Boise River Basin Feasibility Study

Specialist Report:

Vegetation

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
AS	Aspen [map unit]
BB	Bitterbrush [map unit]
BNF	Boise National Forest
CCE	Cat Creek Energy
DF	Douglas Fir [map unit]
DFP	Douglas Fir/Ponderosa [map unit]
EIS	Environmental Impact Statement
EO	Executive Order
FS	Forest Shrubland [map unit]
GR	Grassland [map unit]
MB	Mountain Big Sagebrush [map unit]
MS	Mountain Sagebrush [map unit]
MSE	mechanically stabilized earth
PP	Ponderosa Pine [map unit]
Reclamation	Bureau of Reclamation
RHE	Riparian Herblands [map unit]
RSH	Riparian Shrubland [map unit]
SFBR	South Fork Boise River
SV	Sparsely Vegetated [map unit]
USC	U.S. Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VCMQ	Vegetation Classification Mapping and Quantitative [Inventory]
WY	Weedy Herblands [map unit]

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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, soil cement, or mechanically stabilized earth (MSE). 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 vegetation as described in the EIS.

1.1 Regulatory Framework

The regulatory framework for vegetation biological resources for the proposed alternatives under the Boise River Basin Feasibility Study includes these regulations, guidelines, and policies.

Federal

Regulatory framework in place to guide the analysis of vegetation for implementing the project includes federal the National Environmental Policy Act of 1969 (42 U.S. Code [USC] 4321 et seq.) and several federal regulatory requirements associated with various sections of the Endangered Species Act of 1973 (as amended); Executive Order (EO) 13751, Safeguarding the Nation from the Impacts of Invasive Species; EO 13112, establishing the National Invasive Species Council; Plant Protection (7 USC Chapter 104); Management of Undesirable Plants on Federal Lands (7 USC Chapter 61, Section 2814), and the National Forest Management Act of 1976 (as amended).

State

At the state level, the Idaho Invasive Species Act of 2008 (Idaho Statute 22-1901) is the primary regulation. The *Boise National Forest Land and Resource Management Plan* (U.S. Forest Service [USFS] 2010), and the Idaho State Department of Agriculture *Idaho Invasive Species Strategic Plan 2017–2021* (Idaho State Department of Agriculture, no date) provide regulatory guidance at the regional and local levels.

The National Forest Management Act provides the guiding regulations to manage and develop renewable resources on federal lands including timber, fiber, and other forest land products. *Reclamation Manual* (Bureau of Reclamation [Reclamation], 2020) directives and standards, specifically Land Management and Development (LND 03-01), require interagency coordination with the U.S. Forest Service (USFS) for actions within or adjacent to National Forest System boundaries, in accordance with the Master Interagency Agreement Number 86-SIE-004 between Reclamation and the U.S. Fish and Wildlife Service (USFWS) concerning water resource related Reclamation projects within or adjacent to National Forest System lands. In addition, forest lands are managed in accordance with the Idaho Forest Practices Act, which ensures that terrestrial and aquatic habitat is maintained during the harvest of forest products. This includes stream protection measures during clearing, road construction specifications, and reforestation. Regulatory guidance is also provided by the 2015 *Idaho and Southwestern Montana Greater Sage-Grouse Approved Resource Management Plan Amendments* (Bureau of Land Management 2015), which provides

guidance for resource management of healthy sagebrush-steppe to support the Greater sage-grouse and other wildlife while maintaining multiple uses.

Vegetated wetlands are governed by the regulatory framework presented in the Wetlands Specialist Report included in Appendix B in the EIS.

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2. Affected Environment

Chapter 1 of the EIS describes the purpose and need and general location of the project area potentially affected by the alternatives that were evaluated under the Boise River Basin Feasibility Study. Chapter 2 of the EIS presents a description of the alternatives in detail. The general project area for the evaluation of vegetation for each of the action alternatives is presented on the next page.

Idaho is a diverse state comprised of semiarid shrub- and grass-covered plains, irrigated agricultural valleys, volcanic plateaus, forested mountains, woodland- and shrubland-covered hills, glaciated peaks, lava fields, and wetlands. The state is divided into ecoregions that group areas of similar ecosystems by type, quality, and quantity.

The terrestrial environment in the project area is a mix of developed and undeveloped areas. Many rural residences are scattered through the project area with areas of denser development. Other developed areas include recreational resorts, developed campgrounds, and recreation sites. Natural areas are a mix of coniferous forest, mixed coniferous-deciduous forests, shrublands, bare disturbed sites, agricultural fields, canals, and open fields. Riparian vegetation is found along the tributaries to Anderson Ranch and Arrowrock reservoirs and scattered around the edge of both reservoirs. The South Fork Boise River (SFBR) has a well-developed riparian zone interspersed with upland grassland and sage. The natural areas have considerable human activity due to the popularity of both reservoirs and SFBR with recreationists. Roads are common throughout the project area. Grazing is also common through the terrestrial area, both on USFS permittee allotments and private property.

The project area includes the general vicinity in and around Anderson Ranch Reservoir in Elmore County, Idaho. Anderson Ranch Dam and power plant is located within the foothill shrublands-grasslands ecoregion. This ecoregion is in the rain shadow of high mountains; its hills and benches are dry, treeless, and covered in shrubs and grasses (U.S. Geological Survey [USGS], 2002). Shrubs and grasses include bluebunch wheatgrass (*Pseudoroegneria spicata*), mountain big sagebrush (*Artemisia tridentata)*, Wyoming big sagebrush (*Artemisia tridentata* ssp. w*yomingensis)*, bluegrass species, Idaho fescue (*Festuca idahoensis*), bitterbrush (*Purshia* DC. ex Poir.), and mountain snowberry (*Symphoricarpos oreophilus)* (USGS, 2002). In lower elevations, vegetation includes grasslands, shrublands, ponderosa pine (*Pinus ponderosa*), and Douglas fir (*Pseudotsuga menziesii*). In mid- to high-elevations, vegetation includes shrubs and forest communities of Douglas fir and subalpine fir (*Abies lasiocarpa*) with scattered seral lodgepole pine (*Pinus contorta*) and quaking aspen (*Populus tremuloides)* (USFS, undated a). Adjacent to the reservoir, upland vegetation is predominantly sagebrush and grassland communities, which are composed of dense stands of sagebrush species interspersed with a grass understory of Sandberg's bluegrass (*Poa secunda*), Idaho fescue (*Festuca idahoensis*), and non-native cheatgrass (*Bromus tectorum*) (Reclamation, 1982).

A varial zone is in the northern portion of the Anderson Ranch Reservoir where SFBR discharges into the reservoir. The varial zone is subject to periods of watering and dewatering corresponding to the summer/fall drafting and winter/spring refill of Anderson Ranch Reservoir. This area is characterized by broad, flat valley topography with a braided channel system where silt, sand, and gravel deposit (Reclamation, 2019).

Areas immediately north of Anderson Ranch Reservoir are classified as the high Idaho Batholith ecoregion that have been impacted by glaciation. The area is comprised of jagged peaks, tarns, and rockland. Precipitation is usually greater in this ecoregion when compared to surrounding ecoregions. Mountains in this area are usually snow-capped. The Idaho Batholith ecoregion includes western spruce-fir forest alpine areas, subalpine parkland, and open windblown forest. Vegetation within these forests include subalpine fir and whitebark pine (*Pinus albicaulis*). Areas above the tree line include tundra, grasslands, subirrigated meadows, and wetlands (USGS, 2002). Scattered vegetation in areas above tree line includes subalpine fir, lodgepole pine, whitebark pine, mountain hemlock (*Tsuga mertensiana*), and alpine larch (*Larix lyallii*) (USGS, 2002). Typically, south- and west-facing slopes are sagebrush- and grassland-dominated, while north- and east-facing slopes support denser vegetation, including aspen, Douglas fir, and ponderosa pine with a coniferous and deciduous understory in moist areas (Reclamation, 1982).

Arrowrock Reservoir includes both the foothill shrublands-grasslands ecoregion on the western portion of the reservoir and the high Idaho Batholith ecoregion on the eastern portion (USGS, 2002). Vegetation in the area of Arrowrock Reservoir is like vegetation near Anderson Ranch Reservoir described above. Non-native plants including rush skeletonweed (*Chondrilla juncea)*, spotted knapweed (*Centaurea stoebe)*, Dalmatian toadflax (*Linaria dalmatica* ssp. *dalmatica)*, leafy spurge (*Euphorbia esula)*, and St. John's wort (*Hypericum* sp.) occur in the area, particularly along the main road corridors (USFS, undated b).

Vegetation Types

Vegetation characterization within the project area was based on limited site-specific information (Reclamation, 2019) and desktop analyses of available data. For site-specific information, a wetland determination survey of wetland indicators, including hydrophytic vegetation, hydric soil, and wetland hydrology, was conducted at several point locations in the varial zone by Reclamation in October 2019 (Reclamation, 2019). A list of site-specific species that were found in the varial zone of the project area can be found in Table 1.

Table 1. Vegetative species found in the varial zone of Anderson Ranch Reservoir

Common Name	Scientific Name
Trees	
Lodgepole Pine	*Pinus contorta*
Ponderosa Pine	*Pinus ponderosa*
Fir Species	*Abies* species
Narrowleaf Cottonwood	*Populus angustifolia*
Balsam Poplar	*Populus balsamifera*
Quaking Aspen	*Populus tremuloides*
Narrowleaf Willow	*Salix exigua*
Alder Species	*Alnus* species
Shrubs	
Woods' Rose	*Rosa woodsii*
Rubber Rabbitbrush	*Ericameria nauseosa*
Herbaceous	
Common Yarrow	*Achillea millefolium*
Cheatgrass	*Bromus tectorum*
Northwestern Sedge	*Carex concinnoides*
Douglas' Sedge	*Carex douglasii*
Woodland Horsetail	*Equisetum sylvaticum*
Leafy Spurge	*Euphorbia esula*
Idaho Fescue	*Festuca idahoensis*
Rush Species	*Juncus* species
Forked Woodrush	*Luzula parviflora*
Reed Canarygrass	*Phalaris arundinacea*
Sandberg Bluegrass	*Poa secunda*
Common Sheep Sorrel	*Rumex acetosella*
Saxifrage Species	*Saxifraga* species
Canada Goldenrod	*Solidago lepida*
Red Clover	*Trifolium pratense*

A desktop analysis of USFS Vegetation Classification Mapping and Quantitative Inventory (VCMQ) was used to provide additional information about the vegetation types within the project area. Data from the USFS VCMQ were used from the Boise National Forest (BNF) to develop a species list from a delineation of vegetation types by map units. The project area falls within the map units listed below in Table 2. Two map units—developed and water—were excluded because they are considered non-vegetated. Developed contained areas used for urban, residential, or administrative purposes and water contained areas dominated by open water or a confined water source. A list of map units can be found in Table 2. A summary of potential dominant species for each map unit can be found in Table 3 through Table 15.

