Low Reservoir Response Plan

for the

San Luis Obispo County Flood Control and Water Conservation District
Zone 3

December 16, 2014

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1 INTRODUCTION, PURPOSE AND PLAN ADOPTION

The Low Reservoir Response Plan (LRRP) describes a set of actions that the San Luis Obispo County Flood Control and Water Conservation District (District) Zone 3 will implement when the amount of water in storage within the Lopez Reservoir drops below 20,000 Acre-Feet (AF) provided that the District's Board of Supervisors has declared an emergency related to Zone 3. The purpose of the LRRP is to limit downstream releases and municipal diversions from Lopez Reservoir during periods of low reservoir storage (i.e. less than 20,000 AF) to preserve water within the reservoir, above the minimum pool level, for a minimum of 3 to 4 years under continuing drought conditions. The criteria for reducing municipal diversions and downstream releases are summarized in Section 3.

Droughts have unpredictable impacts on water supplies. The duration of droughts and the actual amount of rainfall and run-off during droughts can differ significantly. As a result, the LRRP has been developed to provide an initial set of prescribed actions combined with an adaptive management approach. The purpose of the LRRP is to act as the guiding document during drought emergencies, as outlined in the Interim Downstream Release Schedule (IDRS). The initial prescribed actions establish baseline actions, and several adaptive management scenarios are included so that actual hydrological conditions can be evaluated during a drought. In summary, ongoing evaluation of actual hydrological conditions is needed during a drought, and through the adaptive management approach, prescribed actions can be modified, if needed, so that the 3-4 year target can be achieved.

The District's Board of Supervisors (BOS) is responsible for final adoption of the LRRP. Prior to adoption by the Board of Supervisors, the following steps are necessary:

1. Development of the draft LRRP guided by the Zone 3 Technical Advisory Committee (TAC).
2. Review of the draft LRRP with Zone 3 agricultural stakeholders.
3. Consideration of policy direction that may be provided by any of the governing boards of the Zone 3 agencies as the draft LRRP is being developed.
4. Review and approval by the Zone 3 Advisory Committee (AC).
5. Formal approval by the governing boards of the Zone 3 member agencies, by resolution, with appropriate findings to address the following:
    a. The California Environmental Quality Act (CEQA).
    b. Emergency provisions that are unique and necessary to the LRRP, but which may differ from contract provisions that control Zone 3 operations and deliveries during normal operating conditions.
6. Final approval by the BOS.
7. Enacting the LRRP as described in this document and outlined in Appendix A.

2 BACKGROUND

Since completion of its construction in 1969, the Lopez reservoir has experienced extended periods of low reservoir inflow that have led to decreased storage levels within the lake. Analysis of historical storage data from Lopez Reservoir identified that the lowest storage water level (16,455 AF) within the reservoir

occurred in November of 1992. Figure 1 shows monthly storage levels within Lopez Reservoir since April 1969. Since 1992, there have been significant changes in dam operations, (e.g. Interim Downstream Release Schedule (IDRS) implementation) that affect the amount of water that is released and diverted from the reservoir on an annual basis. Modified operations and historic drought conditions have highlighted the need for evaluation of LRRP reduction scenarios.

