MELLOR

Record of Decision

Environmental Impact Statement

Lake Berryessa Reservoir Area
Management Plan

FINAL

February 1993

RECORD OF DECISION

Final Environmental Impact Statement
Lake Berryessa Reservoir Area Management Plan

I. INTRODUCTION

This document constitutes the Record of Decision of the Department of the Interior, Bureau of Reclamation (Reclamation), Mid-Pacific Region, regarding the Preferred Actions to be used as the framework for development of the Lake Berryessa Reservoir Area Management Plan (RAMP). The RAMP will provide guidelines for the development and management of the land and water areas of Lake Berryessa to: accommodate a wide range of recreational opportunities in a healthy and safe environment; protect and enhance natural resources including visual resources, cultural resources, threatened and endangered species; and protect water resources including supply and quality. The actions are described in the Final Environmental Impact Statement (Final EIS) (FES 92-12), which was developed in compliance with the National Environmental Policy Act (NEPA).

II. RECOMMENDED DECISION

The Recommended decision is to select the Preferred Actions numbers one (1) through forty-one (41) for development in the Lake Berryessa RAMP. The Final EIS and subsequent RAMP are "generic" or "programmatic" documents which provide the overall direction for planning, development, and management of Lake Berryessa. All actions selected for consideration in the RAMP shall be subject to additional environmental analysis and reports as they are considered for implementation.

Appendix 1 contains a list of the selected forty-one (41) Preferred Actions.

III. OTHER ALTERNATIVE ACTIONS CONSIDERED

Alternative Actions evaluated but not selected are provided on pages 22 - 34 in the Final EIS.

IV. BASIS OF DECISION AND ISSUES EVALUATED

Preferred Actions 1 through 41 best meet the goals and objectives for management of Lake Berryessa as presented in the Final EIS, while complying with the requirements of all applicable environmental laws and regulations. These goals and objectives follow:

Overall Goal - The overall goal is to accommodate and provide for a wide range of outdoor recreation opportunities in a natural environment while optimizing visitor experience levels and safety, consistent with other authorized functions of the Solano Project.

Resource Protection - Projects and actions will comply fully with the intent of NEPA. This includes the protection and management of wildlife resources with special attention to endangered species.

Public Access - Public access to Lake Berryessa and its shoreline will be maintained and improved to meet the expanding demand for recreation and minimize congestion and use conflicts. Existing uses may evolve with day use and other short-term uses taking precedent. The elimination or conversion of some long-term uses may be required to attain this. Access for special needs populations will be emphasized.

Improvement of Short-Term Uses - Short-term uses and facilities will be improved in quality and quantity, emphasizing low density development as most preferable, and located in shoreline areas to support water-oriented recreational opportunities.

Continued Long-Term Uses - Long-term exclusive uses will be allowed in concession areas. Current long-term exclusive uses assist in supporting necessary services for the short-term users and low cost public access. These long-term exclusive uses will be located or relocated in areas that are neither prime shoreline locations that are desirable for short-term uses nor conflict with other greater public needs. Long-term uses will be designed to blend more effectively with the natural environment.

Floodproofing - Structures and facilities in the reservoir floodplain (440 - 455 foot level) will be floodproofed and/or anchored, or removed in accordance with Floodplain Management Executive Order #11988 and subsequently developed Reclamation Instructions, part 215.13.

Protection of Water Resources - All resource and recreational developments will be designed and constructed to minimize impacts on water quality.

Safeguards will be instituted to ensure sewage, toxic material, and other harmful substances are not allowed to contaminate the lake.

Maintenance of Visual Resources - Reclamation recognizes Lake Berryessa as a regional recreation area that has inherent aesthetic and recreational values. Existing developments and new projects will be designed to conform and blend with natural features and visual resources.

Encourage Water-Oriented Outdoor Recreational Uses - Management of water uses and activities at Lake Berryessa is an integral element of Reclamation's responsibility. Decisions and actions will provide for the health and safety of users, protection and enhancement of resources, and compatibility of uses on the water surface.

Improve Enforcement Capabilities - Through agreements with local enforcement agencies or through additional authorities, law enforcement presence will be expanded to provide for the health and safety of visitors and protection of resources.

Expand Visitor Information Services - Reclamation will expand visitor awareness of the lake's environment, wildlife, water management, and safety issues. This will be accomplished by developing visitor information services in concession and public use areas.

Periodic Review of the RAMP - The RAMP will be reviewed and modified, if necessary, every five years. Assistance from other land-managing agencies, local universities and colleges, and the public will be encouraged to provide information on current and future recreational uses and needs.