Table 2. Map units identified within the project area

Map Unit
Aspen
Bitterbrush
Douglas Fir
Douglas Fir/Ponderosa Pine
Forest Shrubland
Grassland
Mountain Big Sagebrush
Mountain Shrubland
Ponderosa Pine
Riparian Herblands
Riparian Shrubland/Deciduous Tree
Sparsely Vegetated
Weedy Herblands

Aspen Map Unit. This map unit consists predominately of quaking aspen, Douglas fir, Ponderosa pine, early-seral shrublands, and early seral herblands The Aspen (AS) map unit was intended to delineate aspen-dominated forests; however, it should be treated as a mosaic of aspen forests, conifer forests, and early-seral shrublands. The AS unit is typically found between 5200 and 6700 feet in elevation and predominantly in areas with between 23 inches

and 48 inches of annual mean rainfall (USFS, 2014). Table 3 includes a list of potential dominant plant species that occur within the AS map unit of BNF.

Table 3. Potential dominant species included in the Aspen map unit

Common Name	Scientific Name
Trees	
Grand Fir	*Abies grandis*
Subalpine Fir	*Abies lasiocarpa*
Englemann Spruce	*Picea engelmannii*
Ponderosa Pine	*Pinus ponderosa*
Douglas Fir	*Pseudotsuga menziesii*
Quaking Aspen	*Populus tremuloides*
Shrubs	
Mallow Ninebark	*Physocarpus malvaceus*
Mountain Big Sagebrush	*Artemisia tridentata*
Herbaceous	
Snowbrush ceanothus	*Ceanothus velutinus*
Sulphur Penstemon	*Penstemon attenuatus*
Intermediate Wheatgrass	*Thinopyrum intermedium*
Slender Cinquefoil	*Potentilla gracilis*

Bitterbrush Map Unit. The Bitterbrush (BB) map unit consists predominantly of antelope bitterbrush (*Purshia tridentata*), mountain big sagebrush, and other riparian communities. This map unit also includes other shrubland and grassland types. The BB map unit is typically found in elevations ranging from 3400 feet to 4900 feet. This map unit ranges from 20 inches to 27 inches of mean annual precipitation (USFS, 2014). Table 4 includes a list of potential dominant plant species that occur within the BB map unit of BNF.

Table 4. Potential dominant species included in the Bitterbrush map unit

Common Name	Scientific Name
Trees	
Ponderosa Pine	*Pinus ponderosa*
Douglas Fir	*Pseudosuga menziesii*
Yellow Willow	*Salix lutea* Nutt.
Water Birch	*Betula occidentalis*
Shrubs	
Bitterbrush	*Purshia* DC. ex Poir.
White Spirea	*Spiraea betulifolia*
Bitter Cherry	*Prunus emarginata*
Mountain Big Sagebrush	*Artemisia tridentata*
Mallow Ninebark	*Physocarpus malvaceus*
Booth's Willow	*Salix boothii*
Mountain Snowberry	*Symphoricarpos oreophilus*
Herbaceous	
Oniongrass	*Melica bulbosa*
Arrowleaf Balsamroot	*Balsamorhiza sagittata*
Cheatgrass	*Bromus tectorum*
Elk Sedge	*Carex geyeri*
Rush Skeletonweed	*Chondrilla juncea*
Annual Willowherb	*Epilobium brachycarpum*
Bulbous Bluegrass	*Poa bulbosa*
Sandberg's Bluegrass	*Poa secunda*
Bluebunch Wheatgrass	*Pseudoroegneria spicata*

Common Name	Scientific Name
Mule-ears	*Wyethia amplexicaulis*
Common Spikerush	*Elocharis palustris*

Douglas Fir Map Unit. The Douglas fir (DF) map unit is defined by stands belonging to the Douglas fir species with similar forested species interspersed. The DF map unit ranges in elevation mostly between 5300 feet and 7,200 feet. Mean annual precipitation ranges from 30 inched to 60 inches (USFS, 2014). Table 5 includes a list of potential dominant plant species that occur within the DF map unit of BNF.

Table 5. Potential dominant species included in the Douglas Fir map unit

Common Name	Scientific Name
Trees	
Grand Fir	*Abies grandis*
Subalpine Fir	*Abies lasiocarpa*
Rocky Mountain Maple	*Acer glabrum*
Engelmann Spruce	*Picea engelmannii*
Douglas Fir	*Pseudotsuga menziesii*
Whitebark Pine	*Pinus albicaulis*
Lodgepole Pine	*Pinus cortorta*
Ponderosa Pine	*Pinus ponderosa*
Black Cottonwood	*Populus balsamifera*
Quaking Aspen	*Populus tremuloides*
Western Larch	*Larix occidentalis*
Sitka Alder	*Alnus viridis*
Shrubs	
White Spirea	*Spiraea betulifolia*
Little Sagebrush	*Artemisia arbuscula*

Common Name	Scientific Name
Mallow Ninebark	*Physocarpus malvaceus*
Bitter Cherry	*Prunus emarginata*
Wax Currant	*Ribes cereum*
Big Mountain Sagebrush	*Artemisia tridentata*
Grouse Whortleberry	*Vaccinium scoparium*
Thinleaf Huckleberry	*Vaccinium membranaceum*
Snowbrush Ceanothus	*Ceanothus velutinus*
Herbaceous	
Pine Grass	*Calamagrostis rubescens*
Geyer's Sedge	*Carex geyeri*
Utah Honeysuckle	*Lonicera utahensis*
Idaho Fescue	*Festuca idahoensis*

Douglas Fir/Ponderosa Pine Map Unit. The Douglas fir/ponderosa pine (DFP) map unit consists of stands belonging to the Douglas fir and ponderosa pine species with similar and ecologically related species interspersed. The DFP map unit ranges in elevation from 4500 feet to 6100 feet and the mean annual precipitation is predominantly between 29 inches and 42 inches (USFS, 2014). Table 6 includes a list of potential dominant plant species that occur within the DFP map unit of BNF.

Table 6. Potential dominant species included in the Douglas Fir/Ponderosa Pine map unit

Common Name	Scientific Name
Trees	
Grand Fir	*Abies grandis*
Ponderosa Pine	*Pinus ponderosa*
Subalpine Fir	*Abies lasiocarpa*
Lodgepole Pine	*Pinus contorta*

Common Name	Scientific Name
Engelmann Spruce	*Picea engelmannii*
Douglas Fir	*Pseudotsuga menziesii*
Quaking Aspen	*Populus tremuloides*
Scouler's Willow	*Salix scouleriana*
Rocky Mountain Maple	*Acer glabrum*
Shrubs	
Big Mountain Sagebrush	*Artemisia tridentata*
Bitter Cherry	*Prunus emarginata*
Chokecherry	*Prunus virginiana*
Mallow Ninebark	*Physocarpus malvaceus*

Forest Shrubland Map Unit. The Forest Shrubland (FS) map unit consists of early-seral stand dominated by forest understory shrub species and ecologically related forest dominance types; also includes ecologically dissimilar dominance types and phases. The FS map unit should be considered a mosaic of shrublands and open forests with small patches of grasslands and riparian areas. The FS map unit ranges in elevation from 4700 and 6900 feet and receives a mean annual precipitation between 27 inches and 44 inches (USFS, 2014). Table 7 includes a list of potential dominant plant species that occur within the FS map unit of BNF.

Table 7. Potential dominant species included in the Forest Shrubland map unit

Common Name	Scientific Name
Trees	
Grand Fir	*Abies grandis*
Ponderosa Pine	*Pinus ponderosa*
Subalpine Fir	*Abies lasiocarpa*
Western Larch	*Larix occidentalis*
Lodgepole Pine	*Pinus contorta*
Douglas Fir	*Pseudotsuga menziesii*
Rocky Mountain Maple	*Acer glabrum*
Scouler's Willow	*Salix scouleriana*
Quaking Aspen	*Populus tremuloides*
Shrubs	
Basin Wildrye	*Leymus cinereus*
Thinleaf Alder	*Alnus incana*
Lemmon's Willow	*Salix lemmonii*
Serviceberry	*Amelanchier alnifolia*
Low Sagebrush	*Artemisia arbuscula* ssp. *arbuscula*
Basin Big Sagebrush	*Artemisia arbuscula* ssp. *thermopola*
Mountain Big Sagebrush	*Artemisia tridentata*
Redstem Ceanothus	*Ceanothus sanguineus*
Snowbrush Ceanothus	*Ceanothus velutinus*
Rubber Rabbitbrush	*Ericameria nauseosa*
Rusty Menziesia	*Menziesia ferruginea*
Mallow Ninebark	*Physocarpus malvaceus*

Common Name	Scientific Name
Bitter Cherry	*Prunus emarginata*
Chokecherry	*Prunus virginiana*
Antelope Bitterbrush	*Purshia tridentata* (Pursh) DC.
Sticky Currant	*Ribes viscosissimum*
Woods' Rose	*Rosa woodsii*
White Spirea	*Spirea betulifolia*
Mountain Snowberry	*Symphoricarpos oreophilus*
Thinleaf Huckleberry	*Vaccinium membranaceum*
Herbaceous	
Arrowleaf Balsamroot	*Balsamorhiza sagittata*
Geyer's Sedge	*Carex geyeri*
Hood's Sedge	*Carex hoodii*
Pipsissewa	*Chimpaphila umbellata*
Alpine Golden Buckwheat	*Eriogonum flavum*
Sulphur-Flower Buckwheat	*Eriogonum umbellatum*
Silvery Lupine	*Lupinus argenteus*
Silky Lupine	*Lupinus sericeus*
Bluebunch Wheatgrass	*Pseudoroegneria spicata*
Intermediate Wheatgrass	*Thinopyrum intermedium*

Grassland Map Unit. The Grassland (GR) map unit consists mostly of stands dominated by upland grasses or sedges and ecologically related shrubland and forbland dominance types. This map unit is interspersed with forblands, shrublands, and small patches of conifer forests and riparian areas. The GR map unit ranges in elevation from 3600 feet to 7,400 feet. The mean annual precipitation is between 22 inches and 43 inches (USFS, 2014). Table 8 includes a list of potential dominant plant species that occur within the GR map unit of BNF.

