Appendix F

Habitat Implementation_2017_BOR

JULY 2018

San Joaquin River Habitat and Flow Changes with SJRRP Implementation

January 31, 2017

This memorandum documents the projected increases in flows and habitat over time, and decreases in temperature due to increasing flows, that will occur as the San Joaquin River Restoration Program implements projects as described in the Framework for Implementation.

Suitable Habitat

The Minimum Floodplain Habitat Area for Spring and Fall-run Chinook Salmon report, dated November 2012, describes suitable rearing and migration habitat goals for juvenile Fall-run and Spring-run Chinook salmon in the San Joaquin River Restoration Program (SJRRP), based on suitable depths, velocities, and cover. Please see that report for a full description of the methodology, input data, and results. Note that suitable habitat is not the same as inundated area. Generally, between 10-25 percent of the total inundated area is suitable. Thus the Minimum Floodplain Habitat Area report estimates that between 3,239 and 8,100 acres of inundated area is needed for habitat to meet the SJRRP's juvenile salmon population goals. Table 1 below shows the suitable habitat needed in each reach.

Table 1: Suitable Habitat Needed (acres)

Lower 1B	2A	2B	3	4A	Middle Eastside Bypass / 4B1	Lower Eastside Bypass / 4B2	5	Total
109	183	144	203	76	54	19	23	810

There is existing habitat in each of these reaches that reduces the amount needed. Table 2 below shows the amount of suitable habitat that already exists in each reach.

Reach 2B and the Middle Eastside Bypass / 4B1 were not modeled as major SJRRP projects will occur in those reaches to create habitat, and so current suitable habitat is estimated there based on a percent of the total inundated area. Existing suitable habitat in Reach 2B was calculated as between 10 and 25% of the total inundated area in that reach. Existing suitable habitat in the Middle Eastside Bypass was calculated based on the total inundated area, and using the same fractions of suitable habitat as Reach 1B (which were 6% in a wet year type, 7% in a normal year type, and 10% in a dry year type). Currently, flows route into the Middle and Lower Eastside Bypasses. In the long term, this or another route may be selected. The existing suitable habitat is calculated as the weighted average by year type, for a dry flow between 1,000 and 1,500 cubic feet per second (cfs), a normal year type flow between 2,180 to 2,500 cfs, and a wet year type flow between 3,600 and 4,500 cfs, depending on the reach. This is the 2-week flow level during the spring pulse in these example water year types.

Table 2: Existing Suitable Habitat (acres)

Lower 1B	2A	2B	3	4A	Middle Eastside Bypass / 4B1	Lower Eastside Bypass / 4B2	5	Total
56	104	71 to 178	62	56	88 / -	18 / 281	371	826

The total existing suitable habitat of 826 acres was calculated using the minimum acreage from Reach 2B, and using the lower Eastside Bypass suitable habitat estimate (18 acres), to get a minimum existing suitable habitat in the SJRRP area.

Table 2 shows that there is slightly more existing suitable habitat (826 acres) than the total needed (810 acres). However, there are still habitat needs when calculated by reach.

Table 3 below shows the suitable habitat deficit, calculated by subtracting the existing suitable habitat from the suitable habitat needed in each reach. Since there is existing suitable habitat in the Eastside Bypass and Reach 5 that is greater than the habitat needed, there is no habitat deficit in those reaches. Habitat is only needed in Reaches 1 through 4A.

Table 3: Suitable Habitat Deficit (acres)

Lower 1B	2A	2B	3	4A	Middle Eastside Bypass / 4B1	Lower Eastside Bypass / 4B2	5	Total
50	79	0 to 73	143	19	0 / -	0 to 1 / 0	0	365

There are two projects of the San Joaquin River Restoration Program that will create large amounts of juvenile suitable habitat. These are the Mendota Pool Bypass and Reach 2B project, which will be constructing floodplain habitat between approximately 2020-2025, as discussed in the Framework for Implementation, and the Reach 4B project, which will be constructing floodplain habitat between approximately 2025-2030.

