BUREAU OF RECLAMATION

Boise River Basin Feasibility Study

Specialist Report: Floodplains

Boise Project, Idaho

Interior Region 9: Columbia Pacific Northwest

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Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Acronyms and Abbreviations

Acronym or Abbreviation	Meaning
EIS	Environmental Impact Statement
EO	Executive Order
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FRM	Flood Risk Management
Reclamation	Bureau of Reclamation
SFBR	South Fork Boise River

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1. Introduction

The Boise River Basin Feasibility Study is a feasibility study to evaluate increasing water storage opportunities within the Boise River basin by expanding Anderson Ranch Reservoir. The project is located at Anderson Ranch dam and reservoir, the farthest upstream of the three reservoirs within the Boise River system and located 28 miles northeast of the city of Mountain Home in Elmore County, Idaho. Anderson Ranch Dam is a zoned earth fill embankment structure that provides irrigation water, flood control, power generation, and recreation benefits. The reservoir also provides a permanent dead storage pool for silt control and the preservation and propagation of fish and wildlife. Anderson Ranch Dam is operated by the Bureau of Reclamation (Reclamation). Reclamation, in partnership with the Idaho Water Resource Board (IWRB), proposes to raise Anderson Ranch Dam. New water storage would provide the flexibility to capture additional water when available, for later delivery when and where it is needed to meet existing and future demands. The alternatives analyzed in this document include the No-Action Alternative (Alternative A), a 6-foot raise of Anderson Ranch Dam (Alternative B), and a 3-foot raise of Anderson Ranch Dam (Alternative C).

Alternative A provides a basis for comparison with the two action alternatives, Alternative B and Alternative C. Under Alternative A, current baseline conditions would continue, without increasing Anderson Ranch Dam height or constructing associated reservoir rim projects, access roads, or facilities. The expected project duration of Alternative B is approximately 51 months and Alternative C is 44 months. Reclamation would continue existing operations of Anderson Ranch Dam. Alternative B proposes to raise the dam by 6 feet from the present elevation of 4196 feet to 4202 feet to capture and store approximately 29,000 additional acre-feet of water. Alternative B would inundate an estimated 146 acres of additional land around the reservoir above the current full pool elevation of 4196 feet. Alternative C proposes to raise the dam by 3 feet to 4199 feet, allowing for the ability to capture and store approximately 14,400 additional acre-feet of water. Alternative C would inundate an estimated 73 acres of additional land around the reservoir above the current full pool elevation of 4196 feet.

Each of the two action alternatives, Alternative B and Alternative C, includes two separate, but similar, structural construction methods for the dam raise, downstream embankment raise, or mechanically stabilized earth wall raise. Otherwise, the only difference is the dam raise elevations of 6 feet for Alternative B and 3 feet for Alternative C. Project areas and construction durations for each method are nearly identical, except for a 200-foot difference in approach road length at the right abutment and an approximate 1-month difference in construction duration. The longer road length is within the dam footprint on previously disturbed ground. Because these differences are negligible, they are not differentiated within the analysis of each alternative. Alternative analysis assumes the longer road length and

construction duration, however, a final construction method will be chosen during later phases of engineering evaluation.

Chapter 1 and Chapter 2 of the Boise River Basin Feasibility Study Environmental Impact Statement (EIS) provide a detailed description of the proposed action, project's purpose and need, project area, and alternatives including design features applicable to the action alternatives. This specialist report supports the analysis of expected impacts to floodplains as described in the EIS.

1.1 Regulatory Framework

Executive Order 11988, "Floodplain Management"

Executive Order (EO) 11988 (May 24, 1977, amended January 30, 2015), "Floodplain Management" instructs Federal agencies to determine whether the action will occur in a floodplain prior to taking an action. If the action occurs in a floodplain, the agency must consider alternatives to avoid long- and short-term adverse impacts associated with the occupancy and modification of floodplains to the greatest extent practicable. If the only feasible alternatives are located within a floodplain, the agency shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out the agency's responsibilities consistent with regulations accompanying EO 11988. This EO defines floodplains as "the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a 1% greater chance of flooding in any given year." The likelihood of a 100-year runoff event, by definition, is 1 in 100 years (1% chance in any given year), and the area inundated by such an event is termed the 100-year floodplain.

In addition, 44 Code of Federal Regulations Part 9 sets forth the policy, procedure, and responsibilities to implement and enforce EO 11988, "Floodplain Management," and EO 11990, "Protection of Wetlands." EO 11990 is addressed in the Wetlands Specialist Report included in Appendix B of the EIS.

