Black Canyon Hydroelectric Project
FERC Project No. P-14110
Preliminary Vegetation Cover Types
February 2013

Prepared for
Black Canyon Hydro, LLC
3633 Alderwood Avenue
Bellingham, WA 98225

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1 INTRODUCTION

Black Canyon Hydro, LLC, (BCH) ultimately plans to file an application for an original license for the Black Canyon Hydroelectric Project (Project), FERC Project Number P-14110, and associated facilities on the North Fork Snoqualmie River (North Fork), approximately 4 miles northeast of North Bend in King County, Washington. The Project has a proposed generation capacity of 25 megawatts (MW) and would be located entirely on private lands.

The project would operate in run-of-river mode. The combined maximum hydraulic capacity of the two project turbines would be 900 cubic feet per second (cfs). The project would divert water from a 2.6-mile-section of the North Fork Snoqualmie River.

The Black Canyon Hydroelectric Project lies within the *Tsuga heterophylla* (western hemlock) zone (as described by Franklin and Dyrness, 1973). The *Tsuga heterophylla* zone in the Western Cascades is dominated by western hemlock, Douglas-fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*). Hardwoods, particularly red alder (*Alnus rubra*), big-leaf maple (*Acer macrophyllum*), and black cottonwood (*Populus trichocarpa*) characterize riparian sites. These hardwood species are also represented in canopy gaps and other recently disturbed sites. Most of the forest within the project area, and in the near vicinity, has been logged. The forest has been replaced by second or third growth forests managed for Douglas-fir. The major vegetative cover types present are described and mapped in the attached appendices.

2 PURPOSE

The purpose of mapping vegetation is to create a preliminary description of vegetation and habitat cover types that can be used to characterize the landscape in the area of the proposed project and its immediate vicinity. This initial characterization has been used by BCH staff as one component of its identification of PHS List Wildlife that may be present within or adjacent to the Study Area identified in the Revised Wildlife, Vegetation, and Sensitive Habitats Study Plan.

3 METHODOLOGY

A base map was created using layer of LiDAR acquired using an Optech Airborne Laser Terrain mapper (ALTM) Gemini sensor in the spring of 2012 under the direction of BCH staff. This layer has been supplemented by publicly available aerial photography taken in

the spring of 2009 to fill in minor gaps on the edge of the image. The 2009 imagery is identified in the figures with red lines.

The boundaries of vegetation cover types were then marked in part by using a series of Google Earth aerial images taken in 2009, 2006, 2005, 2003, 1998, and 1994. Reviewing this series of images allowed logging activities to be tracked and to approximate the age of tree stands. Additionally, stands could be estimated using aerial photography and video captured in February 2012 by helicopter. Once the desktop review was completed, cover types of representative stands were confirmed and photographed on the ground.

Additionally, information regarding the location of old growth forest in the Mt. Si NRCA was provided by the Washington Department of Natural Resources (See Appendix IV).

4 RESULTS

See Appendix I for a delineation of cover types in the overall project area. Appendix II and III show cover types focused on the intake and powerhouse areas respectively.

The following are descriptions of the various cover types mapped with accompanying representative photographs taken at sites within the project area.

4.1 Early Successional Forest

The early successional condition is characterized by small coniferous trees, shrubs and herbaceous vegetation (Figure 1). These stands have been recently harvested (i.e. clearcut) and are in early regenerative stages dominated by shrubs, small conifers and herbaceous species common to disturbed sites. Conifers are generally less than 1 inch in diameter, less than 10 feet tall and providing no greater than 30 percent canopy cover.

This stage may last for up to 10 to 15 years after even-aged timber harvest depending on site conditions and management. Currently in the Project Boundary, conifers are less than 5 feet tall and less than 5 years of age. The dominant conifer species in these stands include western hemlock and Douglas fir. Dominant shrub species include vine maple (*acer circinatum*), salal, (*Gaultheria shallon*), tall Oregon grape (*Mahonia aquifolium*), salmonberry (*Rubus spectabilis*), red huckleberry (*Vaccinium parvifolium*), and thimbleberry (*Rubus parviflorus*). The dominant herbaceous species in these areas include sword fern (*Polystichum munitum*), lady fern (*Athyrium filix-femina*), small-flowered woodrush (*Luzula parviflora*), foxglove (*Digitalis purpurea*), and fireweed (*Epilobium angustifolium*).