The Reach 2B Conceptual Hydraulic Design report dated August 2015 includes calculations of the suitable habitat projected from the preferred alternative of the Reach 2B project. Between 225-243 acres of suitable habitat are expected at flows between 2,180 – 2,500 cfs. The average of these numbers is 234 acres and will be used in the rest of this memo.

The Reach 4B project alternatives were evaluated in the Minimum Floodplain Habitat Report, although suitable habitat acreages were not calculated for alternatives in the Eastside Bypass. As there is no preferred alternative for the Reach 4B project yet, we assume a conservative (low) value for creation of suitable habitat. In a dry yeartype, the levee option A (which puts flows up to 1,500 cfs through the Reach 4B1 river channel without any levee setbacks) is expected to create 981 acres of inundated area. With revegetation, we would expect approximately 25% of this inundated area to be suitable, meaning 245 acres of suitable habitat in Reach 4B. Levee Option B (which sets back levees on Reach 4B1) at flows of 2,180 – 2,500 cfs creates 2,756 acres of inundated area, or 698 acres of suitable habitat. We shall

assume the lower 245 acre number in the following summary plots and figures. Table 4 and 5 summarize this information, as do Figures 1 and 2 below.

Table 4: Projected Increases in Suitable Habitat on the San Joaquin River over time with implementation of the SJRRP

Year	1B	2A	2B	3	4A	Middle Eastside Bypass / 4B1	Lower Eastside Bypass / 4B2	5	Total
2015	56	104	71 - 178	62	56	88	18 / 281	371	1001
2025	56	104	234	62	56	88	18 / 281	371	1243
2030	56	104	234	62	56	245	18 / 281	371	1488
Goal	**109**	**183**	**144**	**203**	**76**	**54**	**19**	**23**	**811**

Table 5: Suitable Habitat Needs Met by Projects

	Required Suitable Habitat to Meet Population Targets (acres)	Suitable Habitat Deficit (acres)	SJRRP Project Suitable Habitat Creation (acres)
1B	109	50	
2A	183	79	
2B	144	0 to 73	234
3	203	143	
4A	76	19	
Middle Eastside Bypass / 4B1	54	54	245+
Lower Eastside Bypass / 4B2	19	0 to 1	
5	23	0	
Total	810	365	479