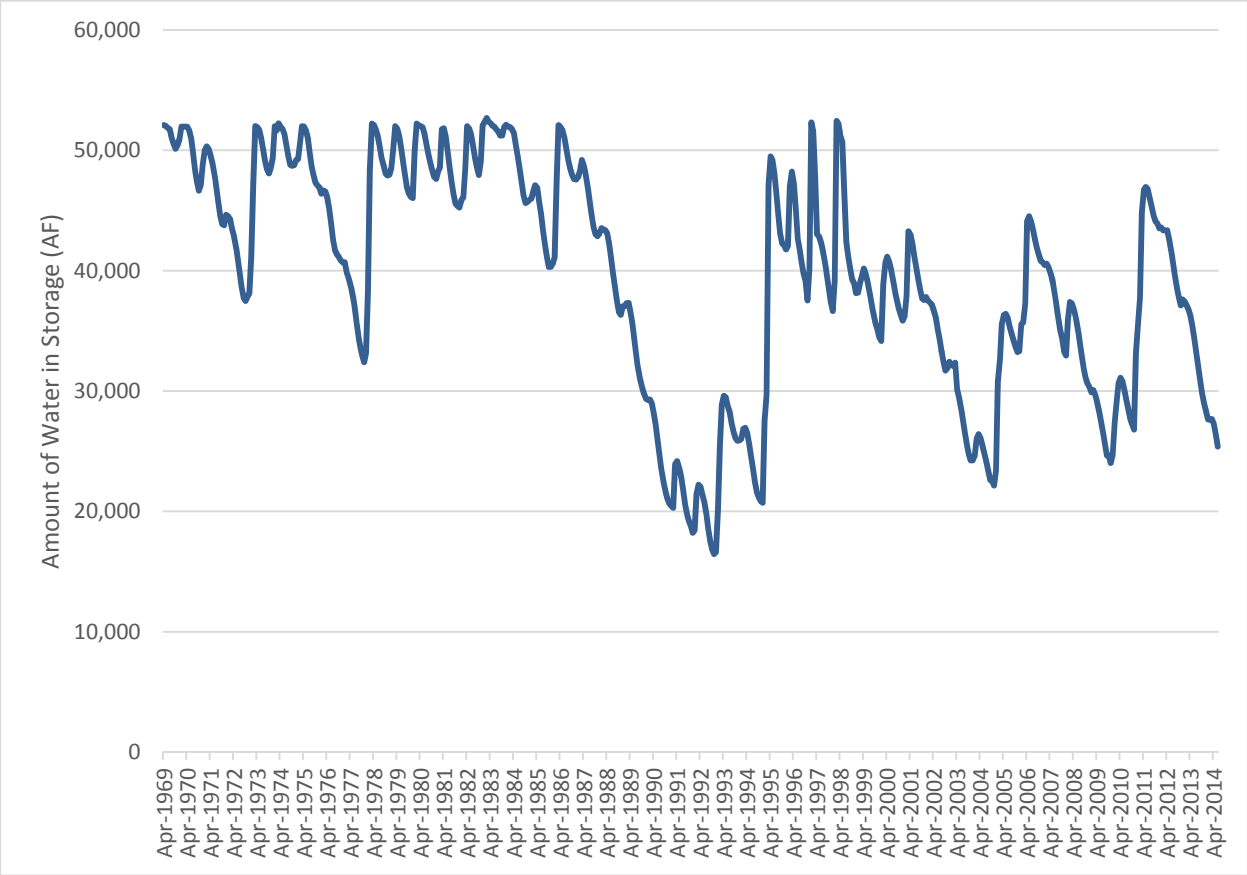


Figure 1. Lopez Reservoir Storage

3 LRRP ELEMENTS

3.1 ENACTING THE LRRP AND INITIAL PRESCRIBED ACTIONS

The LRRP is automatically enacted if the total volume of water in the Lopez Reservoir falls below 20,000 AF and the BOS has declared an emergency related to Zone 3. The initial prescribed actions, once the LRRP is enacted, are as follows:

- Reductions in entitlement water deliveries as set forth in Table 1; and
- Reductions in downstream releases as set forth in Table 2, with actual releases timed to best meet the needs of agricultural stakeholders and to address environmental requirements; and
- No new allocations of Surplus Water from unreleased downstream releases; and

- Extension of time that agencies can take delivery of existing unused water; throughout the duration that the Drought Emergency is in effect, subject to evaporation losses if the water is not used in the year originally allocated.

3.2 ADAPTIVE MANAGEMENT

To provide the District, the Zone 3 agencies and agricultural stakeholders with sufficient flexibility to adapt to changing drought conditions and to address the environmental requirements, the LRRP includes an adaptive management component that allows the initial prescribed actions to be modified and adapted to the specific drought conditions. The steps for modifying the initial prescribed actions are outlined below and are show in Appendix A.

1. The TAC will review several factors including the time of year that the LRRP is enacted, when the reservoir level drops to lower triggers, and Hydrologic Conditions including but not limited to: predicted climatic conditions; anticipated reservoir inflow; and the availability of the Zone 3 agencies' other water supplies.
2. If determined to be necessary, the TAC will make a recommendation to the AC on a strategy for modifying the initial prescribed actions, hereafter referred to as an Adaptive Management Strategy.
3. Upon review of the TAC's recommendation, the AC will vote to approve, deny, modify or continue consideration of the Adaptive Management Strategy for a period not to exceed 30 days, at which time the AC will act to approve, deny or modify. If approved by the AC, the Adaptive Management Strategy will be implemented 14 days following its approval. If the Adaptive Management Strategy is approved, denied, or modified by the AC, AC members, Zone 3 member agencies, and other 3rd parties in interest may appeal to the BOS, within 14 days. If no appeal is made to the BOS, the AC action will be final.
4. If appealed to the BOS, the BOS action shall be final.

3.3 REDUCTION & RECOVERY TRIGGERS

To provide the District, Zone 3 agencies and the agricultural stakeholders with an initial framework for water supply planning, Reduction & Recovery Triggers, tied to the amount of water within the reservoir, were developed for the LRRP. Under the initial prescribed actions the Reduction & Recovery Triggers were set for the following storage levels: 20,000; 15,000; 10,000; 5,000; and 4,000 AF. As the amount of water in the reservoir drops below or rises above these triggers, the TAC will review the hydrologic condition and if necessary, utilize adaptive management to modify municipal diversions and downstream releases to meet the objectives of the LRRP.

Example scenarios provided in Appendix B show how the reservoir would respond to the implementation of the initial prescribed actions and an alternate reduction strategy under various historical hydrological patterns.

