Chapter 5 Natural Environment

Introduction

This element discusses DuPont's natural environment including shorelines, geology and soils, freshwater, marine waters, groundwater, floodplains, plants and animals, climate, and hazard mitigation.

The City of DuPont is defined by its distinctive setting, which includes Puget Sound, a network of creeks, ponds, wetlands, rolling terrain, and forested woodlands. These natural features shape the city's character. This plan provides policy guidance to integrate the natural and built environments, ensuring that DuPont's development and operations remain in harmony with its ecological, geological, and topographical context.

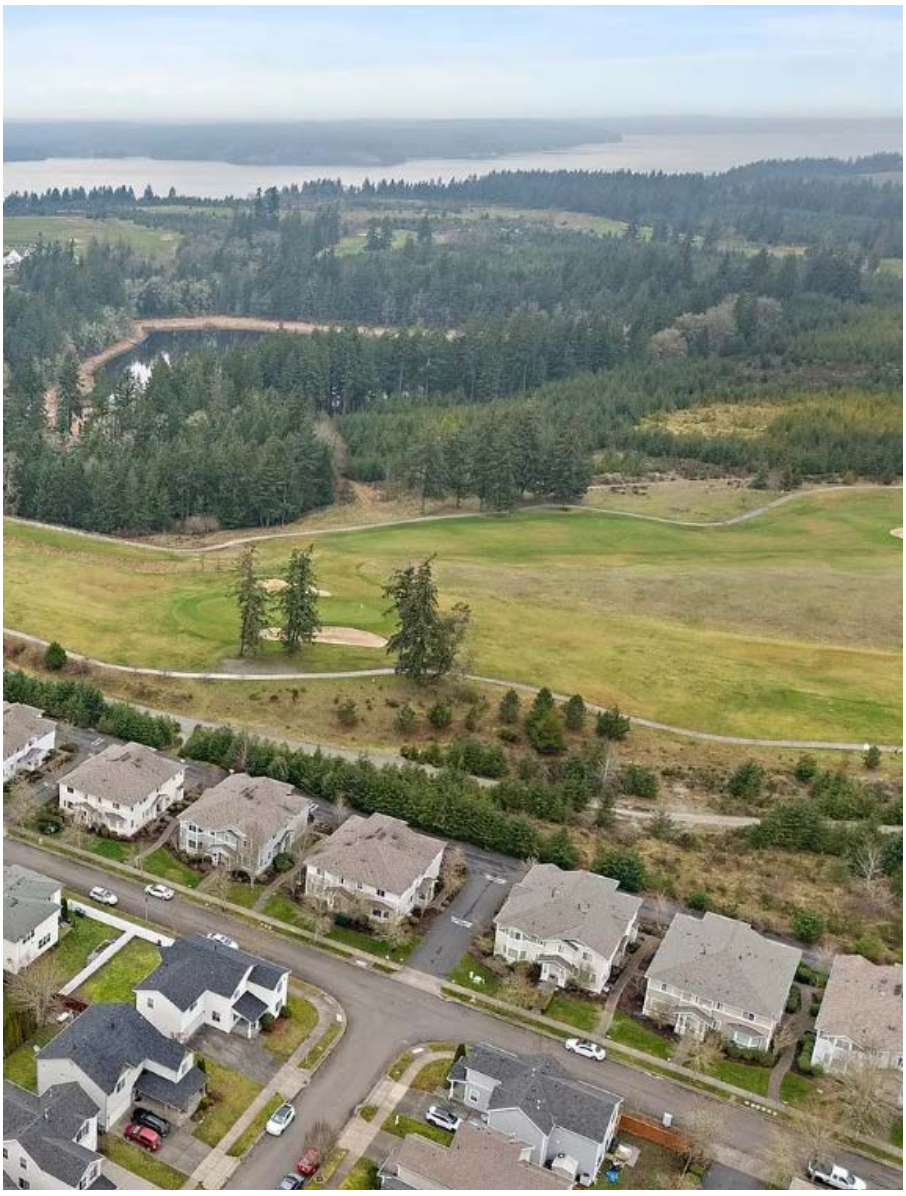
Shorelines

DuPont's shorelines include the Puget Sound and the Sequalitchew Creek Brackish Marsh. Lands extending 200-feet from these shorelines, landward of the ordinary high watermark (OHWM), cover approximately 89 acres and about 3.5 lineal miles. This area defines the shoreline jurisdiction subject to the City's Shoreline Master Program (SMP). The SMP contains goals, policies, regulations, and a use map that guide the development of shorelines in accordance with the Shoreline Management Act (SMA) (RCW 90.58), Ecology SMP Guidelines (WAC 173-26), and Shoreline Management Permit and Enforcement Procedures (WAC 173-27). The City originally adopted a SMP in 1975 and has amended it over time. The SMP was substantially updated when a new version was adopted in January 2013 and the latest amendment to the DuPont SMP was adopted in May 2020.

Geology and Soils

The DuPont planning area consists of undulating uplands, or glacial drift plains, situated about 200 feet above mean sea level and moderate to steep slopes along Puget Sound (ranging from 30 to 65 percent) and Sequalitchew Creek (ranging from 30 to 75 percent). Hoffman and Bell Hills rise above the uplands, with elevations ranging from 260 to 400 feet. The ground surface drops off to Edmond Marsh north of the Historic Village and southwest of the Historic Village to Lake Sellers.

The predominant soil types in DuPont include the *Spanaway*, *Everett*, and *Alderwood* soil series (U.S. Department of Agriculture, Soil Conservation Service, 1979). Additionally, *Kitsap* and *Nisqually* soils are found in the southwestern portion of the city, while *DuPont Muck*, typically associated with marshy areas, is also present in various locations throughout the area.



Data on geologic conditions near the mouth of Sequalitchew Creek show that gravel, silty sand, and gravelly fine to coarse sand are the predominant sediments in the marine area of the creek delta.

Soil Contamination and Remediation

Soils within production areas of the former DuPont Works site were found to be contaminated with chemical compounds associated with former explosives manufacturing. Of these chemicals, lead and arsenic are the primary contaminants. Other lesser contaminants are dinitrotoluene (DNT), trinitrotoluene (TNT), mercury and petroleum.

