

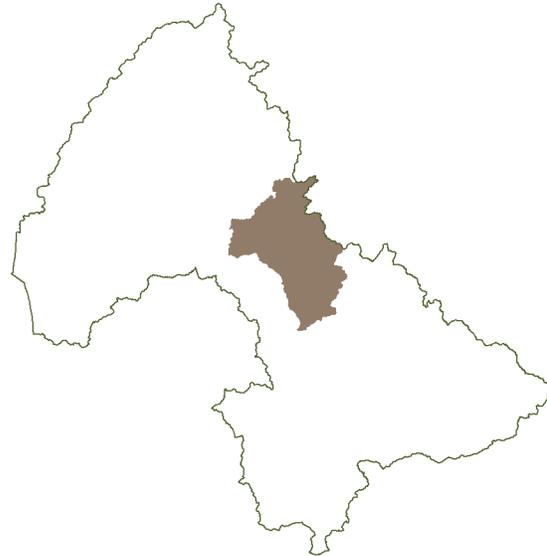
5.7 Black Hills Ecological Region

5.7.1 Overview

The Black Hills Ecological Region encompasses a number of independent tributaries to the Chehalis River that arise in the Black Hills, including Roundtree, Cedar, Gibson, Porter, Mox Chehalis, Wildcat, Cloquallum, Vance, and Newman creeks (Figure 5-13). All of these creeks arise in the glacially deposited Black Hills between Hood Canal and the Chehalis Basin, typically with headwaters dominated by wetlands and short drainages from about 150 to nearly 2,500 feet in elevation. The highest point in this region is also Capitol Peak at 2,659 feet in the Black Hills. This ecological region encompasses 215 square miles (greater than 137,000 acres) and represents approximately 8% of the overall Chehalis Basin.

The geologic landscape of the Black Hills Ecological Region was largely formed from the deposition of materials from continental glaciation. The Puget Lobe of the Cordilleran Ice Sheet extended into the Chehalis Basin at least twice, with the deposition of a terminal moraine north of Rochester (Gendaszek 2011). As the Puget Lobe retreated, meltwater channels drained south, creating a series of channels and valleys and depositing recessional glacial outwash in the Chehalis River and its tributaries (the Skookumchuck, Black, and Satsop rivers and Scatter Creek; Gendaszek 2011). The Black Hills Ecological Region has glacial lakes and relatively large areas of wetlands.

Precipitation in the Black Hills Ecological Region is dominated by rainfall, with 50 to 75 inches of average annual precipitation typically, but it features a convergence zone around the southeast corner of the Olympic Mountains and Hood Canal and can receive up to 200 inches of precipitation annually in the Porter, Mox Chehalis, and Cloquallum creek drainages.