Table 8. Potential dominant species included in the Grassland map unit

Common Name	Scientific Name
Trees	
Subalpine Fir	*Abies lasiocarpa*
Ponderosa Pine	*Pinus ponderosa*
Douglas Fir	*Pseudotsuga menziesii*
Shrubs	
Low Sagebrush	Artemisia arbuscula ssp. arbuscula
Little Sagebrush	Artemisia arbuscula ssp. thermopola
Mountain Big Sagebrush	*Artemisia tridentata*
Thinleaf Alder	*Alnus incana*
Snowbrush Ceanothus	*Ceanothus velutinus*
Mallow Ninebark	*Physocarpus malvaceus*
Bitter Cherry	*Prunus emarginata*
Antelope Bitterbrush	*Purshia tridentata* (Pursh) DC.
Mountain Snowberry	*Symphoricarpos oreophilus*
Herbaceous	
Western Needlegrass	*Achnatherum occidentale*
Tapertip Onion	*Allium acuminatum*
Arrowleaf Balsamroot	*Balsamorhiza sagittata*
Cheatgrass	*Bromus tectorum*
Geyer's Sedge	*Carex geyeri*
Rush Skeletonweed	*Chondrilla juncea*
Tall Annual Willowherb	*Epilobium brachycarpum*
Idaho Fescue	*Festuca idahoensis*

Common Name	Scientific Name
Bulbous Bluegrass	*Poa bulbosa*
Douglas Knotweed	*Polygonum douglasii*
Bluebunch Wheatgrass	*Pseudoroegneria spicata*
Intermediate Wheatgrass	*Thinopyrum intermedium*
Mule Ears	*Wyethia amplexicaulis*
Small Camas	*Camassia quamash*
California Oatgrass	*Danthonia californica*

Mountain Big Sagebrush Map Unit. The varial zone includes habitat currently classified as mountain big sagebrush (MB) based on the VCMQ. This type of vegetation consists of shrublands dominated by mountain big sagebrush, with other early-successional species associated with this community interspersed. This map unit contains a mosaic of shrubland, with patchy grasslands, forested areas, and riparian zones within the larger habitat type. It is commonly found in areas from 3800 feet to 6700 feet in elevation and receives between 21 inches and 35 inches of annual precipitation (USFS, 2014). Table 9 includes a list of potential dominant plant species that occur within the MB map unit of BNF.

Table 9. Potential dominant species included in the Mountain Big Sagebrush map unit

Common Name	Scientific Name
Trees	
Ponderosa pine	*Pinus ponderosa*
Rocky Mountain maple	*Acer glabrum*
Subalpine fir	*Abies lasiocarpa*
Douglas fir	*Pseudotsuga menziesii*
Black cottonwood	*Populus balsamifera* ssp. *trichocarpa*
Quaking aspen	*Populus tremuloides*
Shrubs	
Wyoming Big sagebrush	*Artemisia tridentata* ssp. *wyomingensis*

Common Name	**Scientific Name**
Chokecherry	*Prunus virginiana*
Basin big sagebrush	*Artemisia tridentata* ssp. *tridentata*
Common snowberry	*Symphoricarpos albus*
Spiked big sagebrush	*Artemisia spiciformis*
Cleftleaf sagebrush	*Artemisia arbuscula thermopola*
Low sagebrush	*Artemisia arbuscula arbuscula*
Mallow ninebark	*Physocarpus malvaceus*
Mountain Snowberry	*Symphoricarpos oreophilus*
Goldenbush	*Ericameria suffruticosa*
Mountain silversage	*Artemisia cana*
Redstem ceanothus	*Ceanothus sanguineus*
Mtn. Big sagebrush	*Artemisia tridentata* ssp. *vaseyana*
Bitter cherry	*Prunus emarginata*
Green rabbitbrush	*Chrysothamnus viscidiflorus*
Rubber rabbitbrush	*Ericameria nauseosa*
Serviceberry	*Amelanchier alnifolia*
Bitterbrush	*Purshia* DC. ex Poir.
Wax currant	*Ribes cereum*
Lewis' mockorange	*Philadelphus lewisii*
Snowbrush	*Ceanothus velutinus*
White spirea	*Spiraea betulifolia*
Alpine knotweed	*Polygonum phytolaccifolium*
Herbaceous	
Annual willowherb	*Epilobium brachycarpum*

Common Name	Scientific Name
Arrowleaf balsamroot	*Balsamorhiza sagittate*
Bluebunch wheatgrass	*Pseudoroegneria spicata*
Bulbous bluegrass	*Poa bulbosa*
California false hellebore	*Veratrum californicum*
Cheatgrass	*Bromus tectorum*
Douglas' knotweed	*Polygonum douglasii*
Elk sedge	*Carex geyeri*
Grassy tarweed	*Madia gracilis*
Groundsmoke	*Gayophytum diffusum*
Idaho fescue	*Festuca idahoensis*
Intermediate wheatgrass	*Thinopyrum intermedium*
Buckwheat	*Eriogonum heracleoides*
Rush skeletonweed	*Chondrilla juncea*
Sandberg's bluegrass	*Poa secunda*
Silky lupine	*Lupinus sericeus*
Silvery lupine	*Lupinus argenteus*
Squirreltail	*Elymus elymoides*
Sunflower mule-ears	*Wyethia helianthoides*
Thurber needlegrass	*Achnatherum thurberianum*

Mountain Shrubland Map Unit. The Mountain Shrubland (MS) map unit is comprised mostly of stands dominated by mountain shrub species including similar herbland and shrubland dominance types. The MS map unit includes small areas of forest and riparian dominance types. The MS map unit ranges in elevation from 3600 feet to 6300 feet and the mean annual precipitation is between 22 inches and 38 inches (USFS, 2014). Table 10 includes a list of potential dominant plant species that occur within the MS map unit of BNF.

Table 10. Potential dominant species included in the Mountain Shrubland map unit

Common Name	Scientific Name
Trees	
Ponderosa Pine	*Pinus Ponderosa*
Douglas Fir	*Pseudotsuga menziesii*
Quaking Aspen	*Populus tremuloides*
Rocky Mountain Maple	*Acer glabrum*
Shrubs	
Curl-Leaf Mountain Mahogany	*Cercocarpus ledifolius*
Serviceberry	*Amelanchier alnifolia*
Little Sagebrush	*Artemisia arbuscula*
Mountain Big Sagebrush	*Artemisia tridentata*
Snowbrush Ceanothus	*Ceanothus velutinus*
Rubber Rabbitbrush	*Ericameria nauseosa*
Creeping Barberry	*Mahonia repens*
Mallow Ninebark	*Physocarpus malvaceus*
Bitter Cherry	*Prunus emarginata*
Chokecherry	*Prunus virginiana*
Antelope Bitterbrush	*Purshia tridentata* (Pursh) DC.
Thinleaf Alder	*Alnus incana*
Woods' Rose	*Rosa woodsii*
Red Elderberry	*Sambucus racemosa*
White Spirea	*Spiraea betulifolia*
Alderleaf Buckthorn	*Thamnus alnifolia*
Mountain Snowberry	*Symphoricarpos oreophilus*

Common Name	Scientific Name
Herbaceous	
Arrowleaf Balsamroot	*Balsamorhiza sagittata*
Cheatgrass	*Bromus tectorum*
Parsnipflower Buckwheat	*Eriogonum heracleoides*
Idaho Fescue	*Festuca idahoensis*
Oneflower Helianthella	*Helianthella uniflora*
Desertparsley	*Lomatium*
Bulbous Bluegrass	*Poa bulbosa*
Bluebunch Wheatgrass	*Pseudoroegneria spicata*
Intermediate Wheatgrass	*Thinopyrum intermedium*
Basin Wildrye	*Leymus cinereus*

Ponderosa Pine Map Unit. The map unit that has the greatest mapped acreage in the varial zone is the Ponderosa Pine map unit (PP). This map unit is characterized by tree stands dominated by ponderosa pine, with similar forested species interspersed. The PP map unit is found typically from 4075 feet to 5950 feet in elevation, and predominantly in areas with between 26 inches and 39 inches of annual mean rainfall (USFS, 2014). Table 11 includes dominant plant species that may occur within the PP map unit of BNF.

Table 11. Potential dominant species included in the Ponderosa Pine map unit

Common Name	Scientific Name
Trees	
Douglas fir	*Pseudotsuga menziesii*
Grand fir	*Abies grandis*
Subalpine fir	*Abies lasiocarpa*
Engelmann spruce	*Picea engelmannii*
Rocky Mountain maple	*Acer glabrum*

Common Name	**Scientific Name**
Black cottonwood	*Populus balsamifera* ssp. *Trichocarpa*
Lodgepole pine	*Pinus contorta*
Ponderosa pine	*Pinus ponderosa*
Narrowleaf willow	*Salix exigua*
Scouler's willow	*Salix scouleriana*
Dusky willow	*Salix melanopsis*
Quaking aspen	*Populus tremuloides*
Shrubs	
Wyoming Big sagebrush	*Artemisia tridentata* ssp. *wyomingensis*
Gray alder	*Alnus incana*
Snowbrush	*Ceanothus velutinus*
Cascara buckthorn	*Frangula purshiana*
Drummond willow	*Salix drummondiana*
Chokecherry	*Prunus virginiana*
Curl-leaf mountain mahogany	*Cercocarpus ledifolius*
Lewis' mockorange	*Philadelphus lewisii*
White spirea	*Spiraea betulifolia*
Arrowleaf balsamroot	*Balsamorhiza sagittate*
Beaked spikerush	*Eleocharis rostellata*
Red elderberry	*Sambucus racemosa*
Mallow ninebark	*Physocarpus malvaceus*
Mtn. Big sagebrush	*Artemisia tridentata* ssp. *vaseyana*
Bitter cherry	*Prunus emarginata*
Redosier dogwood	*Cornus sericea*

Common Name	Scientific Name
Serviceberry	*Amelanchier alnifolia*
Western larch	*Larix occidentalis*
Water birch	*Betula occidentalis*
North. Black currant	*Ribes hudsonianum*
Bitterbrush	*Purshia* DC. ex Poir.
Black hawthorn	*Crataegus douglasii*
Herbaceous	
Cheatgrass	*Bromus tectorum*
Bulbous bluegrass	*Poa bulbosa*
Elk sedge	*Carex geyeri*
Bluebunch wheatgrass	*Pseudoroegneria spicata*
Fireweed	*Chamerion angustifolium*
Idaho fescue	*Festuca idahoensis*
Lakeshore sedge	*Carex lenticularis*
NW Territory sedge	*Carex utriculata*
Rush skeletonweed	*Chondrilla juncea*
Silky lupine	*Lupinus sericeus*
Swordleaf rush	*Juncus ensifolius*
Water buttercup	*Ranunculus aquatilis*
Wheeler bluegrass	*Poa wheeleri*
Baltic rush	*Juncus arcticus Willd*. ssp. *littoralis*
Annual willowherb	*Epilobium brachycarpum*

Riparian Herblands Map Unit. The Riparian Herblands (RHE) map unit consists of riparian herbland with some riparian shrubland interspersed. The RHE map unit includes

small patches of forest and can be found in elevations of 5300 feet to 7,400 feet. It ranges from 23 inches to 59 inches of average annual rainfall (USFS, 2014). Table 12 includes a list of potential dominant plant species that occur within the RHE map unit of BNF.