V. CONSULTATION AND COORDINATION

Environmental Review and Consultation Requirements

The RAMP/EIS was prepared concurrently with environmental review and consultation required by Federal environmental laws other than NEPA, as required by 40 Code of Federal Regulations (CFR) 1502.25.

Public Involvement

A summary of public involvement activities for the RAMP/EIS was provided in the Final EIS, Chapter VII-Consultation and Coordination.

Further public review of the Final EIS was provided between June 16, 1992, and August 7, 1992. On July 12, 1992, an Open House meeting was held at the Clarion Inn, Napa, California. Participants at the Open House were afforded the opportunity to ask questions or express their concerns on the Final EIS. In addition to the Open House, Reclamation staff conducted a number of small, informal meetings with various groups to discuss the Final EIS in greater detail.

VI. PUBLIC RESPONSE TO FINAL ENVIRONMENTAL IMPACT STATEMENT

Following the filing of the Final EIS, Reclamation received 20 letters commenting on the adequacy of the document. These letters, with the exception of additional comments on the determination of floodplain elevations, did not present new issues, or issues that had not been previously addressed in the Final EIS and Public Involvement Report.

A number of comments were received questioning the adequacy of the data on floodplain elevations presented in the Final EIS. To clarify the information presented in the Final EIS, a December 1986 report, Flood Elevation Probability Study is included as Appendix 2 in this document.

Some comments indicated the need for modification to the Final EIS or additional information. The following supportive information is provided:

--Page 38, Table 2, "Water Elevation Frequency" of the Final EIS has been revised as shown below to more specifically reflect the 1986 Flood Elevation Probability Study (Appendix 2).

WATER ELEVATION FREQUENCY

Frequency (years)	Elevation (feet)	Confidence Range
1.25	440	+ or - 0.5
5	445	+ or - 1.5
10	446.5	+ or - 2.0
25	447.5	+ or - 2.5
50	448.5	+ or - 2.75
100	449.5	+ or - 3.0

--Appendix H of the Final EIS is updated with the addition of the following fish species: Sacramento Sucker, *Catostomus occidentalis* (Ayres) and Sacramento Blackfish, *Orthodon Microlepidotus* (Ayres).

VI. IMPLEMENTING THE DECISION AND ENVIRONMENTAL COMMITMENTS

The Preferred Actions are programmatic in nature and will form the basic framework for the RAMP. In the RAMP, specific plans and operational policies will be developed to implement the objectives identified in the Final EIS. These operational policies and plans will be subject to further environmental analysis and public involvement. Under NEPA and the Council on Environmental Quality guidelines, this sequence of analysis is called "tiering" and is appropriate when the implementation of specific actions may not occur for several years, but where general (programmatic) direction and guidance is needed.

If future decisions could affect wetlands, fish and wildlife, cultural resources, or other resources, Reclamation will prepare site specific analyses as required by executive orders, public laws, etc. When site specific impacts are identified, mitigation measures will be developed which are implementable, effective, and enforceable. Examples of typical mitigation measures are provided in Chapter VI-Environmental Consequences of the Final EIS.

Approved

Date 1/5/93

ACTING FOR Don m. Fults
Regional Director

Date 2-11-93

Deputy Commissioner

APPENDICES

PREFERRED ACTIONS SELECTED FOR IMPLEMENTATION:

1. Land Acquisition.

Preferred Action:

Acquire additional lands to provide recreational access and services to public lands and minimize impacts to adjoining lands. Priority acquisitions include the following sites:

✓ Private lands between Putah and Eticuera Creeks southeast of the Knoxville-Berryessa Road. Two parcels involving 200 acres may ultimately be involved.

✓ Private land south of Spanish Flat Resort adjacent to Knoxville-Berryessa Road. Two parcels totaling approximately 2-1/2 acres may ultimately be involved.

2. Land Disposal.

Preferred Action:

Dispose of or exchange lands around Lake Berryessa not required for either the operation of the Solano Project, watershed protection, or recreational or wildlife purposes. Only lands separated from the lake by highways would be considered in this action. As lands are identified for disposal, appropriate public involvement and environmental documentation procedures will be followed. Approximately 500 acres could ultimately be involved.

3. Dispersed Recreation Area Improvements.

Preferred Action:

Develop and/or improve dispersed recreation areas (Class III) which could include access trails, sanitation facilities, garbage collection, parking, visitor information signing, etc. to provide for the health and safety of the public and protection of resources. In some cases, improvements would only involve a replacement of existing deteriorated facilities. Sites to be developed and/or improved generally would include areas with existing improvements and those areas being used frequently by the public which lack any improvements.