Figure 1. Early successional forest

4.2 Closed Canopy Sapling/Pole Coniferous Forest

This cover type is composed of second growth forests generally 5 to 40 years old, with tree canopy closure greater than 60 percent. Average pole diameter at breast height (dbh) in most stands is 1 to 12 inches, with larger trees over 16 inches. Dominant tree species are Douglas-fir and western hemlock, with western red cedar, red alder, and bigleaf maple being common subordinates. Canopy gaps are uncommon and small; they are generally characterized by a dense shrub layer and/or deciduous tree species (Figure 2). Within the densest stands, understory and herbaceous vegetation are sparse, except for a variety of moss species and sword fern. The dominant shrub species include red huckleberry, Alaskan blueberry (*Vaccinium alaskaense*), salal (*Gaultheria shallon*), dull Oregon grape (*Mahonia nervosa*), salmonberry, vine maple (*Acer circinatum*), trailing blackberry, devils club (*Opalopanax horridus*), and false azalea (*Menziesia ferruginea*). The dominant herbaceous species include sword fern, lady fern, deer fern (*Blechum spicant*), bunchberry (*Cornus canadensis*), Siberian Miner's lettuce (*Claytonia sibirica*),

false lily of the valley (*Maianthemum*), foam flower (*Tiarella trifoliate*), and beadlily (*Clintonia uniflora*).

Figure 2. Closed canopy sapling/pole coniferous forest

4.3 Mixed Deciduous/Coniferous Forest

In some stands mixed conifer-hardwood forest is represented as a heterogeneous mixture of conifers (Douglas-fir and western hemlock, with occasional western red cedar) and hardwoods (red alder and bigleaf maple); elsewhere, relatively large gaps filled with hardwoods occur in stands otherwise dominated by conifers. Because of greater light penetration through the canopy, understory trees, shrubs, and ground vegetation are common and sometimes lush. Mixed forests are best developed on moist sites.

Dominant understory tree species and shrubs are vine maple, salmonberry, red elderberry, Cascade Oregon grape, tall Oregon grape, Alaskan blueberry, and devil's club. Herbaceous vegetation may be dominated by a few species such as sword fern, dull Oregon grape, or salal, but is often diverse. Other common species include lady fern,

deer fern, western springbeauty (*Montia sibirica*), foam flower, and bedstraw (*Galium* sp.).

Figure 3. Mixed deciduous/coniferous forest

4.4 Open Canopy Sapling/Pole Coniferous Forest

The open canopy sapling/pole coniferous forests are timber reproduction areas dominated by young conifers, and they exhibit varying ages, diameters, densities, and degrees of canopy closure depending on thinning practices and timing of management activities (Figure 4). Vegetative cover in these areas, in general, is much higher than in early successional growth stands. Tree canopy closure is generally less than 60 percent and a shrub understory is present. They have yet to reach the closed canopy stage, or are young stands which have been thinned. Undergrowth in thinned stands is limited by a layer of slash. Coniferous trees are between 5 and 40 feet tall. This condition usually follows early-successional forest as a result of tree height growth. Trees are generally between 5 and 40 years of age, and are 1 to 12 inches in diameter, depending on management and site conditions. Currently, conifers are between 5 to 30 feet tall and generally between 5 and 20 years old. The dominant conifer species are western hemlock and Douglas firs. The herbaceous and shrub layers are usually sparser and less diverse than in the early-successional stand conditions due to shading by the dominant tree layer, but varies in cover and diversity based on canopy closure. The dominant shrub species include

salmonberry, thimbleberry, red elderberry (*Sambucus racemosa*), evergreen blackberry (*Rubus laciniatus*), and trailing blackberry (*Rubus ursinus*). The dominant herbaceous species include sword fern, foxglove, fireweed, and common St. Johnswort (*Hypericum perforatum*).