Remediation of the site was conducted under a Consent Decree with oversight from Washington State Department of Ecology. Groundwater and surface water were studied and a determination was made that treatment was not required. The remediation efforts were conducted under the Consent Decree, with oversight from the Washington State Department of Ecology. By 2006, all cleanup activities were completed, and the site was released for development in 2007. The following describes the general cleanup timeline and process:

- In 1991, the Department of Ecology, Weyerhaeuser Company, and DuPont Company signed a Consent Decree under the state's Model Toxics Control Act (MTCA) to conduct remedial cleanup activities at the site. The Department of Ecology, in accordance with statutory provisions, determined the final cleanup actions and standards for both areas covered by the Consent Decree.
- In 2000, the Department of Ecology was the lead agency in preparing the Draft Environmental Impact Statement (EIS) for the cleanup proposal.
- *Consent Decree Area #1*, spanning 636 acres south of Sequalitchew Creek, was the first part successfully cleaned and cleared for development. Under an agreement between DuPont and Weyerhaeuser, this area is restricted to non-residential development and use.
- *Consent Decree Area #2,* covering 205 acres north of Sequalitchew Creek, was remediated and then released for industrial use by the Department of Ecology in 2002.
- According to a January 1995 draft study issued to the Washington State Department of Ecology by the DuPont and Weyerhaeuser Companies, over 75,000 tons of contaminated soils have been removed from the site through interim activities. An additional 600,000 to 1,100,000 cubic yards were remediated through placement in discrete areas and were capped with the golf course. Any soils that could not be safely placed under the containment cap were treated and removed from the site. Groundwater and surface water do not require treatment.

Soil/Slope Stability

Soil type and slope degree are key factors in determining the suitability of a site . Within DuPont, soil and slope stability are particularly vulnerable to the effects of earthquakes (seismicity). Soils on the steep slopes of the Sequalitchew Creek ravine, as well as those on the side slopes of glacial kettles, ponds, and depressions, are more prone to erosion and slope failure compared to flatter upland areas. While the slopes adjacent to Puget Sound and Sequalitchew Creek are generally stable, areas with Kitsap soil formation are exceptions. The risk of slope failure increases in areas where the Olympia Bed Formation and associated springs and seeps discharge from the overlying Vashon Drift Aquifer, particularly along Sequalitchew Creek.

