Chapter 5

Hydrology and Water Quality Impacts Assessment

5. Hydrology and Water Quality Impacts Assessment

This chapter analyzes the effects of the WHCP on hydrology and water quality. The chapter is organized as follows:

A. Environmental Setting

B. Impact Analysis and Mitigation Measures.

The environmental setting describes the hydrology and water quality status of the Delta. This discussion covers water quality requirements, surface water quality, surface water hydrology, Delta exports, and groundwater.

The impact analysis provides an assessment of the specific environmental impacts to hydrology and water quality potentially resulting from program operations. The discussion utilizes findings from WHCP environmental monitoring and research projects, technical information from scientific literature, government reports, relevant information on public policies, and program experience. The impact assessment is based on technical and scientific information.

For each of the potential WHCP impacts to hydrology and water quality we provide a description of the impact, analyze the impact, classify the impact level, and identify mitigation measures to reduce the impact level. The mitigation measures are specific actions that the DBW will undertake to avoid, or minimize, potential environmental impacts. The DBW has undergone, and will continue to undergo, consultation with various local, State, and federal agencies, including the Central Valley Regional Water Quality Control Board (CVRWQCB) regarding impacts and mitigation measures. Proposed mitigation measures may be revised, and/or additional mitigation measures incorporated, as a result of this ongoing consultation with regulatory agencies and water providers.

A. Environmental Setting

1. Water Quality Regulatory Setting

The State Water Resources Control Board (SWB) regulates water quality in California, through the federal Clean Water Act (CWA), and the Porter-Cologne Water Quality Control Act. The State Water Code gives Regional Water Boards primary responsibility for formulating and adopting water quality control plans in each of the State's nine regions.

There are two plans that jointly specify water quality controls for the Delta, the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan), and the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins. The Bay- Delta Plan, developed by the SWB, is

Table 5-1
Beneficial Uses in Delta Waters

Beneficial Use	Abbreviation
Municipal and domestic supply	MUN
Industrial service supply	IND
Industrial process supply	PRO
Agricultural supply	AGR
Groundwater recharge	GWR
Navigation	NAV
Water contact recreation	REC-1
Non-contact water recreation	REC-2
Shellfish harvesting	SHELL
Commercial and sport fishing	COMM
Warm freshwater habitat	WARM
Cold freshwater habitat	COLD
Migration of aquatic organisms	MIGR
Spawning, reproduction, and/or early development	SPWN
Estuarine habitat	EST
Wildlife habitat	WILD
Rare, threatened, or endangered species	RARE

complementary to the Basin Plan developed by the CVRWQCB. Water quality plans must also be approved by the USEPA.

Both plans consist of beneficial uses to be protected, water quality objectives, and a program for implementation of the water quality objectives. A primary goal of the water quality planning process is to identify and protect beneficial uses for surface and groundwater in a given region. **Table 5-1,** above, summarizes several of the beneficial uses for Delta waters.

Water quality objectives are "the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area" (Water Code Section 13050(h), in CVRWQCB 2007). In establishing water quality objectives, the Regional Water Boards must consider the following:

- Past, present, and probable future beneficial uses;
- Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;
- Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;
- Economic considerations;
- The need for developing housing within the region;
- The need to develop and use recycled water (Water Code Section 13241).

The SWB and Regional Water Boards refine their respective plans over time to take into account new water quality issues. The most recent Bay-Delta Plan was published in December 2006, and the most recent Basin Plan was published in October 2007. These plans specify surface water quality objectives for a range of categories, including: bacteria, biostimulatory substances, chemical constituents, color, dissolved oxygen, floating material, methylmercury, oil and grease, pH, pesticides, radioactivity, salinity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity. The Bay-Delta Plan identifies additional requirements for chloride, salinity, dissolved oxygen, delta outflow, river flows, and export limits. These Bay-Delta Plan water quality objectives are intended to protect municipal, industrial, agricultural, and fish and wildlife beneficial uses. The Bay-Delta Plan requirements supersede those of the Basin Plan.

One mechanism that the CVRWQCB uses to implement the Bay-Delta and Basin Plans is a National Pollutant Discharge Elimination System (NPDES) permit. NPDES permits are issued to entities that discharge to waterways, known as point source dischargers. In the 2001 Headwaters, Inc. v. Talent Irrigation case, the Ninth Circuit Court of Appeals held that discharges of pollutants from the use of aquatic pesticides to waters of the United States required coverage under a NPDES permit (CVRWQCB 2006). The DBW obtained an individual NPDES permit in March 2001, and operated under this permit until April 2006. In April 2006, the DBW applied to operate under the General NPDES Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States – General Permit No. CAG990005 (General Permit).

Since the Talent decision, there has been some confusion regarding the need to obtain an NPDES permit for aquatic pesticide use. In November 2006, the USEPA issued a regulation stating that application of a pesticide in compliance with relevant requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) does not require a NPDES permit when the application is made directly in waters to control pests in the water, or when the application of the pesticide is made to control pests that are over (or near) waters (Federal Register 2006). The rulemaking was based on the USEPA's interpretation of the term "pollutant" under the Clean Water Act.

In theory, this regulation eliminated the need for a NPDES permit for the WHCP. However, there were at least two legal challenges to this regulation, and SWB legal counsel recommended that the SWB not rescind their general NPDES permits related to aquatic pesticides (SWB 2007). The USEPA ruling did mean that agencies operating under the General Permit had the option to terminate their coverage by the General Permit. The DBW elected to maintain coverage under the General Permit until legal challenges to the ruling were resolved. In January 2009, an appeals court vacated the USEPA rule that had allowed pesticides to be applied to U.S. waters without a NPDES permit. This ruling does not change WHCP operations because DBW maintained permit coverage.

Key NPDES requirements for the WHCP are as follows:

- **Dissolved oxygen** – specific DO limits depend on the location and season, but range from 5.0 mg/l (ppm) to 8.0 mg/l (ppm). DO levels are not to drop below these levels as a result of WHCP treatments
- **Turbidity** – specific turbidity standards are not to increase above a specified number or percent of Nephelometric Turbidity Units (NTUs), depending on the initial level of natural turbidity. Generally, the WHCP shall not increase turbidity more than 10 to 20 percent
- **pH** – WHCP discharges shall not cause pH to fall below 6.5, or exceed 8.5, or change by more than 0.5 units
- **2,4-D residues** – maximum 2,4-D levels are based on EPA municipal drinking water standards, and shall not exceed 70 µg/l, or 70 ppb
- **Glyphosate residues** – maximum glyphosate levels are based on EPA municipal drinking water standards, and shall not exceed 700 µg/l, or 700 ppb
- **Adjuvant residues** – there are no specified limits for adjuvants; however, DBW is required to monitor adjuvant levels
- **Monitoring** – requires a monitoring protocol. Monitoring is required at 10 percent of sites treated, for each chemical and waterbody type. Sampling stations are identified as : "A" (where treatment occurred), "B" (downstream of the treatment area), and "C" (control, typically upstream). Sampling times are identified as: "1" (pre-treatment), "2" (immediately post-treatment), and "3" (within seven days after treatment). Thus, sample 2B is taken immediately post-treatment, downstream of the treatment location
- **Reporting** – the DBW is required to submit an annual report by March 1st of each year.

2. Surface Water Quality

The Bay-Delta Plan notes that "the Bay-Delta Estuary itself is one of the largest ecosystems for fish and wildlife habitat and production in the United States. Historical and current human activities (e.g. water development, land use, wastewater discharges, introduced species, and harvesting), exacerbated by variations in natural conditions, have degraded the beneficial uses of the Bay-Delta Estuary, as evidenced by the declines in populations of many biological resources of the Estuary" (SWB 2006).

Pollutants in Delta waterways include: pesticides (chlorpyrifos, DDT, diazinon, furan compounds, and Group A pesticides[1]), exotic species, mercury, salinity, dissolved oxygen, pathogens, and PCBs (CVRWQCB 2006). Potential sources of these pollutants include: agriculture, municipal point sources, urban runoff, storm sewers, resource extraction, and hydromodification. More recently, concerns have been raised about ammonia levels in the Delta. The CVRWQCB is working with researchers at San Francisco State University and the University of California, Davis, to evaluate the impact of ammonia in the Delta (CVRWQCB 2008).

While evidence of gross pollution in the Delta has been largely eliminated, the recent rapid growth in population and industrial activity in tributary areas has left some problems unsolved and has created new ones. Existing water quality problems may be categorized as 1) eutrophication and associated dissolved oxygen fluctuations, 2) suspended sediments and turbidity, 3) salinity, 4) toxic material, and 5) bacteria.

Pesticides are found in the water and bottom sediments throughout the Delta. The more persistent chlorinated hydrocarbon pesticides are consistently found at higher levels than the less persistent organophosphate compounds. Sediments in the western Delta have the highest pesticide content. Pesticides have concentrated in aquatic life, but long-term effects and the effects of intermittent exposure are not known. There are now concerns about the aquatic toxicity of pyrethroid-based pesticides, which are replacing organophosphorus pesticides such as diazinon and chlorpyrifos.

Bacteriological quality, as measured by the presence of coliform bacteria, varies depending on the proximity to waste discharges and significant runoff. The highest concentration of coliform organisms is generally in the western Delta and near major municipal waste discharges.

The most serious enrichment in the Delta is due to a high influx of nutrients. Enrichment problems in the Delta occur along the lower San Joaquin River and in certain areas receiving waste discharges but having little or no net freshwater flow. These problems occur mainly in the late summer and coincide with low streamflow, high temperature, and the harvest season when fruit and vegetable canneries are in full operation. Deepening channels for navigation has further depressed dissolved oxygen levels to the point that at times levels are insufficient to support aquatic life. In the fall, these circumstances, combined with reverse flows due to export pumping, have created conditions unsuitable for salmon passage through the Delta to spawning areas in the San Joaquin Valley.