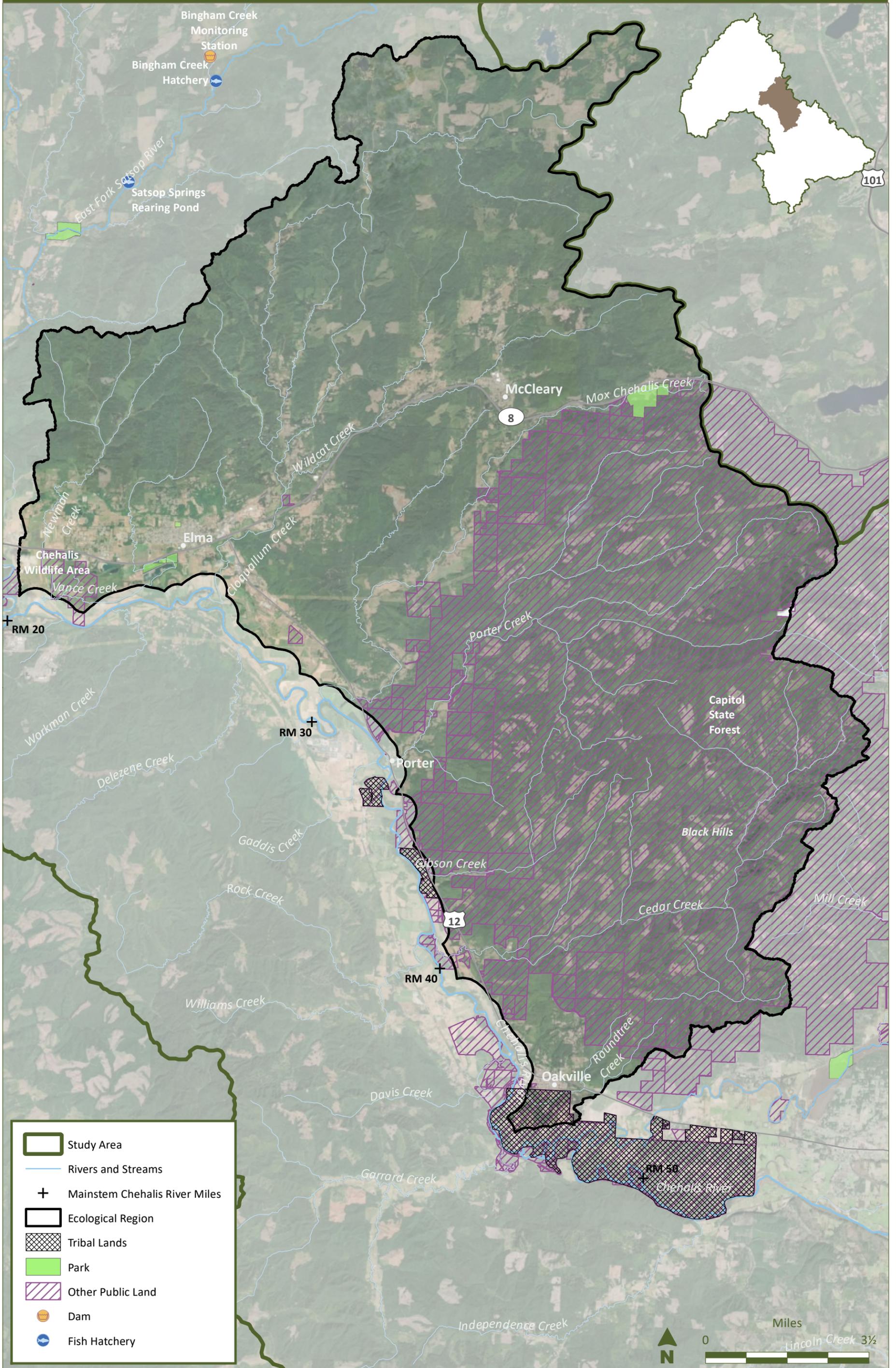
Important Features and Functions

- This ecological region is composed of relatively short woodland tributaries flowing south from the Black Hills into the Chehalis River. The lower sections (typically less than 0.5 mile) of these tributaries are often slough-like with low-gradient, slow- or no-flow habitat that contrasts with the riffle/pool or plane bed habitat observed throughout much of the rest of the streams.
- Several of the streams (such as Porter and Cedar creeks) are within the Capitol State Forest managed by WDNR, which offers protection of stream and riparian habitat. Habitat Conservation Plans developed for the managed forests retain riparian buffers that are essential for shading and wood delivery to stream channels.
- Underlying glacial geology can supply spawning gravel and groundwater recharge, and these creeks are an important cold-water inflow to the Chehalis River.

*Ecological Regions:
Black Hills Ecological Region*

The Black Hills Ecological Region is primarily within Grays Harbor County (97,561 acres, or 71%), with smaller portions in Mason County (20,536 acres, or 15%) and Thurston County (19,283 acres, or 14%). Cities and towns within this ecological region include McCleary, Elma, and Oakville.

Figure 5-13
Black Hills Ecological Region Map



Aerial Photo Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

5.7.2 Historical Conditions and Changes

Historical records for the pre-Euro-American settlement conditions are not available. GLO mapping from the late 1800s primarily shows steep timbered slopes, but survey notes indicate medium- to large-size cedar, fir, and hemlock present (considered first-rate timber). The Black Hills Ecological Region was likely historically dominated by old-growth Western hemlock and Douglas-fir forest on the hillslopes and cedar swamps and marsh wetlands in the headwaters of several creeks. It is likely there were abundant beaver and beaver ponds. Key changes that occurred in the Black Hills Ecological Region following Euro-American settlement were extensive timber harvest and agricultural development in the lower ends of the streams (primarily within the Chehalis River floodplain) and development of transportation corridors (including SR 12, SR 8, and railroad lines). Agricultural development as well as road, bridge, and residential construction likely also incrementally moved and straightened some of the rivers and creeks in the Black Hills Ecological Region over time.