Table 12. Potential dominant species included in the Riparian Herblands map unit

Common Name	**Scientific Name**
Trees	
Douglas Fir	*Pseudotsuga menziesii*
Englemann Spruce	*Picea engelmannii*
Sublapine Fir	*Abies lasiocarpa*
Diamondleaf Willow	*Salix planifolia*
Lodgepole Pine	*Pinus contorta*
Shrubs	
Shrubby Cinquefoil	*Dasiphora fruitcosa*
Booth's Willow	*Salix boothii*
Undergreen Willow	*Salix commutata*
Gray Alder	*Alnus viridis*
Mountain Big Sagebrush	*Artemisia tridentata*
Rubber Rabbitbrush	*Ericameria nauseosa*
Herbaceous	
Western Needlegrass	*Achantherum occidentale*
Elk Sedge	*Carex geyeri*
Hood's Sedge	*Carex hoodii*
Idaho Fescue	*Festuca idahoensis*
Parry's Rush	*Juncus parryi*
Alkali Bluegrass	*Poa secunda*
Bluebunch Wheatgrass	*Pseudoroegneria spicata*

Common Name	Scientific Name
Sunflower Mule-ears	*Wyethia helianthoides*
Tufted Bulrush	*Trichophorum cespitosum*
Bluejont Reedgrass	*Calamagrostis canadensis*
California False Hellebore	*Veratrum californicum*
Narrowleaf Bur-reed	*Sparganium angustifolium*
Woolyfruit Sedge	*Carex lasiocarpa*
Darkthroat Shootingstar	*Dodecatheon pulchellum*
Mud Sedge	*Carex limosa*
Fewflower Spikerush	*Eleocharis quinqueflora*
Meadow Barley	*Hordeum brachyantherum*
Buckbean	*Menyanthes trifoliata*
Rocky Mountain Pond-Lily	*Nuphar polysepala*
Nebraska Sedge	*Carex nebrascensis*
Rock Sedge	*Carex saxatilis*
Mountain Sedge	*Carex scopulorum*
Timber Oatgrass	*Danthonia intermedia*
Tufted Hairgrass	*Deschampsia cespitosa*
Analogue Sedge	*Carex simulata*

Riparian Shrubland/Deciduous Tree Map Unit. The Riparian Shrublands/Deciduous Tree (RSH) map unit is comprised of mostly riparian shrubland with some riparian deciduous woodland and herbland dominance types. The RSH map unit is a mosaic of riparian shrublands and herblands with small patches of forest. The elevation ranges from 3800 feet to 7000 feet with annual mean rainfall between 21 inches and 53 inches (USFS, 2014). Table 13 includes the dominant plant species that may occur within the RSH map unit of BNF.

Table 13. Potential dominant species included in the Riparian Shrubland/Deciduous Tree map unit

Common Name	Scientific Name
Trees	
Subalpine Fir	*Abies lasiocarpa*
Lodgepole Pine	*Pinus contorta*
Engemann's Spruce	*Picea engelmannii*
Ponderosa Pine	*Pinus ponderosa*
Diamondleaf Willow	*Salix planifolia*
Scouler's Willow	*Salix scouleriana*
Greenleaf Willow	*Salix lucida*
Black Cottonwood	*Populus balsamifera*
Douglas Fir	*Pseudotsuga menziesii*
Bebb Willow	*Salix bebbiana*
Geyer Willow	*Salix geyeriana*
Yellow Willow	*Salix lutea*
Quaking Aspen	*Populus tremuloides*
Shrubs	
Dwarf Birch	*Betula nana*
Redosier Dogwood	*Cornus sericea*
Thinleaf Alder	*Alnus incana*
Shrubby Cinquefoil	*Dasiphora fruticosa*
Alderleaf Buckthorn	*Rhamnus alnifolia*
Booth's Willow	*Salix boothii*
Undergreen Willow	*Salix commutata*
Drummond's Willow	*Salix drummondiana*

Common Name	**Scientific Name**
Mountain Willow	*Salix eastwoodiae*
Lemmon's Willow	*Salix lemmonii*
Wolf's Willow	*Salix wolfii*
Sitka Alder	*Alnus viridis*
Water Birch	*Betula occidentalis*
Rose Spirea	*Spiraea douglasii*
Herbaceous	
Water Sedge	*Carex aquatilis*
Bluejoint	*Calamagrostis canadensis*
Cusick's Sedge	*Carex cusickii*
White Marsh Marigold	*Caltha leptosepala*
Woodrush Sedge	*Carex luzulina*
Clustered Field Sedge	*Carex praegracilis*
Northwest Territory Sedge	*Carex ulriculata*
Heartleaf Springbeauty	*Claytonia cordifolia*
Timber Oatgrass	*Danthonia intermedia*
Tufted Hairgrass	*Deschampsia cespitosa*
Fewflower Spikerush	*Eleocharis quinqueflora*
Tall Cottongrass	*Eriophorum angustifolium*
Small Floating Mannagrass	*Glyceria borealis*
Meadow Barley	*Hordeum brachyantherum*
Mountain Rush	*Juncus arcticus*
Swordleaf Rush	*Juncus ensifolius*
Rice Cutrgrass	*Leersia oryzoides*

Common Name	Scientific Name
Pullup Muhly	*Muhlenbergia filliformis*
Slender Cinquefoil	*Potentilla gracilis*
Panicled Bullrush	*Scirpus microcarpus*
Tall Groundsel	*Senecio hydrophiloides*
Arrowleaf Ragwort	*Senecio triangularis*
Queen Palm	*Syagrus romanzoffiana*
Pale False Mannagrass	*Torreyochloa pallida*
Broadleaf Cattail	*Typha latifolia*

Sparsely Vegetated Map Unit. The Sparsely Vegetated (SV) map unit consists of little to zero vegetated cover consisting of barren, sparse vegetation and some forest vegetation. The elevation for this map unit ranges from 3400 feet to 8,900 feet and the mean annual precipitation ranges between 19 inches to 58 inches of rainfall (USFS, 2014). Table 14 includes the dominant plant species that may occur within the SV map unit of BNF.

Table 14. Potential dominant species included in the Sparsely Vegetated map unit

Common Name	Scientific Name
Trees	
Douglas Fir	*Pseudotsuga menziesii*
Herbaceous	
Bulbous Bluegrass	*Poa bulbosa*
Sierra Shootingstar	*Dodecatheon jeffreyi*

Weedy Herblands Map Unit. The Weedy Herblands (WY) map unit consists of stands dominated by weedy upland forbs and grasses and ecologically related dominance types. It includes a variety of native forblands, grasslands, and shrublands as well as non-native weedy herbs and small patches of conifer forests and riparian areas. The average elevation for the WY map unit ranges from 3500 feet and 5100 feet and receives mean annual rainfall between 19 inches and 32 inches (USFS, 2014). Table 15 includes the dominant plant species that may occur within the WY map unit of BNF.

Table 15. Potential dominant species included in the Weedy Herbaceous map unit

Common Name	Scientific Name
Trees	
Arroyo Willow	*Salix lasiolepis*
Ponderosa Pine	*Pinus ponderosa*
Shrubs	
Mountain Big Sagebrush	*Artemisia tridentata*
Yellow Rabbitbrush	*Chrysothamnus viscidiflorus*
Rubber Rabbitbrush	*Ericameria nauseosa*
Chokecherry	*Prunus virginiana*
Antelope Bitterbrush	*Purshia tridentata* (Pursh) DC.
Woods' Rose	*Rosa woodsii*
Redosier Dogwood	*Cornus sericea*
Lewis' Mock Orange	*Philadelphus lewisii*
Herbaceous	
Cheatgrass	*Bromus tectorum*
Rush Skeletonweed	*Chondrilla juncea*
Bulbous Bluegrass	*Poa bulbosa*
Canada Bluegrass	*Poa compressa*
Sandberg Bluegrass	*Poa secunda*
Bluebunch Wheatgrass	*Pseudoroegneria spicata*
Tall Tumblemustard	*Sisymbrium altissimum*
Arrowleaf Balsamroot	*Balsamorhiza sagittata*
Intermediate Wheatgrass	*Thinopyrum intermedium*

USFS Sensitive Plant Species

USFS identifies species that require special management to maintain their habitat and improve their status within USFS lands in the hope of preventing these species from further listing under the Endangered Species Act. Plant species identified as sensitive species by USFS that occur in BNF were analyzed for their potential to occur in the vicinity of Anderson Ranch Reservoir and Arrowrock Reservoir. These sensitive species and their potential to occur in the project area are provided in Table 16. None of these sensitive species are anticipated to occur in the project area because they are not known to occur in Elmore County or because suitable habitat is not present within the project area as described in Table 16.

Sensitive species found in Elmore County in the vicinity of the project area include the giant helleborine orchid (*Epipactis gigantea*), Kellogg's bitterroot (*Lewisia kelloggii*), and Wilcox's primrose. Sensitive species that occur within this area include bug-leg goldenweed (*Pyrrocoma insecticruris*), least phacelia (*Phacelia minutissima*), Wilcox's primrose (*Primula* sp.), and hooked stylocline (*Stylocline filagiaea*) (USFS, undated a).

Table 16. USFS sensitive plant species with the potential to occur in the project area

Common Name	Scientific Name	Habitat	Potential to Occur in the Project Area
Trees			
Whitebark Pine	*Pinus albicaulis*	Montane forests on thin rocky soils at or near the timberline. Historically abundant in upper subalpine plant communities.	Occurs in Elmore County in the vicinity of the project area. Species is candidate listed so it is discussed in the Threatened and Endangered Species Specialist Report.
Herbaceous			
Tolmie's onion	*Allium tolmiei* var. *persimile*	Heavy clay soils with sagebrush, typically between 3,000- and 5,000-foot elevations.	Not known to occur in Elmore County. Not likely to occur in the project area.
Beautiful Bryum	*Bryum calobryoides*	Found on moist to dry soil and rock at montane and alpine elevations.	Not known to occur in Elmore County. Not likely to occur in the project area.
Idaho dwarf-primrose	*Douglasia idahoensis*	Subalpine ridges and adjacent slopes on gravel soils from granitic parent material. Often on north-facing slopes.	Not known to occur in Elmore County. Not likely to occur in the project area.

Common Name	Scientific Name	Habitat	Potential to Occur in the Project Area
Sacajawea's bitterroot	*Lewisia sacajaweana*	Montane and subalpine habitats between 5,000- and 9,500-foot elevations.	Observed in Elmore County, including one sighting on Lava Mountain. Project area does not support habitat for this species.
Small-flower phacelia	*Phacelia minutissima*	Damp areas (meadows, streambanks, under shrubs) at moderate elevations.	Not known to occur in Elmore County. Not likely to occur in the project area.
Bugleg goldenweed	*Pyrrocoma insecticruris*	Montane meadows and sagebrush/grass communities at 5,000- to 6,000-foot elevations.	Not known to occur in Elmore County. Not likely to occur in the project area.

Source: USFS, 1993; USFS, 2016; NatureServe, 2019; Idaho Department of Fish and Game, 2019

Invasive Species

In some areas, noxious weeds and introduced grasses and forbs are replacing native shrubs and grasses. There are 67 known species of noxious weeds in Idaho. Noxious weeds can cause significant modifications to the landscape such as replacing native vegetation, reducing agricultural productivity, causing wind and water erosion, and posing an increased threat to communities from wildfire (Elmore County, 2019). Idaho's noxious weeds are plant species that have been designated "noxious" by law in the Idaho code (Title 22, Chapter 24, "Noxious Weeds") and the Plant Protection Act (7 USC Chapter 104 "Plant Protection") and "Management of Undesirable Plants on Federal Lands" (7 USC Chapter 61, §2814).