3.4 MUNICIPAL DIVERSION REDUCTIONS

Upon enactment of the LRRP, the initial prescribed actions dictate that municipal diversions are to be reduced according to the reduction strategy described in Table 1, which includes Reduction Triggers, reduction percentages and resulting municipal diversions. This municipal diversion reduction strategy may be modified through adaptive management, following the protocol outlined in Section 3.2.

Table 1. Initial Prescribed Municipal Diversion Reduction Strategy

Amount of Water In Storage (AF)	Municipal Diversion Reduction	Municipal Diversion (AFY)[1]
20,000	0%	4,530
15,000	10%	4,077
10,000	20%	3,624
5,000	35%[2]	2,941
4,000	100%	0

3.5 DOWNSTREAM RELEASE REDUCTIONS

Upon enactment of the LRRP, the initial prescribed actions dictate that downstream releases are to be reduced according to the reduction strategy described in Table 2, which includes Reduction Triggers, reduction percentages and resulting downstream releases. The Initial Prescribed Downstream Release Reduction Strategy was developed through a collaborative process that included input from the District and agriculture and municipal stakeholders. The resulting downstream releases represent the maximum amount of water that can be released. The District will control the timing of the reduced releases to meet the needs of the agricultural stakeholders and to address environmental requirements. This downstream release reduction strategy may be modified through adaptive management, following the protocol outlined in Section 3.2.

[1] The actual amount of water diverted may vary as agencies extend the delivery of their Lopez Entitlement, as described in Section 3.6.

[2] The 35% reduction provides sufficient water to supply 55 gallons per capita per day (GPCD) for the estimated population of the Zone 3 agencies (47,696 in 2010 per the 2010 Zone 3 UWMP). 55 GPCD is the target residential indoor water usage standard used in California Department of Water Resource's 2010 UWMP Method 4 Guidelines.

Table 2. Initial Prescribed Downstream Release Reduction Strategy

Amount of Water In Storage (AF)	Downstream Release Reduction	Downstream Releases (AFY)[3]
20,000	9.5%	3,800
15,000	9.5%	3,800
10,000	75.6%	1,026
5,000	92.9%	300
4,000	100.0%	0

3.5.1 HCP Reduction Strategy

An alternate downstream reduction strategy that could be implemented through adaptive management includes the Habitat Conservation Plan (HCP) Reduction Strategy. Under the HCP Reduction Strategy, downstream releases would be reduced according criteria outlined in the proposed HCP Water Release Program for consecutive low inflow years. Under this strategy, downstream releases would be either 3 cfs or equal to the average inflow over the previous 14-day period, whichever is less.

3.6 EXTENDED DELIVERY PROVISIONS

Once the LRRP is enacted, and in order to promote conservation and a reduction in the demand on Zone 3 water, Zone 3 member agencies will be provided the ability to extend the time that they may have water delivered, while the BOS drought emergency is in effect. The following is how water allocations to Zone 3 member agencies will be determined at the beginning of each water year while the LRRP is in effect. It is important to note that during a water year, increases and decreases in allocations are possible as a result of adaptive management strategies.

1. At the end of each Water Year (WY) (March 31st), the amount of unused Lopez water from the previous WY will be calculated and documented for each member agency for later use.
2. On April 1st, the quantity of Entitlement Water for the new WY will be documented for each agency in accordance with the LRRP determinations. Unused water from the prior WY is subject to evaporation losses, which are further described in Section 3.6.1.

