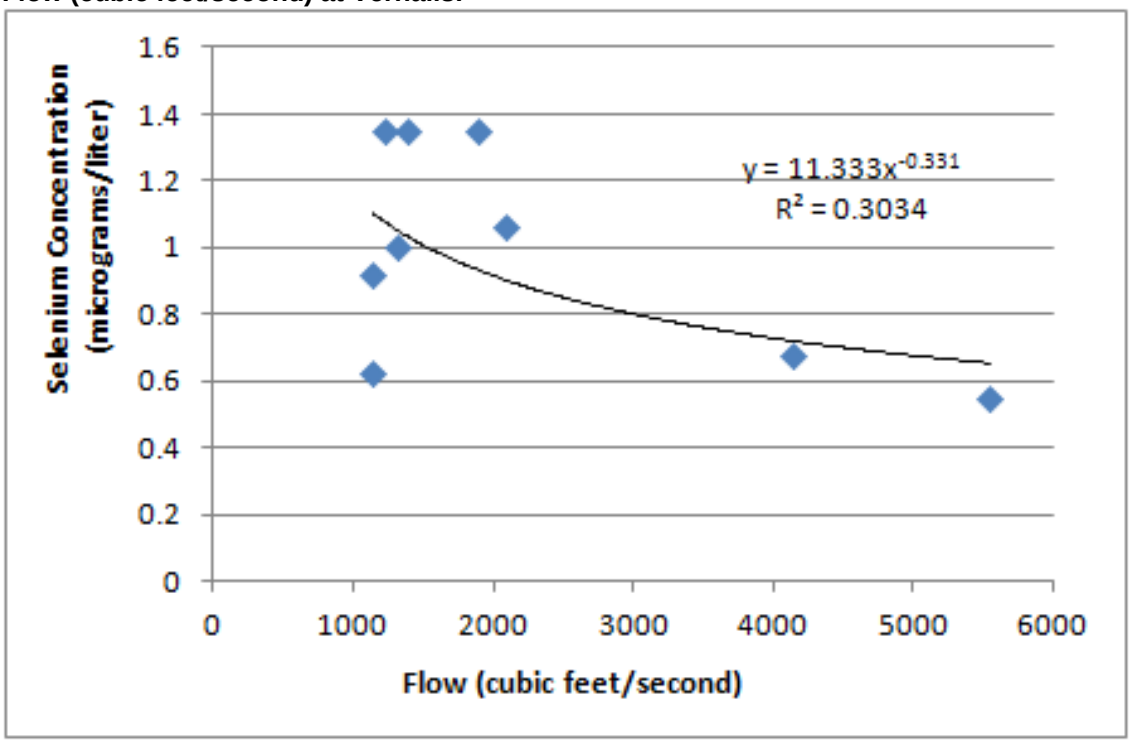


Figure M-17. August Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

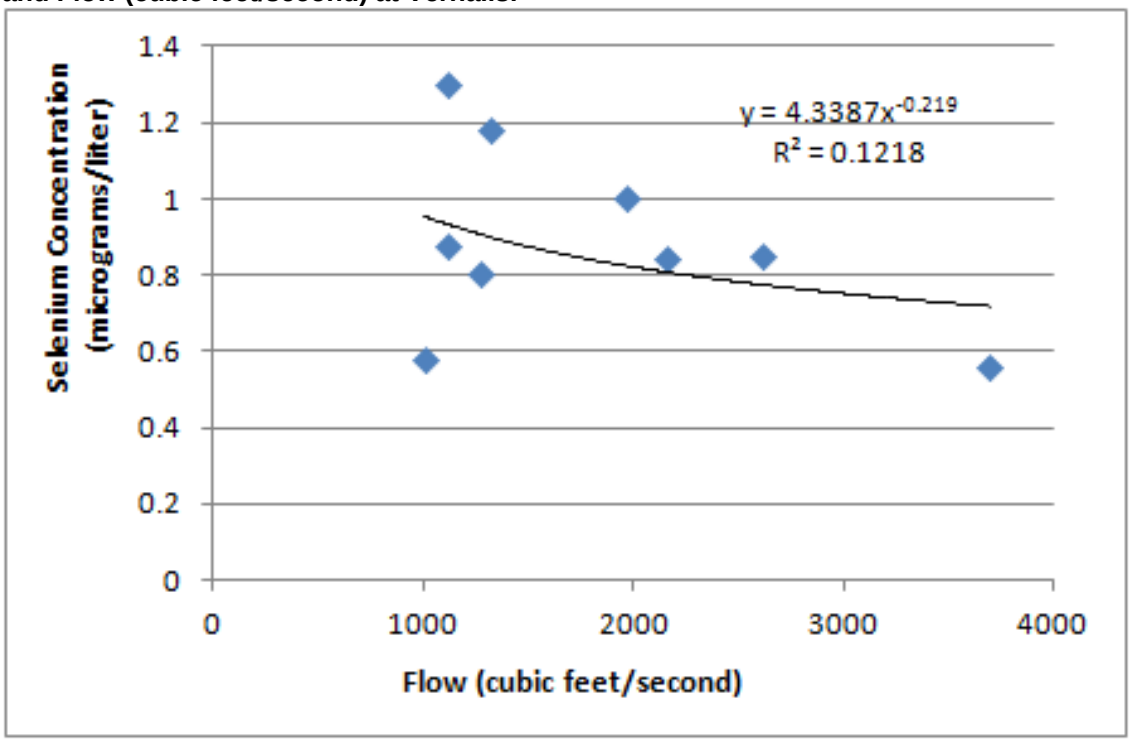


Figure M-18. September Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

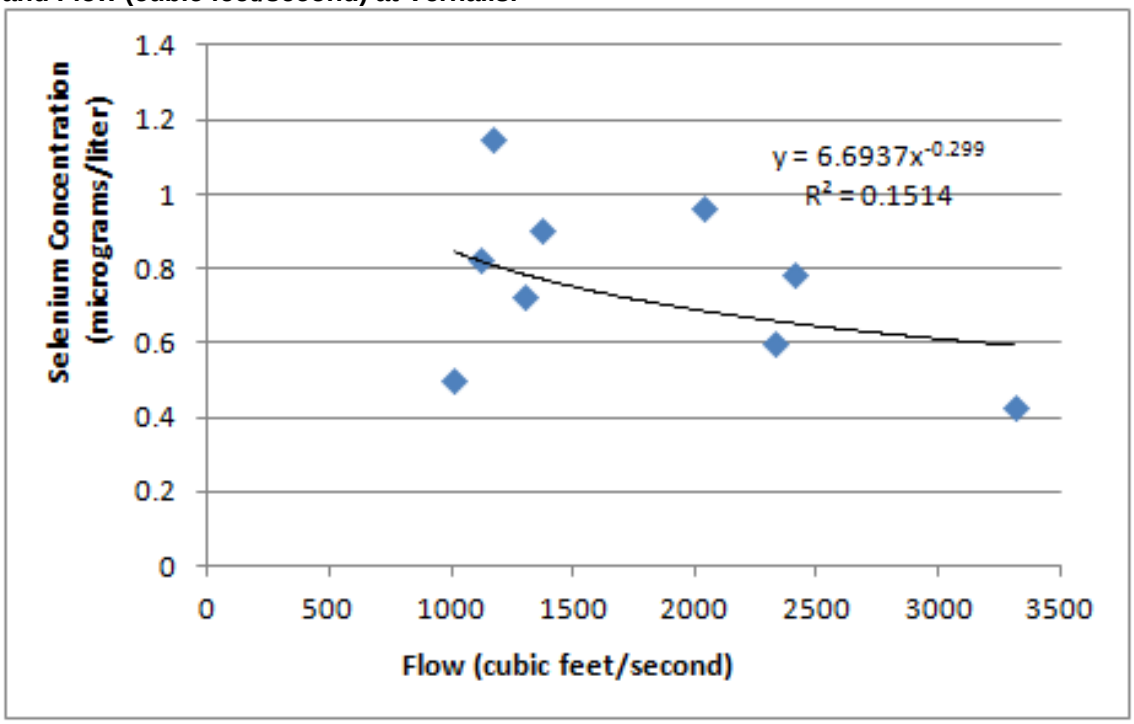


Figure M-19. October Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

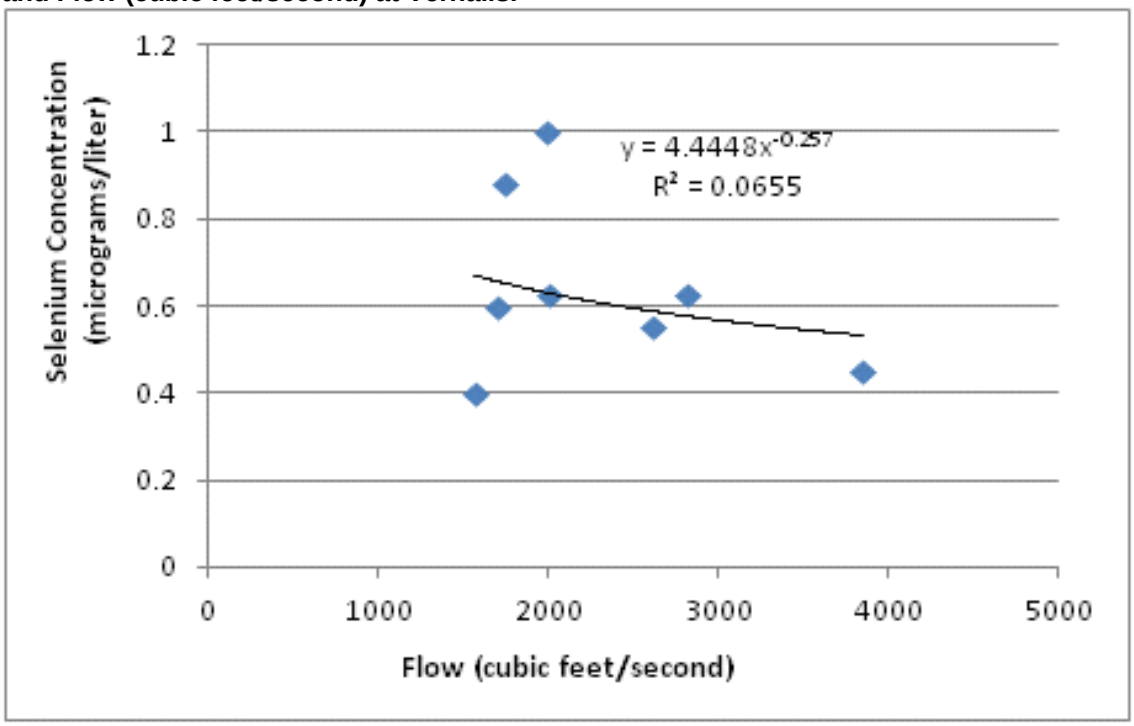