4. Administration Point Day Use Area.

Preferred Action:

Improve access to Administration Point to provide a dispersed/semi-primitive day use experience. Access will normally be limited to walk-in users. Provision for limited motor vehicle access will be available for special needs populations. The site totals 30 acres of which only a small portion of the land would be disturbed for site development.

5. Smittle Creek Day Use Area.

Preferred Action: Take No New Action

Maintain Smittle Creek Day Use Area in accordance with the Oak Shores Plan which retains it as a day use area. No campground development would be allowed.

6. Facilities for Special Needs Populations.

Preferred Action:

Improve accessibility for special needs populations in all facilities at Lake Berryessa including concession areas. In some cases, retrofitting of appropriate facilities may be required in accordance with Section 504 of the Rehabilitation Act of 1973, as amended.

7. Trail Development.

Preferred Action:

Develop a predominantly unsurfaced multi-purpose riding and hiking trail system (30 to 50 miles) in dispersed recreation (Class III) and semi- primitive areas (Class IV). Trails could accommodate a variety of uses, but would not be available to motorized vehicles. Any development of trails on the eastside would have to conform with a management plan for that area to be developed as a result of preferred action 13.

8. Boat Access Camping.

Preferred Action:

Establish a boat access camping program for areas designated as semi-primitive (Class IV) and dispersed recreation (Class III) which will be administered by Reclamation. Under a permit system, resorts could provide parking and launching for a fee. Initially, only 50-100 sites would be established.

9. Island Uses and Improvements.

Preferred Action:

Provide dispersed recreation area improvements such as boat access camping sites on Small and Big Island (450 + acres). This would change the existing land-use classification from semi-primitive (Class IV) to dispersed recreation (Class III).

10. North Area Campground.

Preferred Action:

Develop a low density, high quality campground and day use area on the west shore, north of Putah Creek. The exact location would be made in consideration of minimizing potential impacts to bald eagles. Approximately 50-100 individual sites plus a group site on 30-40 acres of rolling grass-oak woodland would be provided for tent camping and/or recreational vehicles. This would result in a land-use classification change from dispersed recreation (Class III) to general outdoor recreation (Class II) for the actual campground site. The remaining north shore lands would continue to be in the dispersed recreation classification.

11. Boat Launching.

Preferred Action:

Develop additional boat launching opportunities in conjunction with the proposed north shore campground to disperse use. It will be utilized by day users and campground users. Fees may be charged, depending upon applicable policies or legislation at the time of construction.

12. User Fees.

Preferred Action:

Where legally authorized, charge user fees in areas where improvements have been made or a special service is provided. Semi-primitive (Class IV) and dispersed recreation (Class III) areas around the lake will remain open to the public at no charge. Fees could be charged for:

- ✓ Houseboat inspections
- ✓ Boat access camping program services
- ✓ Special events
- ✓ Special permit processing

13. Fish and Wildlife Management Area.

Preferred Action:

Plan and establish a fish and wildlife management area under an agreement with the California Department of Fish and Game (DFG) for lands on the eastshore of Lake Berryessa, extending from Eticuera Creek to the Monticello Dam (approximately 1,400 acres). The non-exclusive grazing easement area (Gunn Ranch) may preclude certain management activities above the 440 elevation mark. This action will be coordinated with the US Fish and Wildlife Service (FWS) and a special Focus Group will be established and may consist of representatives from the FWS, Reclamation, adjacent landowners, and special interest groups For the remainder of the lake, management of fish and wildlife resources will be retained by Reclamation with technical input provided by DFG. As a fish and wildlife area, a variety of actions could be implemented such as:

- ✓ Cattle enclosures and/or cattle grazing restrictions
- ✓ Waterfowl nesting habitat
- ✓ Roosting and nesting sites for eagles, ospreys, great blue herons, etc.
- ✓ Native tree planting
- ✓ Fertilization and seeding of the fluctuation zone to provide waterfowl food
- ✓ Establish riparian vegetation along water courses
- ✓ Continue fishery related management efforts and habitat improvement projects

14. Visitor Information Services.

Preferred Action:

Expand visitor information services which could include:

- ✓ Interpretive center facilities and activities
- ✓ Develop mini interpretive center in the dam area
- ✓ Overlooks at appropriate locations along roads
- ✓ Interpretive trails
- ✓ Interpretive displays in developed access points and concession areas
- ✓ Additional signing

15. Limited Special Uses of Lands.

Preferred Action:

Allow limited special uses of Reclamation lands around Lake Berryessa, including those shoreline areas exposed due to extreme drawdowns, only if such uses are not exclusive nor incompatible with other recreational activities. Off road vehicle use will continue to be prohibited. Lands may not be closed to the public to accommodate limited special uses. However, general public access to an area where limited special uses have been approved may be restricted temporarily for reasons of public health and safety. Specific guidelines and procedures and mitigation measures may be developed for each special use to minimize impacts on resources including water supplies.