2. Affected Environment

The project area relating to Alternative B and Alternative C refers to the general vicinity in and around Anderson Ranch Reservoir extending downstream to the extent of Arrowrock Dam, via the South Fork Boise River (SFBR). The existing shoreline of the reservoir and SFBR below the dam see controlled annual inundation in accordance with Flood Risk Management (FRM) operations, discussed below.

Anderson Ranch Dam operates in conjunction with downstream Arrowrock and Lucky Peak Dams. Beginning January 1 and generally continuing each month through July, the U.S. Army Corps of Engineers Walla Walla District and Reclamation Water Management Group generate and coordinate seasonal runoff volume forecasts for the Boise River basin. These forecasts are used to determine the reservoir space requirements to meet the FRM objectives in the basin. During these operations, Anderson discharge varies as the reservoir is operated for FRM and reservoir refill. (Additional operations information is included in the Water Operations and Hydrology Specialist Report in Appendix B of EIS.)

Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Maps (FIRM) for Elmore County, Idaho were used to determine the extents of the 100-year special flood hazard area within the project area (FIRM panels 1602120325B and 1602120425B; June 19, 1989). The 100-year regulatory floodplain in the project area is predominately Zone A (base flood elevations not determined); for a reservoir the floodplain is the water's surface. There is also a Zone AE floodplain (base flood elevations determined with no floodway) beginning at the upstream face of the existing Pine bridge.

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3. Environmental Consequences

3.1 Methods for Evaluating Impacts

The methods used to assess the potential impacts of the alternatives on the regulatory floodplain in the immediate vicinity of Anderson Ranch Reservoir and Arrowrock Reservoir is based on data from the following sources:

- FEMA Flood Insurance Study (FIS) for Elmore County, Idaho - Unincorporated Areas, revised on March 15, 1994 (FEMA Flood Map Service Center Online)
- FIRMs for Elmore County, Idaho (FEMA Flood Map Service Center Online)
- Water Operations and Hydrology Specialist Report (Appendix B of EIS)
- Water Operations Technical Memorandum (Appendix B of EIS)

3.1.1 Assumptions

- The study area encompasses the regulatory floodplain at Anderson Ranch Reservoir, SFBR immediately upstream of Anderson Ranch Reservoir, SFBR between Anderson Ranch Dam and Arrowrock Reservoir, and the lower portions of all Anderson Ranch Reservoir tributaries within FEMA special flood hazard areas, that would be affected by post-project changes to water surface elevation. There are currently no known plans to allocate space in the expanded reservoir to flood control or to modify current FRM operations. Therefore, regulatory floodplain outside of this study area is assumed to be unaffected by the alternatives.
- Impacts are assessed for the short term (1–5 years) and long term (more than 5 years).
- The baseline for the analysis is the existing regulatory floodplain, which is the water surface elevation of the reservoirs.

3.1.2 Impact Indicators and Significance Criteria

Impacts from the alternatives were determined by assessing the project's perceived impacts to the regulatory floodplain in the area immediately surrounding Anderson Ranch Reservoir and associated tributaries, as well as downstream of Anderson Ranch Dam, at Arrowrock Reservoir, and at any construction areas within the project area.

Impacts to floodplains may be short term (1–5 years) or long term (more than 5 years) and may be direct (change in regulatory floodplain, such as elevation of the reservoir) or indirect (a change in hydrology that effects the floodplain). Impacts to floodplains would be significant if the proposed action resulted in either a decrease in natural and beneficial floodplain function or an increase in flood hazard and risk exposure to a community within the study area.

Table 1. Floodplains impact indicators and significance criteria.

Impact Indicator	Significance Criteria
Alteration of floodplain function, including natural and outstanding floodplain values for ecosystem quality	Substantial adverse effect on floodplain function
Risk of additional flooding	Adverse impacts to human health, safety, and welfare from flooding
Building in a 100-year floodplain unless no other practical alternative exists	Substantial adverse effect on floodplain function

3.2 Direct, Indirect, and Cumulative Impacts

3.2.1 Alternative A – No Action

Under Alternative A, the baseline conditions for floodplains would remain as they currently exist because there would be no increase in the Anderson Ranch Dam height or construction of the associated reservoir rim projects, access roads, or facilities. Operations and maintenance of Anderson Ranch Dam would not change.

Floodplains around the reservoir rim and along the South Fork Boise River would continue to be seasonally inundated as a result of ongoing operational fluctuations in water storage and releases. There would be no project related alteration of existing floodplains. No project related activities would decrease the functionality or change the classification of existing floodplains and there would be no increase in risk to human health, safety, and welfare due to flooding; therefore, Alternative A would not result in direct or indirect impacts to floodplains.