Figure 4. Open canopy sapling/pole coniferous forest

4.5 Riparian Forest

The riparian zone includes those areas adjacent to aquatic habitats that are influenced by, or that directly influence, the aquatic ecosystem (Figure 5). This includes streamside wetland and upland areas where the vegetation, water tables, soils, microclimate, and wildlife are often influenced by perennial or intermittent water. It may also include a narrow strip of trees excluded from timber harvest as part of a riparian buffer. Riparian zones along streams may experience fluctuating water levels and resulting flooding, erosion, or scouring of vegetation.

Vegetation characteristics in the riparian zone vary depending on number of factors (e.g., level of inundation, light availability, soil type, degree of disturbance, etc.), which are generally associated with landscape position relative to the aquatic system. Along the North Fork, there are a range of Riparian Forest types depending on topography (e.g., steep canyon or low gradient), where lower water velocities due to relatively flat

topography exhibit broad riparian zones with wider bands of wetland vegetation lining either side of the stream. In these areas, there is often a gradual transition from the riparian zone to moist, mixed conifer-hardwood forest. In contrast, river segments moving through higher gradients (much of Black Canyon) are characterized by higher water velocities and exposed rock, often creating a sharp transition from water and the riparian zone to upland forest.

Riparian vegetation along the North Fork varies from shrub-dominated to tree-dominated. The dominant tree species include red alder, western red cedar, and western hemlock, with black cottonwood present in some areas. The dominant shrub species at the water's edge include Sitka willow (*Salix sitchensis*), devil's club, and salmonberry. Common shrubs in forested areas include salmonberry, thimbleberry, red elderberry, red huckleberry, Alaskan huckleberry, early blueberry (*Vaccinium ovalifolium*), devil's club, and vine maple. Herbaceous vegetation is lush and includes ferns and forbs such as sword fern, deer fern, lady fern, bracken fern, bunchberry, foam flower, youth-on-age (*Tolmiea menziesii*), enchanter's nightshade (*Circaea alpina*), and large leaved avens (*Geum macrophyllum*).

Figure 5. Riparian Forest

4.6 Small Sawtimber Forest

The small sawtimber condition is characterized by trees between 9 and 20 inches dbh, with larger trees exceeding 24 inches dbh. Stands are usually between 40 and 80 years old and conifers are between 50 to 100 feet tall. Understory vegetation is similar to the closed sapling/pole stage, but usually more developed. In denser areas it is still sparse, and often dominated by moss and sword fern (Figure 6). Tree density is less than in younger stands due to mortality of suppressed trees. Canopy closure is generally uniform within the stand, ranging between 60 and 100 percent.