16. Special Events on Land.

Preferred Action:

Allow special events and/or activities (equestrian activities, races, bicycling events, etc.) which may temporarily displace other recreational uses on a limited irregular basis through a permit system. The temporary closure of lands to the general public for reasons of public health and safety may be authorized for the duration of the event. Specific guidelines and procedures and mitigation measures may be developed for each special use, to minimize impacts on resources, including water supplies.

17. Water Surface Zoning and Restrictions.

Preferred Action:

Establish and implement (after coordination with the Napa County Sheriffs Dept.) specific zoning and/or restrictions for water surface uses and activities to promote public health and safety, foster compatibility of recreational uses, and protect and enhance natural resources, including water supplies, wetlands, and riparian habitats. Activities or areas subject to zoning restrictions could include, but are not limited to, the following:

- ✓ Water skiing and similar activities in Neither Cove
- ✓ Parasailing around power lines in the Narrows, Wragg Canyon, and Neither Cove
- ✓ Jet skiing in Oak Shores
- ✓ Closure of specific areas because of water supply intakes, endangered species issues, approved construction projects, etc.
- ✓ Aircraft operations
- ✓ Speed zones for specific areas
- ✓ Floating structures
- ✓ Establishment of boat traffic patterns on lake surface

18. Limited Special Uses of the Water Surface

Preferred Action:

Allow limited special uses (such as water skiing instruction or slalom courses) of designated coves and other specific water surface areas only if such uses are not exclusive nor incompatible with other recreational activities. The closure of coves or other areas for limited special uses is prohibited. However, general public access to an area where limited special uses have been approved may be restricted temporarily for reasons of public health or safety. Additional public involvement and necessary environmental documentation may be required prior to restricting public access for limited special uses.

19. Special Water Use Events.

Preferred Action:

Allow special water use events and/or activities (races, regattas, swims, fishing derbies, etc.) which may temporarily displace other recreational uses on a limited irregular basis through a permit system. The temporary closure of coves or other areas for reasons of public health and safety may be authorized for the duration of the event.

20. Water Craft Carrying Capacity.

Preferred Action:

Limit the total launching, marina capacity, and storage capabilities of water craft (power boats, sail boats, etc.) on Lake Berryessa to 3,000, based upon recommendations presented in the 1959 Pubic Use Plan. The carrying capacity will be revised if planned research shows that additional watercraft may be safely accommodated. The additional launching capabilities of the north shore boat ramp (preferred action No. 11) are to be included in the carrying capacity limit of 3,000.

21. Establish Law Enforcement Capabilities.

Preferred Action:

Obtain additional law enforcement support to fully administer Public Law 93-493. This may involve contracting with Napa County to increase enforcement activities at the lake and establishing specific Federal rules and regulations.

22. Floodproofing and/or Anchoring of Structures and Facilities in the Base Floodplain

Preferred Action:

Generally, all structures and facilities, including those for long-term uses, located in the Base Floodplain (440 feet to 450 feet mean sea level) will be floodproofed per Reclamation Instructions or removed. However, mobile homes, travel trailers, and their additions which cannot be easily floodproofed per Reclamation Instructions will, as a minimum, be securely anchored and have all sewage systems floodproofed.

Criteria for floodproofing and/or anchoring of all structures and facilities, including mobile homes, travel trailers, and their additions, will be determined in a subsequent Operational Policy to be developed after appropriate public involvement and environmental documentation procedures. Within one year after issuance of the Operational Policy, any structure or facility failing to meet the requirements of the Operational Policy must be removed or relocated above the reservoir floodplain (455 foot elevation).

Resort operators shall develop a Reclamation approved emergency floodproofing plan for securing water, sewage and utility systems within the Reservoir Floodplain against contamination due to high water. Structures and facilities which are floodproofed and/or anchored may remain in the Base Floodplain provided: (1) their value is amortized over a period no longer than that remaining until a resort-wide reorganization (period varies with individual concessions); and, (2) all applicable leases and agreements (including rental agreements) are modified to contain a "hold harmless" provision removing Reclamation from liability in case of a base or greater flood.

23. Prohibit Construction and Placement of Facilities in Reservoir Floodplain

Preferred Action:

Prohibit the construction or placement of new or additional permanent structures and facilities, including those for long-term uses to be located within the Reservoir Floodplain (440 feet to 455 feet mean sea level), except items which have been authorized in master plans for water or related activities. This prohibition does not apply to normal routine maintenance required for existing structures and facilities. Temporary facilities serving day and short-term uses may be allowed in the Reservoir Floodplain provided they can be floodproofed or removed on short notice.