To support the ASRP analysis and EDT modeling efforts, the SRT developed assumptions of the channel lengths and areas of floodplain habitat that were likely to be present in historical conditions. These assumptions were based on the GLO mapping from the late 1800s and interpretation of current LiDAR data that show remnant channels and other floodplain features. Streams in the Black Hills Ecological Region are unconfined to partly confined and low gradient within moderately sized valleys. Compared to historical conditions, the stream channel lengths do not appear to be significantly reduced, but side channels would have historically been more prevalent, and the streams could have had up to 3 times the area of frequently connected floodplain. Large wood has been removed from the channels throughout this region, and the streams are scoured to bedrock in some reaches.

5.7.3 Current Conditions

Current conditions reflect ongoing forest management, agricultural land uses, and residential and commercial development. Land cover in the Black Hills Ecological Region is approximately 47% coniferous forest, 18% scrub-shrub, 8% mixed forest, 7% developed, 6% grassland, 5% deciduous forest, 4% wetland, 4% agriculture, and small percentages of other cover²⁴ (Figure 5-14).

As noted previously, the Black Hills Ecological Region is primarily forested uplands, about half of which are contained within the Capitol State Forest. The remainder is a mix of small and large privately owned managed forest lands and rural residential or small agricultural properties. WDFW manages the Chehalis Wildlife Area along lower Vance Creek that is protected for waterfowl and other wildlife. An assessment of riparian conditions and functions by NOAA (Beechie 2018) found that levels of shading are only moderately reduced from the reconstructed historical conditions (i.e., in the managed forests), except on Vance and Newman creeks, where riparian conditions are poor, and in some reaches of Cloquallum and Wildcat creeks.

The stream channels were observed to lack wood in most reaches, and some reaches have been scoured to bedrock.

Black Hills Current Snapshot

Condition of Watershed Processes:

Hydrology –impaired
Floodplain connectivity – moderately impaired
Riparian condition – moderately impaired
Water quality – impaired

Restoration Potential: High

Protection Potential: Moderate

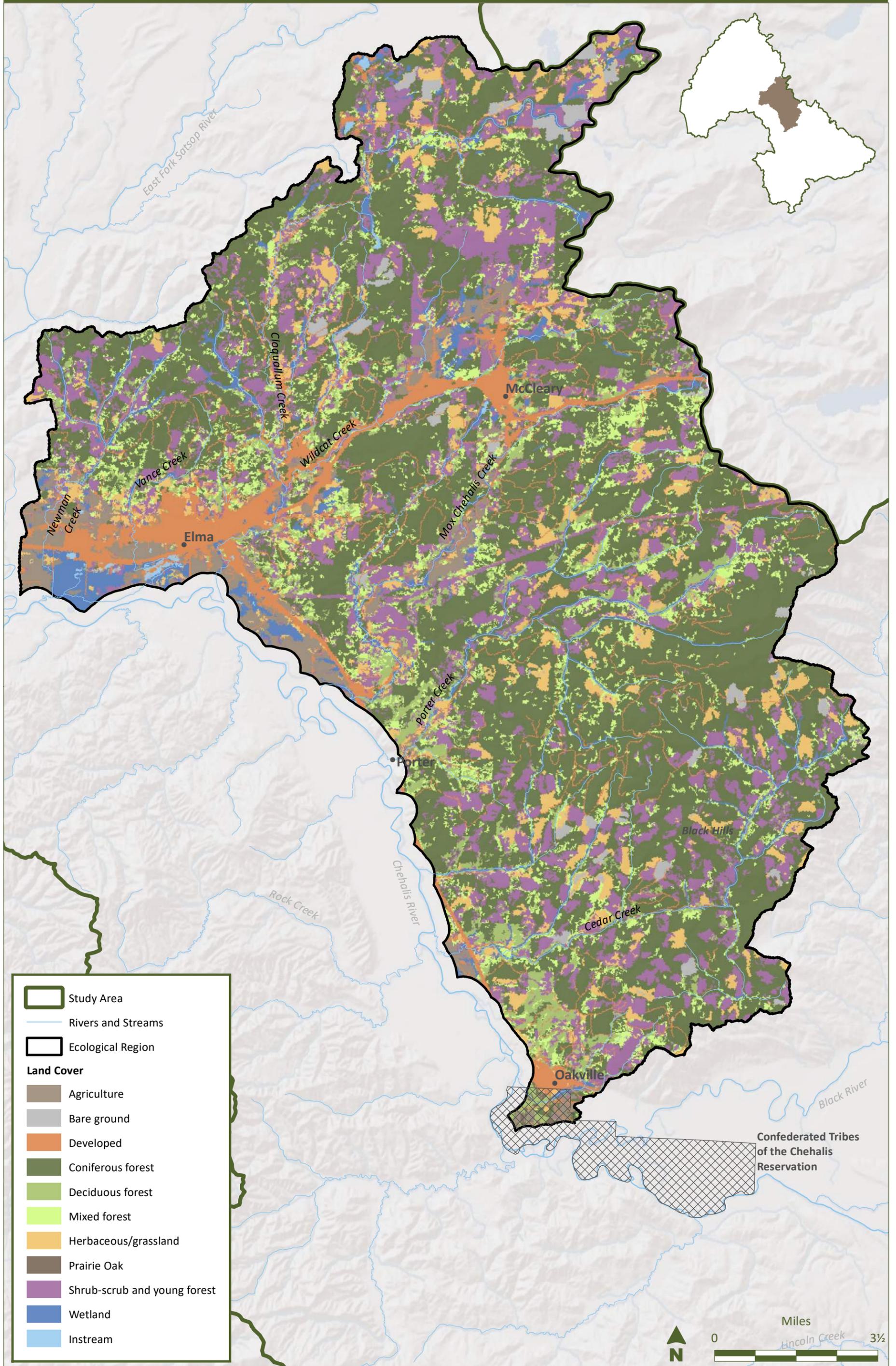
Geographic Spatial Units: Cedar Creek, Porter Creek, Mox Chehalis Creek, Cloquallum-Wildcat Creek, and Newman-Vance Creek