Warm, shallow, dead-end sloughs of the eastern Delta support populations of potentially toxic planktonic blue-green algae during the summer. Floating, semi-attached and attached aquatic plants such as water primrose *(Ludwigia peploides),* water hyacinth *(Eichhornia crassipes),* hornwort or coontail *(Ceratophyllum demersum),* eurasian milfoil *(Myriophylum spicatum), and Egeria densa* frequently clog Delta waterways during summer. Extensive growth of these plants interferes with small boat traffic and contributes to the total organic load as these plants break loose and move downstream in the fall and winter.

[1] Group A pesticides include: aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane, endosulfan, and toxaphene.

Most Delta waters are turbid as a result of suspended silt, clay, and organic matter. Most of these sediments enter the Delta system with flow from major tributaries. Some enriched areas are turbid as a result of planktonic algal populations, but inorganic turbidity tends to suppress nuisance algal populations in much of the Delta. Continuous dredging to maintain deep channels for shipping also has contributed to turbidity and has been a significant factor in the temporary destruction of bottom organisms through displacement and suffocation.

Salinity control is necessary in the Delta because it is contiguous with the ocean and its channels are at, or below, sea level. Unless repelled by continuous seaward flow of fresh water, ocean water will advance up the estuary and degrade water quality. During winter and early spring, flows through the Delta are usually above the minimum required to control salinity (described as “excess water conditions”). At least for a few months in summer and during the fall of most years, however, salinity must be carefully monitored and controlled for “balanced water conditions”. The Central Valley Project and State Water Project monitor and control salinity, and salinity levels are regulated by the State Water Resources Control Board under its water right authority (through the Bay-Delta and Basin Plans). There are concerns that Delta salinity is increasing as more water is diverted through the SWP and CVP.

Salinity intrusion is a problem mainly during years of below-normal runoff, although in recent years with higher export levels, salinity has also been a concern. The degree of seawater intrusion into the Delta, and thus one source of salinity, is a result of daily tidal fluctuations, freshwater inflow to the Delta from the Sacramento and San Joaquin Rivers, the rate of export at the SWP and CVP intake pumps, and the operation of various control structures such as the Delta Cross-Channel Gates and Suisun Marsh Salinity Control System (USBR 2003).

In the eastern Delta salinity is largely associated with agricultural drainage and the high concentration of salts carried by the San Joaquin River. The Banks and Jones pumping plant operations draw high quality Sacramento River water across the Delta and restrict the low quality area to the southeastern corner. In areas such as dead-end sloughs, irrigation returns cause localized problems. In the western Delta, incursion of saline water from San Francisco Bay is one of the main water quality problems.

Another concern is that Delta water contains trihalomethane (THM) precursors. THMs are suspected carcinogens produced when chlorine used for disinfection reacts with natural substances during the water treatment process. Dissolved organic compounds that originate from decayed vegetation act as precursors by providing a source of carbon in THM formation reactions. During periods of reverse Delta flow, bromides from the ocean mix with Delta water at the western edge of Sherman Island. When bromides occur in water along with organic THM precursors, THMs are formed that contain bromine as well as chlorine. Drinking water supplies taken from the Delta are treated to meet THM standards, set at 0.080 mg/l, MRDL (maximum residual disinfectant level (USBR 2003). Contra Costa Water District (CCWD) reports that bromide in the Delta is 6.5 times above the national average (Taugher 2005). To reduce THM formation, CCWD has reduced the amount of chlorine used in their treatment process.

3. Surface Water Hydrology

Prior to the mid-1800s, the Delta was a floodplain consisting of marshes and tidal channels. Beginning around the 1850s, European settlers constructed levees to reclaim marshes and floodplains for farming. There are approximately 1,100 miles of levees in the Delta.

Table 5-2
Delta Water Balance in Million Acre Feet (MAF) (1998, 2000, 2001)

	Inflows to Delta					Outflows from Delta			
Type – Year	Precipitation	Sacramento River	San Joaquin River	Other	Total	In-Delta Consumption	Exports	Outflow to SF Bay	Total
Wet – 1998	1.42	37.94	8.44	2.09	49.89	1.69	4.78	43.42	49.89
Average – 2000	0.95	21.28	2.84	1.08	26.15	1.69	6.32	18.14	26.15
Dry – 2001	0.76	10.87	1.73	.37	13.73	1.69	5.08	6.96	13.73

Source: URS Corporation 2007, p.18

The Sacramento and San Joaquin Rivers unite at the western end of the Delta at Suisun Bay. Over 40 percent of the State's runoff drains into the Delta. The Sacramento River contributes roughly 80 percent of the Delta inflow in most years, the San Joaquin River contributes 15 percent, with the remaining 5 percent of flows contributed from the Mokelumne, Cosumnes, and Calaveras rivers. From Suisun Bay, water flows through Carquinez Strait into San Pablo Bay (the northern half of San Francisco Bay) and then through the Golden Gate to the Pacific Ocean.

Most of the Delta is subject to tidal action with mean fluctuations of approximately two to three feet. This tidal influence is important throughout the Delta. Historically, when mountain runoff dwindled during the summer, ocean water intruded upstream as far as Sacramento. During winter and spring, fresh water from heavy rains pushed the salt water back, sometimes past the mouth of San Francisco Bay.

With the addition of Shasta, Folsom, and Oroville dams, salt water intrusion during summer has been controlled by reservoir releases. Peaks in winter and spring flows have been dampened, and summer and fall flows have been increased. The result is relatively consistent salinity levels in the Delta throughout the year. However, in very wet years reservoirs are unable to control runoff, so during the winter and spring the upper bays become fresh and even the upper several feet of water at the Golden Gate can be fresh.

On average, about 26 million acre-feet of water reaches the Delta annually, but actual inflow varies widely from year-to-year and within the year (DWR 2005). **Table 5-2,** above, provides the Delta water balance for wet, average, and dry years. There is even greater variation between extreme water years. For example, in 1977, a year of extraordinary drought, Delta inflow totaled only 5.9 million acre-feet. Inflow for 1983, an exceptionally wet year, was about 70 million acre-feet. On a seasonal basis, average natural flow to the Delta varies by a factor of more than 10 between the highest month in winter or spring and the lowest month in fall. Because of the large tidal flows compared to inflows, outflow must be calculated rather than measured. Calculated outflows are reasonably accurate on time scales longer than a few weeks but not at all accurate for shorter periods.

Delta hydraulics are complex. The influence of the tide is combined with freshwater outflow, resulting in flow patterns that vary daily. Inflow varies seasonally and is affected by upstream diversions. Hydraulics are further complicated by a multitude of agricultural, industrial, and municipal diversions for use in the Delta itself and by exports for the CVP and SWP. The primary factors currently influencing Delta hydrodynamic conditions are: river inflow from the Sacramento and San Joaquin Rivers;

daily tidal inflow and outflow through the San Francisco Bay, and export pumping from the south Delta through the Harvey O. Banks Pumping Plant and the C.W. “Bill” Jones Pumping Plant (USBR 2003). Delta hydraulics are likely to be further modified in the future due to climate change, sea level rise, and risk of levee failure.

4. Delta Exports

The CVP, operated by the U.S. Bureau of Reclamation, and the SWP, operated by the Department of Water Resources, coordinate operations to manage the flow of water into, and out of, the Delta. Both agencies monitor and manage releases from upstream reservoirs and export pumping at the SWP Banks and CVP Jones pumping plants (DWR 2005).

To minimize water level fluctuation caused by the SWP intake along Old River, Clifton Court Forebay is operated so water is drawn through the gates at high tides and the gates are closed at low tides. This operation provides a more constant head for the pumps and allows the Department of Water Resources to maintain optimum velocities in the channel and across the fish screens. The CVP draws water directly from the channels over the entire tidal cycle, resulting in a continuous flow toward the Jones Pumping Plant whenever it is operating.

Operational changes of the SWP and CVP can affect flow in the lower San Joaquin River along Sherman Island. When outflow is low, increases in export and internal use results in a net reverse flow in this portion of the river, so that net movement of water is upstream toward the pumps. Although they are small in relation to tidal flows, there is concern that net reverse flows may harm fish, including salmon, steelhead, delta smelt, and planktonic eggs and larvae of striped bass.

The CVP can pump a maximum of 4,600 cubic feet per (cfs) second into the Delta-Mendota Canal. This is equivalent to a maximum annual export volume of 3.33 million acre-feet, however, CVP export has historically averaged approximately 2.5 million acre-feet per year (DWR 2006). Adding the Contra Costa Canal brings the CVP export capacity to 4,900 cfs. The SWP can pump 10,300 cfs at Banks Pumping Plant (up to 4.2maf annually, but an agreement with the U.S. Army Corps of Engineers limits pumping to 6,680 cfs).

The SWP typically exports approximately 3 million acre-feet per year. Pumping at both facilities was curtailed to levels thought to be more protective of Delta fish in December 2007 under an order by federal Judge Oliver Wanger. Judge Wanger also required the USBR and DWR to obtain a new biological opinion from the USFWS for the Operation and Criteria Plan for the SWP and CVP. Although significant changes to export mechanisms in the Delta are unlikely for many years, there are several initiatives to evaluate around-Delta export mechanisms (see Chapter 7 for additional discussion).

5. Groundwater

The groundwater hydrology of the Sacramento-San Joaquin Delta, as with the geology, is contiguous with that of the Sacramento River Basin. Large amounts of water are stored in thick sedimentary deposits in the Sacramento Valley groundwater basin. Groundwater is used intensively in some areas but only slightly in areas where surface water supplies are abundant.

Groundwater occurs in various degrees of confinement in the Sacramento Valley basin. Groundwater is generally unconfined in the relatively shallow alluvial fan, flood plain, and stream channel deposits and partially confined in and under the flood basin deposits. In the older Pleistocene and Pliocene formations, especially at deeper levels, water is confined beneath impervious thick clay and mudflow strata.

Groundwater levels fluctuate according to supply and demand on daily, seasonal, annual, and even longer bases. Short-term and long-term water level changes have been recorded for wells since the first documented measurements in 1929. In the low-lying central portion of the Sacramento Valley Basin, from the Delta north to Glenn and Butte counties, depth to water in wells is 10 feet or less.