The Flood Insurance Study (FIS) for Elmore County, Idaho - Unincorporated Areas depicts the 100-year water surface elevation upstream of the bridge at 4209.5 feet, which is approximately 4.5 feet higher than more detailed hydraulic modeling performed more recently indicates (T-O Engineers, 2013) and as illustrated in Appendix C of the EIS. That the FIS over predicts the 100-year water surface elevation is noteworthy, and reasons for this inconsistency include the following.

- The FEMA hydraulic model uses idealized triangular cross-sections downstream of the Pine Bridge, which do not fully represent the existing topography and bathymetry of the reservoir and surrounding area. The result is a significant reduction in modeled effective flow area, which increases the resulting water surface elevation (base flood elevations).
- The thalwags on the cross-sections in the FEMA model are several feet above surveyed topography and bathymetry, further reducing the effective flow area and artificially increasing the resulting regulatory floodplain elevations.

- The FEMA model also uses an extremely conservative boundary condition at the downstream extent of the hydraulic model (4205.78 feet). This elevation is more than 7.5 feet higher than the maximum allowable surcharge level for Anderson Ranch (4198.2 feet), and 7.8 feet higher than the maximum historic observed water surface elevation at Anderson Ranch.

In summary, the hydraulic information informing the regulatory base flood elevation information near the town of Pine (upstream of the Pine Bridge) is overly conservative, and overpredicts the existing 100-year flood elevations.

3.2.2 Alternative B – Anderson Ranch Dam Six-Foot Raise

Inundation Impacts

Under Alternative B, the 6-foot dam raise would increase the storage capacity of Anderson Ranch Reservoir by approximately 29,000 acre-feet for an active capacity of approximately 442,074 acre-feet. The dam raise represents an increase in the active capacity of Anderson Ranch Reservoir, and the proposed full pool elevation of Anderson Ranch Reservoir would result in an increase of 146 inundated acres. This would result in a long-term direct impact to the regulatory floodplain due to the increase in the surface water elevation of the reservoir, thus increasing the floodplain area. However, the function of the floodplain would not change and natural and beneficial values served by the floodplains would be preserved.

Immediately upstream of Anderson Ranch Reservoir is the privately-owned Nester's Campground. This campground is accessed via a narrow gravel road that spans multiple side channels of the river with small culvert and make-shift bridge structures. This area is within a Zone AE floodplain (base flood elevations determined with no floodway). As a part of the feasibility-level design efforts related to the Boise River Basin Feasibility Study, a hydraulic evaluation was completed to assess potential for increased inundation associated with proposed higher tailwater conditions due to implementation of Alternative B. The proposed increase in the reservoir water surface results in a backwater effect that affects the water surface at the Pine Bridge during flood flows if they occur at the same time as high reservoir water surface elevations (6-foot Dam Raise Engineering Summary, Appendix C of EIS).

However, the hydraulic evaluation confirms that the campground is not protected from naturally occurring floods. Flooding impacts at Nester's Private Campground may be the result of South Fork Boise River flows and not a result of backwater influence from the existing or the proposed reservoir elevations. Results from the analysis indicate that increased reservoir water surface elevations would not measurably increase flood depths or inundation extents at Nester's Private Campground (6-foot Dam Raise Engineering Summary, Appendix C of EIS). Therefore, it can be reasonably assumed that the regulatory floodplain outside of the normal operating extents of the reservoir would be unaffected.

Overall, the frequency and duration of reservoir inundation would remain largely unchanged; the existing surface water elevation of the reservoir would increase, but the natural and beneficial values served by the regulatory floodplain would continue to function and the risk

of flood on human safety, health, and welfare would be preserved (in compliance with EO 11988).

Downstream Impacts

Installation of a cofferdam would result in short-term direct impacts to the regulatory floodplain due to sustained lower reservoir levels being maintained for approximately 42 months. However, the floodplains in the analysis area would continue to serve their function by contributing to ecosystem quality, including but not limited to soils, vegetation, wildlife habitat, dissipation of flood energy, sedimentation processes, and groundwater recharge so no significant impacts are identified.

Construction Impacts

Cumulative effects are analyzed for Alternative B and Alternative C. Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. The cumulative effects analysis considers projects, programs, and policies that are not speculative and are based on known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable. Reclamation has identified two potential future projects to be considered for the cumulative impact analysis: the Cat Creek Energy Project and the South Fork Boise River Diversion Project. Additional project proposal information for these, as known by Reclamation to date, is provided in Chapter 2 of the EIS.