24. Limitation on Long-term Uses.

Preferred Action.

Prohibit any increase in the total number of long-term uses within any resort. Uses eliminated due to other actions may be relocated, provided space is available and approved by Reclamation (see Preferred Action 37).

25. Removal of Structures and Facilities for Environmental Causes

Preferred Action:

Structures and facilities, including long-term uses, will be eliminated in unstable or environmentally unacceptable areas, provided no effective mitigation measures can be implemented. This action will be implemented through periodic reviews of each resort. Affected long-term sites may be relocated, provided space is available and approved by Reclamation (see Preferred Action 37).

26. Storage in Shoreline Areas.

Preferred Action:

Prohibit storage of solid wastes, materials, equipment, and other inappropriate items in shoreline areas to protect water supplies, eliminate clutter and aesthetic incompatibility, improve public access, and minimize safety hazards, unless specifically approved by Reclamation.

27. Resort Master Plans and Limitation on Development

Preferred Action

No development actions which require significant environmental documentation and public involvement will be approved prior to completion of an approved Master Plan for the resort. This limited moratorium will not preclude development actions which:

- ✓ Are needed to alleviate health and safety problems or are the result of emergency situations.
- ✓ Involve the general maintenance or replacement of deteriorated facilities.
- ✓ Could be approved as per the "Decisions for Lake Berryessa Actions" dated April 14, 1987.
- ✓ Are required by actions in this document and are otherwise directed by Reclamation.

28. Land Planning and Development Criteria

Preferred Action

All new projects within concession/special use areas will generally adhere to the basic planning and development criteria included in Appendix C of the Final EIS. Such criteria will minimize the impacts of new development on existing resources and will require some changes over the previous patterns of development occurring within concession/special use areas.

29. Facility Development and Design Standards

Preferred Action

Whenever feasible, establish and implement facility development and design standards for resorts including size restrictions, density, architectural styles, lot development, resort motif, and utility service standards to upgrade facilities. These would supplement existing State of California "Title 25" Standards.

30. Commercial Houseboats/Overnight Occupancy Vessels (OOVs)

Preferred Action

Allow 75 commercial houseboats or other types of commercial OOVs to occupy Lake Berryessa. A higher quota may be imposed if supported by sufficient studies.

31. Sewage and Gray Water Holding Facilities

Preferred Action

All vessels, including houseboats, cruisers, patio boats, etc., capable of discharging sewage and gray water shall be equipped with holding tanks that can be discharged by vacuum pumping only. Resorts having moored vessels capable of holding and discharging sewage and gray water shall provide sufficient pumpout facilities. All existing houseboats/OOVs on Lake Berryessa shall fully comply with sewage and gray water holding criteria within three years after adoption of a houseboat/OOV operational policy. Houseboats/ OOVs to be placed on the lake in the future, for short-term or long-term use, shall fully comply with this action.

32. Private Houseboats/Overnight Occupancy Vessels (OOVs)

Preferred Action

A maximum of 75 privately owned houseboats (noncommercial vessels) will be allowed at Lake Berryessa. Houseboats will be authorized for placement on the lake by permit issued by Reclamation and moorage agreements with those resorts capable of providing pumpout services. Houseboats and OOVs will be regulated by size, sewage and gray water holding capabilities, etc.

33. Limitations on Shoreline Modifications Below 440 Feet Mean Sea Level

Preferred Action

Modifications of the shoreline (dredging, filling, earth shaping, revetment work) below 440 feet mean sea level will only be allowed as required for maintenance of existing facilities, to improve aesthetics, day-use public access, or to alleviate health and safety problems. Modifications could include improvements to provide for additional day use activities such as swimming, picnicking, shoreline access and minor marina facilities. The original shoreline configuration will not be altered to accommodate additional overnight facilities, storage areas, etc. Reclamation approval is subject to receipt of appropriate Napa County, DFG, Army Corps. of Engineers, or other Federal or state agency permits as may be required.

34. Removal of Long-term Uses from Base Floodplain Area, and Floodproofing and/or Anchoring Long-term Uses between 450 - 455 feet.

Preferred Action

Remove all structures and facilities used for tenant occupancy or habitation (long-term uses) from the Base Floodplain (440 feet to 450 feet mean sea level) within one year after resort reorganization. Long-term uses located at elevations 450 feet to 455 feet may remain so long as they are: (1) floodproofed and/or securely anchored per Reclamation Instructions; and (2) are not subject to removal for other reasons. This action applies to all mobile homes, travel trailers, and their additions and improvements located in the Base or Reservoir Floodplain. Preferred Action 23, no new long-term uses will be constructed or placed in the Reservoir Floodplain (440 to 455 feet mean sea level).