Groundwater is replenished through deep percolation of streamflow, precipitation, and applied irrigation water. Recharge by subsurface inflow is negligible compared to other sources. Groundwater quality is generally excellent throughout the area and is suitable for most uses, although at shallow depths within the Delta the water is often saline.

B. Impact Analysis and Mitigation Measures

For purposes of this analysis, we considered an impact to hydrology and water quality to be significant and require mitigation if it would result in any of the following:

- Violate any water quality standards or waste discharge requirements
- Substantially alter the existing drainage pattern of the site or area in a manner which would result in substantial erosion or siltation on- or off-site
- Substantially alter the existing drainage pattern of the site or area in a manner which would result in flooding on- or off-site
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff
- Otherwise substantially degrade water quality
- Otherwise substantially degrade drinking water quality
- Place housing within a 100-year flood hazard area
- Place structures which would impede or redirect flood flows within a 100-year flood hazard area
- Expose people or structures to a significant risk of loss, injury, or death involving flooding
- Inundation by seiche, tsunami, or mudflow.

Table 5-3, on the next page, provides a summary of the potential WHCP impacts for hydrology and water quality significance areas which could potentially be affected. Table 5-3 also explains potential benefits, and those hydrology and water quality significance areas in which there will be no impacts. We discuss potential impacts of the WHCP on water intake pump systems in Chapter 6.

The first three potential impacts, Impact W1: Chemical constituents; Impact W2: Pesticides; and Impact W3: Toxicity; are closely related. We discuss each of these potential impacts and their mitigation measures separately. However, to minimize duplication, within one particular impact, we may reference discussions within either of the other two related impacts. In addition, we reference more detailed discussions of Biological Resource impacts related to herbicide toxicity in Chapter 3.

Impact W1 – Chemical constituents: following WHCP herbicide treatment, waters may potentially contain chemical constituents that adversely affect beneficial uses, violating water quality standards or otherwise substantially degrading water quality or drinking water quality

WHCP herbicide treatments involve spraying chemical constituents onto water hyacinth plants growing in the Delta and its tributaries. Anderson (1982) determined that 10 to 20 percent of herbicide reaches the water following water hyacinth treatment, either moving through the water hyacinth mat, or as a result of drift. This herbicide is considered a chemical constituent in the water.

Table 5-3

Crosswalk of Hydrology and Water Quality Significance Criteria, Impacts, and Benefits of the WHCP

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	Mitigation Measures	Unavoidable or Potentially Unavoidable Significant Impact	Avoidable Significant Impact	Less than Significant Impact	No Impact	Beneficial Impact
a) Violate any water quality standards or waste discharge requirements?						Removal of water hyacinth through WHCP efforts could improve Delta water quality so that measurements are more closely aligned with standards (e.g. increased dissolved oxygen, and reduced fragments)
Impact W1: Chemical constituents	3, 6, 7, 21	**[X]**				
Impact W2: Pesticides	1, 3, 4, 6, 7, 21	**[X]**				
Impact W3: Toxicity	1, 3, 4, 6, 7, 21	**[X]**				
Impact W4: Dissolved oxygen levels	9, 10, 11, 12	**[X]**				[X]
Impact W5: Floating material	13, 21, 22		**[X]**			[X]
Impact W6: Turbidity	4			[X]		
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?					WHCP will not deplete groundwater supplies or interfere substantially with groundwater recharge	
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?					WHCP will not alter the existing drainage pattern of the site or area in a manner which would result in erosion or siltation on- or off-site	
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?					WHCP will not alter the existing drainage pattern of the site or area, or increase the rate of runoff, in a manner which would result in flooding on- or off-site	
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?					WHCP will not create or contribute runoff water or provide additional sources of polluted runoff	

Table 5-3
Crosswalk of Hydrology and Water Quality Significance Criteria, Impacts, and Benefits of the WHCP *(continued)*

Page 2 of 2

	Mitigation Measures	Unavoidable or Potentially Unavoidable Significant Impact	Avoidable Significant Impact	Less than Significant Impact	No Impact	Beneficial Impact
f) Otherwise substantially degrade water quality?						Removal of water hyacinth through WHCP efforts could improve Delta water quality so that measurements are more closely aligned with standards (e.g. increased dissolved oxygen, and reduced fragments). The WHCP will also improve several beneficial uses of Delta waterways
Impact W1: Chemical constituents	3, 6, 7, 21	**[X]**				
Impact W2: Pesticides	1, 3, 4, 6, 7, 21	**[X]**				
Impact W3: Toxicity	1, 3, 4, 6, 7, 21	**[X]**				
Impact W4: Dissolved oxygen levels	9, 10, 11, 12	**[X]**				[X]
Impact W5: Floating material	13, 21, 22		**[X]**			[X]
Impact W6: Turbidity	4			[X]		
g) Otherwise substantially degrade drinking water quality?						
Impact W1: Chemical constituents	3, 6, 7, 21	**[X]**				
Impact W2: Pesticides	1, 3, 4, 6, 7, 21	**[X]**				
Impact W3: Toxicity	1, 3, 4, 6, 7, 21	**[X]**				
h) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?					WHCP will not place housing within a 100-year flood hazard area	
i) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?					WHCP will not place structures within a 100-year flood hazard area	
j) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?					WHCP will not expose people or structures to risk of loss, injury, or death involving flooding	
k) Inundation by seiche, tsunami, or mudflow?					WHCP will not result in inundation by seiche, tsunami, or mudflow	

Table 5-4
Post-Treatment Water Samples Collected for Residue Analysis from Inside Treatment Area and Downstream from Treatment Area (2001 to 2005)

	Number of Samples		Percent of Samples		Minimum Detected Residue (ppb)	Maximum Detected Residue (ppb)	Mean Residue (ppb)[a]	Median Residue (ppb)[a]	Number of Samples Exceeding MCL
Chemical	Tested	Non-Detectable (ND)	ND	Detected					
2,4-D	149	27	18.1%	81.9%	0.10	867.0	20.18	1.40	6
Glyphosate	70	52	74.3	25.7	9.80	246.0	15.88	0.50	0
Total	219	79	36.1%	63.9%					6

[a] Non-detected samples were given a value of 0.50ppb, one half of difference between 0 ppb and the 1.0 ppb limit of detection.

The Basin Plan water quality objectives related to chemical constituents are as follows: *"Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses… At a minimum, water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations…"* (CVRWQCB 2007). The relevant MCL levels for the WHCP are:

- 70 ppb or µg/l for 2,4-D
- 700 ppb or µg/l for glyphosate.

For purposes of compliance with these MCLs, the relevant chemical concentrations are in receiving waters, e.g., waters downstream of the treatment site. We briefly discuss the potential for the WHCP to result in chemical constituents, below. Refer to Chapter 3, Impact B2, for a more detailed description of calculated and actual maximum herbicide and adjuvant levels immediately following WHCP treatments. Chapter 3, Impact B2, also includes a discussion of the fate of WHCP herbicides in water.

WHCP monitoring results provide data on actual herbicide residue levels following treatments. Between 2001 and 2005, DBW obtained chemical residue tests on 219 post-treatment water samples, collected inside, and downstream of, treatment areas. Samples were obtained from 48 different sites, and throughout the treatment season (for both chemicals at some sites). **Table 5-4,** above, summarizes these results. Over the five year period, only six of the 149 2,4-D samples (4 percent) were above the MCL of 70 ppb. None of the 70 glyphosate samples were above the MCL of 700 ppb.

Over the last three years of environmental monitoring (2006 to 2008), DBW monitored receiving waters directly downstream of the treatment site, immediately after treatment. As in previous years, environmental scientists also returned to each site two to seven days later to sample upstream, within, and downstream of the treatment site. Over the three year period, DBW conducted 36 sampling events for 2,4-D, and 21 sampling events for glyphosate. All 57 samples of the adjuvant Agridex® were at non-detectable levels.

None of the 2,4-D samples were above the MCL of 70 ppb, and the highest 2,4-D sample was significantly lower than 70 ppb, at 16.3 ppb. None of the glyphosate samples were above the MCL of 700 ppb, and the highest glyphosate sample was also significantly lower than 700 ppb, at 21 ppb. In both cases, given the time and location of sampling, it was unlikely that these highest sample readings were even a result of WHCP treatments, but rather were due to ambient herbicide levels in Delta waters.

The calculated, test plot, and actual WHCP herbicide levels indicate that 2,4-D, glyphosate, and adjuvant levels in the Delta following herbicide treatment are low. Maximum 2,4-D levels immediately following spraying within a treatment site may reach levels as high as 800 ppb, although this was extremely rare. Maximum 2,4-D levels immediately downstream of the site are likely to be less than 10 ppb. Maximum glyphosate levels within a treatment site, immediately after spraying, may reach as high as 158 ppb, but are likely to be less than 30 ppb. Maximum glyphosate levels immediately downstream are likely to be less than 2 ppb. Herbicides may remain at these maximum levels for a relatively short period of time (for example, the downstream sampling typically occurs within one hour of treatment).

The potential for WHCP herbicide treatments to be present in water at concentrations that would adversely affect beneficial uses, or result in violations of MCL levels is low. However, should WHCP herbicide levels occur at such concentrations, it would constitute an **unavoidable or potentially unavoidable significant impact.** This impact would potentially be reduced by implementing the following four mitigation measures.

- **Mitigation Measure W1a (same as Mitigation Measures B2b; B4a; and W1a)** – Monitor herbicide and adjuvant levels to ensure that the WHCP does not result in potentially toxic concentrations of chemicals in Delta waters.

  The DBW will conduct comprehensive monitoring. This monitoring is in compliance with the general NPDES permit, and NOAA-Fisheries and USFWS Biological Opinions. The DBW will collect samples prior to treatment, immediately after treatment, and post-treatment within one week of spraying. The DBW will conduct water quality monitoring for visual parameters, physical parameters, and chemical parameters at ten (10) percent of the sites it treats for each pesticide, per water body type. Water samples will be submitted to a certified analytical laboratory to measure 2,4-D, glyphosate, and adjuvant levels. Should these levels exceed allowable limits, DBW will take immediate measures to reduce chemical levels at future treatment sites.