Seismicity

The Puget Sound region is highly susceptible to earthquake damage. Two surficial geologic units are particularly vulnerable to earthquake hazards: alluvial deposits and recessional outwash. Significant seismic hazards, particularly those with the highest risk of damage, align with the alluvial plain of the Nisqually River. The unconsolidated soils in this area make it especially prone to liquefaction during large earthquakes. Recessional outwash, found throughout the entire DuPont planning area, also contributes to seismic vulnerability.

According to the Washington State Coastal Atlas, developed and maintained by Ecology, slope stability is described as modified along the entire western City boundary abutting the Puget Sound shoreline and ranges from moderate to unstable upland and inland and along the Sequalitchew Creek Ravine. Ecology describes modified slopes as areas highly modified by human activity and includes areas of significant excavation or filling. Modified slope response to a combination of natural processes and human activities may be unpredictable. Intermediate slopes are described as generally steeper than 15 percent except where conditions such as weaker material and/or abundant groundwater exist. Identified areas include slopes of sand and gravel, till, or thin soils over bedrock which have no known failures. Unstable slopes are described as areas of landslides.

Freshwater

Chambers-Clover and Nisqually Watersheds

DuPont falls within two Water Resource Inventory Areas (WRIA), the Chambers - Clover watershed – WRIA 12 and the Nisqually watershed – WRIA 11. The Washington Department of Ecology (Ecology) states that "WRIAs are areas defined by higher elevation that capture precipitation and funnel rain and snowmelt through smaller subbasins into streams, tributaries, and rivers." WRIA 12 is referred to as the Chambers-Clover watershed and includes the areas of the City north of McNeil Street. WRIA 11 is referred to as the Nisqually watershed and includes the areas of the City south of McNeil Street known as Hoffman Hills. Ecology regulates and manages water availability for each WRIA through the adoption of a Watershed Restoration and Enhancement Plan. The WRIA 12 and 11 Watershed Restoration and Enhancement Plans were adopted by Ecology respectively in 2021 and 2019.

Sequalitchew Creek

Flow from Sequalitchew Lake into Sequalitchew Creek begins at the outlet of Sequalitchew Lake (RM 3.05) where an adjustable-height diversion weir was installed to help control the water elevation of the lake. The flows in the area are controlled by this weir, associated culverts, a secondary diversion weir, and multiple beaver dams. Under the diversion weir's original design, outflow from Sequalitchew Lake would flow into Sequalitchew Creek, and would overflow to the diversion canal if the lake elevation exceeded 211 feet (Aspect 2004a). However, the continued presence of beaver dams in Sequalitchew Creek has prevented the flow from the lake to Sequalitchew Creek, and instead forced the outflow from the lake to the diversion canal.

Downstream of Sequalitchew Lake, Sequalitchew Creek flows for 1.5 miles through extensive wetland complexes, including Edmond Marsh. Within these wetland complexes, Sequalitchew Creek is characterized by low gradient, glide-pool habitat that is impounded by beaver dams and choked with dense brush thickets (Runge et al. 2003). The water level in Edmond Marsh rarely rises high enough to discharge into Sequalitchew Creek near the Center Drive bridge crossing, as evidenced by the lack of a defined channel and the presence of upland vegetation growing in the channel. Prior to construction of the diversion canal, Edmond Marsh frequently overflowed into Sequalitchew Creek.

The lower 1.4 miles of Sequalitchew Creek, between the Center Drive bridge and the Puget Sound shoreline, descends through a ravine that parallels the southern boundary of the proposed expansion area. The uppermost reach of the ravine is typically dry from the west end of Edmond Marsh to the first identified springs about 300 feet west of Center Drive. Flow at this location is intermittent. Remnants of the old dam and power works are located here as well.

The channel drops approximately 220 feet in elevation in 7,750 feet (average slope of 2.8 percent) between Center Drive and the brackish marsh located directly upstream of the railroad embankment (USGS 1981). The channel is confined by ravine slopes ranging from 30 to 80 percent for an average slope of 60 percent.

Sequalitchew Creek Trail is a popular pathway linking City Hall to Puget Sound. (Source Studio Cascade Inc.)