Salmon Use and Potential: Fall-run Chinook salmon, spring-run Chinook salmon (holding at tributary confluences), coho salmon, chum salmon, and steelhead

Non-Salmon Use and Potential: Coastal tailed frog, Oregon spotted frog, northern red-legged frog, Western toad, North American beaver, Olympic mudminnow, largescale sucker, mountain whitefish, Pacific lamprey, riffle and reticulate sculpin, speckled dace, great blue heron, Barrow's goldeneye, common goldeneye, and wood duck

²⁴ Land cover data from Multi-Resolution Land Characteristics Consortium, National Land Cover Database 2011, augmented by WDFW Habitat Guild 2015 floodplain data where available.

Figure 5-14
Black Hills Ecological Region Land Cover



Water quality is impaired in multiple reaches in the Black Hills Ecological Region, primarily for temperature, low dissolved oxygen, and bacteria (Ecology 2018). Recent temperature monitoring in lower Cedar and Porter creeks by Ecology (2015 data) indicates that temperatures regularly exceed water quality standards (16°C [61°F] core summer salmonid habitat) from May through September, and they typically exceed the 13°C (55°F) supplemental spawning incubation criterion (September 15 to July 1) from May to July (Ecology 2016, 2011a).²⁵

WDFW's Thermalscape model indicates that from 2013 to 2018, many stream reaches of the Black Hills Ecological Region (ranging from 39% [2018] to 91% [2014 to 2015] of reaches) had mean August temperatures equal to or exceeding 16°C (61°F) and are projected to increase to 98% and 99% of reaches in 2040 and 2080, respectively, without restoration actions (Winkowski and Zimmerman 2019).

The NOAA model that incorporates mature riparian conditions and anticipated climate change shows a likely future increase in summer water temperatures ranging from 1.5°C (2.7°F) to more than 2.5°C (4.5°F) by 2080 in the Black Hills Ecological Region, although some cooling potential exists for Vance and lower Newman creeks due to their current lack of riparian zone (Beechie 2018).

Existing wetland mapping (Ecology 2011b) indicates that many lowland or low gradient reaches along Mox Chehalis, Wildcat, and Cloquallum creeks and some of their smaller tributaries have a variety of associated wetlands, including emergent, shrub, and forested wetlands. No specific analysis of channel incision has been conducted for the Black Hills Ecological Region, but many of the streams have been scoured to bedrock or boulders, most likely due to removal of large wood and beaver dams from the channels. Approximately 100 fish passage barriers were incorporated into the EDT model²⁶ for the Black Hills Ecological Region, with the majority of those present in the Cloquallum Creek sub-basin. Vance, Newman, and McDonald creeks flow through urbanized areas of Elma; these creeks have been ditched and straightened and have numerous road crossings.