- **Mitigation Measure W1b** – Follow the Memorandum of Understanding (MOU) protocol for herbicide applications within one (1) mile of Contra Costa Water District (CCWD) drinking water intake facilities.

  The MOU is an agreement between CCWD and DBW. Generally, no applications shall occur within Rock Slough, or within one mile of the confluence of Rock Slough and Old River, or within one mile of CCWD's Old River or Mallard Slough intake pumps without consensual agreement between CCWD and DBW. Herbicide applications within one mile of CCWD's water intakes may only occur with prior consent of CCWD. In order to treat within one mile of an intake, DBW must notify CCWD at least two weeks in advance, and make every reasonable attempt to schedule applications during periods when CCWD's intakes are shut down for environmental or maintenance reasons, allowing at least two complete tidal cycles between application and restart. This measure is primarily aimed at reducing the potential for drinking water contamination from the WHCP.

- **Mitigation Measure W1c (same as Mitigation Measures B2c; B4b; and H2c)** – Implement an adaptive management approach to minimize the use of herbicides.

  Under an adaptive management approach, DBW will seek to improve efficacy and reduce environmental impacts over time as new and better information is available. Specifically, DBW will evaluate the need for control measures on a site by site month to month basis; select appropriate indicators for pre-treatment monitoring; monitor indicators following treatment and evaluate data to determine program efficacy and environmental impacts; support ongoing research to explore impacts of the WHCP and alternative control methodologies; report findings to regulatory agencies; and adjust program actions, as necessary, in response to recommendations and evaluations by regulatory agencies and stakeholders.

In addition to this adaptive management approach, DBW will follow maintenance control practices that seek to reduce the number of acres of water hyacinth to be treated each year, until treatment acreage reaches a minimal level. This will reduce the volume of herbicide utilized by the WHCP.

- **Mitigation Measure W1d (same as Mitigation Measures B1c; B2f; and H2d) –** Conduct herbicide treatments in order to minimize potential for drift.

  In addition to following the label requirements, DBW will, to the degree possible, schedule herbicide applications to occur at high tide, or at a point in the tidal cycle determined by the field supervisor to provide the least non-target impact at a particular site. In general, treatment at high tide will allow for better spray accuracy and access and will provide for greater dilution volume of herbicides. DBW crews will change nozzle type and spray pressures whenever conditions warrant, limiting the amount of herbicide which may inadvertently contact non-target species or enter the water.

Impact W2 – Pesticides: following WHCP herbicide treatment pesticides may potentially be present in concentrations that adversely affect beneficial uses, violating water quality standards or otherwise substantially degrading water or drinking water quality

WHCP herbicide treatments entail spraying of 2,4-D, glyphosate, and adjuvants on water hyacinth plants located in Delta and tributary waterways. These treatments have the potential to adversely affect beneficial uses, violating water quality standards or otherwise substantially degrading water or drinking water quality. The following water quality objectives for pesticides are potentially relevant to the WHCP:

- *"No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses.*
- *Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses.*
- *Pesticide concentrations shall not exceed those allowable by applicable antidegradation policies (see State Water Resources Control Board Resolution No. 68-16 and 40 C.F.R. Section 131.12).*
- *Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.*
- *Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the Maximum Contaminant Levels set forth in California Code of Regulations, Title 22, Division 4, Chapter 15" (CVRWQCB 2007).*

Below, we discuss these five water quality objectives and the potential for WHCP herbicide treatments to adversely affect beneficial uses related to these objectives. Several of these potential impacts are discussed in Chapter 3, and for Impacts W1 and W3.

Presence of WHCP Herbicides in Concentrations that Adversely Affect Beneficial Uses

The beneficial uses that are most likely to be affected by WHCP herbicide treatments are MUN, AGR, WARM, COLD, WILD, BIOL, RARE, MIGR, and SPWN. As noted above under Impact W1, the potential for WHCP herbicides to be present in concentrations that would affect MUN beneficial uses (e.g. to exceed the MCLs) is low. As noted in Chapter 6, the potential for WHCP herbicides to be present in concentrations that would affect AGR beneficial uses are avoidable, and can be mitigated to a less-than significant level.

The potential for WHCP herbicide treatments to impact the biological resource beneficial uses, WARM, COLD, WILD, RARE, MIGR, and SPWN are discussed in Chapter 3. These impacts represent unavoidable or potentially unavoidable impacts that could adversely affect beneficial uses. Below, and in Chapter 3, we identify a number of mitigation measures that can reduce these potential impacts to biological resource beneficial uses.

Presence of WHCP Herbicides in Bottom Sediments or Aquatic Life

WHCP herbicides are not considered to bioaccumulate in aquatic plant or animal life forms. Both herbicides are excreted and/or metabolized following exposure. We discuss the potential for WHCP herbicide bioaccumulation in Chapter 3, Impact B3. In Chapter 3, we determined that the impact of bioaccumulation of WHCP herbicides on special status species is expected to be less than significant. Similarly, the potential for WHCP herbicides to be present in any other aquatic life forms in concentrations that would adversely affect beneficial uses is less than significant.

Herbicide characteristics related to sediment are not necessarily the same as herbicide characteristics related to bioaccumulation. Glyphosate and 2,4-D exhibit very different characteristics in sediment, however neither herbicide is likely to accumulate in sediment, or to result in toxic effects to species present in sediment. The potential for WHCP herbicide treatments to result in concentrations that would adversely affect beneficial uses is less than significant.

The soil adsorption coefficient, K_{OC}, for 2,4-D is relatively low, at 48 μg/g (University of California 2005).This means that 2,4-D does not persist in soil or sediments. The half life of 2,4-D in soil is also relatively short, at 10 days (University of California 2005). The major method of 2,4-D breakdown in soil is microbial degradation (Walters 1999).

Glyphosate binds strongly to soil and sediment and becomes biologically unavailable (Monsanto 2002; Monsanto 2005). The soil adsorption coefficient for glyphosate , K_{OC}, is 24,000 μg/g (University of California 2005). This is one of the highest K_{OC} values among pesticides, and indicates extremely strong binding to sediments. The half life of glyphosate in soil is 47 days (University of California 2005). Once bound to sediments, glyphosate does not move back into the water, but is degraded by soil microbes and fungi to aminomethylphosphonic acid (AMPA), and then carbon dioxide and phosphate. AMPA also strongly adsorbs to soil (NPTN 2000), and is characterized as having little toxicity to non-target organisms (Monsanto 2005).

Presence of WHCP Herbicides in Concentrations that Exceed Applicable Antidegradation Policies

In 1968, the SWB passed Resolution 68-16, *Statement of Policy with Respect to Maintaining High Quality Water in California* (SWB 1968, CVRWQCB 2007). This resolution addresses the USEPA Clean Water Act requirement to adopt an "antidegradation" policy. The goal of the policy is to maintain high quality waters. This policy generally restricts Regional Water Boards and dischargers from reducing the water quality of surface or groundwaters even though such a reduction in water quality might still allow the protection of beneficial uses associated with the water (CVRWQCB 2007).

The waters of the Delta and its tributaries within the WHCP project area are not high quality waters. Significant portions of the Delta and its tributaries are considered impaired due to pesticides, dissolved oxygen, salinity, mercury, exotic species, pathogens, and other discharges. If antidegradation policies did apply in the Delta, the relatively small volumes of WHCP herbicides, applied annually to 200 to 2,500 of the Delta's 50,000 water acres, would be extremely unlikely to exceed any such antidegradation policies.

Presence of pesticides at levels that shall not exceed the lowest levels technically and economically achievable

Through their adaptive management approach and maintenance control (see Mitigation Measure W2c), DBW seeks to minimize the amount of herbicide utilized in the WHCP. Thus, the WHCP will not result in pesticide levels in the Delta and tributaries that exceed the lowest levels technically and economically achievable.

Presence of WHCP Herbicides in Concentrations in Excess of MCLs

The potential for WHCP herbicide treatments to exceed MCLs is discussed extensively under Impact W1, above, and in Chapter 3, Impact B2. The potential for WHCP herbicides to be present in concentrations in excess of MCLs of 70 ppb for 2,4-D, and 700 ppb for glyphosate, is low.

Pesticides present in Delta waters following WHCP herbicide treatments are unlikely to bioaccumulate in species or accumulate in sediment, are unlikely to affect antidegradation policies, and are unlikely to be present in concentrations that exceed MCLs. The DBW will not apply WHCP herbicides at levels that exceed the lowest levels technically and economically achievable.

It is also unlikely that pesticide concentrations resulting from WHCP herbicide treatments will adversely affect beneficial uses, violate water quality standards, or otherwise substantially degrade water or drinking water quality. However, should such concentrations result, it would represent **an unavoidable or potentially unavoidable significant impact.** This impact would be reduced by implementing the following six mitigation measures.

- **Mitigation Measure W2a (same as Mitigation Measures B1a; B2d; B4c; and B6a)** – Avoid herbicide application near special status species, and sensitive riparian and wetland habitat; and other biologically important resources.

  Each year, prior to the start of the treatment season, DBW will conduct field crew environmental awareness training. Under this training, crews will be informed about the presence and life histories of special status species, habitats associated with species, sensitive habitats and wetlands, the terms and conditions of the program's biological opinions, incidental take procedures, and that unlawful take of an animal or destruction of its habitat is a violation of the Endangered Species Act. The DBW will provide crews with a field guide (Species Identification Deck) for easy identification of special status species on site. Prior to treating a site, crews will conduct a visual survey to determine whether special status plants, animals, or sensitive habitats are present. Crews will complete an Environmental Observations Checklist for each site to document the presence or absence of special status species. If any special status species or sensitive habits are present at the site, the field crew will not perform the treatment.

- **Mitigation Measure W2b (same as Mitigation Measures B3b; B4a; and W1a) -** Monitor herbicide and adjuvant levels to ensure that the WHCP does not result in potentially toxic concentrations of chemicals in Delta waters.