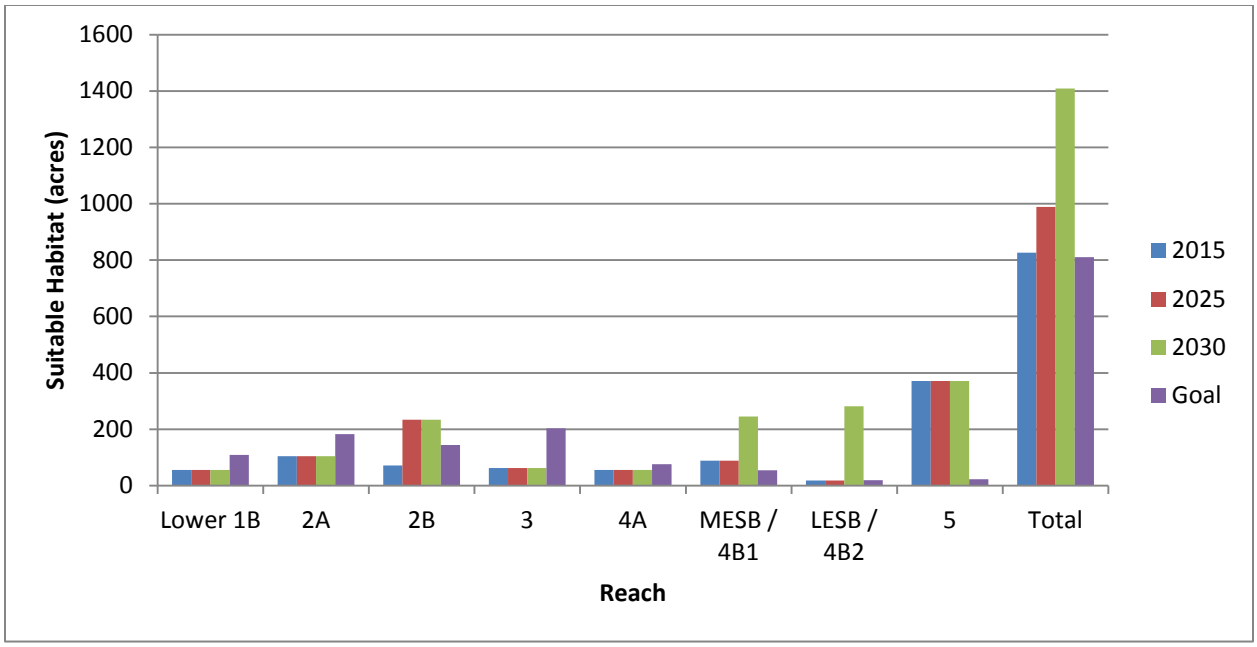

Figure 1: Suitable Habitat Projected by Reach over time compared to Minimum Floodplain Habitat goals

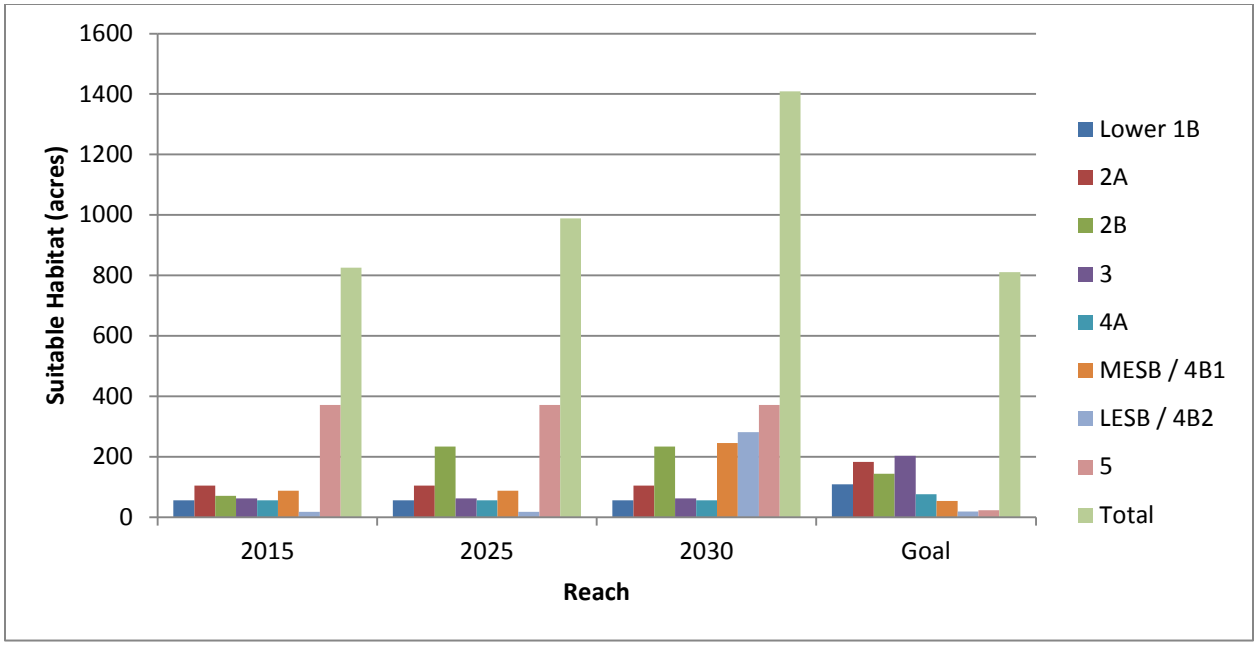

Figure 2: Suitable Habitat Projected by Reach over time compared to Minimum Floodplain Habitat goals

In addition to the suitable habitat shown here, it is expected that seepage projects may result in some land acquisition and habitat projects. These are unknown at this point and not included. In addition, some additional vegetation will recruit in all of the reaches of the river as a result of Restoration Flows. This increase in cover associated with this vegetation would increase the suitable habitat in primarily reaches 1B, 2A, 3, and 4A, and is not depicted in this information.