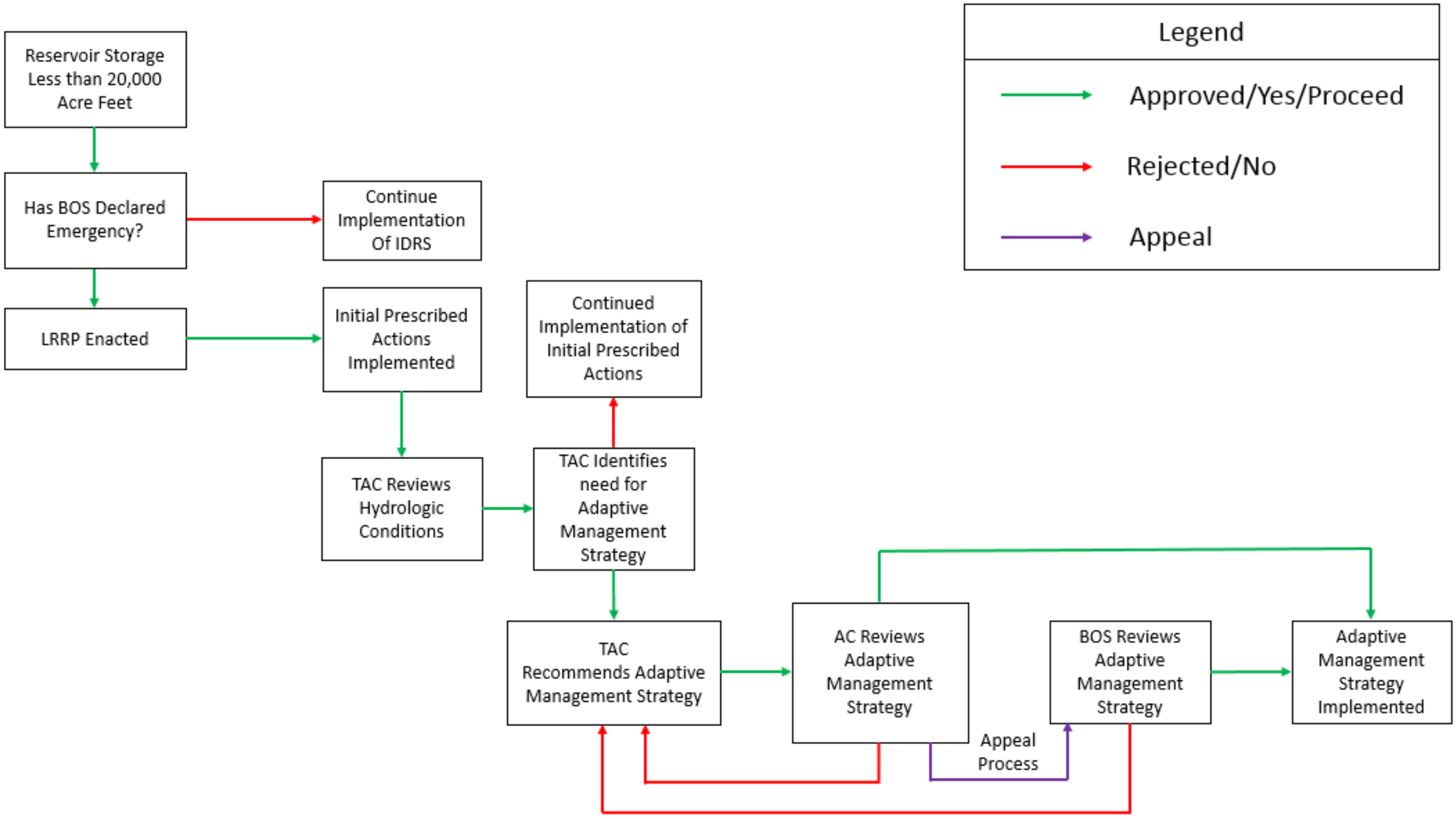
[3] These downstream releases represent the maximum amount of water that can be released. Actual releases may be less if releases can be reduced while still meeting the needs of the agricultural stakeholders and addressing the environmental requirements.

3.6.1 Evaporation Losses

While unused water from the prior WY is retained within the Lopez Reservoir, it is subject to evaporation losses. Evaporation losses are to be calculated quarterly and applied to the total amount of unused prior WY water retained by each agency at the end of the quarter. Evaporation losses will be calculated by comparing the surface area of the reservoir with the unused water against what the surface area would be if there were no unused water retained in the reservoir. Evaporation estimates from the District's weather station would then be applied to the difference in surface area to calculate the increased evaporation losses due to the storage of the unused water. The unused water evaporation losses will be subtracted from each agency's unused water at a rate proportional to the amount of unused water retained by each individual agency.

APPENDIX A. LRRP ENACTMENT & ADAPTIVE MANAGEMENT FLOW CHART

LRRP Enactment & Adaptive Management Flow Chart



A

APPENDIX B. REDUCTION STRATEGY EVALUATION

Scenario A-1-Water Year 1989/90 Inflow & Rainfall

Initial Prescribed Reduction Strategy

Year	Inflow[1]	Rainfall [1]	Evap. [2]	Municipal Reduction [3]	Municipal Diversions [3]	Downstream Releases [4]	Change in Storage	Total Storage
0								20,000
1	3,440	465	2,240	0%	4,530	3,800	-6,666	13,334
2	3,440	465	1,691	10%	4,077	3,800	-5,664	7,671
3	3,440	465	1,260	20%	3,624	1,026	-2,006	5,665
4	3,440	465	1,077	20%	3,624	1,026	-1,823	3,842

[1] Value assumed to be same as Water Year 1989/90 measurement.

[2] Evaporation assumed to equal the maximum historical value between April 1970 and March 2014 (76.25 in/yr in WY 1971-72) applied to the previous year's total lake surface area. Lake surface area estimated based on a lookup table provided by the County, which uses a 2002 survey to correlate reservoir elevation, storage, and surface area.

[3] Municipal diversions are assumed to be the same as the contract amount for the duration of the first year. Years following are dependent upon the storage at the end of the water year and municipal reduction assumptions.

[4] Release volumes are controlled by the Initial Prescribed Downstream Release Reduction Strategy, which was developed through a collaborative effort by the District and agriculture and municipal stakeholders.