The DBW will conduct comprehensive monitoring. This monitoring is in compliance with the general NPDES permit, and NOAA-Fisheries and USFWS Biological Opinions. The DBW will collect samples prior to treatment, immediately after treatment, and post-treatment within one week of spraying. The DBW will conduct water quality monitoring for visual parameters, physical parameters, and chemical parameters at 10 percent of the sites it treats for each pesticide, per water body type. Water samples will be submitted to a certified analytical laboratory to measure 2,4-D, glyphosate, and adjuvant levels. Should these levels exceed allowable limits, DBW will take immediate measures to reduce chemical levels at future treatment sites.

- **Mitigation Measure W2c (same as Mitigation Measures B2c; B4b; H2c; and W1c)** - Implement an adaptive management approach to minimize the use of herbicides.

  Under an adaptive management approach, DBW will seek to improve efficacy and reduce environmental impacts over time as new and better information is available. Specifically, DBW will evaluate the need for control measures on a site by site basis; select appropriate indicators for pre-treatment monitoring; monitor indicators following treatment and evaluate data to determine program efficacy and environmental impacts; support ongoing research to explore the impacts of the WHCP and alternative control methodologies; report findings to regulatory agencies; and adjust program actions, as necessary, in response to recommendations and evaluations by regulatory agencies and stakeholders. In addition to this adaptive management approach, DBW will follow maintenance control practices that seek to reduce the number of acres of water hyacinth to be treated each year, until treatment acreage reaches a minimal level. This will reduce the volume of herbicide utilized by the WHCP.

- **Mitigation Measure W2d (same as Mitigation Measure W1b)** - Follow the Memorandum of Understanding (MOU) protocol for herbicide applications within one (1) mile of Contra Costa Water District (CCWD) drinking water intake facilities.

  The MOU is an agreement between CCWD and DBW. Generally, no applications shall occur within Rock Slough, or within one mile of the confluence of Rock Slough and Old River, or within one mile of CCWD's Old River or Mallard Slough intake pumps without consensual agreement between CCWD and DBW. Herbicide applications within one mile of CCWD's water intakes may only occur with prior consent of CCWD. In order to treat within one mile of an intake, DBW must notify CCWD at least two weeks in advance, and make every reasonable attempt to schedule applications during periods when CWD's intakes are shut down for environmental or maintenance reasons, allowing at least two complete tidal cycles between application and restart. This measure is primarily aimed at reducing the potential for drinking water contamination from WHCP herbicide treatments.

- **Mitigation Measure W2e (same as Mitigation Measures B1c; B2d; H2d; and W1d)** – Conduct herbicide treatments in order to minimize potential for drift.

  In addition to the label requirements noted above, DBW will, to the degree possible, schedule herbicide applications to occur at high tide, or at a point in the tidal cycle determined by the field supervisor to provide the least non-target impact at a particular site. In general, treatment at high tide will allow for better spray accuracy and access and will provide for greater dilution volume of herbicides. DBW crews will change nozzle type and spray pressures whenever conditions warrant, limiting the amount of herbicide which may inadvertently contact non-target species.

- **Mitigation Measure W2f (same as Mitigation Measures B1d and B6b)** – Operate program vessels in a manner that causes the least amount of disturbance to the habitat.

  Operational procedures for DBW vessels will minimize boat wakes and propeller wash. These procedures will be particularly important in shallow water, or other sensitive habitats.

* * * * *

Pesticide application in the Delta and its tributaries, through the WHCP, are intended to result in improvements to a number of beneficial uses. One of the causes of impaired use in the Delta and its tributaries is exotic species, including water hyacinth. The goal of the WHCP is to keep waterways safe and navigable by controlling the growth and spread of water hyacinth.

By reducing the amount of water hyacinth clogging pumps and intake pipes, the WHCP will improve municipal and domestic supply (MUN), industrial service supply (IND), and agricultural supply (AGR) beneficial uses. These benefits are discussed in Chapter 6, and below under Impact W5.

By reducing the amount of water hyacinth clogging Delta and tributary waterways, the WHCP will improve navigation (NAV), and recreation beneficial uses (REC-1 and REC-2). By removing monospecific mats of water hyacinth from Delta and tributary waterways, the WHCP will result in increased DO levels, and improved native habitats for aquatic species. Control of water hyacinth in Delta waterways expands habitat suitable for native species. These benefits, discussed in more detail under Impact W4, and in Chapter 3, will result in improvements to warm freshwater habitat (WARM), cold freshwater habitat (COLD), migration of aquatic organisms (MIGR), spawning, reproduction, and/or early development (SPWN), and estuarine habitat (EST) beneficial uses.

Impact W3 – Toxicity: following WHCP herbicide treatment toxic substances may potentially be found in waters in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life, violating water quality standards or otherwise substantially degrading water or drinking water quality

Application of WHCP herbicides to Delta waters and tributaries could result in concentrations of chemicals that produce toxic responses. The water quality objectives for toxicity are as follows:

> *"All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. The objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests of appropriate duration or other methods as specified by the Regional Water Board" (CVRWQCB 2007).*

In response to the SWB's initial interim NPDES permit for aquatic pesticides, prepared in 2001 (Order 2001-12-DWQ), Waterkeepers Northern California filed a lawsuit against the SWB. As part of the settlement with Waterkeepers Northern California, the SWB agreed to fund a comprehensive aquatic pesticide monitoring program to assess toxicity of pesticides in receiving water following aquatic pesticide treatments. The SWB contracted with the San Francisco Estuary Institute (SFEI) to conduct the study. In their 2004 study, SFEI found no toxicity for the two WHCP herbicides, 2,4-D and glyphosate.

DBW monitoring, and a review of scientific literature, as discussed in Chapter 3, Impact B2, also found no evidence of acute toxicity at herbicide levels likely to be present following WHCP treatments. As discussed in Chapter 3, there is some evidence of potential sublethal effects on aquatic species, although data are not conclusive.

At the concentrations at which they will be applied, WHCP herbicides are known to be toxic to plants and algae. The method of action of 2,4-D and glyphosate on plants is discussed in Chapter 3, Impact B1. Any broadleaf vegetation subject to overspray is vulnerable to 2,4-D activity. Exposure of any non-target plant to glyphosate could result in loss of plant species.

The potential for impacts resulting from herbicide overspray depend on the amount of exposure, concentration of herbicide, and proximity of sensitive habitats, wetlands, and plants. One study found that only three to four percent of 2,4-D droplets drift beyond the target zone, and no significant amount of material is collected as drift (HSDB 2001). Blankenship and Associates (2004) found that using conservative application rates, detectable adverse effects could result from less than one percent spray drift of glyphosate or 2,4-D.

The concentration of active ingredient (2,4-D or glyphosate) leaving the spray nozzle is high enough (ranging from 600 ppm to 4,800 ppm) to cause adverse effects. Thus, there is the potential that uncontrolled herbicide overspray could affect nearby non-target vegetation.

Treatment of water hyacinth could result in loss of native submerged aquatic vegetation growing in and around treatment areas. While loss of non-target plant species could constitute a significant impact under certain conditions, it is expected to be less than significant for the WHCP. Dense canopies of water hyacinth reduce light levels for submerged plant photosynthesis and thus can effectively shade out native vegetation. The benefit to native submerged aquatic vegetation from removal of water hyacinth is expected to outweigh any losses due to herbicide toxicity.

While there is a potential toxic risk to plants due to herbicide overspray, the likelihood of such effects occurring is low. Herbicide application will be focused directly on target plants to decrease the possibility that concentrated herbicides will come in contact with non-target plants. The DBW will follow herbicide label application instructions that reduce herbicide drift. These steps include using the largest size spray droplets, and lowest spray pressure, that will provide sufficient coverage and control. Furthermore, DBW will not treat at a particular site if the wind is greater than 10 mph (or 7 mph in Contra Costa County).

Should any acute or sublethal toxic effects to non-target plants or aquatic species occur, it would represent a significant impact. These impacts would be **unavoidable or potentially unavoidable significant impacts.** These impacts could be reduced by implementing the following mitigation measures. The six mitigation measures for this impact are identical to the six mitigation measures for Impact W2. Both sets of mitigation measures are directed toward reducing the potential for pesticide toxicity impacts following WHCP treatments.

- **Mitigation Measure W3a (same as Mitigation Measures B1a; B2d; B4e; B6a; and W2a)** – Avoid herbicide application near special status species, and sensitive riparian and wetland habitat; and other biologically important resources.

  Each year, prior to the start of the treatment season, DBW will conduct field crew environmental awareness training. Under this training, crews will be informed about the presence and life histories of special status species, habitats associated with species, sensitive habitats and wetlands, the terms and conditions of the program's biological opinions, incidental take procedures, and that unlawful take of an animal or destruction of its habitat is a violation of the Endangered Species Act. The DBW will provide crews with a field guide (Species Identification Deck) for easy identification of special status species on site. Prior to treating a site, crews will conduct a visual survey to determine whether special status plants, animals, or sensitive habitats are present. Crews will complete an Environmental Observations Checklist for each site to document the presence or absence of special status species. If any special status species or sensitive habits are present at the site, the field crew will not perform the treatment.

- **Mitigation Measure W3b (same as Mitigation Measures B2b; B4a; W1a; and W2b) -** Monitor herbicide and adjuvant levels to ensure that the WHCP does not result in potentially toxic concentrations of chemicals in Delta waters.

  The DBW will conduct comprehensive monitoring. This monitoring is in compliance with the general NPDES permit, and NOAA-Fisheries and USFWS Biological Opinions. The DBW will collect samples prior to treatment, immediately after treatment, and post-treatment within one week of spraying. The DBW will conduct water quality monitoring for visual parameters, physical parameters, and chemical parameters at 10 percent of the sites it treats for each pesticide, per water body type. Water samples will be submitted to a certified analytical laboratory to measure 2,4-D, glyphosate, and adjuvant levels. Should these levels exceed allowable limits, DBW will take immediate measures to reduce chemical levels at future treatment sites.

- **Mitigation Measure W3c (same as Mitigation Measures B2c; B4b; H2c; W1c; and W2c)** – Implement an adaptive management approach to minimize the use of herbicides.