Flow

The Framework for Implementation describes implementation of seepage and levee stability projects over time to gradually increase the capacity of the San Joaquin River. Table 6 below shows how the channel capacity constraints of the San Joaquin River Restoration Program will gradually lift over time, allowing more flow through the river. This information is documented primarily in the Framework for Implementation. The Reach 2B capacity constraint of 1,120 cfs and the Eastside Bypass capacity constraint of 580 cfs are documented in the Public Draft Channel Capacity Report for the 2016 Restoration Year, dated September 2015. Table 7 shows the maximum flow in each reach of the San Joaquin River Restoration Program area by year and the constraint on flows in that reach. There are no constraints in Reach 1.

Table 6: Channel Capacity Schedule

Year	Reach 2B capacity (cfs)	Levee Capacity Maximum (cfs)	Groundwater Seepage Maximum (cfs)	Maximum Friant Dam Release (cfs)	Maximum flow in Reach 4 (cfs)	Constraint on Maximum Flow (project)
2016	1,120	580	300	1,490	300	Groundwater seepage
2017	1,120	580	500	1,490	500	Groundwater seepage
2018	1,120	580	1,300	1,490	580	Levees
2019	1,120	580	1,300	1,490	580	Levees
2020	1,120	1,300	1,300	1,490	1,120	Reach 2B
2021	1,120	1,300	1,300	1,490	1,120	Reach 2B
2022	1,120	1,300	2,500	1,490	1,120	Reach 2B
2023	1,120	1,300	2,500	1,490	1,120	Reach 2B
2024	1,120	1,300	2,500	1,490	1,120	Reach 2B
2025	4,500	2,500	2,500	2,725	2,500	Levees
2026	4,500	2,500	2,500	2,725	2,500	Levees
2027	4,500	2,500	2,500	2,725	2,500	Levees
2028	4,500	2,500	2,500	2,725	2,500	Levees
2029	4,500	2,500	2,500	2,725	2,500	Levees
2030	4,500	4,500	4,500	4,500	4,500	Levees

Table 7: Maximum Flow in each reach over time (cubic feet per second)

Reach	1	2A	Reach 2A Constraint	2B	Reach 2B Constraint	3	Reach 3 Constraint	4A	Reach 4A Constraint	4B / ESB	ESB Constraint	5	Reach 5 Constraint
2015	8000	2140	seepage	1120	levees	900	seepage	0	seepage	0	seepage	2350	levees
2016	8000	2140	seepage	1120	levees	900	seepage	300	seepage	300	seepage	2350	levees
2017	8000	2140	seepage	1120	levees	900	seepage	1490	seepage	500	seepage	2350	levees
2018	8000	2140	seepage	1120	levees	900	seepage	1490	seepage	580	levees	2350	levees
2019	8000	2140	seepage	1120	levees	900	seepage	1490	seepage	580	levees	2350	levees
2020	8000	2140	seepage	1120	levees	1420	seepage	1490	seepage	1300	levees	2350	levees
2021	8000	2140	seepage	1120	levees	1620	seepage	1910	seepage	1300	levees	2350	levees
2022	8000	2140	seepage	1120	levees	1950	seepage	2840	levees	1300	levees	2350	levees
2023	8000	2140	seepage	1120	levees	2430	seepage	2840	levees	1300	levees	2350	levees
2024	8000	2140	seepage	1120	levees	2580	seepage	2840	levees	1300	levees	2350	levees
2025	8000	2500	seepage	4500		2630	seepage	2840	levees	2500	levees	2500	levees
2026	8000	2500	seepage	4500		2860	levees	2840	levees	2500	levees	2500	levees
2027	8000	2500	seepage	4500		2860	levees	2840	levees	2500	levees	2500	levees
2028	8000	2500	seepage	4500		2860	levees	2840	levees	2500	levees	2500	levees
2029	8000	2500	seepage	4500		2860	levees	2840	levees	2500	levees	2500	levees
2030	8000	4500		4500		4500		4500		4500		4500	