Scenario A-2-Water Year 1989/90 Inflow & Rainfall

Potential Adaptive Management Scenario-HCP Reduction Strategy

Year	Inflow[1]	Rainfall [1]	Evap. [2]	Municipal Reduction [3]	Municipal Diversions [3]	Downstream Releases [4]	Change in Storage	Total Storage
0								20,000
1	3,440	465	2,240	0%	4,530	2,060	-4,926	15,074
2	3,440	465	1,808	0%	4,530	2,060	-4,493	10,582
3	3,440	465	1,494	10%	4,077	2,060	-3,726	6,856
4	3,440	465	1,188	20%	3,624	2,060	-2,968	3,888

[1] Value assumed to be same as Water Year 1989/90 measurement.

[2] Evaporation assumed to equal the maximum historical value between April 1970 and March 2014 (76.25 in/yr in WY 1971-72) applied to the previous year's total lake surface area. Lake surface area estimated based on a lookup table provided by the County, which uses a 2002 survey to correlate reservoir elevation, storage, and surface area.

[3] Municipal diversions are assumed to be the same as the contract amount for the duration of the first year. Years following are dependent upon the amount of water in storage at the end of the water year and municipal reduction assumptions.

[4] Release volumes are assumed to be equivalent to a release rate of 3 cfs or 181 AF/Month or equal to the amount of inflow to the reservoir for that month, whichever is less. This scenario is based on the HCP Hydrologic Analyses report recommended release program provision that sets the maximum release at 3 cfs or the average inflow to the reservoir over the previous 14-day period, when the 3-year running average inflow to Lopez Reservoir is less than 26,190 AFY.

Scenario B-1- Water Year 2013/14
Inflow & Rainfall **Initial Prescribed Reduction Strategy**

Year	Inflow[1]	Rainfall [1]	Evap. [2]	Municipal Reduction [3]	Municipal Diversions [3]	Downstream Releases [4]	Change in Storage	Total Storage
0								20,000
1	1,519	337	2,240	0%	4,530	3,800	-8,714	11,286
2	1,519	337	1,546	10%	4,077	3,800	-7,567	3,719
3	1,519	337	870	100%	0	0	986	4,705
4	1,519	337	980	35%	2,941	300	-2,364	2,340

[1] Value assumed to be same as Water Year 2013/2014 measurement.

[2] Evaporation assumed to equal the maximum historical value between April 1970 and March 2014 (76.25 in/yr in WY 1971-72) applied to the previous year's total lake surface area. Lake surface area estimated based on a lookup table provided by the County, which uses a 2002 survey to correlate reservoir elevation, storage, and surface area.

[3] Municipal diversions are assumed to be the same as the contract amount for the duration of the first year. Years following are dependent upon the storage at the end of the water year and municipal reduction assumptions.

[4] Release volumes are controlled by the Initial Prescribed Downstream Release Reduction Strategy, which was developed through a collaborative effort by the District and agriculture and municipal stakeholders.

Scenario B-2- Water Year 2013/14
Inflow & Rainfall **Potential Adaptive Management Scenario-HCP Reduction Strategy**

Year	Inflow[1]	Rainfall [1]	Evap. [2]	Municipal Reduction [3]	Municipal Diversions [3]	Downstream Releases [4]	Change in Storage	Total Storage
0								20,000
1	1,519	337	2,240	0%	4,530	1,253	-6,167	13,833
2	1,519	337	1,725	10%	4,077	1,253	-5,199	8,633
3	1,519	337	1,341	20%	3,624	1,253	-4,362	4,272
4	1,519	337	933	35%	2,941	1,253	-3,271	1,001

[1] Value assumed to be same as Water Year 2013/2014 measurement.

[2] Evaporation assumed to equal the maximum historical value between April 1970 and March 2014 (76.25 in/yr in WY 1971-72) applied to the previous year's total lake surface area. Lake surface area estimated based on a lookup table provided by the County, which uses a 2002 survey to correlate reservoir elevation, storage, and surface area.

[3] Municipal diversions are assumed to be the same as the contract amount for the duration of the first year. Years following are dependent upon the amount of water in storage at the end of the water year and municipal reduction assumptions.

[4] Release volumes are assumed to be equivalent to a release rate of 3 cfs or 181 AF/Month or equal to the amount of inflow to the reservoir for that month, whichever is less. This scenario is based on the HCP Hydrologic Analyses report recommended release program provision that sets the maximum release at 3 cfs or the average inflow to the reservoir over the previous 14-day period, when the 3-year running average inflow to Lopez Reservoir is less than 26,190 AFY.