  Under an adaptive management approach, DBW will seek to improve efficacy and reduce environmental impacts over time as new and better information is available. Specifically, DBW will evaluate the need for control measures on a site by site basis; select appropriate indicators for pre-treatment monitoring; monitor indicators following treatment and evaluate data to determine program efficacy and environmental impacts; support ongoing research to explore the impacts of the WHCP and alternative control methodologies; report findings to regulatory agencies; and adjust program actions, as necessary, in response to recommendations and evaluations by regulatory agencies and stakeholders. In addition to this adaptive management approach, DBW will follow maintenance control practices that seek to reduce the number of acres of water hyacinth to be treated each year, until treatment acreage reaches a minimal level. This will reduce the volume of herbicide utilized by the WHCP.

- **Mitigation Measure W3d (same as Mitigation Measures W1b)** - Follow the Memorandum of Understanding (MOU) protocol for herbicide applications within one (1) mile of Contra Costa Water District (CCWD) drinking water intake facilities.

  The MOU is an agreement between CCWD and DBW. Generally, no applications shall occur within Rock Slough, or within one mile of the confluence of Rock Slough and Old River, or within one mile of CCWD's Old River or Mallard Slough intake pumps without consensual agreement between CCWD and DBW. Herbicide applications within one mile of CCWD's water intakes may only occur with prior consent of CCWD. In order to treat within one mile of an intake, DBW must notify CCWD at least two weeks in advance, and make every reasonable attempt to schedule applications during periods when CCWD's intakes are shut down for environmental or maintenance reasons, allowing at least two complete tidal cycles between application and restart. This measure is primarily aimed at reducing the potential for drinking water contamination from WHCP herbicide treatments.

- **Mitigation Measure W3e (same as Mitigation Measures B1c; B2f; H2d; W1d; and W2e)** – Conduct herbicide treatments in order to minimize potential for drift.

In addition to the label requirements noted above, DBW will, to the degree possible, schedule herbicide applications to occur at high tide, or at a point in the tidal cycle determined by the field supervisor to provide the least non-target impact at a particular site. In general, treatment at high tide will allow for better spray accuracy and access and will provide for greater dilution volume of herbicides. DBW crews will change nozzle type and spray pressures whenever conditions warrant, limiting the amount of herbicide which may inadvertently contact non-target species.

- **Mitigation Measure W3f (same as Mitigation Measures B1d; B6b; and W2f)** – Operate program vessels in a manner that causes the least amount of disturbance to the habitat.

  Operational procedures for DBW vessels will minimize boat wakes and propeller wash. These procedures will be particularly important in shallow water, or other sensitive habitats.

Impact W4 – Dissolved oxygen: following WHCP herbicide treatment, dissolved oxygen may potentially be reduced below Basin Plan and Bay-Delta Plan objectives, violating water quality standards or otherwise substantially degrading water quality

Dissolved oxygen levels may potentially be reduced below Basin Plan and Bay-Delta Plan objectives following WHCP herbicide treatments, and the resulting rapid decay of water hyacinth, other aquatic macrophytes, and algae. Decomposition of vegetative material may create an organic carbon slug, which could in turn reduce dissolved oxygen concentrations.

The Basin Plan water quality objectives for dissolved oxygen in the WHCP project area are as follows:

"Within the legal boundaries of the Delta, the dissolved oxygen concentration shall not be reduced below:

7.0 mg/l in the Sacramento River (below the I Street Bridge) and in all Delta waters west of the Antioch Bridge; 6.0 mg/l in the San Joaquin River (between Turner Cut and Stockton, 1 September through 30 November); and 5.0 mg/l in all other Delta waters except for those bodies of water which are constructed for special purposes and from which fish have been excluded or where the fishery is not important as a beneficial use.

For surface water bodies outside the legal boundaries of the Delta, the monthly median of the mean daily dissolved oxygen (DO) concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percentile concentration shall not fall below 75 percent saturation. The dissolved oxygen concentrations shall not be reduced below the following minimum levels at any time:

- *Waters designated WARM 5.0 mg/l*
- *Waters designated COLD 7.0 mg/l*
- *Waters designated SPWN 7.0 mg/l"* (CVRWQCB 2007).

In addition, there are more stringent requirements for the Merced River from Cressy to New Exchequer Dam, of 8.0 mg/l (all year), and for the Tuolumne River from Waterford to La Grange, of 8.0 mg/l from October 15th to June 15th.

Dissolved oxygen is the content of oxygen found in water. DO is determined by temperature, weather, water flow, nutrient levels, algae, and aquatic plants. Generally, a higher level of DO is beneficial. Fish begin to experience oxygen stress or exhibit avoidance at levels below 5 mg/l (5 ppm).

DO levels drop in warmer temperatures, and increase with precipitation, wind, and water flow. Running water, such as tidal water in the Delta, dissolves more oxygen than still water. High levels of nutrients in water reduce DO levels, while algae and aquatic plants can increase DO through photosynthesis, but decrease DO through respiration and decomposition. DO levels fluctuate throughout the day, and are typically lowest in the morning and peak in the afternoon. In deep, still waters, DO levels are lower in the hypolimnion (bottom layer of water) because there is little opportunity for oxygen replenishment from the atmosphere.

There is the potential that following herbicide treatment, the biomass of decaying water hyacinth will create a large biological oxygen demand, resulting in decreases in dissolved oxygen. The label for Weedar 64® (2,4-D) notes that decaying weeds use up oxygen, and recommends treating only one-half of a lake or pond to avoid fish kill. In larger bodies of weed infested waters, the label recommends leaving 100-foot wide buffer strips untreated, and delaying treatment of these strips for four to five weeks, until the treated dead vegetation has decomposed. The label for AquaMaster™ (glyphosate) recommends treating an area in strips when there is full coverage of the weed in impounded areas to avoid oxygen depletion. The DBW follows these label recommendations in their operations, to avoid reductions in DO.

Dissolved oxygen levels under water hyacinth are already low, and may be in violation of water quality standards. In the Delta, Toft (2000) and others have found lower levels of dissolved oxygen under hyacinth canopies. Average spot measures were below 5 ppm in hyacinth (Toft 2000). These results were supported by a study in Texas which found lower dissolved oxygen in hyacinth compared to other aquatic weeds, and a University of California, Davis study which also found dissolved oxygen levels as low as 0 ppm below a solid water hyacinth mat in the Delta (Toft 2000).

The DBW analyzed monitoring results from 2001 to 2005 to determine whether there were statistical differences between water quality parameters before, and after, treatment. In general, there was no statistical evidence that water quality degraded significantly as a result of aquatic herbicide treatments. When there was a demonstrated change in dissolved oxygen, it appears that DO increased after treatment. The average post-treatment increase in DO at 110 first-visit follow-up monitoring visits was 0.66 mg/l. When the DBW conducted additional (second to fifth) follow-up monitoring visits, DO levels remained higher than the pre-treatment levels. This increase in DO following treatment supports the findings of Toft and others that water hyacinth depresses DO levels.

The DBW did find some exceptions in post-treatment DO levels. Between 2001 and 2005, in 16 of 110 sampling events, the post-treatment DO dropped below 5 mg/l from a pre-treatment level that was greater than 5 mg/l. These follow-up DO levels ranged from a low of 1.5 mg/l to a high of 4.95 mg/l. Many of these 16 sample event locations were already characterized as low DO sites with ambient DO levels that often fluctuated well below 5.0 mg/l (e.g. Snodgrass Slough and Lost Slough), particularly during the warmer times of the year (July through September) and depending on the time of day. The DBW concluded that these cases were not the result of changes to the DO caused by decaying plant material from WHCP spraying.

The DBW permit requirements allow treatments to proceed only when DO is below 3.0 mg/l, or above the Basin Plan limit for that location. The DBW treatment crews monitor DO levels prior to treatment to determine whether treatment can occur. However, between 2001 and 2005, there were ten instances in which treatment occurred when DO levels were greater than 3.0 mg/l, but below the Basin Plan limit. In most cases, DO levels were fractionally below the limit. The DBW believes that there were no significant impacts from these occurrences; however, they have worked to improve field communication to prevent treatments when DO is not within specified limits.

In 2006, DO basin limits for receiving waters were exceeded on two occasions. One occurred at site 011, two days following treatment. The Basin Plan limit for this site is 5.0 mg/l, and the measured DO was 4.99 mg/l. This measures was within the range of accuracy of DO measurement, 0.01 mg/l. The second exceedence occurred at site 028, also on August 3, at follow-up sampling two days after treatment. In this case, the DO level was 4.76 mg/l. Although the limits were exceeded on this date, spray crew measurements taken after this date showed that DO levels were back above basin limits. DO was well above the 3.0 mg/l required for fish survival, the reduced DO was shown to be temporary, and all fish passage protocol were followed. Thus it is unlikely that there was any serious impact to water quality.

In 2007, DO limits for receiving waters were exceeded on one occasion. This occurred post-treatment at site 065 on August 24. The basin plan limit for this site is 5.0 mg/l, and the DO measurement was 4.93 mg/l. The field crew also noted that algae were present in this area, in addition to the first stages of water hyacinth mortality, both potential contributors to reduced DO. It is believed in this case, there was not any serious impact to water quality.

Reductions in DO levels below Basin Plan limits occur only infrequently as a result of WHCP treatments, and if they do occur, are likely to be short-lived. However, should WHCP treatments result in violations of the Bay-Delta Plan or Basin Plan water quality objectives for dissolved oxygen, it would constitute an **unavoidable or potentially unavoidable significant impact.** These impacts would potentially be reduced by implementing the following four mitigation measures.

- **Mitigation Measure W4a (same as Mitigation Measure B5a)** – Monitor dissolved oxygen (DO) levels pre- and post-treatment for all WHCP treatments.