Figure M-20. November Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

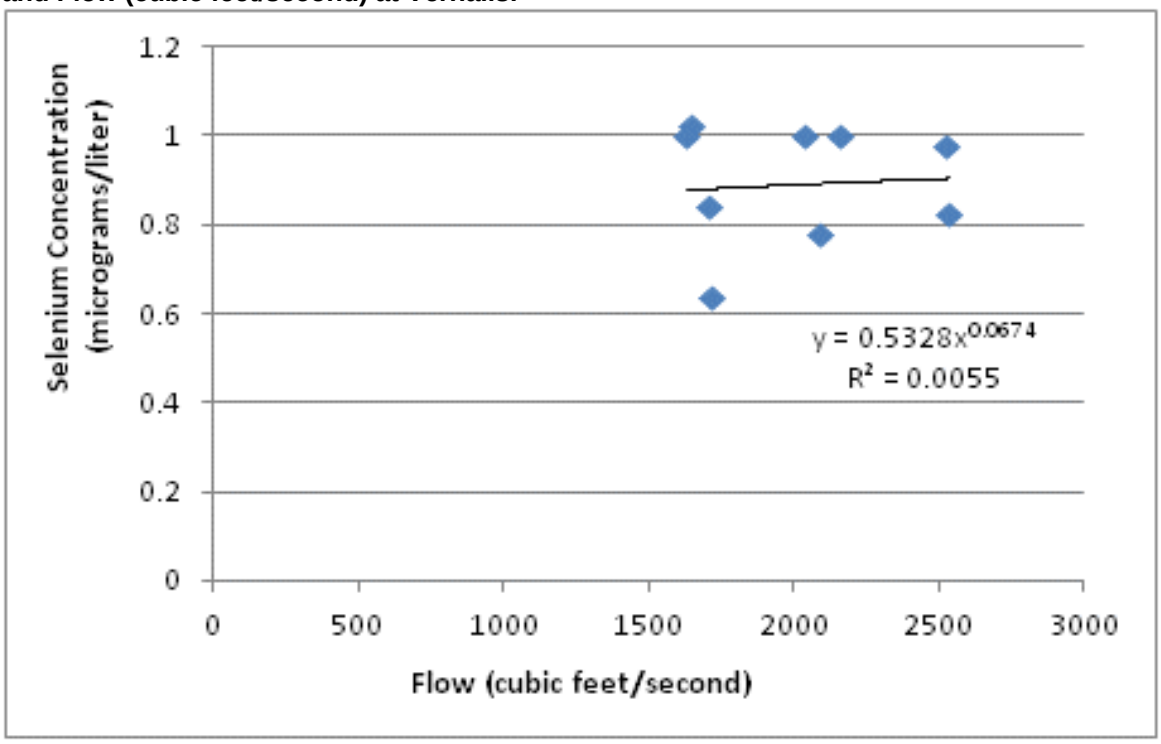


Figure M-21. December Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.