Scenario C-1- Average of Water Years
2012/13-2013/14 Inflow & Rainfall **Initial Prescribed Reduction Strategy**

Year	Inflow[1]	Rainfall [1]	Evap. [2]	Municipal Reduction [3]	Municipal Diversions [3]	Downstream Releases [4]	Change in Storage	Total Storage
0								20,000
1	2,176	806	2,240	0%	4,530	3,800	-7,588	12,412
2	2,176	806	1,627	10%	4,077	3,800	-6,522	5,890
3	2,176	806	1,099	20%	3,624	1,026	-2,767	3,123
4	2,176	806	798	100%	0	0	2,184	5,307

[1] Value assumed to be same as 2 year average from Water Year 2012/13 through 2013/2014 measurement.

[2] Evaporation assumed to equal the maximum historical value between April 1970 and March 2014 (76.25 in/yr in WY 1971-72) applied to the previous year's total lake surface area. Lake surface area estimated based on a lookup table provided by the County, which uses a 2002 survey to correlate reservoir elevation, storage, and surface area.

[3] Municipal diversions are assumed to be the same as the contract amount for the duration of the first year. Years following are dependent upon the storage at the end of the water year and municipal reduction assumptions.

[4] Release volumes are controlled by the Initial Prescribed Downstream Release Reduction Strategy, which was developed through a collaborative effort by the District and agriculture and municipal stakeholders.

Scenario C-2- Average of Water Years
2012/13-2013/14 Inflow & Rainfall **Potential Adaptive Management Scenario-HCP Reduction Strategy**

Year	Inflow[1]	Rainfall [1]	Evap. [2]	Municipal Reduction [3]	Municipal Diversions [3]	Downstream Releases [4]	Change in Storage	Total Storage
0								20,000
1	2,176	806	2,240	0%	4,530	1,435	-5,223	14,777
2	2,176	806	1,788	10%	4,077	1,435	-4,318	10,458
3	2,176	806	1,484	10%	4,077	1,435	-4,014	6,444
4	2,176	806	1,151	20%	3,624	1,435	-3,228	3,216

[1] Value assumed to be same as 2 year average from Water Year 2012/13 through 2013/2014 measurement.

[2] Evaporation assumed to equal the maximum historical value between April 1970 and March 2014 (76.25 in/yr in WY 1971-72) applied to the previous year's total lake surface area. Lake surface area estimated based on a lookup table provided by the County, which uses a 2002 survey to correlate reservoir elevation, storage, and surface area.

[3] Municipal diversions are assumed to be the same as the contract amount for the duration of the first year. Years following are dependent upon the amount of water in storage at the end of the water year and municipal reduction assumptions.

[4] Release volumes are assumed to be equivalent to a release rate of 3 cfs or 181 AF/Month or equal to the amount of inflow to the reservoir for that month, whichever is less. This scenario is based on the HCP Hydrologic Analyses report recommended release program provision that sets the maximum release at 3 cfs or the average inflow to the reservoir over the previous 14-day period, when the 3-year running average inflow to Lopez Reservoir is less than 26,190 AFY.

Scenario D-1- Average of Water Years 2011/12-2013/14 Inflow & Rainfall **Initial Prescribed Reduction Strategy**

Year	Inflow[1]	Rainfall [1]	Evap. [2]	Municipal Reduction [3]	Municipal Diversions [3]	Downstream Releases [4]	Change in Storage	Total Storage
0								20,000
1	4,305	827	2,240	0%	4,530	3,800	-5,438	14,562
2	4,305	827	1,774	10%	4,077	3,800	-4,519	10,044
3	4,305	827	1,453	10%	4,077	3,800	-4,197	5,847
4	4,305	827	1,095	20%	3,624	1,026	-612	5,235

[1] Value assumed to be same as 3 year average from Water Year 2011/12 through 2013/2014 measurement.

[2] Evaporation assumed to equal the maximum historical value between April 1970 and March 2014 (76.25 in/yr in WY 1971-72) applied to the previous year's total lake surface area. Lake surface area estimated based on a lookup table provided by the County, which uses a 2002 survey to correlate reservoir elevation, storage, and surface area.

[3] Municipal diversions are assumed to be the same as the contract amount for the duration of the first year. Years following are dependent upon the storage at the end of the water year and municipal reduction assumptions.

[4] Release volumes are controlled by the Initial Prescribed Downstream Release Reduction Strategy, which was developed through a collaborative effort by the District and agriculture and municipal stakeholders.

Scenario D-2- Average of Water Years 2011/12-2013/14 Inflow & Rainfall **Potential Adaptive Management Scenario-HCP Reduction Strategy**