Elmore County is home to 29 state-designated noxious weeds including two species of aquatic noxious plant species. Suitable habitat exists within the project area for all the species that occur in the county (Table 17). As shown in Table 17, nine noxious weed species are known to occur within the project area (Hampton, 2019). Leafy spurge (*Euphorbia esula)* is the highest priority for control by USFS.

Table 17. Noxious weeds found in Elmore County

Common Name	Scientific Name	Suitable Habitat in Project area	Known to be Found in Project area
Terrestrial Plants			
Buffalobur	*Solanum rostratum*	Yes	
Canada Thistle	*Cirsium arvense*	Yes	Yes

Common Name	Scientific Name	Suitable Habitat in Project area	Known to be Found in Project area
Dalmatian Toadflax	*Linaria dalmatica* ssp. *dalmatica*	Yes	Yes
Diffuse Knapweed	*Centaurea diffusa*	Yes	
Dyer's Woad	*Isatis tinctoria*	Yes	
Field Bindweed	*Convolvulus arvensis*	Yes	
Hoary Alyssum	*Berteroa incana*	Yes	Yes
Houndstongue	*Cynoglossum officinale*	Yes	Yes
Johnsongrass	*Sorghum halepense*	Yes	
Jointed Goatgrass	*Aegilops cylindrica*	Yes	
Leafy Spurge	*Euphorbia esula*	Yes	Yes
Musk Thistle	*Carduus nutans*	Yes	
Orange Hawkweed	*Hieracium aurantiacum*	Yes	
Oxeye Daisy	*Leucanthemum vulgare*	Yes	Yes
Perennial Pepperweed	*Lepidium latifolium*	Yes	
Perennial Sowthistle	*Sonchus arvensis*	Yes	
Poison Hemlock	*Conium maculatum*	Yes	
Puncturevine	*Tribulus terrestris*	Yes	
Purple Loosestrife	*Lythrum salicaria*	Yes	
Rush Skeletonweed	*Chondrilla juncea*	Yes	Yes
Russian Knapweed	*Acroptilon repens*	Yes	
Saltcedar	*Tamarix* sp	Yes	
Scotch Thistle	*Onopordum acanthium*	Yes	
Spotted Knapweed	*Centaurea stoebe*	Yes	Yes
Whitetop	*Cardaria draba*	Yes	Yes
Yellow Starthistle	*Centaurea solstitialis*	Yes	
Yellow Toadflax	*Linaria vulgaris*	Yes	
Aquatic Plants			
Common Reed	*Phragmites australis*	Yes	
Curlyleaf Pondweed	*Potamogeton crispus*	Yes	

USFS notes that although limited aquatic invasive plant species have been found on USFS lands surrounding the project area, aquatic weeds and other aquatic invasive species still pose a threat of becoming established (USFS, 2019). Boat inspections conducted on the Sawtooth National Recreation Area (north of the project area) in 2014 documented 28 boats with aquatic weeds present (USFS, 2019). Additionally, 23 watercraft were identified as carrying contaminated aquatic vegetation (Vuono, 2014). The proximity of these inspections to the project area highlights the potential risk to waterbodies within the Boise River system. The total number of boats inspected is unavailable; therefore, it is difficult to relate these numbers to total number of boats inspected.

The Idaho State Department of Agriculture also assembled roving aquatic invasive monitoring stations in BNF in 2015 and documented 13 boats preparing to launch on Cascade Lake, and one boat preparing to launch on Lucky Peak Reservoir as harboring aquatic weeds (cited as personal communication Thomas Woolf, Idaho Department of Agriculture in USFS, 2019). Eurasian watermilfoil (*Myriophyllum spicatum* L.) has been found within the Idaho City Ranger District and appears to be gaining a foothold in Idaho's lakes, ponds, rivers, and other waterways, with approximately 4000 surface acres of the plant identified through state surveys (USFS, 2019). Eurasian watermilfoil has been found in several counties that contain portions of BNF (USFS, 2019) and is of concern in the project area.

When aquatic invasive plant species become established, they become extremely difficult to eradicate and pose a serious threat to the ecological health and integrity of waters in the state. USFS identifies an integrated management strategy, implementing timely and effective invasive plant control and eradication measures as critical to preventing these species from becoming established (USFS, 2019). Establishing these species in headwaters of the Columbia River system poses a threat to the entire downstream aquatic ecosystem.

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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 vegetation in the immediate vicinity of Anderson Ranch Reservoir, Arrowrock Reservoir, and associated tributaries is presented below. The methods for analysis included reviewing the following sources to determine impacts to vegetation communities.

- Publicly available data and geospatial files on vegetation species surrounding Anderson Ranch Reservoir.
- Reclamation and other agency documents and descriptions of vegetation in agency reports and documents.
- Available data on the known or anticipated occurrence of invasive species from discussions with individuals from Reclamation, the state of Idaho, and BNF. Expected presence of invasive species in the project area was based on known or anticipated occurrence of individuals, habitat suitability, and available literature.
- Data on invasive species from the Sawtooth and Boise National Forests Invasive Species Project Final EIS (USFS, 2019).

Impacts to vegetation were considered substantial when actions resulted in changes that permanently altered the vegetative community, resulted in the loss of a community, or resulted in the fragmentation of a vegetative community.

Several of the rim project areas overlap with the boundaries of the inundation areas. Where this occurred, the potential vegetation impacts were included in the calculations for the inundation areas only.

Identification of potential invasive species impacts that may occur as a result of the project focused on areas temporarily or permanently disturbed by construction activities (including upstream and downstream waters directly or indirectly affected), new infrastructure in the project area and/or other areas affected by the increased reservoir footprint, the extent of vehicular traffic and other activities (including in-stream work) associated with project alternative elements within the project area. Effects anticipated to invasive species were described relative to anticipated shifts from existing conditions as a result of the project, including future operations and maintenance activities after project completion.

3.1.1 Assumptions

The analysis of impacts to vegetation were prepared using the same assumptions in Alternative B and Alternative C. The following assumptions were made for the vegetation impact analysis.

- Each polygon of a map unit type is considered a habitat stand in this report.

- Impacts to riparian and other wetland vegetation communities are considered in the Wetlands Specialist Report.
- Impacts to federal or state protected plant species or impacts to vegetation that impact federal or state protected fauna species are covered within the Threatened and Endangered Species Specialist Report.
- Invasive species information is provided by Reclamation, BNF representatives, and the state of Idaho. Reclamation also provided information on four known invasive species databases with partner information.
- No methods for field studies nor actual field studies were completed.

3.1.2 Impact Indicators and Significance Criteria

The impacts from the alternatives were determined by assessing the project's perceived impacts to vegetation and invasive species 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, staging, and borrow areas or areas within the project area where ground disturbance or vegetation clearing is proposed.

This includes any impacts the project would have (during and after construction) that would alter the existing vegetation. Impacts to vegetation are indicated by effects presented in Table 18 and are classified based on the following for this resource:

- Short-term: such as temporary impacts during construction activities that are reseeded following construction and do not result in long-term changes in the vegetative community.
- Long-term: such as a permanent loss or an alteration in a vegetative community resulting from the alternative, including the alteration of a community to a different vegetative community.
- Direct: such as loss due to grading, the placement of fill, or pavement that cannot be reseeded.
- Indirect: such as a change to characteristics or quality of a vegetative community due to a change in surrounding conditions, including the introduction of non-native species.
- Adverse: such as loss or degradation of a vegetated area due to development or fill, or by the introduction or spread of invasive species.
- Beneficial: such as the creation or improvement of a lower quality vegetative community to one that provides higher habitat value.
- Negligible: impacts that are imperceptible or slight such as localized disturbance or clearing of vegetation that would not be permanent.
- Insignificant: disturbance that is limited in scope, including permanent clearing of vegetation that represents less than 30 percent (see below for explanation of this indicator) of a habitat stand of the map unit types found within the project area, or disturbance within already disturbed communities during construction that are returned to pre-construction conditions at the conclusion of the project.

- Significant: such as the permanent development of a formerly undeveloped vegetated area, permanent disturbance representing more than 30 percent (see below for explanation of this indicator) of a habitats stands of map unit types found within the project area, or permanent degradation of a high value habitat to one of less ecological value.

A threshold for disturbance is when conditions are present sufficient to modify ecosystem structure and function beyond the limits of ecological resilience, resulting in transition to alternative states (Briske et al., 2008). Disturbance impacts on an ecosystem are complex, and the use of a threshold is intended to serve as a general guideline and is considered in this analysis along with other factors, including the regeneration of the habitat map unit type, the acreage of the map unit type in the general vicinity of the project area, and the type of impact.

The acreage threshold of 30 percent of a habitat stand of a map unit within the project area was determined using available scientific studies and research, management guidance, and best professional judgement. Impacts that resulted in a loss of more than 30 percent of a habitat stand may cause fragmentation and can jeopardize the ecological function, and even the continued persistence of that habitat stand. Resource studies that informed this 30 percent threshold include the following:

- There is an apparent threshold across songbird species at 40 percent sagebrush landcover; after this coverage songbird abundance nearly doubles (Doherty et al. 2016).
- The *National Greater Sage-Grouse Conservation Measures/Planning Strategy* goals state that a minimum range of 50-70 % of the acres in sagebrush cover should be maintained for long-term sage grouse persistence (Sage-grouse National Technical Team 2011).
- The USFS *Potential Vegetation, Disturbance, Plant Succession, and Other Aspects of Forest Ecology* technical report cites some research that suggests vertebrate survival will be affected if the area of suitable habitat falls below a threshold of 20-30 % (Powell 2000).
- Studies have found that 20-25 % vegetative cover provides a threshold for resilience of soil and ecosystems, below which a system enters a degraded stable state (Mayor et al. 2013; Gao et al. 2011).
- The dispersal of invasive species is confined to a small portion of the landscape if disturbance is small and localized until about 70% of the landscape is disturbed, or 30% habitat disturbance if disturbances are large and concentrated (With 2002).

Table 18. Vegetation indicators and significance criteria

Impact Indicator	Significance Criteria
• Loss or alteration of existing vegetation that results in a decrease in the extent, connectivity, or integrity of a biological community • Alterations to existing vegetation, including a loss of community or change in community type • Acres of disturbance equivalent to a permanent loss of more than 30 percent of a habitat stand of a map unit type found within the project area • Creating or reducing plant communities (e.g., water inundation, topography, bathymetry)	• Substantial adverse effect on any vegetation community, habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the Idaho Department of Fish and Game or USFWS. Substantial adverse effects are those that result in a significant loss or permanent change in a vegetative community to one that is considered of a lower quality for habitat. This would include a shift in vegetation or a loss of habitat function. • Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. • Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.
• Potential for introducing or spreading new and/or existing invasive species within the project area is due to implementation of project alternatives.	• Increasing invasive species above existing conditions. This includes expansions into new areas and/or increases in diversity (i.e., introduction of a species not currently found in the project area), cover, and density in existing occupied areas.

3.2 Direct, Indirect, and Cumulative Impacts

3.2.1 Alternative A – No Action

Under Alternative A, the baseline conditions for vegetation 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.