  Based on the pre-treatment DO levels, the application crew will determine whether to conduct treatment at that site. No treatment will be performed when dissolved oxygen levels are between 3 ppm (the level below which DO is considered to be detrimental to fish species) and the basin plan limits established by the CVRWQCB. The basin plan limits depend on location and time of year, and range from 5 ppm to 8 ppm. The DBW will maintain written and map summaries of specific DO numeric limits. The current dissolved oxygen map summaries are shown in **Exhibits 5-1a** and **5-1b,** on the following pages. When pre-treatment levels are below 3 ppm, fish species are not likely to be present due to the extremely low oxygen levels. When pre-treatment levels are above the basin plan limit, WHCP treatment, following label guidelines and mitigation measures, are not expected to adversely affect dissolved oxygen levels.

- **Mitigation Measure W4b (same as Mitigation Measure B5b)** – Treat no more than three contiguous acres at any treatment site.

  Crews will create a buffer zone around all treatment sites to ensure that impacts will be spread out and not segregated to one larger area. Buffer zones will be at least equal in size to the previously treated site. After treating three maximum acres, crews will then skip at least one adjacent site before treating another site. The DBW crews will not treat skipped sites until two tidal changes have occurred or, in nontidal areas, until 24 hours after treatment.

- **Mitigation Measure W4c (same as Mitigation Measure B5c)** – Treat no more than one-half of the area at one time of completely infested dead-end sloughs, to allow for fish passage.

  The DBW will return to treat the remaining half according to label instructions and permit conditions. The remaining area may be treated after four to five weeks, or when the dead vegetation has decomposed.

- **Mitigation Measure W4d (same as Mitigation Measure B5d)** – Treat no more than one-half of completely infested moving waterways, at one time, to allow for fish passage. The DBW will not treat the remaining area until the treated water hyacinth is decomposed or until a passage has opened up in the waterway.

Exhibit 5-1a

WHCP Dissolved Oxygen Limits – Northern Sites

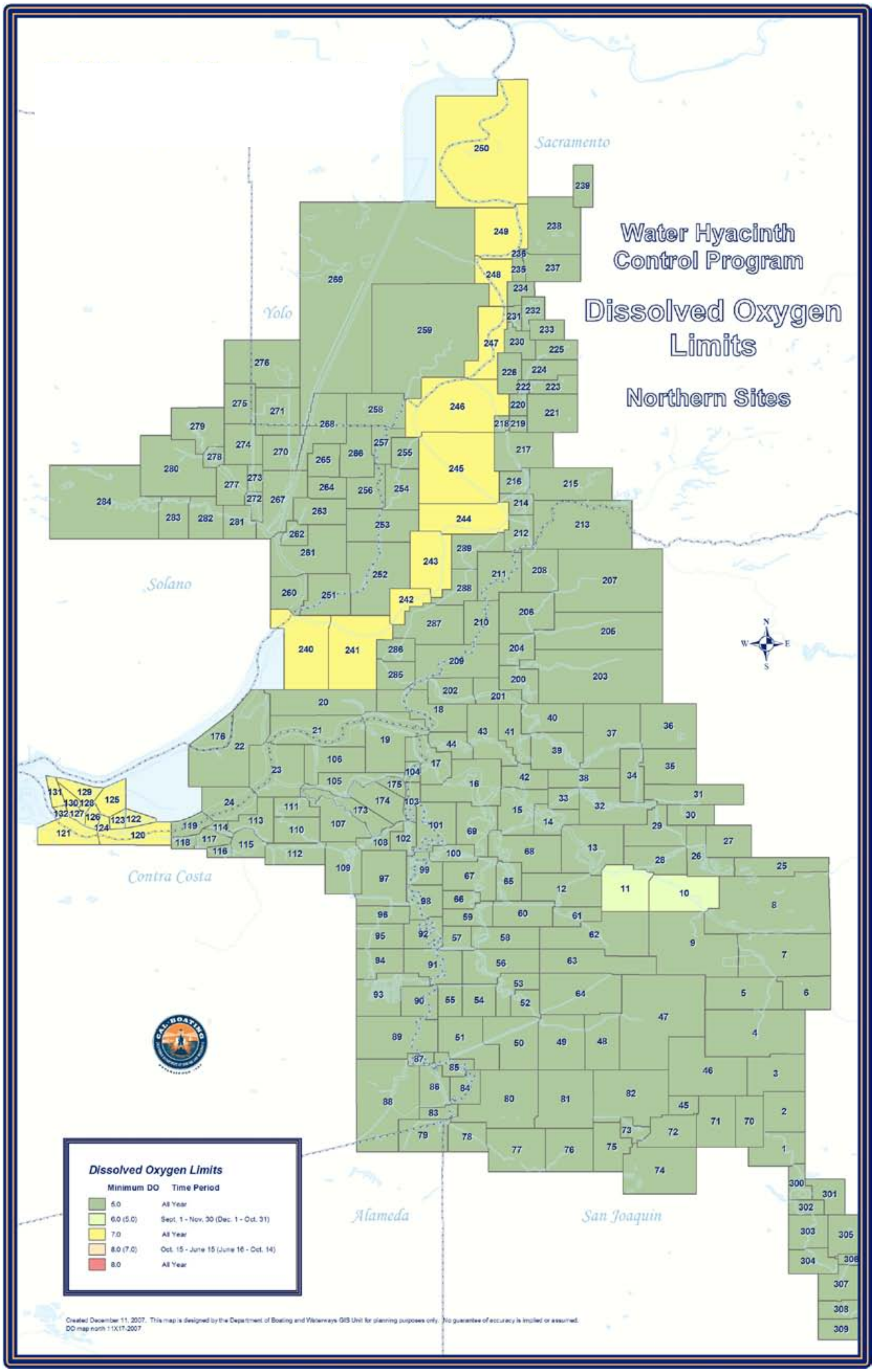
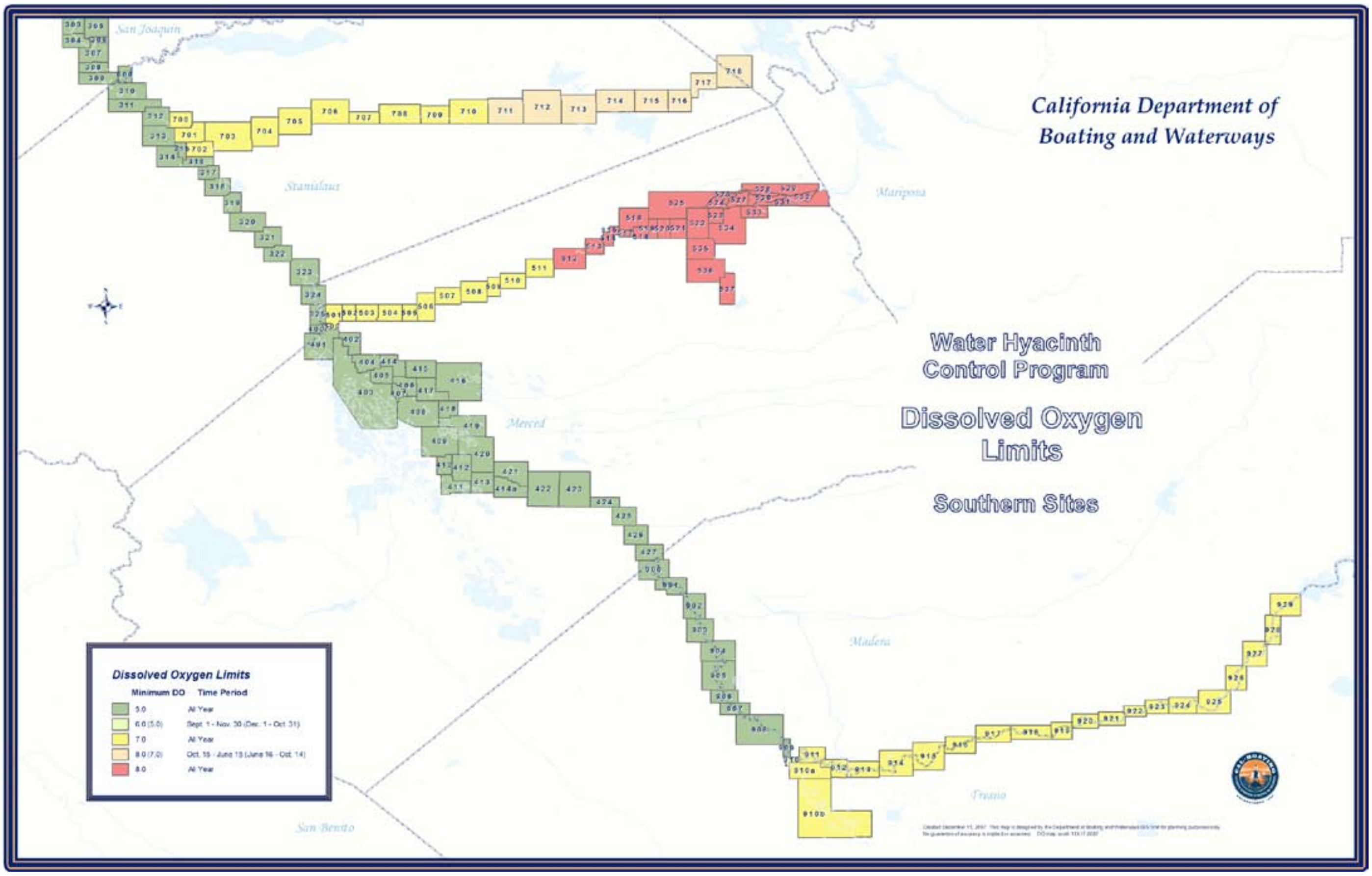


Exhibit 5-1b
WHCP Dissolved Oxygen Limits – Southern Sites



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There are also positive impacts related to dissolved oxygen that will result from the WHCP. Dissolved oxygen levels at treatment sites will increase, improving compliance with water quality standards, once dead water hyacinth have decayed or floated away. Removing large patches of water hyacinth will allow DO levels to increase, thus enhancing the beneficial uses of Delta waters. It can be argued that such a benefit can outweigh the impact of short-term localized decreases in dissolved oxygen.

Impact W5 – Floating material: following WHCP treatment, waters may potentially contain floating water hyacinth fragments in amounts that cause nuisance or adversely affect beneficial uses, violating water quality standards or otherwise substantially degrading water quality

Herbicide treatments, handpicking, and herding may break fragments of water hyacinth loose in Delta waterways. These water hyacinth fragments could result in nuisance or adversely affect beneficial uses. The Basin Plan specifies that *"water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses"* (CVRWQCB 2007).