Figure 6. Small sawtimber forest

5 REFERENCES

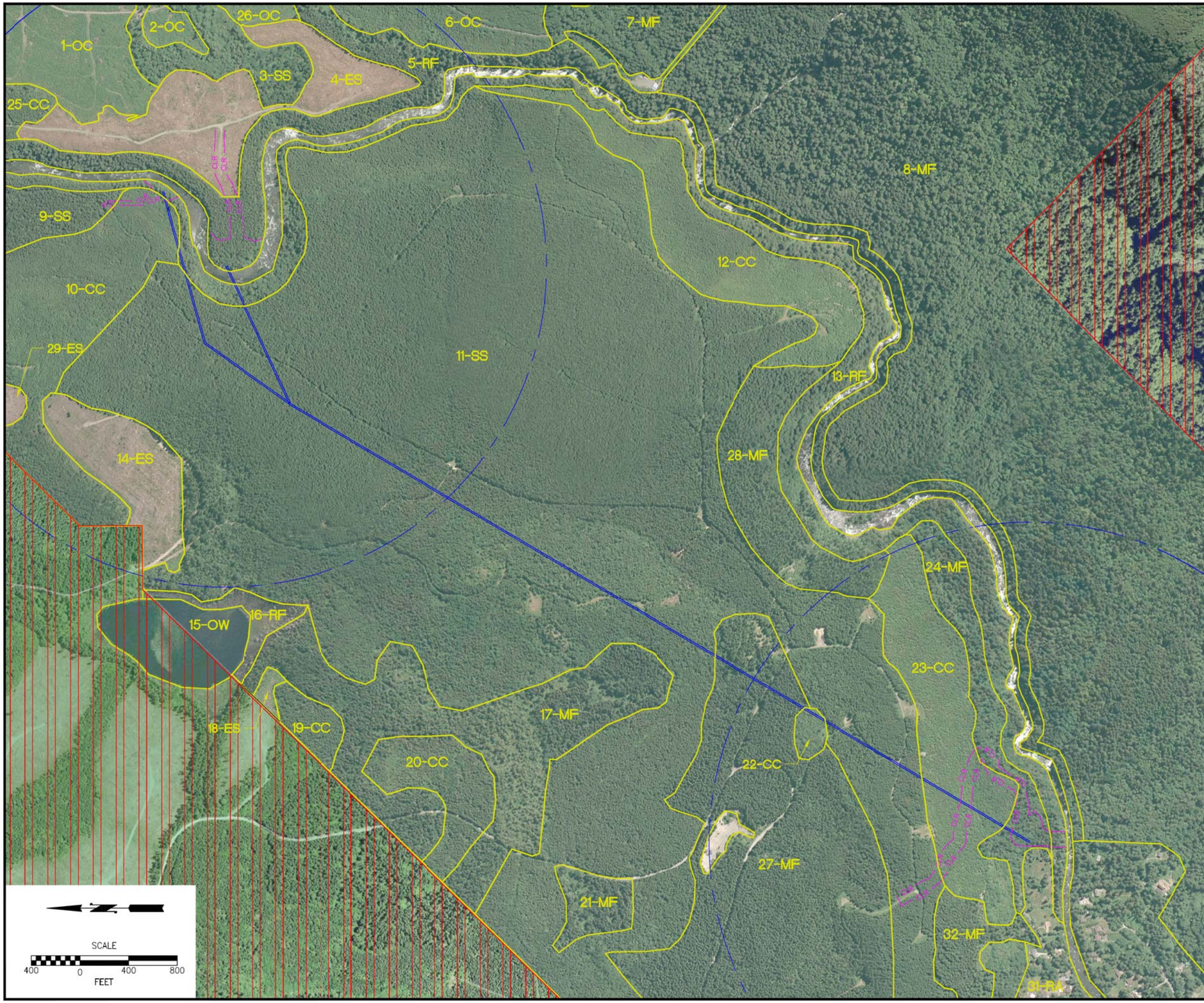
Franklin, J.F. and C.T. Dyrness. 1973. Natural Vegetation of Oregon and Washington. USDA Forest Service, Pacific Northwest Region, Forest and Range Experiment Station. Gen Tech. Rep. PNW-8. 417 p.

Franklin, J.F., T. Spies, R. Van Pelt, et al. 2005. Definition and Inventory of Old Growth Forests on DNR-Managed State Lands. Washington State Department of Natural Resources. Olympia, WA

6 APPENDICES

Appendix I

Overall Project Area



LEGEND

ES=EARLY SUCCESSIONAL FOREST
CC=CLOSED-CANOPY SAPLING/POLE CONIFEROUS FOREST
MF=MIXED DECIDUOUS/CONIFEROUS FOREST
OC=OPEN-CANOPY SAPLING/POLE CONIFEROUS FOREST
OW=OPEN WATER
RF=RIPARIAN FOREST
SS=SMALL SAWTIMBER FOREST
WL=WETLAND
RA=RESIDENTIAL AREA

CLR =CLEARING LIMITS
=TUNNEL ALIGNMENT
=AERIAL PHOTO FROM 04/30/2009
=BUFFER

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4=ES
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29=ES
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BLACK CANYON