The salmonid species present in the Black Hills Ecological Region include fall-run Chinook salmon, coho salmon, chum salmon, and steelhead. Spring-run Chinook salmon hold at the confluence of some of these streams with the Chehalis River, as they provide cooler water (Holt 2018b). Non-salmon indicator species include Western toad, coastal tailed frog, northern red-legged frog, North American beaver, Olympic mudminnow, largescale sucker, mountain whitefish, Pacific lamprey, riffle and reticulate sculpin, and speckled dace. The bird indicator species present include great blue heron, Barrow's goldeneye, common goldeneye, and wood duck.

Occasionally, excess hatchery fish are released into Vance Creek Pond for sport fishing. Hatchery production in excess of program goals are released as fingerings into lakes without outlets.

²⁵ Cedar Creek typically remains below 20°C (68°F), while Porter Creek regularly exceeds 20°C (68°F) during the June-to-August time period (Ecology gage data).

²⁶ Fish passage barrier data from WDFW processed through EDT model.

5.7.4 Limiting Factors

Limiting factors for salmonids have been identified in several assessments of the Chehalis Basin, including EDT (ICF 2019) and NOAA modeling (Beechie 2018) conducted for the ASRP and earlier studies (GHLE 2011; Smith and Wenger 2001). Additional limiting factors and a diagnosis of what is working and what is broken in the ecological region were determined by the SRT, drawing on local basin knowledge and reconnaissance conducted within the region.

The combined results of these assessments indicate that the major issues for salmonids in the region are as follows (in relative order of importance):

- Low habitat diversity (lack of side channels, large wood, floodplain connectivity, and significant loss of beaver ponds)
- Fish passage barriers
- Reduced quantity and quality of instream habitats
- High water temperatures
- Predation (non-native fish species)
- Sediment conditions (fine sediments)
- Channel instability (bed scour and sediment transport)
- Low flows

These identified issues for salmonids are consistent with earlier findings from Smith and Wenger (2001) and the Chehalis Basin Lead Entity (GHLE 2011), which indicated that the key limiting factors in this ecological region include lack of large wood, gravel (sediment) conditions, fish passage barriers, floodplain conditions, riparian conditions, water quality, and water quantity.

Limiting factors and threats to non-salmon indicator species are not well understood but may include high water temperatures, changes in flow conditions and water level variations, fine sediments, riparian conditions, and non-native predator species (as identified for Pacific lamprey by Clemens et al. [2017]).

Diagnostic Snapshot

- Widespread loss of stable instream wood has resulted in extensive conversion of pool-riffle channels to plane bed channels. This has resulted in the loss of many miles of spawning habitat and hundreds of pools, as well as floodplain disconnection and the loss of floodplain habitat-forming processes.
- Several of the streams (such as Vance, Newman, and McDonald creeks) are urbanized.
- The existing riparian canopy provides good shading for smaller tributaries; species composition is primarily red alder, which provides shade but offers limited long-term large wood recruitment.
- The lower portions of Cedar, Mox Chehalis, and Cloquallum creeks provide temperature refugia for spring-run Chinook salmon.
- Substantial channel length lacks stable gravel.
- Invasive plant species, including reed canarygrass, are present.

5.7.5 Strategies and Actions in the Ecological Region

5.7.5.1 Habitat and Process Protection

Many of the protection actions described in Section 4.2.1 are appropriate in the Black Hills Ecological Region. Based on existing conditions, the following areas and actions are recommended for a protection focus:

- Ensure continued protection and management of riparian areas.
- Identify and protect areas with wetlands and cool-water inputs such as Cedar, Racoon, and Sand creeks.
- Protect areas with existing beaver ponds, such as Racoon Creek.

The majority of the Black Hills Ecological Region is within Grays Harbor County, which has regulations and policies in place to protect wetlands, floodplains, riparian areas, and fish and wildlife habitat conservation areas from degradation and development and manage invasive species. Grays Harbor County’s draft SMP that is currently in final review with Ecology contains regulations to protect channel migration zones and riparian vegetation, along with general development regulations related to shoreline areas in the County (Grays Harbor County 2018).