The brackish marsh was cut off from Puget Sound by the construction of the railroad berm in 1912 (Andrews 1994), and a culvert was constructed around 1936. Since then, the discharge of Sequalitchew Creek has varied as upstream natural modifications (e.g., beaver dams) and unnatural modifications (e.g., diversion for hydroelectric power and to control the elevation of Sequalitchew Lake, channelization of wetlands to increase fish passage) have been installed and removed by the DuPont Works, Corps of Engineers, and the Washington Department of Fish and Wildlife (WDFW) (Ch2MHill 2003; Andrews 1994).

Throughout much of this time period, which includes 40 years prior to the 1952 Corps installation of the diversion at the outlet of Sequalitchew Lake, flows in lover Sequalitchew Creek were several times greater than the current flows. This would indicate that the sediment load in the creek and rate of deposition in the marsh were also greater than they are today (Anchor 2004c).

Several springs that provide hydrology to Sequalitchew Creek are located along the north and south banks of the stream, between approximately 0.6 miles to 1.1 miles upstream of the mouth (Anchor 2004b). Until recently, an abandoned narrow gauge railroad bed paralleled the north bank of Sequalitchew Creek. This former railroad has been removed and a trail now exists in the location of the former track. This trail intercepts ground water springs on the north bank of Sequalitchew Creek and collects the runoff in ditches that are culverted beneath the access road to Sequalitchew Creek. These ground water springs emanate at the interface between the Vashon Drift and underlying Olympia Beds (geologic units) and currently provide most of the flow in lower Sequalitchew Creek and maintain base flow during the summer months (CH2M Hill 2003a).

Between 1949 and 1954 Sequalitchew Creek was dammed and diverted by the U.S. Army at Sequalitchew Lake. A canal channels this diversion to an outfall at Tatsolo Point on Puget Sound. The result of this diversion is the virtual elimination of historic flows in Sequalitchew Creek and degradation of Edmond Marsh.

On August 22, 1986 DuPont petitioned the State Department of Ecology (Ecology) to remove Sequalitchew Creek and its associated wetlands from the designation as a shoreline of the state because it fell under the 20 cfs threshold mandated by the Shoreline Management Act. On November 19, 1986 Ecology approved the request. On October 9, 1991 the DuPont City Council approved an ordinance removing Sequalitchew Creek and its associated wetlands from the designation as a shoreline of the state (Ord. No. 439).

Sequalitchew Creek Springs

One major spring and several smaller seeps are located along the north and south banks of Sequalitchew Creek canyon. Flows originating from the Vashon Drift Aquifer; discharge from the spring has not been gauged.

Wetlands

A total of 14 wetlands, including forested swamp, scrub/scrub swamp, and emergent marsh wetlands, are located throughout the City. Some of these wetlands are associated with the Sequalitchew Creek system (e.g., Edmond Marsh) and are fed by the Vashon Drift Aquifer. A small, fresh-water wetland is located in a glacial kettle north of Sequalitchew Creek (in the existing industrial area). The glacial kettle wetland is also fed by the Vashon Drift Aquifer. A number of smaller, seasonally wet kettle depressions are located throughout the City. A saltwater influenced marsh is located at the mouth of Sequalitchew Creek.

A number of small ponds are also located within the City and include Strickland Lake, Grant Lake, Lake Sellers, and Pond Lake. Old Fort Lake, which is 14 acres in size, is the largest lake within the City; its depth varies with the groundwater level. Edmond Marsh, is the largest wetland with an area of 134 acres.

Marine Waters

Nisqually Delta

A large delta has formed where the Nisqually River enters Puget Sound. The Delta extends northward from the mouth of the Nisqually River to a point approximately three-quarters of a mile from Lyle Point on the southern end of Anderson Island (or just over one-quarter mile from the mouth of Sequalitchew Creek (NOAA, 1989). Water quality of the delta is largely influenced by mixing of fresh and marine waters. Violations of Class A standards for fecal coliform bacteria have been observed in the Nisqually River and estuary. These violations generally correspond to periods of high water runoff (December to February).

The Nisqually National Wildlife Refuge, managed by the US Fish and Wildlife Service (USFWS) and additionally stewarded by the Nisqually Tribe, includes approximately 2,810 acres of the delta/estuary region lying north of I-5, and includes portions of the un- diked salt marsh, upland bluffs, and Red Salmon Creek.