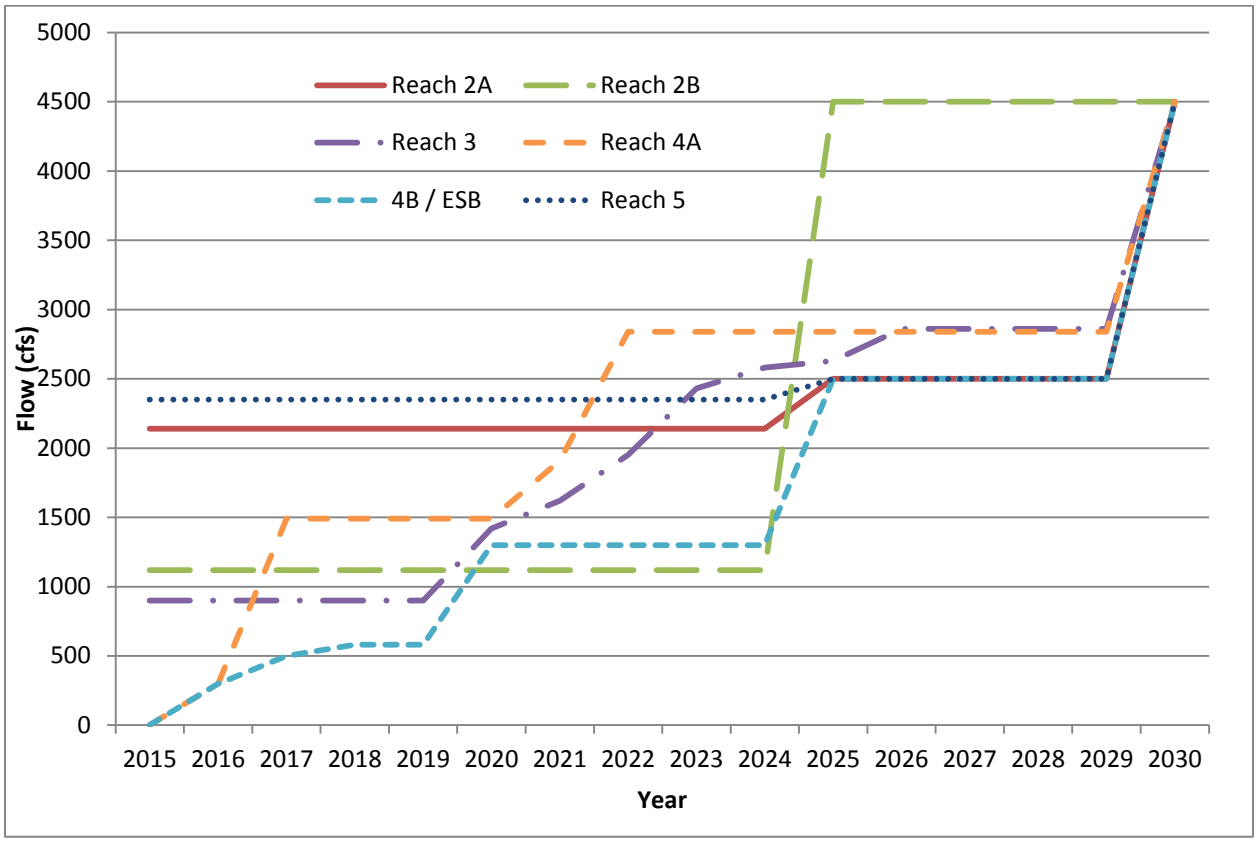

Figure 3: Maximum Flow Capacity of each reach over time as seepage, levee stability, and channel improvement projects are implemented (cubic feet per second)

Figure 4 below shows the flow exceedance plot of Restoration Flows and holding contract releases during 3 different time periods during implementation of the Framework. Between now, 2015, and 2024, the Restoration Administrator will be constrained to a maximum Friant release of 1,490 cfs (although this maximum release changes depending on the time of year). After Reclamation completes the Mendota Pool Bypass and Reach 2B Channel Improvements Project, the maximum Friant Dam release is projected to increase to 2,725 cfs in order to meet channel capacity constraints due to groundwater seepage in Reach 2A. Figure 4 assumes the Restoration Administrator will try to release as much water as possible, by rescheduling the higher flow releases into a longer and smaller in magnitude spring pulse. It is unknown at this time how the Restoration Administrator will decide to schedule flows during the next 15 years as channel capacity constraints are in place. One can see on Figure 4 the percentage of time Restoration Flows will be above a certain level under each flow constraint if these assumptions are useful.