Vegetation found along the shoreline of the Anderson Ranch Reservoir would continue to be exposed to varying levels of inundation as a result of ongoing operational fluctuations in water storage and releases. New infestations of invasive plants and noxious weeds would continue, and existing infestations would expand if left untreated. Invasive species control and eradication measures as currently practiced by the USFS, Idaho Department of Transportation, Idaho Department of Agriculture, and private landowners would continue. There would be no project-related loss or alteration of existing vegetation, or activities that would decrease the extent, connectivity, or integrity of a biological community, including a

loss of community or change in community type; therefore, Alternative A would not result in direct or indirect impacts to vegetation resources.

3.2.2 Alternative B – Anderson Ranch Dam Six-Foot Raise

Alternative B would require clearing vegetation in borrow areas along haul roads, storage or laydown areas, and for the proposed rim projects. Details on projects included in Alternative B are provided in the 6-foot Dam Raise Engineering Summary included in Appendix C of the EIS. Raising the full pool elevation would inundate areas previously above the full pool elevation, including upland and riparian habitats after construction is complete and the areas are reseeded. Impacts to vegetation would result from these activities.

Inundation from Dam Raise

The increased water storage at Anderson Ranch Dam would impact vegetation within the new proposed full pool elevation and along the shoreline, as well as within the varial zone where water levels would also rise. The increased inundation associated with Alternative B would likely alter vegetation along the shoreline and in the varial zone of Anderson Ranch Reservoir as upland areas that receive more regular inundation become more favorable to wetland and riparian species and no longer support upland species.

In areas that would be inundated for longer periods or where inundation would be deeper, plant communities less tolerant to increased inundation frequency or duration may be lost. Plant communities that experience shallower inundation or more temporary inundation may tolerate these limited periods of inundation with little effect. Upland communities along the existing shoreline areas that were inundated more deeply would not sustain upland species in the long term. Established trees may be able to withstand periods of inundation, but seedlings may not be able to establish in these areas. A study of conifer seedling submergence found that less than a third of Douglas fir and lodgepole pine seedlings submerged for more than 14 days survived, with no seedlings surviving 28 days of submergence (McCaughey and Weaver, 1991). Over time, these areas would be converted from upland areas to riparian and wetland areas that provided different functions and habitat. Upland forested habitat and grasslands are common in the region, and this impact in the context of the larger region would be minimal.

Table 19 provides the approximate acreage of vegetation communities that would be impacted under Alternative B by inundation from the dam raise based on data from the USFS VCMQ.

Table 19. Inundation acreage impacts of Alternative B

Impact Type	Vegetation Map Unit	Acres	Percent of Map Unit Habitat Stand Impacted
Rim Inundation	Aspen	1.55	1.29
	Bitterbrush	16.97	2.22
	Douglas Fir	5.24	0.44
	Douglas Fir/Ponderosa Pine	0.50	0.60
	Forest Shrubland	0.25	0.32
	Grassland	0.10	0.41
	Mountain Big Sagebrush	19.44	0.02
	Mountain Shrubland	2.91	2.48
	Ponderosa Pine	3.38	0.57
	Riparian Herblands	5.11	13.97
	Riparian Shrubland/Deciduous Tree	11.32	5.73
	Sparsely Vegetated	0.11	1.93
	Weedy Herblands	1.15	2.11
Varial Zone	Bitterbrush	0.11	0.59
	Mountain Big Sagebrush	8.70	1.44
	Ponderosa Pine	28.35	57.23
	Riparian Herblands	2.58	51.89
	Riparian Shrubland/Deciduous Tree	16.92	28.51
	Weedy Herblands	1.30	24.76
	Total	**125.96**	

Rim Inundation

Based on the USFS VCMQ, the vegetation map units with the most potential acreage to be affected by the rim inundation are the mountain big sagebrush, bitterbrush, and riparian shrubland/deciduous tree map units. The mountain big sagebrush and bitterbrush map units are upland plant communities and impacts from inundation would result in a shift in these communities toward more riparian or wetland communities. Inundation has a physiological

effect on species from changes in oxygen availability and chemical soil constituents, as well as a physical effect from floodwaters. Acreages in the riparian shrubland/deciduous tree map unit would also likely change in function and value as inundation depth and time would be altered in these areas. As the riparian habitat experiences longer periods of inundation, this community may shift toward a more emergent wetland community.

Overall, the raised pool elevation would likely result in a long-term, direct, adverse impact on upland vegetation and riparian vegetation, with the predominant effect being a shift of vegetation based on the new water levels within the area; however, impacts are not considered significant because vegetative communities would re-establish along the new shoreline elevation. Upland communities that converted to riparian or wetland vegetation communities would provide ecological functions and habitat, though it would be different than those provided by the former upland vegetation community. Surrounding upland vegetation and habitat is prevalent in the study area and would continue to provide the functions formerly provided by areas that converted to riparian and wetland habitat.

Varial Zone

The potential vegetation map units with the greatest acreage affected in the varial zone based on the USFS VCMO are ponderosa pine, riparian shrubland/deciduous tree, and mountain big sagebrush. Impacts to upland areas that are ponderosa pine and mountain big sagebrush map units would be similar as those noted for the rim inundation. Depending on the length and duration of inundation changes in the varial zone, these communities would likely experience the mortality of some upland species and a shift toward riparian and wetland habitat. Areas that are currently riparian shrubland/deciduous tree map unit habitat would likely be altered in function and may shift to an emergent wetland vegetative community in areas that receive greater and more frequent inundation.

Species present within the varial zone of the SFBR would be anticipated to change in composition toward a more hydrophytic species that are more tolerant of the increased inundation (Table 19). Currently, the varial zone is generally dewatered for most of each year, which results in a mix of upland species interspersed with riparian species (Reclamation, 2019). Conifer species noted in the varial zone (lodgepole pine, ponderosa pine, firs) and aspen may experience mortality if these species cannot tolerate inundation conditions of the expected duration. Woody vegetation may shift toward a greater dominance of hydrophytic woody species, such as willows, alder, and cottonwood. Alternately, species that are well suited to longer and deeper inundation periods may increase overall in the varial zone, including rushes and sedges.

As noted above for the Anderson Ranch Reservoir rim inundation, the dam raise would likely result in a long-term, direct, adverse impact on upland vegetation and riparian vegetation in the varial zone. Impacts to vegetation within the varial zone may be greater than those on the rim of the Anderson Ranch Reservoir due to the more broad, flat topography found in the varial zone, which may result in a more widespread impact. Alternative B would impact more than 30% of the ponderosa pine map unit habitat stand in the varial zone. This stand is

part of a larger heterogeneous habitat patch of forested upland habitat, with a mix of Douglas fir and ponderosa pine stands. In the Boise National Forest, ponderosa pine stands are typically a seral stage to Douglas Fir stands, consist largely of managed or recently disturbed stands within the Douglas Fir map unit, and are ecologically similar (USFS, 2014). The loss of this habitat patch would not be significant in the context of this larger habitat area. The functions and values lost by the inundation of upland vegetation would continue to be provided by the adjacent upland habitat that was not impacted.

Impacts would be negligible and insignificant as the adverse impacts are expected to be offset by the conversion of the upland areas into wetlands and riparian habitat. This converted upgradient vegetation would provide a more beneficial ecological function and habitat. Even though Alternative B would impact more than 30 % of the riparian herbland map unit habitat stand in the varial zone, riparian habitat would re-establish in this zone. In addition, the species within the riparian herbland map unit tolerate free or unbound water (USFS, 2014), and may continue to persist despite the increased inundation, depending on the depth, duration, and frequency of inundation. The predominant effect of the increased inundation would be the alteration of vegetation based on the increased frequency, duration, depth, and extent of inundation within the area (Appendix B, Specialist Report: Water Operations / Hydrology).

Rim Projects, Roadway Projects, and Borrow Areas

The rim projects, roadway projects, and borrow areas would result in impacts to vegetative communities from activities generally associated with construction. Impacts to vegetation include clearing, grading, or grubbing and disturbance of vegetation that could result in a loss of the vegetative community or a loss in ecological function. Depending on the action, impacts from these activities would be short to long term, direct or indirect, and adverse. Some areas would be permanently impacted by new construction, roadways, or facilities.

The rim projects include roadway projects, recreational facilities, and the realignment of Pine Airstrip. Rim projects involve both permanent roadway improvements (such as the Cow Creek Road realignment, abutment approach road, and roadway improvements), and temporary construction access road activities. Activities associated with recreational facility improvements and construction as well as the Pine Airstrip would require clearing and grading activities.

The borrow areas include the Dixie Borrow Area, which was used during the original dam construction, borrow areas along tributary drainages of the SFBR alluvial and fluvial deposits, and the Riprap Borrow Area, which is a basalt talus pile downstream of the dam (6-foot Dam Raise Engineering Summary, Appendix C of the EIS). Removing material from these borrow areas would likely require removing riparian and upland vegetation, though the nature of these sites as alluvium, previous borrow areas, or talus likely means they contain only limited or sparse vegetation. Sites for staging, stockpiling, and contractor use are vegetated and would require clearing, grubbing, and some revegetation, but these sites were

chosen in part for their moderate grades and low vegetative density (6-foot Dam Raise Engineering Summary, Appendix C of the EIS).

The impact of these projects from Alternative B and the vegetation map units impacted are discussed below. Table 20 provides the approximate acreage of vegetation that would be impacted by the proposed rim projects, road realignment, and borrow areas based on USFS VCMQ data.

Table 20. Rim projects, Roadway Projects, and borrow area acreages under Alternative B

Impact Type	Vegetation Map Unit	Acres	Percent of Map Unit Impacted
Roadway Riprap Placement and mechanically stabilized earth (MSE) Wall Construction	Bitterbrush	0.39	0.52
	Grassland	<0.01	0.05
	Mountain Big Sagebrush	1.09	0.05
	Ponderosa Pine	0.17	0.46
	Riparian Herblands	0.38	1.68
	Sparsely Vegetated	0.22	3.87
Pine Airstrip Realignment	Bitterbrush	1.56	11.64
	Mountain Big Sagebrush	1.92	4.32
Pine Bridge Construction	Ponderosa Pine	0.26	0.63
	Riparian Shrubland/Deciduous Tree	0.25	1.90
Lime Creek Bridge Armoring	Douglas Fir	0.05	0.05
Deer Creek Culvert	Riparian Shrubland/Deciduous Tree	0.22	0.40
Fall Creek Culvert	Ponderosa Pine	0.15	0.41
Campground Modifications and Improvements	Aspen	0.34	2.0
	Mountain Big Sagebrush	0.01	0.0
	Mountain Shrubland	0.60	4.11
	Riparian Herblands	0.03	0.19
	Riparian Shrubland/Deciduous Tree	0.41	1.94
Cow Creek Road Realignment	Bitterbrush	0.06	0.22
	Mountain Big Sagebrush	1.50	<0.01
	Weedy Herblands	0.86	9.96

Impact Type	Vegetation Map Unit	Acres	Percent of Map Unit Impacted
Staging and Borrow Areas	Aspen	1.53	62.40
	Bitterbrush	8.24	2.49
	Douglas Fir	1.65	0.80
	Mountain Big Sagebrush	54.04	0.06
	Ponderosa Pine	0.79	1.01
	Riparian Shrubland/Deciduous Tree	10.17	11.86
	Sparsely Vegetated	0.09	1.58
	Total	**86.98**	

Based on the USFS VCMQ, the vegetation map units with the most potential acreage to be affected by the rim projects, roadway projects, and borrow areas are the mountain big sagebrush, bitterbrush, and riparian shrubland/deciduous tree map units.