Nisqually Reach

The Nisqually Reach, one of the southernmost arms of Puget Sound, separates the Nisqually Delta from Anderson Island was designated an "Aquatic Reserve" by the Washington State Department of Natural Resources in 2011 due to its unique and irreplaceable ecosystem functions. The reach has two flood and ebb tides daily. Tidal influence extends about 4 miles up the Nisqually River.

Approximately every 8 days, the water in Nisqually Reach is replaced, contrasting with 56 days for southern Puget Sound. The Nisqually Reach is designated as Class AA marine water. Two significant point sources of pollution to the Reach are found near Tatsolo Point (approximately 2 miles north of the City); these are the Tatsolo Point wastewater treatment plant and a storm drainage canal originating from Hamer Marsh.

The Nisqually Reach borders the City of DuPont where it meets the Puget Sound. (Source Studio Cascade Inc.)

Intertidal Springs

Several seeps are located along the Nisqually Reach bluff. Flow for these springs originates from the Sequalitchew Delta Aquifer. A large intertidal spring is located about 800 feet north of the mouth of Sequalitchew Creek and a smaller seep is located south of the mouth of Sequalitchew Creek.

Groundwater

Aquifers identified as underlying portions of the City of DuPont include the Vashon Drift, Sequalitchew Delta, Salmon Springs (Flett Creek), Stuck (Lakewood) Glacial Drift, Orting (Lone Star), and an Unnamed Glacial Aquifer (Qugl). In general, several low permeability soil layers (aquitards) and other aquifers separate the near surface aquifers (Vashon Drift and Sequalitchew Delta) from the deeper aquifers (such as the Stuck, Orting, and Qugl).

The City of DuPont's four primary water supply wells are developed in the Upper Salmon Springs aquifer (Bell Hill No. 1 and 3, and Hoffman Hill Wells). Bell Hill Well No. 2 is not developed in the same aquifer as wells No. 1 and 3 and Hoffman Hill. Bell Hill Well No. 2 is developed in the Undifferentiated/Outwash/Lakewood Glacial aquifer.

Floodplains

Floodplains are critical components of the natural environment, providing ecological, hydrological, and societal benefits. In DuPont, WA, floodplains are primarily associated with the Sequalitchew Creek watershed and other low-lying areas influenced by surface water and stormwater flows. These areas serve as vital natural systems for flood storage, groundwater recharge, water quality improvement, and habitat for wildlife. Protecting and managing floodplains is essential for public safety, environmental sustainability, and resilience to climate change.

Floodplains provide habitat for fish and wildlife species, including migratory birds, amphibians, and salmonids, by supporting riparian vegetation and maintaining wetlands. They also facilitate sediment transport and nutrient cycling, enhancing overall watershed health. In DuPont, preserving floodplain ecosystems is critical to maintaining biodiversity and the integrity of Sequalitchew Creek.

Flood risk in DuPont is relatively low compared to other regions in Washington State due to its topography, but localized flooding may occur during heavy rainfall events. To mitigate flood risk, the City enforces regulations consistent with the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP). These regulations restrict development within floodplain areas, reducing the potential for property damage and ensuring the safety of residents. The City will continue to identify and map floodplain areas in collaboration with FEMA and Ecology. Updates to critical area ordinances, development regulations, and the City's stormwater management program will reflect current best practices in floodplain protection.

Plants

Upland areas within the City are primarily dominated by second-growth Douglas fir and western hemlock forests, which have been thinned across much of the site. The understory is typically composed of salal, Cascade hollygrape, dewberry, oceanspray, twinflower, and hazelnut. In more open areas, you may also find Pacific blackberry, Scotch broom, common snowberry, hairy cats-ear, sheep sorrel, common sword fern, and bracken fern. Along the bluffs of Puget Sound, coniferous forest and shrub vegetation thrive, with Douglas fir and salal dominating the forest. Openings along the bluff and on south-facing slopes host madrone, poison oak, and a few Pacific yew trees.

Parts of the upland areas have been heavily disturbed by previous DuPont Works operations, with sections of land being graded, mined, or otherwise altered. These disturbed areas are now dominated by invasive, non-native plants, including Scotch broom and evergreen and Himalayan blackberry.