35. Floodproof or Remove Permanent Structures and Facilities in the Reservoir Floodplain

Preferred Action

All existing permanent structures and facilities located in the Reservoir Floodplain (440 to 455 feet mean sea level), other than those associated with long-term uses (covered in Preferred Action 34), will be floodproofed per Reclamation Instructions or removed. Preferred Action 23, no new permanent structures or facilities will be constructed within the Reservoir Floodplain (440 to 455 feet mean sea level).

36. Create Short-term Sites from Existing Long-term Sites

Preferred Action

Provide additional short-term facilities (day use, camping, etc.) in designated shoreline locations (cluster

concept) currently occupied by long-term uses. Locations which are desirable for conversion from long-term to short-term uses will be determined during master planning and resort reorganizations. Conversions to short-term will be based upon a number of criteria and not just on where the sites are located. Preferred Action 37, relocations of displaced long-term sites may be permitted provided space is available and is approved by Reclamation. This action does not preclude the development of needed short-term facilities at other undeveloped areas within the resort.

37. Relocation of Long-term Sites

Preferred Action

Long-term uses (mobile homes, travel trailers, etc.) which are eliminated during a reorganization may be relocated to another site in the resort provided space is available and approved by Reclamation. Sites may be identified in subsequent resort master plans or reorganization plans. No net increase in the total number of long-term sites will be allowed. The number of relocation opportunities will depend upon existing situations at each resort.

38. Facility Development and Design Standards

Preferred Action

Establish and implement facility development and design standards for resorts including size restrictions, density, architectural styles, lot development, resort motif, and utility service standards to upgrade facilities. This would supplement portions of existing State of California "Title 25" Standards.

39. Deletion of Land from Concession Areas

Preferred Action

Delete undeveloped, unused, and/or inappropriately used recreation land and water areas from within the concession boundaries and modify concession agreements as appropriate.

40. Variable Rate Franchise Fees

Preferred Action

Establish and implement variable rate franchise fees within concession areas as an incentive to emphasize capital investment, health and safety, maintenance levels, public access, and/or other Reclamation recreation objectives.

41. Fee Reviews and Approvals

Preferred Action

Adjustment of long-term use fees will not require review and approval by Reclamation. Long-term use fees may be reviewed and approved by Reclamation at the request of a concessionaire provided all administrative costs involved are reimbursed. Adjustment of fees and charges for other resort services would continue to be subject to Reclamation review and approval prior to implementation.

Date: December 12, 1986

From: Robert D. O'Connor, Hydraulic Engineer

Subject: Flood Elevation Probability Study -- Lake Berryessa, Mid-Pacific Region, Sacramento, California

To: Chief, Water Resources Branch

As requested, in the September 29, 1986, memorandum to the Chief, Division of Planning and Technical Services, from the Regional Supervisor of Water and Power Resources Management, the study analyzing the probability of flooding within the surcharge zone (elevation 440 feet to 455 feet) of Lake Berryessa has been completed.

SUMMARY OF STUDY RESULTS

Shown in Table 1 and Table 2, respectively, are the computed probabilities and estimated recurrences of flood water reaching and surpassing the lake elevations within the surcharge zone specified in the memorandum. Computed probabilities beyond a 100-year recurrence are not considered to be reliable, therefore, only confidence limits are presented. There is a 90 % probability of a specific event ocurring somewhere in the interval between the confidence limits.

The probability curve shown on Plate 1 was developed for use in assessing the risk of development within the surcharge zone for elevations other than those specified in the memorandum.

FREQUENCY ANALYSIS

The frequency floods derived for Lake Berryessa were developed using USGS stream gage records at "Putah Creek near Winters", station # 11454000, for water years 1931 through 1956, and Bureau of Reclamation computed inflows to Lake Berryessa, for water years 1957 through 1986. The Putah Creek flows near Winters were assumed to be representative of the flows at Monticello damsite for water years 1931 through 1956.

The above records were analyzed to determine the relative frequency of the highest mean daily flows greater than 2,660 ft3/s for the following number of consecutive days, 1,2,3,...,20 or more. The flow of 2,660 ft3/s is the discharge capacity of Monticello Dam at elevation 440 feet. It was assumed that mean daily inflows less than this could be released without increasing the water surface elevation of Berryessa Reservoir. This analysis determined that 90 percent of all consecutive mean daily inflows greater than 2660 ft3/s for water years 1931 through 1986 were of 7 days duration or less.

An annual frequency analysis was performed on the highest consecutive 1- day, 3-day, 5-day, and 7-day flows for the period of record.