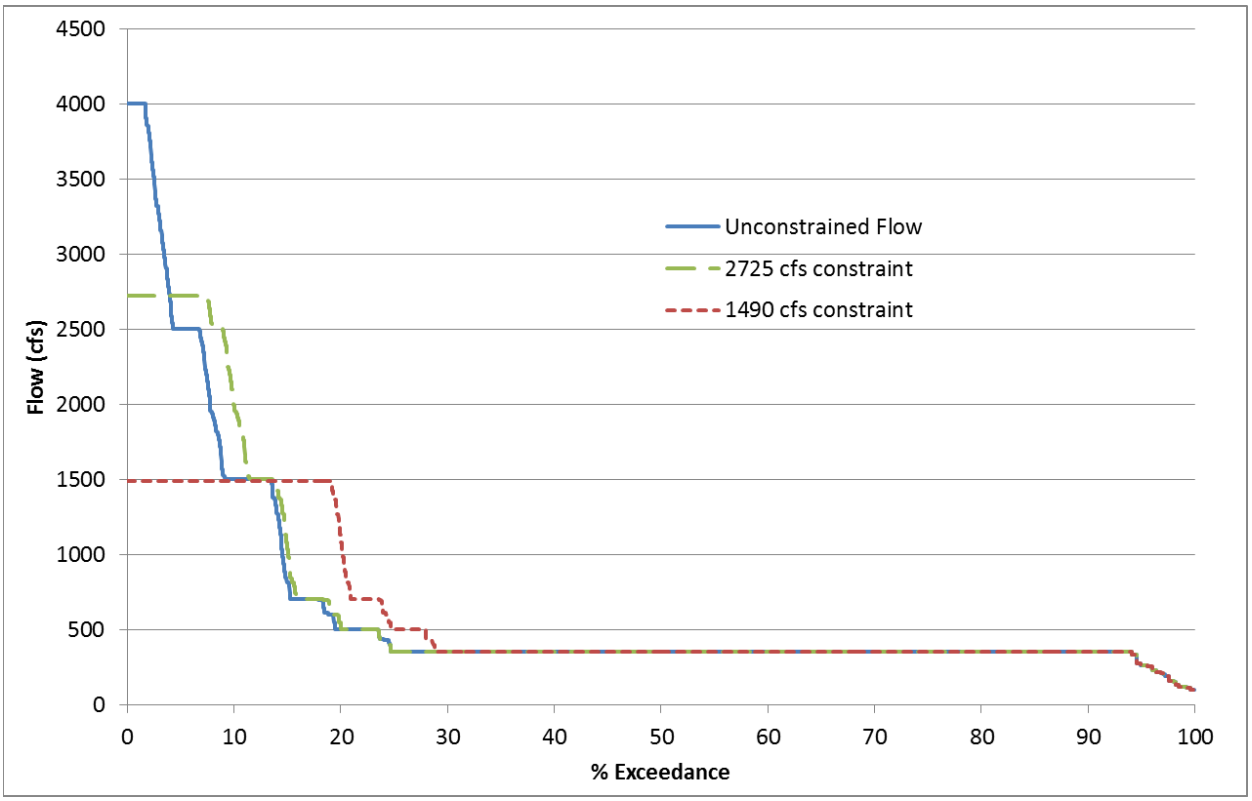

Figure 4: Flow Exceedance of Friant Dam releases for Restoration Flows and holding contracts under different Friant release constraints, assuming rescheduling. Does not include flood flow releases.

References

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