Sequalitchew Creek is flanked by a second-growth mixed forest, primarily western hemlock and red alder established in the early 20th century. Other common species in the area include vine and big-leaf maples, Pacific yew, western red cedar, and Pacific dogwood. The shrub understory is dominated by Pacific blackberry, red elderberry, salmonberry, and Oregon grape, while common sword fern, stinging nettle, lady fern, false lily-of-the-valley, Siberian montia, licorice fern, and western trillium are also abundant. A similar mixed forest community can be found on the west slope of Hoffman Hill.

Oak Savannah

A former, expansive oak savannah, covering approximately 131 acres, once stretched from the western edge of Edmond Marsh to just north of the JBLM Golf Course. The densest concentration of this savannah can still be found within Powderworks Park on the northeast side of Yehle Park Village and in a three-acre area east of Hammond Avenue in Palisade Village.

This oak/grassland community serves as a transitional zone between the coniferous forests to the west and contributes to the area's species biodiversity. Approximately 70 percent of the trees in this area are Oregon white oak, many of which are over 200 years old. The understory is characterized by species such as Scotch broom, common snowberry, hairy cats-ear, and various grasses. Oak communities like this one are designated as Priority Habitat by the Washington Department of Fish and Wildlife.

According to the Washington Department of Wildlife, Oregon white oak woodland/grassland communities are quite rare in the state. These communities represent potential habitat for both the western gray squirrel and western bluebird (both listed as sensitive species by the state), as well as a diversity of other plant and animal species. The Department of Wildlife has stressed urgency for protection of these communities from further cutting or development[1].

Oak woodlands are identified as critical fish and wildlife habitat areas in Pierce County's Sensitive Areas Ordinance (Ordinance No., 91-120S5). Oak woodlands are defined to include areas where Oregon white oak comprises more than 20 percent of the trees in a stand, and where the stand is one acre or greater in size. The ordinance emphasizes and encourages education, information and voluntary action to enhance, protect, rehabilitate, and restore critical species and habitats.

[1] "Best management practices for mitigating impacts to Oregon white oak priority habitat" by Washington Dept. of Fish and Wildlife, January 2, 2024 available online at https://wdfw.wa.gov/sites/default/files/publications/02465/wdfw02465.pdf

The Pierce County critical areas ordinance 2024 draft update describes Oregon white oaks as indicators of critical wildlife habitat or presence and identifies them as habitat conservation areas. Per the Pierce County's 2024 draft critical areas ordinance, Oregon white oak woodlands, stands, and individual trees meeting the following criteria shall be considered priority habitat and shall be subject to protection under the provisions of this Chapter:

a. Priority Oregon White Oak Woodlands. Stands of Oregon white oak or oak/conifer associations where the stand is at least one acre in size and the canopy coverage of the oak component of the stand is greater than or equal to 25 percent. (See Figure 18E.40-1 in Chapter 18E.120 PCC.)

b. Significant Oaks and Stands. Within the urban growth area, single oaks or stands of oaks smaller than one acre in size when any of the following criteria are met:

   i. Individual trees having a diameter at breast height of 20 inches or more; or

   ii. Oregon white oak stands in which the oak trees have an average diameter at breast height of 15 inches or more regardless of stand size.

Oak protection provisions are established under the DuPont Municipal Code tree retention regulations under 25.120.040. DuPont's groves of Oregon white oaks are recognized as a unique resource that demands separate treatment. Accordingly, in 1996, Jones & Stokes Associates, Inc., prepared oak management recommendations under contract to the City. To implement those recommendations, Oak management mapping units were established under Ord. 02-707 and codified in this chapter. The oak management map is held at the City's office and identifies the location of the oak stands for which regulations under DMC 25.120.040 apply. [insert oak management map]

Prairie

A grassland prairie grows on about 198 acres in the northeastern portion of the City (adjacent to and including portions of the JBLM Landfill). Common species in this area include Idaho fescue, Puget balsamroot, meadow death-camas, Scotch broom, kinnikinnick, and black hawthorn.

Wetland Plants

Previous studies[2] have documented thirteen freshwater wetlands scattered across DuPont, primarily located in glacial kettles. The largest of these is Edmond Marsh, which spans 134 acres. Vegetation consists of non-persistent emergent, persistent emergent, and scrub-shrub wetland plant associations. Dominant herbaceous species include reed canary grass, slough sedge, toad rush, and soft rush. Scrub-shrub areas are mainly composed of red-twig dogwood, willow, hardhack, and climbing nightshade.