VEGETATION COVER TYPES

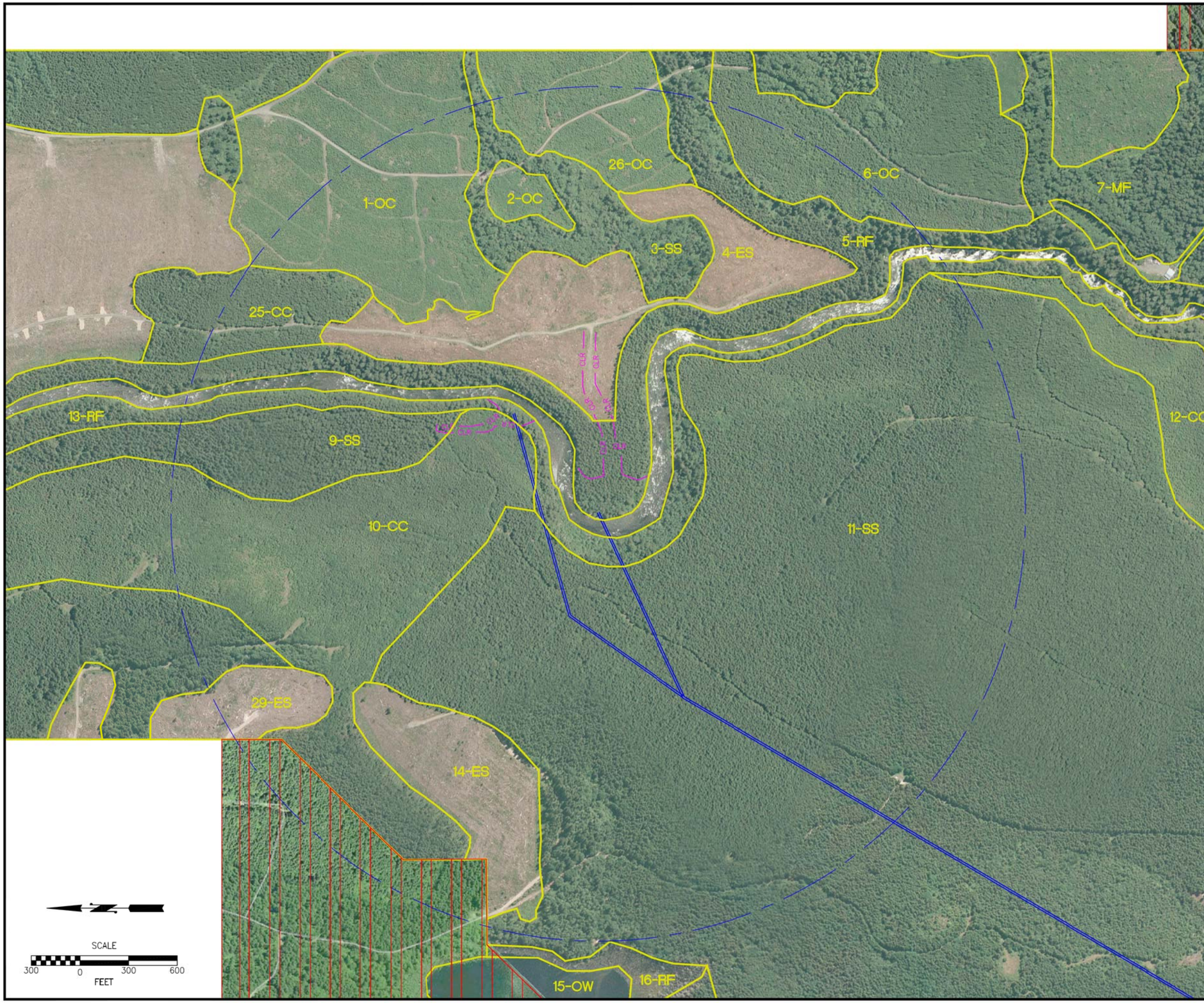
SCALE AS SHOWN

EX-1

SHEET 1 OF 3

Appendix II

Intake Area



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BLACK CANYON

VEGETATION COVER TYPES

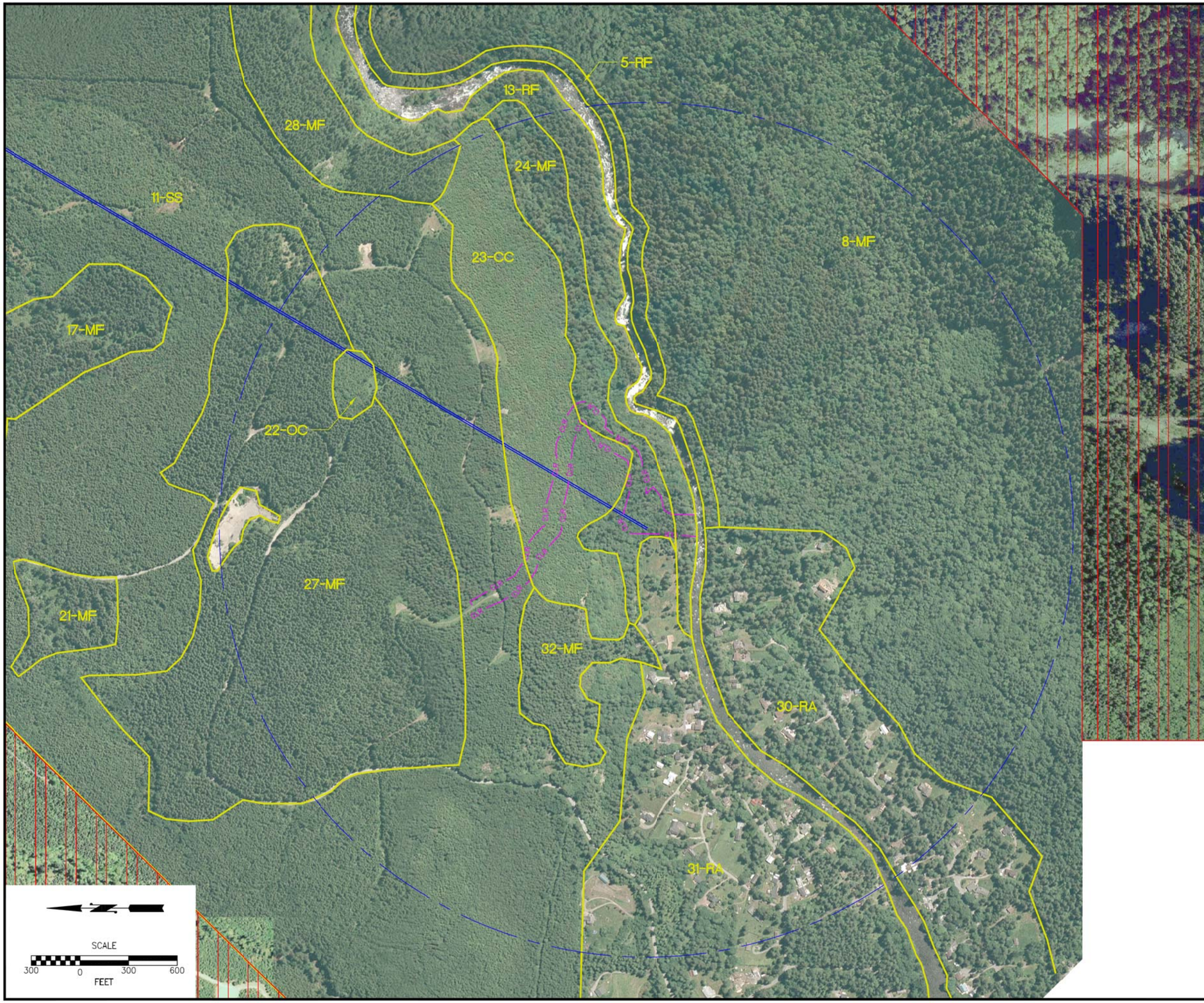
SCALE AS SHOWN

EX-2

SHEET 2 OF 3