Overall, impacts from reservoir rim projects and roadway construction and upgrade projects are expected to be short and long term, direct, and adverse on herbaceous and shrubland riparian vegetation and upland shrubland and forested from removing and disturbing vegetation within the project area. Temporary impacts to herbaceous vegetation would be direct, and adverse but are not considered significant because areas disturbed would be reseeded. Reseeding of areas temporarily impacted would establish herbaceous species within a shorter timeframe. Rim projects that are not temporary, such as Pine Airstrip, creation of new recreational facilities, roadways, boat docks, and riprap placement would have significant long term, direct, adverse impacts to vegetation from the permanent conversion to developed land. These areas would no longer provide an ecosystem function or serve as habitat. These impacts would be significant in a localized area but represent minimal acreage in the larger project area and vicinity and would likely not be significant in the context of habitat provided by the larger project area.

Impacts to vegetation from borrow sites and staging areas would be short term, direct, and adverse during construction, and long term, direct, and adverse once construction had ceased, and areas were reseeded with native species. Borrow sites and staging areas would impact more than 30% of a habitat stand of the aspen map unit. The aspen map unit type includes a mosaic of aspen forests, conifer forests, and early seral shrublands (USFS, 2014). This stand is isolated and small, but larger habitat stands of aspen are present within the vicinity of the project area. In addition, aspen are early successional species and are quick to regenerate. Reseeding and natural regeneration would reestablish herbaceous species in these areas within a few years, followed by aspen and early seral shrubs. It would take longer to fully

reestablish shrubland and forested areas and the ecosystem functions and habitat values provided by these areas before clearing. To reduce impacts to vegetation, areas for staging, stockpiling, and contractor use were chosen in areas with minimal vegetation. Reseeding these sites would restore some of the vegetation but using and storing equipment and supplies may compact soils, which would have a long-term, indirect, adverse impact on vegetation. Impacts to vegetation from borrow and contractor use sites are not considered significant, as these areas were chosen in part because they currently provide lower quality habitat and would be re-established with native species, increasing habitat and ecosystem function.

Invasive Species

Soil disturbance from reservoir rim projects and roadway projects would also increase the potential for invasive species introduction. Invasive species can permanently alter habitats and function of ecosystems by changing the species composition and environmental conditions present that can result in potentially adverse impacts. However, the implementation of mitigation and conservation measures including those discussed in Section 3.2.5 would help to reduce the likelihood of invasive species introduction. Therefore, no significant impacts from terrestrial invasive species from implementing Alternative B are expected.

In-water work under Alternative B has the greatest potential of introducing aquatic invasive species into the project area. Vehicles and construction equipment (including materials used for coffering in some cases) have the potential to harbor and transport aquatic invasive species from waterbody to waterbody. Aquatic invasive species pose a great threat to valued aquatic resources in the project area. In turn, mitigation and conservation measures discussed below, as well as the Fisheries Specialist Report (Appendix B) would be implemented to reduce the risk of introducing aquatic invasive species into the project area as a result of Alternative B. Conservation measures in place would reduce the potential for the introduction of aquatic invasive species into water bodies within the project area and as a result, no significant direct or indirect impacts from aquatic invasive species would be anticipated to occur from implementing Alternative B.

3.2.3 Alternative C – Anderson Ranch Dam Three-Foot Raise

Similar to Alternative B, Alternative C would require clearing vegetation in borrow areas along haul roads, storage or laydown areas, and for the proposed rim projects. Raising the full pool elevation would inundate areas previously above the full pool elevation, including upland and riparian habitats after construction is complete and the areas are reseeded. Impacts to vegetation would result from these activities.

Inundation from Dam Raise

As described for Alternative B, the increased water storage as a result of the three-foot dam raise under Alternative C would impact vegetation along the new shoreline and in the varial zone, but these impacts would impact less acres of habitat than under Alternative B. The change in the shoreline would alter previously upland areas, which would instead provide

conditions to support wetland and riparian species. Formerly upland areas along the shoreline may experience inundation that is deep or frequent enough to where they can no longer support upland plant communities, particularly forested habitats. As with Alternative B, upland forested habitat and grasslands are common in the region, and this impact in the context of the larger region would be minimal.

Table 21 provides the approximate acreage of vegetation communities that would be impacted by the inundation under Alternative C based on data from the USFS VCMQ.

Table 21. Inundation acreage impacts of Alternative C

Impact Type	Vegetation Map Unit	Acres	Percent of Map Unit Impacted
Rim Inundation	Aspen	0.76	0.63
	Bitterbrush	7.18	0.95
	Douglas Fir	2.26	0.19
	Douglas Fir/Ponderosa Pine	0.24	0.32
	Forest Shrubland	0.11	0.14
	Grassland	0.05	0.20
	Mountain Big Sagebrush	9.71	0.01
	Mountain Shrubland	1.34	1.14
	Ponderosa Pine	1.68	0.28
	Riparian Herblands	3.01	8.23
	Riparian Shrubland/Deciduous Tree	6.31	3.26
	Sparsely Vegetated	0.06	1.06
	Weedy Herblands	0.60	1.10
Varial Zone	Bitterbrush	0.04	0.21
	Mountain Big Sagebrush	2.86	0.47
	Ponderosa Pine	13.36	31.72
	Riparian Herblands	2.44	49.08
	Riparian Shrubland/Deciduous Tree	10.37	20.89
	Weedy Herblands	0.88	16.76

Impact Type	Vegetation Map Unit	Acres	Percent of Map Unit Impacted
	Total	**63.27**	

Rim Inundation

Based on the USFS VCMQ, the vegetation map units with the most potential acreage to be affected by the rim inundation under Alternative C are the mountain big sagebrush, bitterbrush, and riparian shrubland/deciduous tree map units. These upland map units are the same as those most impacted under Alternative B by shifts towards more riparian or even wetland communities.

Overall, under Alternative C the 3-foot dam raise pool elevation would likely result in a long-term, direct, adverse impact on upland vegetation and riparian vegetation, but the amount of acreage impacted by Alternative C is lower than under Alternative B and impacts are not considered significant, as vegetation would re-establish. Upland areas converted to riparian or wetland habitat would provide beneficial habitat, and upland habitat would still be present in the areas surrounding the pool elevation raise.

Varial Zone

The potential vegetation map units with the greatest acreage affected in the varial zone based on the USFS VCMO are ponderosa pine, riparian shrubland/deciduous tree, and mountain big sagebrush. Alternative C would impact more than 30 % of individual habitat stands of ponderosa pine and riparian herbland map units. Impacts to these communities would be as described above under Alternative B, with a shift in function and vegetative community composition from increased inundation. This would likely include a shift towards more hydrophytic species such as willows, sedges, and rushes, and possible mortality of upland species such as conifers and aspen.

Impacts from Alternative C would be long-term, direct, adverse impact on upland vegetation and riparian vegetation in the varial zone, but the acreage impacted would be less than under Alternative B. Larger stands of ponderosa pine are present in the project vicinity, and the ecological functions provided by this habitat type would still be provided in adjacent habitat stands even if the stands within the varial zone convert to riparian habitats. Riparian herblands may persist in the varial zone even in areas of increased inundation, depending on the frequency, depth, and duration of the inundation, or may migrate upslope. Overall, impacts to the varial zone are not considered significant, as the conversion of upland areas to riparian or wetland habitat would provide ecosystem function and habitat and upland habitat would still be present in the varial zone. The predominant effect of the increased inundation would be the alteration of vegetation based on the increased frequency, duration, depth, and extent of inundation within the area (Water Operations / Hydrology Specialist Report in Appendix B of the EIS).

Rim Projects, Roadway Projects, and Borrow Areas

The rim projects, roadway projects, and borrow areas would result in impacts to vegetative communities from activities generally associated with construction. Impacts to vegetation include clearing, grading, or grubbing and disturbance of vegetation that could result in a loss of the vegetative community or a loss in ecological function. Depending on the action, impacts from these activities are short to long term, direct or indirect, and adverse. Some areas would be permanently impacted by new construction, roadways, or facilities.

In general, rim projects would be decreased under Alternative C, and some projects would no longer be needed under Alternative C. Borrow areas under Alternative C would be the same as described under Alternative B.

The impact of these projects from Alternative C and the vegetation community types impacted are discussed below. Table 22 provides the approximate acreage of vegetation that would be impacted by the proposed rim projects, road realignment, and borrow areas based on USFS VCMQ data under Alternative C.

Table 22. Rim projects, Roadway Projects, and borrow area acreages under Alternative C

Impact Type	Vegetation Map Unit	Acres	Percent of Map Unit Impacted
Roadway Riprap Placement and MSE Wall Construction	Bitterbrush	0.30	0.40
	Grassland	<0.01	0.05
	Mountain Big Sagebrush	0.59	0.03
	Ponderosa Pine	0.13	0.35
	Riparian Herblands	0.27	1.20
	Sparsely Vegetated	0.22	3.87
Pine Airstrip Realignment	Bitterbrush	<0.01	<0.01
	Mountain Big Sagebrush	0.02	0.16
Lime Creek Bridge Armoring	Douglas Fir	0.04	0.04
Deer Creek Culvert	Riparian Shrubland/Deciduous Tree	0.22	0.40
Fall Creek Culvert	Ponderosa Pine	0.14	0.41
Campground Modifications and Improvements	Aspen	0.34	2.0
	Mountain Big Sagebrush	0.01	0.0
	Mountain Shrubland	0.60	4.11
	Riparian Herblands	0.03	0.19

Impact Type	Vegetation Map Unit	Acres	Percent of Map Unit Impacted
	Riparian Shrubland/Deciduous Tree	0.41	1.94
Cow Creek Road Realignment	Bitterbrush	0.06	0.22
	Mountain Big Sagebrush	1.50	<0.01
	Weedy Herblands	0.86	9.96
Staging and Borrow Areas	Aspen	1.53	62.4
	Bitterbrush	8.24	2.49
	Douglas Fir	1.65	0.80
	Mountain Big Sagebrush	53.93	0.06
	Ponderosa Pine	0.06	0.16
	Riparian Shrubland/Deciduous Tree	9.68	13.33
	Sparsely Vegetated	0.09	1.58
	Total	**79.41**	

The types of impacts to vegetation from rim projects, roadway projects, and borrow areas would be similar to those described under Alternative B, but the acreages of habitat impacted would differ. As noted in the methodology, there are some areas along Anderson Ranch Reservoir where inundation overlaps the rim project footprints. In these cases, impacts were calculated as acreage impacted by the rim projects only and not the acreages impacted by the inundation in order to avoid double-counting acreage impacts. Impacts under the 3-foot dam raise are generally similar or lower than those under Alternative B.