A saltwater-influenced marsh, approximately half an acre in size, is situated at the mouth of Sequalitchew Creek. The lower, seaward portion of the marsh is dominated by tufted hair-grass, bent grass, fat hen, western dock, Lyngbye's sedge, and various species of Hordeum. The higher areas feature Douglas aster and other less salt-tolerant species such as yarrow and marsh cinquefoil. An eelgrass bed extends off the western shoreline, reaching northward beyond the creek's mouth.

Rare Plants & Plant Communities

The white-top aster, commonly found in association with open oak woodland/grassland communities, is a state-listed sensitive plant species and a federally listed "Candidate 2" species. A moderately sized grouping of white top asters was identified during site investigations for the Glacier Northwest Mining Facility (approximately 50 feet west of the north/south access road).

Animals

The diverse plant communities within DuPont and the Nisqually Delta provide habitat for a wide range of wildlife species. As many as 159 bird species, 21 mammal species, and 6 reptile and amphibian species have been observed in the area.

[2] Previous studies document the wetland locations and characteristics at the time the study was performed and are not to be used for permitting purposes, as wetland delineation and ratings can change over time.

Birds

A wide variety of songbirds, waterfowl, game birds, and raptors have been observed in DuPont and the adjacent Nisqually Delta area. Common land birds include swallows, thrushes, nuthatches, kinglets, siskins, warblers, chickadees, wrens, sparrows, jays, finches, crows, and blackbirds. Other bird species in the area include blue and ruffed grouse, California quail, band-tailed pigeons, mourning doves, pileated and hairy woodpeckers, common flickers, and red-breasted sapsuckers. Concentrations of nesting birds have been identified in the pasture area of the oak savannah, in a forested area north of Sequalitchew Creek, and near the creek's mouth.

An adult band-tailed pigeon (Source Creative Commons Zero)

The Washington Department of Fish and Wildlife (DFW) recognized that the DuPont area provides important habitat for the band-tailed pigeon. DFW data and staff interpretations confirm both sightings and habitat use in the area. Management recommendations for those species include preservation of any mineral springs and particular vegetation providing food. In April 1994, representatives from the Department of Ecology, the Nisqually Delta Association, and Weyerhaeuser Real Estate Company (WRECO) toured the Hoffman Hill area. Following this visit, an expanded buffer corridor was established extending inland from the bluff around Hoffman Hill to protect and support the species' habitat.

The Nisqually Delta serves as the major non-coastal nesting and feeding area for migrating waterfowl and shorebirds between Skagit Flats and the Columbia River. Water birds frequently observed in Puget Sound near DuPont and the Delta include gulls, grebes, loons, scaup, scoters, common murres, and rhinoceros auklets. Pigeon guillemots and marbled murrelets have also been observed, though less frequently. The highest concentrations of water birds typically occur during the fall and winter months.

Raptors commonly observed in DuPont include red-tailed hawks, Cooper's hawks, and great-horned owls. Other raptors spotted in the surrounding area include turkey vultures, sharp-shinned hawks, bald eagles, ospreys, American kestrels, barn owls, and short-eared owls.

Mammals

The extensively forested habitat, including the oak savannah, supports an abundance and diversity of animal species. Most of the mammal species in the area are herbivores, including striped skunk, beaver, muskrat, porcupine, snowshoe hare, eastern cottontail, opossum, and black tail deer. Shrub and forb growth in more open forested areas provide excellent habitat for herbivores, such as deer.

Mammalian predators observed within DuPont include the cougar, coyote, longtail weasel, and raccoon. Smaller mammals found in the terrestrial habitats include western gray squirrel and chickaree, moles, shrews deer mice, and jumping mice.

Gray whales have been reported infrequently in the area during migration in the spring. Harbor seals and the otter are common in the area.

Reptiles & Amphibians

Reptiles and amphibians observed within DuPont are generally common in the region. The most abundant and widespread species include Pacific tree frogs and red-legged frogs (a federal candidate species). Northern rough-skinned newts are also abundant. The bluffs along the shoreline provide habitat for northern alligator lizards and western fence lizards.