Appendix III

Powerhouse Area



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32=MF

BLACK CANYON

VEGETATION COVER TYPES

SCALE AS SHOWN

EX-3

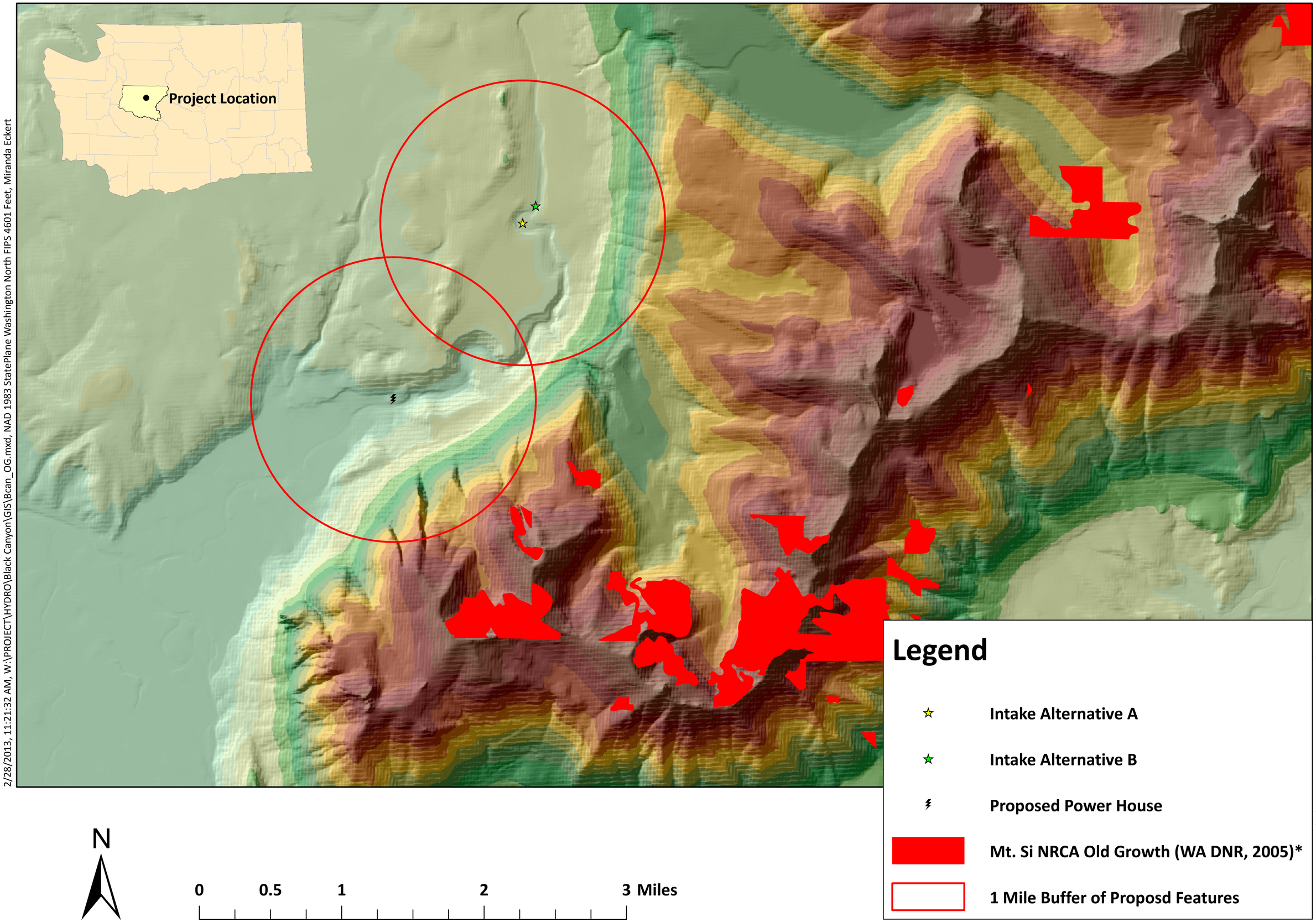
SHEET 3 OF 3

Appendix IV

Old Growth in DNR-Managed Lands

King County, Washington

Black Canyon Proposed Project and Old Growth Forest



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* Franklin, J.F., T. Spies, R. Van Pelt, et al. 2005. Definition and Inventory of Old Growth Forests on DNR-Managed State Lands. Washington State Department of Natural Resources. Olympia, WA