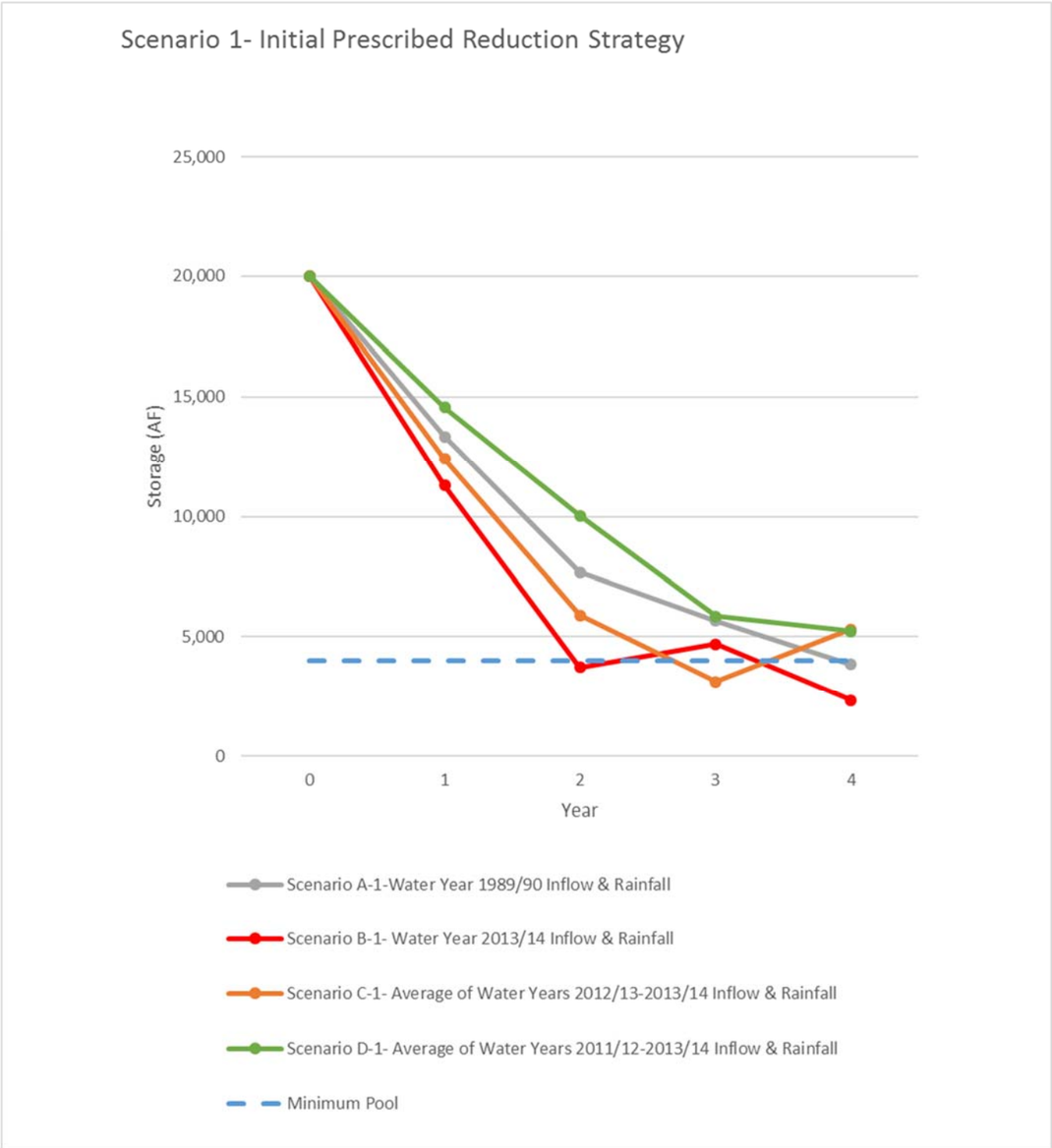
Year	Inflow[1]	Rainfall [1]	Evap. [2]	Municipal Reduction [3]	Municipal Diversions [3]	Downstream Releases [4]	Change in Storage	Total Storage
0								20,000
1	4,305	827	2,240	0%	4,530	1,681	-3,318	16,682
2	4,305	827	1,878	0%	4,530	1,681	-2,956	13,726
3	4,305	827	1,718	10%	4,077	1,681	-2,343	11,383
4	4,305	827	1,553	10%	4,077	1,681	-2,178	9,205