Frequency Flood Derivation

The 1984 flood study for Lake Berryessa provided the frequency flood peak discharges which were used in conjunction with the computed 1 day, 3-day, 5-day, and 7-day frequency flows to derive the symmetrical synthetic 100- year, 50-year, 25-year, 10-year, and 5-year frequency floods for Lake Berryessa shown on Plate 2. All the frequency floods developed for this study have a duration of 7 days. Time-discharge values for the above frequency floods are presented in Table 3.

RESERVOIR ROUTING

The above frequency floods were routed through Berryessa Reservoir and the maximum water surface elevations reached during the floods were used to develop the probability curve shown on Plate 1. The routing of the 1984 Probable Maximum Flood through the reservoir produced a water surface elevation of 463.7 feet, or 7.7 feet above the crest of the dam. Monticello
Dam was assumed not to fail and discharge over the top of the dam was treated as flow over a broad crested weir. The 463.7 foot elevation was assumed to be the maximum reservoir elevation that could be reached during a flood.

All frequency floods routed in this study were started at lake elevation 440 feet which is the top of active conservation pool and the recommended elevation to begin routing all floods. The initial elevation of 440 feet, which is a conservative estimate of the reservoir water surface elevation at the start of a flood, is also the crest elevation of the uncontrolled glory hole spillway.

PROBABILITY CURVE

The maximum reservoir water surface elevations reached when routing the 100, 50, 25, 10, and 5-year frequency floods through Berryessa Reservoir were plotted on Arithmetic Probability paper and a probability curve was drawn through the respective points. The probability curve was then extended below the 5-year return period to the point where it intersects water surface elevation 440 feet by linear extrapolation.

The upper and lower confidence limits between the 5-year and 200-year floods, as shown on Plate 1, were defined by developing the 5-year and 200- year floods at the upper and lower confidence limits and routing the four floods through the reservoir. The upper confidence limit curve was more clearly defined by developing the 50-year upper confidence limit flood and routing it through the reservoir.

In order to extent the upper and lower confidence limits beyond the 200 year flood the the 1984 Probable Maximum Flood was routed through the reservoir and the maximum water surface elevation reached was used to define the maximum elevation. A line was drawn between the upper confidence limit at the 200-year flood and elevation 463.7 feet at the 10,000 year return period (0.01 percent probability). The same process was repeated extending the lower confidence limit to elevation 463.7 feet at the 1,000,000 year return period (0.0001 percent probability). The method described to the extend the confidence limits beyond

the 200-year flood is recommended by the Engineering and Research Center for use in developing peak discharge probability curves and was assumed to be applicable to this study.

In order to define the portion of the upper and lower confidence curves below the 5-year return period the following method was used. At the point where the probability curve intersects water surface elevation 440 feet, the upper and lower confidence limits were assumed to be plus or minus 0.5 feet above and below the computed curve. The confidence limit curves were then assumed to be linear between these two points and the 5 year return period upper and lower confidence limits.

The probability curve developed in this study and shown on Plate 1 can be used to assess the risk of development within Lake Berryessa's surcharge zone (elevation 440 feet to 455 feet) for elevations other than those specified in the September 29, 1986 memorandum.

Noted :