As discussed in Chapter 6, potential negative impacts from floating debris include increasing debris loading at water utility intake facilities and agricultural irrigation intakes. Municipal and domestic supply, industrial service supply, and agricultural supply, are designated beneficial uses of Delta waters.

The potential for water hyacinth fragments resulting from WHCP treatments to result in violations of water quality standards or otherwise substantially degrade water quality is low. However, should water hyacinth debris resulting from the WHCP cause nuisance or adversely affect beneficial uses, it would represent a significant impact. This impact would be an **avoidable significant impact, reduced to a less-than-significant level by implementing the following three mitigation measures:**

- **Mitigation Measure W5a (same as Mitigation Measures W1b; W2d; and W3d)** – Follow the Memorandum of Understanding (MOU) protocol for herbicide applications within one (1) mile of Contra Costa Water District (CCWD) drinking water intake facilities.

  The MOU is an agreement between CCWD and DBW. Generally, no applications shall occur within Rock Slough, or within one mile of the confluence of Rock Slough and Old River, or within one mile of CCWD's Old River or Mallard Slough intake pumps without consensual agreement between CCWD and DBW. Herbicide applications within one mile of CCWD's water intakes may only occur with prior consent of CCWD. In order to treat within one mile of an intake, DBW must notify CCWD at least two weeks in advance, and make every reasonable attempt to schedule applications during periods when CCWD's intakes are shut down for environmental or maintenance reasons, allowing at least two complete tidal cycles between application and restart. This measure is primarily aimed at reducing the potential for drinking water contamination from the WHCP, however, it would also serve to minimize the potential for water hyacinth fragments to occur near water intake pumps.

- **Mitigation Measure W5b** – Notify County Agricultural Commissioners about WHCP activities.

  Before an application may occur, DBW shall file Pesticide Use Recommendations (PUR) and a Notice of Intent (NOI) with the appropriate County Agricultural Commissioner (CAC) office. Each NOI will include the site number, spray dates, locations, and herbicides and adjuvants to be used. NOIs will be submitted by no later than

2 pm on the Wednesday before the upcoming treatment week. Based on information in the NOIs, CAC's could inform land owners of particular periods of time during which irrigation should not occur. If necessary, DBW shall also obtain a Restricted Use Permit (RUP) from all appropriate CACs.

- **Mitigation Measure W5c (same as Mitigation Measure B7a)** – Collect plant fragments during and immediately following treatments.

  To maximize containment of plant fragments, crews will collect water hyacinth fragments. Crews will also be trained on the importance of minimizing fragment escape.

* * * * *

The potential increase in floating material resulting from the WHCP is likely to be outweighed by the benefits to water utility and agricultural intake pump systems that result from removing water hyacinth from Delta waterways. One concern resulting from water hyacinth's invasion in the Delta in the 1980s was untreated plants blocking CVP and SWP pumps (U.S. Army Corps of Engineers 1985). In fact, the Bureau of Reclamation estimated that the WHCP saved the Bureau $400,000 per year in reduced operating and maintenance costs associated with removing water hyacinth from just the C.W. "Bill" Jones Pumping Plant (DBW 2001).

Similarly, clogging of agricultural pumps by untreated water hyacinth can result in inefficient pumping, increased pumping costs, and possible mechanical failure of pumps. Prior to the start of the WHCP, in a letter to the U.S. Army Corps of Engineers, the San Joaquin Farm Bureau Federation stated that growers were facing increased costs from efforts to open clogged channels where water hyacinth was decreasing the flow of water to pumps and clogging screens (U.S. Army Corps of Engineers 1985).

Impact W6 – Turbidity: WHCP treatment may potentially result in changes to turbidity that cause nuisance or adversely affect beneficial uses, violating water quality standards or otherwise substantially degrading water quality

Operation of WHCP vessels for treatment and monitoring may potentially result in changes in turbidity that violate water quality standards or otherwise substantially degrade water quality. Such turbidity increases could result in nuisance or adversely affect beneficial uses.

The WHCP operates under the General NPDES permit CAG990005, and the Basin Plan objectives for turbidity. The Basin Plan turbidity objectives are as follows:

"Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

- *Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.*
- *Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.*
- *Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.*
- *Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.*

In Delta waters, the general objectives for turbidity apply subject to the following: except for periods of storm runoff, the turbidity of Delta waters shall not exceed 50 NTUs in the waters of the Central Delta and 150 NTUs in other Delta waters. Exceptions to the Delta specific objectives will be considered when dredging operations can cause an increase in turbidity. In this case, an allowable zone of dilution within which turbidity in excess of limits can be tolerated will be defined for the operation and prescribed in a discharge permit" (CVRWQB 2007).

DBW analyzed monitoring results from 2001 to 2005 to determine whether there were statistical differences between water quality parameters before, and after, treatment. In general, there was no statistical evidence that water quality degraded significantly as a result of aquatic herbicide treatments.

DBW measured compliance with turbidity requirements by comparing pre-treatment turbidity levels with post-treatment turbidity levels measured at follow-up visits. For the 2001 to 2005 time period, DBW compared pre- and post-treatment turbidity for 352 pairs of samples. In all cases, the WHCP was in compliance with Basin Plan limits for changes in turbidity.

In 2006, 2007, and 2008, there were a total of 20 occasions and 10 sites for which turbidity levels exceeded basin plan limits. In all but three instances in each year, the exceedences were due to the sampling boat entering areas where it was very shallow, many submerged aquatic plants, agricultural discharges, inputs from more turbid tributaries, wading livestock, or instrument error. In the three other instances each year, there was no recorded explanation for the exceedence in the measured turbidity levels. In most cases, the exceedences occurred on the treatment day, and when the turbidity was measured on the follow-up sampling day, they were again within basin limits. In a few cases, the follow-up turbidity levels were still high. Therefore, if the WHCP was responsible for the turbidity violations, the effects were only temporary and most likely did not have any adverse affects on beneficial uses.

While exceedences in Basin Plan limits may occur within the Delta, it is difficult to determine whether these exceedences are a result of WHCP activities. In addition, any exceedences that are a result of WHCP activities are likely to be short-term. The WHCP is not likely to result in increases in turbidity that create nuisance or adversely affect beneficial uses. As a result, **the impact of the WHCP on turbidity is expected to be less than significant.** While no mitigation measures are required, DBW will implement the following mitigation measure to further reduce any potential impact level.

- **Mitigation Measure W6a (same as Mitigation Measures B1d; B6b; W2f; and W3f)** – <u>Operate program vessels in a manner that causes the least amount of disturbance to the habitat</u>.

  Operational procedures for DBW vessels will minimize boat wakes and propeller wash. These procedures will be particularly important in shallow water, or in other sensitive habitats.

This section identified twenty-four (24) mitigation measures to address six (6) potential impacts to hydrology and water quality. Many of these mitigation measures are duplicative, as they each apply to multiple impacts. **Table 5-5,** on the next page, combines and summarizes the hydrology and water quality mitigation measures.

Table 5-5
Summary of Potential Hydrology and Water Quality Impacts and Mitigation Measures

	Mitigation Measure Summary[1]	Mitigation Measure Number	Impacts Applied To	Same As Prior Mitigation Numbers
1.	Avoid herbicide applications near special status species, and sensitive riparian and wetland habitat; and other biologically important resources	Mitigation Measure W2a Mitigation Measure W3a	Impact W2: Pesticides Impact W3: Toxicity	B1a; B2d; B4c; B6a
3.	Conduct herbicide treatment in order to minimize potential for drift	Mitigation Measure W1d Mitigation Measure W2e Mitigation Measure W3e	Impact W1: Chemical constituents Impact W2: Pesticides Impact W3: Toxicity	B1c; B2f
4.	Operate program vessels in a manner that causes the least amount of disturbance to the habitat	Mitigation Measure W2f Mitigation Measure W3f Mitigation Measure W6a	Impact W2: Pesticides Impact W3: Toxicity Impact W6: Turbidity	B1d; B6a
6.	Monitor herbicide and adjuvant levels to ensure that the WHCP does not result in potentially toxic concentrations of chemicals in Delta waters	Mitigation Measure W1a Mitigation Measure W2b Mitigation Measure W3b	Impact W1: Chemical constituents Impact W2: Pesticides Impact W3: Toxicity	B2b; B4a
7.	Implement an adaptive management approach to minimize the use of herbicides	Mitigation Measure W1c Mitigation Measure W2c Mitigation Measure W3c	Impact W1: Chemical constituents Impact W2: Pesticides Impact W3: Toxicity	B2c; B4b; H2c
9.	Monitor dissolved oxygen (DO) levels pre- and post-treatment for all for all WHCP treatments	Mitigation Measures W4a	Impact W4: Dissolved oxygen	B5a
10.	Treat no more than three contiguous acres at any treatment site	Mitigation Measure W4b	Impact W4: Dissolved oxygen	B5b
11.	Treat no more than one-half of the area of completely infested dead-end sloughs to allow for fish passage	Mitigation Measure W4c	Impact W4: Dissolved oxygen	B5c
12.	Treat no more than one-half of completely infested moving waterways to allow for fish passage	Mitigation Measure W4d	Impact W4: Dissolved oxygen	B5d
13.	Collect plant fragments during and immediately following treatments	Mitigation Measure W5c	Impact W5: Floating material	B7a
21.	Follow the Memorandum of Understanding (MOU) protocol for herbicide applications within one (1) mile of Contra Costa Water District (CCWD) drinking water intake facilities	Mitigation Measure W1b Mitigation Measure W2d Mitigation Measure W3d Mitigation Measure W5a	Impact W1: Chemical constituents Impact W2: Pesticides Impact W3: Toxicity Impact W5: Floating Material	**New**
22.	Notify County Agricultural Commissioners about WHCP activity	Mitigation Measure W5c	Impact W5: Floating material	**New**

[1] Please refer to the text for the complete mitigation measure description.