Based on the USFS VCMQ, the vegetation map units with the most potential acreage to be affected by the rim projects, roadway projects, and borrow areas are the mountain big sagebrush, bitterbrush, and riparian shrubland/deciduous tree map units. Acreages impacted by roadway construction under Alternative C would be lower for the mountain big sagebrush and bitterbrush map units but impacts under both alternatives were less than one acre. Under Alternative C, no impacts would occur to vegetative communities as a result of activities proposed for the Pine Bridge Construction under Alternative B, reducing impacts to ponderosa pine and riparian shrubland/deciduous tree map units. Acres of vegetation impacted would also be reduced for other construction and culvert projects under Alternative C. Campground modifications would impact similar or slightly less acreage under Alternative C than under Alternative B.

Although acreages differ slightly between Alternative B and Alternative C, impacts from reservoir rim projects and roadway construction and upgrade projects under Alternative C are expected to be the similar to Alternative B: short and long term, direct, and adverse as a result of removing and disturbing vegetation. Reseeding of areas temporarily impacted would establish herbaceous species within a shorter timeframe, but shrubs and trees would take longer to reestablish. Permanent impacts from roadways and development would be locally significant, but represent minimal acreage in the project area, and would likely not be significant in the context of habitat provided by the larger project area. In addition, implementation of mitigation and conservation measures would reduce the potential for the introduction of invasive species into area of disturbance within the project area, minimizing impacts from invasive species.

Acreage impacts to vegetation from staging and borrow areas would be similar under Alternatives B and C, with Alternative B resulting in impacts to slightly more acreage of the mountain big sagebrush, ponderosa pine, and riparian shrubland/deciduous tree map units. Borrow sites and staging areas would impact more than 30 % of a habitat stand of the aspen map unit, but this habitat is still present in the project area vicinity and is an early successional habitat type that may regenerate after disturbance. Impacts would be short-term, direct, and adverse during construction, and long-term, direct, and adverse once construction had ceased and areas were reseeded with native species, but the re-establishment of vegetation would be in the long-term.

Invasive Species

Similar to Alternative B, soil disturbance from reservoir rim projects and roadway projects has the potential to increase the likelihood of establishing invasive species in the project area. Invasive species can permanently alter habitats and function of ecosystems by changing the species composition and environmental conditions present that can result in potentially adverse impacts. However, the implementation of mitigation and conservation measures including those discussed in the Vegetation Specialist Report (Appendix B) would help to reduce the likelihood of invasive species introduction. Therefore, no significant impacts from terrestrial invasive species from implementing Alternative C are expected.

In-water work under Alternative C has the greatest potential of introducing aquatic invasive species into the project area, but these impacts would be less pronounced than under Alternative B, as less in-water work is proposed. As described under Alternative B, other potential sources of aquatic invasive species spread and introduction are vehicles and construction equipment. Mitigation and conservation measures would be implemented to reduce the risk of spreading aquatic invasive species, and as a result, no significant direct or indirect impacts from aquatic invasive species would be anticipated to occur from implementing Alternative C.

3.2.4 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. While no present actions are identified, Reclamation has identified two past actions: Pine Bridge replacement and the Anderson Ranch Dam crest raise for security enhancement. Reclamation has also identified two potential future actions to be considered for the cumulative impact analysis: Cat Creek Energy Project and 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.

The Pine Bridge replacement resulted in one bridge being replaced with another bridge in the same location, and therefore would not have changed the overall vegetation in the area. The Anderson Ranch Dam crest raise was completed on top of the existing dam and would not have impacted vegetation. Therefore, these past projects would not contribute to cumulative effects.

The Cat Creek Energy project proposes an energy and water storage renewable power station; a 100,000-acre-foot reservoir created near the mouth of Cat Creek above Anderson Ranch Reservoir; a pipeline from Anderson Ranch reservoir to Cat Creek reservoir; and wind and solar energy equipment. The South Fork Boise River Diversion Project is a pipeline and pumping station project proposed to be located on the far southeast side of the reservoir toward the dam. A pipeline would carry water to Elmore County, approximately 28 miles to the southwest of the reservoir. Alternatives B and C would result in permanent loss and/or change in vegetation due to construction and inundation. It can be assumed that the Cat Creek Energy project would also cause loss or change in vegetation from installing a pipeline from Anderson Ranch reservoir to Cat Creek reservoir, construction of the Cat Creek Reservoir, and installation of the and wind and solar energy equipment. The South Fork Boise River Diversion Project would also cause loss or change in vegetation due to installation of a pipeline. However, the analysis of impacts on vegetation from either Alternative B or C was found to be insignificant. Therefore, Alternative B or C would only contribute slightly to the cumulative effects on vegetation in the local area when added to these future projects.

3.2.5 Mitigation

Removing vegetation as a result of construction activities at borrow sites, storage areas, along haul roads, and rim projects would impact vegetation. In many cases, clearing these areas would be necessary; additional areas of vegetation could also be impacted by dust or soil compaction.

The following conservation measures would be implemented to manage impacts to vegetation.

- Before removing any vegetation for construction activities, a survey would be conducted on the vegetative communities present in each construction area. Removing mature riparian vegetation and other sensitive vegetation would be minimized to the extent possible.
- Staging of construction equipment would be limited to areas specifically identified for use during construction.
- A revegetation plan would be prepared on a site-specific basis to restore native vegetation in all areas impacted immediately after construction is completed. The objectives of the revegetation plan would be to reestablish native vegetation to provide ground cover, minimize opportunities for invasive species to establish; and provide habitat and opportunities for recreation as the site matured. The revegetation plan would include monitoring requirements, performance standards, and success criteria to ensure the areas successfully revegetated.

Riparian vegetation would be replaced through planting and establishment on-site. Sensitive plant communities, if present, may be replaced through restoration of comparable native vegetation at other sites, if necessary. Planting saplings and bare root trees and shrubs would decrease the time required for reestablishment because they can more rapidly adapt to new soil conditions.

Invasive Species

Many invasive plant species prefer bare, disturbed ground for establishment. Ground-disturbing activities have the potential to introduce noxious weeds into construction areas through transport and disturbance. Reclamation would direct monitoring for infestations of invasive plant species associated with project-related ground disturbance. Periodic inspections would identify new plants and control them before they can spread. Noxious weed treatment would be conducted following manufacturer's instructions, applied by licensed applicators, and approved by county weed agents or USFS, depending on location. Inspections and conservation measures could prevent the expansion or new colonization of terrestrial invasive species. When present, Reclamation would direct implementation of suppression strategies to control invasive plant populations. These strategies could involve mechanical, chemical, and biological controls. Reclamation would evaluate strategies to reduce environmental risks associated with such controls and ensure compliance with federal, state, and local laws and requirements and would comply with the requirements under EO 13423 "Strengthening Federal Environmental, Energy, and Transportation Management" to incorporate integrated pest management concepts.

The Boise and Sawtooth Forest-wide Integrated Weed Management Prevention Plan incorporates management direction from the Forest Plan including guidelines and standards relative to noxious weeds (USFS, 2019). These are incorporated into conservation measures to avoid noxious weeds becoming established or spreading as shown in Table 23.

Table 23. Boise and Sawtooth national forests management direction for noxious weeds

Type	Number	Direction Description
Standards	NPST01	Only certified noxious weed-free hay, straw, or feed is allowed on National Forest system lands.
	NPST02	All seed used on National Forest system lands would be certified to be free of seeds from noxious weeds listed on the current All States Noxious Weeds List.
	NPST03	To prevent invasion/expansion of noxious weeds, the following provisions would be included in all special use authorizations, timber sale contracts, service contracts, or operating plans where land-disturbing activities are associated with the authorized land use: Revegetate areas, as designated by USFS, where the soil has been exposed by ground-disturbing activity. Implement other measures, as designated by USFS, to supplement the influence of re-vegetation in preventing invasion or expansion of noxious weeds. Potential areas would include construction and development sites, underground utility corridors, skid trails, landings, firebreaks, slides, slumps, temporary roads, cut and fill slopes, and travel ways of specified roads. Earth-disturbing equipment used on National Forest system lands such as cats, graders, and front-loaders would be cleaned to remove all visible plant parts, dirt, and material that may carry noxious weed seeds. Cleaning would occur before entry onto the project area and again upon leaving the project area, if the project area has noxious weed infestations.
	NPST04	Contractors would be required to clean earth-disturbing, construction, and road maintenance equipment of all sizes to remove all plant parts, dirt, and material that may carry noxious weed seeds before entering the forest, or movement from one forest project area to another.
	NPST06	Materials such as hay, straw, or mulch that are used for rehabilitation and reclamation activities would be free of noxious weed seed and would comply with the 1995 weed-free forage special order against use of non-certified hay, straw, or mulch. Materials that are not covered under a weed-seed-free certification, and that have the potential to contain noxious weed seed, would be inspected and determined to be free of weed seed before purchase and use.
	NPST07	Source sites for gravel and borrow materials would be inspected for noxious weeds before materials are processed, used, or transported from the source site into the project area or onto the National Forest.
	NPST07	Source sites for gravel and borrow materials would be inspected for noxious weeds before materials are processed, used, or transported from the source site into the project area or onto the National Forest.

Type	Number	Direction Description
	NPST08	Gravel or borrow material source sites with noxious weed species present would not be used, unless effective treatment or other mitigation measures are implemented.
Guidelines	NPGU02	Clean borrow and gravel sources on USFS land should be maintained as noxious-weed free through an inspection and treatment program. For non-USFS land, property inspections and treatments should be coordinated with county weed agents.
	NPGU03	Identify areas with extensive noxious weed infestations where precautionary actions are necessary when planning and implementing management activities. In areas of extensive weed infestations, designated wash sites should be established as part of project planning. Wash sites should be located: 1) where they are easily accessible and useable, 2) on gravelly or well-drained soils, 3) where wash water runoff would not carry seeds away from site, 4) where wash water runoff would not directly enter streams, and 5) where they may be used repeatedly for several projects or activities within the area.

In addition to the measures in Table 23, conservation measures to reduce any risk of introducing aquatic invasive species into waters within the project area under Alternative B and Alternative C would be implemented. This includes requiring equipment inspections to ensure the equipment is not contaminated. Visible plants, mud, and dirt would be removed at a predetermined decontamination area away from waters in the project area(s) or other waters of the state and all machinery or equipment would be washed with high pressure hot water (>140ºF) and decontaminated before entering or leaving any waters within the project area. Removing noxious plants from vessels that may mobilize to Anderson Ranch Reservoir, the SFBR, and Arrowrock Reservoir is critical to keeping these invasive species out of waterbodies within the project areas and protecting native aquatic biota.

Additional conservation measures to protect terrestrial and aquatic biota under the project alternatives are discussed in the Specialist Reports for Fisheries and Threatened and Endangered Species in Appendix B of the EIS.

In summary, no significant impacts have been identified from the introduction of invasive species due to implementing alternatives. Multiple conservation measures and best management practices are identified and would be implemented as part of the proposed project.

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