Chief, Water Resources Branch

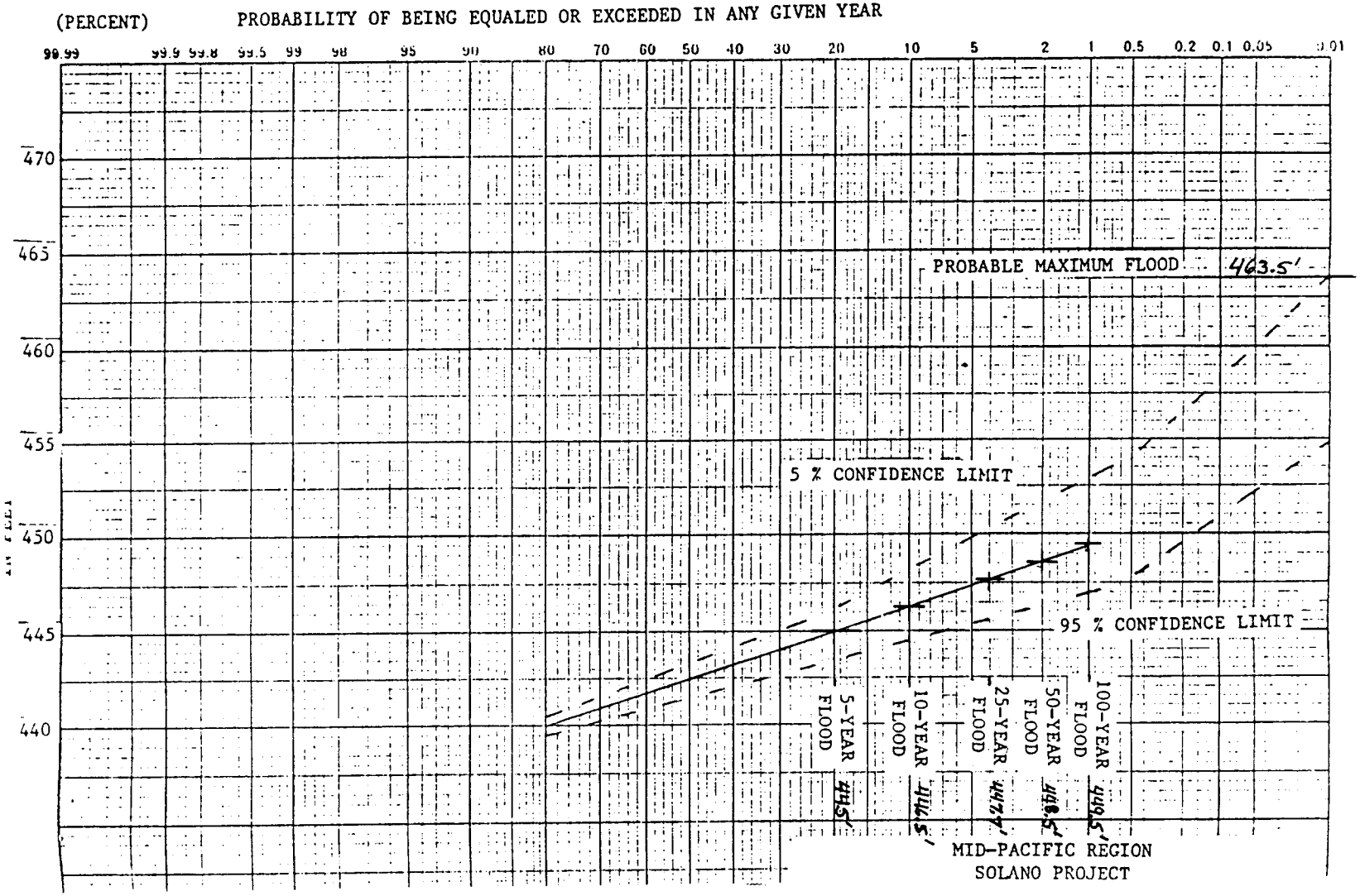
(PERCENT) PROBABILITY OF BEING EQUALED OR EXCEEDED IN ANY GIVEN YEAR
99.99 99.9 99.8 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
470
465
460
455
450
445
440
PROBABLE MAXIMUM FLOOD 463.5'
5 % CONFIDENCE LIMIT
95 % CONFIDENCE LIMIT
5-YEAR FLOOD 445'
10-YEAR FLOOD 446.5'
25-YEAR FLOOD 447.7'
50-YEAR FLOOD 448.5'
100-YEAR FLOOD 449.5'
MID-PACIFIC REGION
SOLANO PROJECT

Table 1

Flood Probability Study
for
Lake Berryessa
December 1986

Probability of being Equaled
or Exceeded in any Given Year

Surcharge Zone Elevation (feet)	5 % Confidence Limit (percent)	Computed Probability (percent)	95 % Confidence Limit (percent)	
456	0.24	n/r	0.006 *	Crest of dam
455	0.35	n/r	0.009 *	Top of surcharge zone
454	0.50	n/r	0.016	
452	1.34	n/r	0.05	
450	4.60	n/r	0.20	
448	11.00	2.90	0.42	
445	30.00	20.00	6.70	
440	83.00	80.00	71.00	Top of active conservation and bottom of surcharge zone

* --- estimated from extension of 95 % confidence limit on Plate 1
n/r - not reliable

Table 2

Flood Probability Study
for
Lake Berryessa
December 1986

Probability of being Equaled
or Exceeded in any Given Year

Surcharge Zone Elevation (feet)	Recurrence Interval at the 5 % Confidence Limit (years)	Recurrence at the Computed Probability (years)	Recurrence Interval at the 95 % Confidence Limit (years)		
456	417	n/r	16,667	*	Crest of dam
455	286	n/r	11,111	*	Top of surcharge zone
454	200	n/r	6250		
452	75	n/r	2000		
450	21	n/r	500		
448	9.1	35	238		
445	3.3	5.0	15		
440	1.2	1.3	1.4		Top of active conservation and bottom of surcharge zone

* --- estimated from extension of 95 % confidence limit on Plate 1
n/r - not reliable

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