The northern portion of the ecological region is in Mason County, which has regulations and policies in place to restore shoreline ecological functions and floodplain connectivity, improve habitat for salmon populations, and protect wetlands and groundwater. They also have objectives to coordinate with nearby counties on conservation plans and programs to ensure that protection measures occur at the watershed scale.

The eastern portion of the ecological region is in Thurston County, which has regulations in place to



Streams within the Capitol State Forest could be easily restored by adding wood.



Mox Chehalis Creek and other Black Hills streams could be enhanced for off-channel and beaver pond habitat for coho salmon.



Larger streams such as Porter and Cedar creeks—with areas of forested riparian and relatively intact habitat—could be easily enhanced with wood and supplemental tree plantings to increase habitat potential and long-term wood recruitment.

protect water quantity and quality; maintain or increase forest cover; establish and protect riparian habitat; protect streams, wetlands, floodplains, and prairies from development; limit impervious surfaces; and allow channel migration.

As part of the community planning strategy (see Section 5.7.5.3), funding support to align the counties' regulations with the ASRP and conduct enforcement will be considered.

5.7.5.2 Restoration

The restoration actions described in Section 4.2.2 are all appropriate in the Black Hills Ecological Region. Based on existing conditions, the following areas and actions are recommended for a restoration focus:

- Restore and manage riparian areas.
- Address fish passage barriers.
- Place extensive stable instream wood to capture alluvium (finer gravel), increase variations in bed textures, increase the number of pools and cover, raise streambeds, and increase floodplain and groundwater connectivity. Large-scale loss of gravel in many Black Hills channels is a substantial restoration opportunity.
- Construct beaver dam analogs and promote beaver use and creation of beaver ponds.
- Put immediate effort into restoring Porter, Cedar, and Sherman creeks with large wood augmentation.
- Protect and enhance areas around confluences with the mainstem Chehalis River to provide deep cold-water pools for spring-run Chinook salmon holding.
- Restore riparian and floodplain habitats along lower ends of streams where they enter the Chehalis River valley.

Priority areas for restoration in the Black Hills Ecological Region include Cloquallum, Porter, Cedar, and Sherman creeks.

5.7.5.3 Community Planning

As noted in Section 4.2.3, community planning actions would be coordinated with state and local governments, landowners, and other stakeholders to ensure the long-term success of the ASRP. Focus programs and policies that could be developed or investigated in the Black Hills Ecological Region include the following:

- Improve water typing for improved forest management around creeks.
- Discuss with Grays Harbor County additional planning measures that could effectively promote and protect the following:
 - Surface and groundwater supplies through reduction of withdrawals
 - Minimization of impervious surfaces
 - Improved wood recruitment for retention of spawning gravel and sources
 - Increasing channel migration

- Discuss with Thurston County additional planning measures that could effectively promote and protect the following:
 - Floodplain connectivity
 - Surface and groundwater supplies through reduction of withdrawals
 - Improved wood recruitment for retention of spawning gravel and sources
- As the Chehalis Basin Strategy becomes more integrated, coordinate the ASRP with the CFAR program to build habitat restoration and protection actions into community flood risk reduction efforts (such as restoring areas where structures and people have been relocated from floodplains).

5.7.5.4 Community Involvement

As noted in Section 4.2.4, community involvement and voluntary landowner participation are essential to the success of the ASRP, and the actions described in that section will be further evaluated for the Black Hills Ecological Region in Phases 2 and 3 based on the restoration and protection scenario selected. Based on the specific issues in this area, the following actions are recommended for focused community involvement:

- Continue outreach, engagement, and involvement processes to incorporate landowner expertise into ASRP planning and local implementation efforts.
- Partner with and support the efforts of existing local organizations (see Appendix E for a list of potential partner organizations).

5.7.5.5 Institutional Capacity

The institutional capacity strategy is intended to build on and support the work of existing organizations, as well as support creativity in how local organizations approach working toward the goals of the ASRP. The actions described in Section 4.2.5 will be further evaluated for the Black Hills Ecological Region in Phases 2 and 3 based on the restoration and protection scenario selected. Based on the specific issues in this area, the following focused institutional capacity actions are recommended:

- Provide additional support for the small forest landowner program.
- Provide training on improved processes for water type-based decisions at the counties.
- Provide technical training on process-based restoration practices and principles.
- Provide funding for groups and individuals interested in restoration projects.
- Build on and support the work of existing organizations with missions that overlap with the ASRP vision (see Appendix E for a list of potential groups).