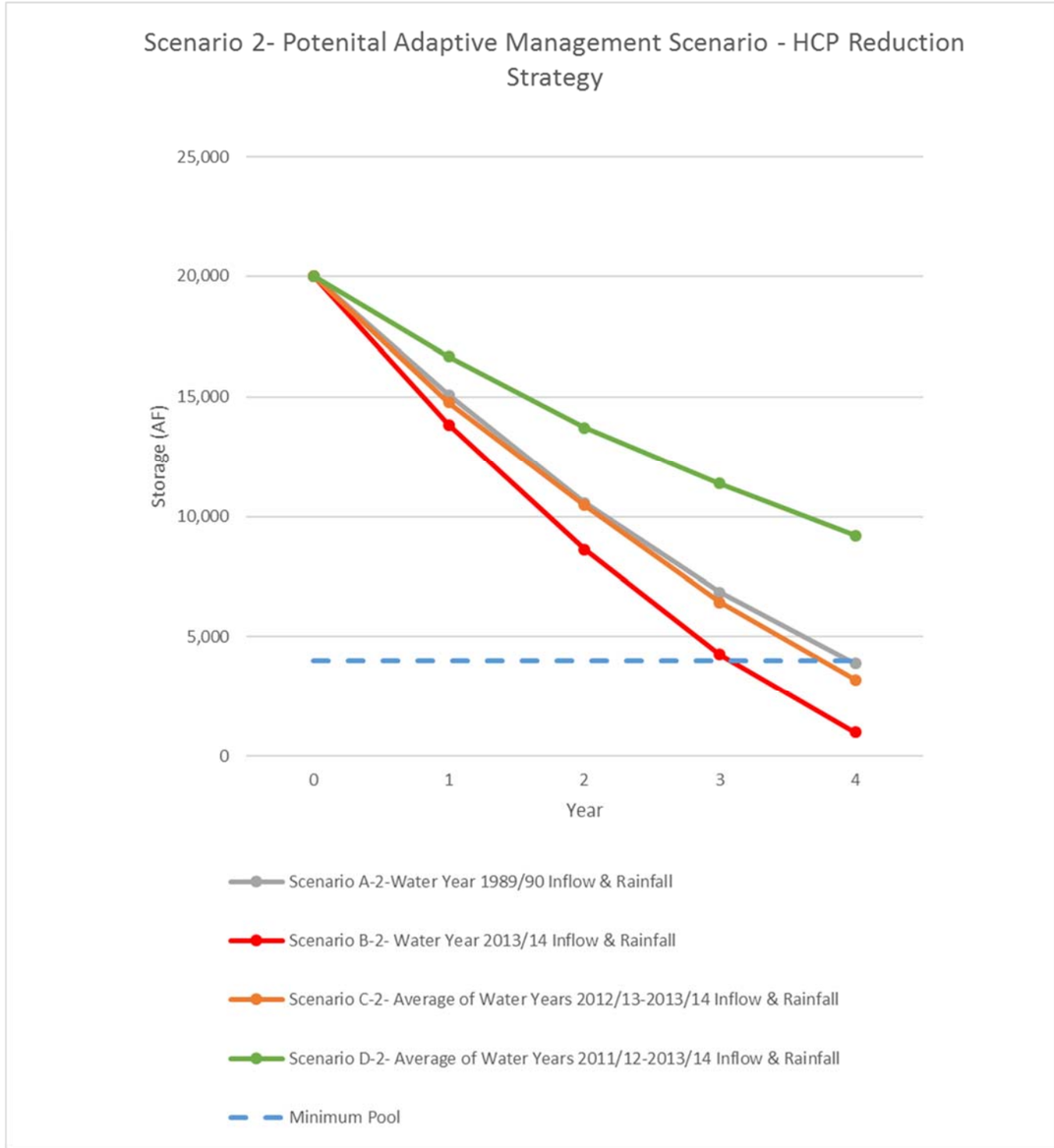
[1] Value assumed to be same as 3 year average from Water Year 2011/12 through 2013/2014 measurement.

[2] Evaporation assumed to equal the maximum historical value between April 1970 and March 2014 (76.25 in/yr in WY 1971-72) applied to the previous year's total lake surface area. Lake surface area estimated based on a lookup table provided by the County, which uses a 2002 survey to correlate reservoir elevation, storage, and surface area.

[3] Municipal diversions are assumed to be the same as the contract amount for the duration of the first year. Years following are dependent upon the amount of water in storage at the end of the water year and municipal reduction assumptions.

[4] Release volumes are assumed to be equivalent to a release rate of 3 cfs or 181 AF/Month or equal to the amount of inflow to the reservoir for that month, whichever is less. This scenario is based on the HCP Hydrologic Analyses report recommended release program provision that sets the maximum release at 3 cfs or the average inflow to the reservoir over the previous 14-day period, when the 3-year running average inflow to Lopez Reservoir is less than 26,190 AFY.


Scenario 1- Initial Prescribed Reduction Strategy
25,000
20,000
15,000
10,000
5,000
0
Storage (AF)
0
1
2
3
4
Year
Scenario A-1-Water Year 1989/90 Inflow & Rainfall
Scenario B-1- Water Year 2013/14 Inflow & Rainfall
Scenario C-1- Average of Water Years 2012/13-2013/14 Inflow & Rainfall
Scenario D-1- Average of Water Years 2011/12-2013/14 Inflow & Rainfall
Minimum Pool


Scenario 2- Potenital Adaptive Management Scenario - HCP Reduction Strategy
25,000
20,000
15,000
10,000
5,000
0
Storage (AF)
0
1
2
3
4
Year
Scenario A-2-Water Year 1989/90 Inflow & Rainfall
Scenario B-2- Water Year 2013/14 Inflow & Rainfall
Scenario C-2- Average of Water Years 2012/13-2013/14 Inflow & Rainfall
Scenario D-2- Average of Water Years 2011/12-2013/14 Inflow & Rainfall
Minimum Pool