Construction of both the Cat Creek Energy Project and South Fork Boise River Diversion Project would be required to comply with federal floodplain regulations. Long-term operations of both projects would include minor reservoir fluctuations during the seasonally allowed pumping of water from Anderson Ranch reservoir. Water right stipulations for each project stipulate that any water diverted from the reservoir would be flood water required to be spilled from Anderson Ranch Dam and only after multiple other downstream minimum flow requirements are met. Floodplains at the reservoir would continue to function and no increased flood hazard would be realized. Downstream, flows are projected to be reduced in April by up to 710 cfs under Alternative B and 380 cfs under Alternative C. These reductions are short in duration, up to 7 and 5 days respectively, but with potential for the Cat Creek Energy and South Fork Boise River Diversion projects to divert flood flows at the same time, spring flows would likely be reduced to flows typically realized later in the season. This could result in less springtime floodplain inundation, however floodplains would continue to function and there would be a reduced flood hazard along the South Fork Boise River. No adverse cumulative impacts to floodplains would be added to cumulative impacts from the Cat Creek Energy and Elmore County projects.

3.2.3 Alternative C – Anderson Ranch Dam Three-Foot Raise

Similar to Alternative B, Alternative C would increase the storage capacity of Anderson Ranch Reservoir, resulting in impacts to the regulatory floodplain**.**

Under Alternative C would increase the storage capacity of Anderson Ranch Reservoir by approximately 14,400 acre-feet for an active capacity of approximately 427,474 acre-feet. A proposed full pool elevation of Anderson Ranch Reservoir would result in an increase of 73 inundated acres. This would result in a long-term direct impact to the regulatory floodplain due to the increase in the surface water elevation of the reservoir, thus increasing the floodplain area, but the floodplain function would be preserved in compliance with EO 11988.

Although reduced in magnitude, inundation, downstream, and construction impacts to the regulatory floodplain are identical to Alternative B. The frequency and duration of inundation would remain largely unchanged. Floodplains would continue to serve their function by contributing to ecosystem quality, including but not limited to soils, vegetation, wildlife habitat, dissipation of flood energy, sedimentation processes and groundwater recharge. As with Alternative B, it can be reasonably assumed that the regulatory floodplain outside of the normal operating extents of the reservoir would be unaffected.

3.3 Cumulative Impacts

Cumulative effects are analyzed for Alternative B and Alternative C. Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. The cumulative effects analysis considers projects, programs, and policies that are not speculative and are based on known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable. Reclamation has identified two past projects (Pine Bridge replacement and the Anderson Ranch Dam security berm) and two potential future projects (the Cat Creek Energy Project and South Fork Boise River Diversion Project) to be considered for the cumulative impact analysis. Additional project proposal information for these, as known by Reclamation to date, is provided in Chapter 2 of the EIS.

The Pine Bridge Replacement Project and Anderson Ranch Dam Security Berm Project are past projects that would not contribute to cumulative effects on floodplains since these projects retained the same footprint. The bridge was replaced at the same location and the berm crest was added to the dam for security purposes and does not provide any water retention. No present actions or projects were identified within or near the project area.

Two potential future projects to be considered for the cumulative impact analysis include the Cat Creek Energy Project and the South Fork Boise River Diversion Project. Additional project proposal information for these, as known by Reclamation to date, is provided in Chapter 2 of the EIS.

Construction of both the reasonably foreseeable future Cat Creek Energy Project and South Fork Boise River Diversion Project would be required to comply with federal floodplain regulations. Long-term operations of either of the projects would include minor reservoir fluctuations during the seasonally allowed pumping of water from Anderson Ranch reservoir. Water right stipulations for either project stipulate that any water diverted from the reservoir

would be flood water required to be spilled from Anderson Ranch Dam and only after multiple other downstream minimum flow requirements are met. Floodplains at the reservoir would continue to function and no increased flood hazard would be realized regardless of the project. Downstream, flows are projected to be reduced in April by up to 710 cfs under Alternative B and 380 cfs under Alternative C. These reductions are short in duration, up to 7 and 5 days respectively, but with potential for the Cat Creek Energy and South Fork Boise River Diversion projects to divert flood flows at the same time, spring flows would likely be reduced to flows typically realized later in the season. This could result in less springtime floodplain inundation; however, regardless of the project, floodplains would continue to function and there would be a reduced flood hazard along the South Fork Boise River. Cumulative impacts on floodplains from the proposed action when added to the cumulative impacts from either the CCE or the South Fork Boise River Diversion projects would be insignificant since floodplains would continue to function after implementation of these projects.

3.4 Mitigation

No significant impacts to regulatory floodplains would occur under the proposed action; therefore, no mitigation is required. The increase to the existing Special Flood Hazard Area (SFHA) that would result from the proposed action is on Federal land, in the Reclamation Zone authorized for inundation; therefore, it does not create a significant burden to participants in the National Flood Insurance Program (NFIP).

4. References

Federal Emergency Management Agency, 2015. *Guidelines for Implementing Executive Order 11988, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input.* April.

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