Rare Animals & Birds

Wintering peregrine falcons, formerly classified as endangered under the Endangered Species Act[3], are typically found along Washington's coastal areas. These falcons inhabit intertidal mudflats and estuaries, where they perch on pilings, large trees, and snags to scout for prey, such as shorebirds and ducks, commonly found in estuarine habitats. Although peregrine falcons have not been observed within DuPont, the mouth of Sequalitchew Creek presents potential foraging habitat for these raptors. Additionally, the large trees and snags along the bluff may serve as suitable hunting perches for the species.

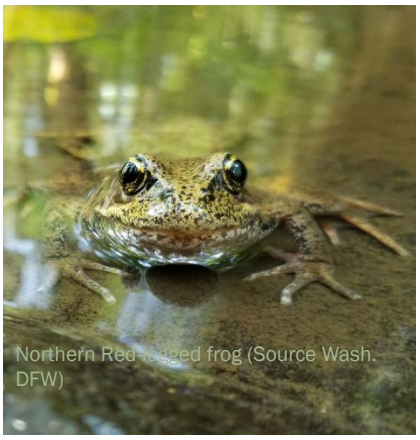
Marbled murrelets are listed as endangered species in Washington State under the Endangered Species Act[4]. Marbled murrelets occur in the Nisqually Reach from May through July and infrequently at other times. The Nisqually Reach represents foraging habitat for murrelets, which nest in old-growth forest. Murrelets have been observed on Puget Sound in the area from approximately the former DuPont dock south to the mouth of Red Salmon Creek, and from the shoreline to approximately the location of the Nisqually River channel buoy. Murrelets have also been observed farther from shore in the main channel, between Anderson Island and the south end of Ketron Island.

The oak grassland community could provide habitat for the western bluebird and western gray squirrel. Western bluebirds are found in open, riparian, burned, or cut over woodlands and other open country with scattered trees.

[3] In Washington State, the peregrine falcon was historically listed as endangered under the Endangered Species Act (ESA) due to significant population declines caused by pesticides such as DDT. However, as a result of successful recovery efforts the peregrine falcon was delisted from the federal ESA in 1999. In Washington State, peregrine falcons are still considered a species of concern and may receive protections under state laws or regulations, particularly for nesting sites and habitat.

[4] The ESA has listed this species as Threatened

Western gray squirrels are also found in oak habitat. No squirrels were observed during site investigations for the Pioneer Aggregates Mining facility conducted in 1991, or more recent investigations of the Weyerhaeuser property (Raedeke Associates, 1993). There have been no recorded sightings of gray squirrels in the City of DuPont since 1978.


Northern Red-legged frog (Source Wash. DFW)

The Northern Red-legged Frog is listed as a federal candidate species. The red-legged frog is commonly found in forested swamps. Forested wetland and riparian habitats within DuPont could provide habitat for the red-legged frog, which were observed in abundance during surveys for the proposed Weyerhaeuser Export Facility.

Marine Environment

Fish

The Nisqually River, along with local tributaries, Red Salmon Creek, and adjacent marine waters, support a wide array of fish and wildlife species. Red Salmon Creek is especially significant as an important spawning ground for various species of salmon and trout.

Anadromous fish, including coho, chinook, chum salmon, as well as steelhead, sea-run cutthroat trout, and Dolly Varden, migrate through or offshore of DuPont as part of their seasonal journey to and from the ocean. Notably, the fish produced in McAllister Springs, Sequalitchew Creek, and the Nisqually River basin play a vital role in the area's ecological balance. Additionally, the Washington Department of Fish and Wildlife plants species such as coho, chum, chinook, and pink salmon in the Nisqually River drainage to support and bolster local fish populations.

Natural production of anadromous fish in Sequalitchew Creek is limited because of low flow conditions in the creek. The Washington Department of Fish and Wildlife operated a release program in Sequalitchew Lake from 1980 until at least 1994 as part of a cooperative agreement between the Nisqually Tribe, the Department, and JBLM to restore releases of coho salmon into Sequalitchew Lake. Sequalitchew Creek is the only route for coho salmon smolts migrating from Sequalitchew Lake to marine waters.

The DuPont region of the Puget Sound is part of the Nisqually Reach Aquatic Reserve which is a highly diverse, productive, and unique ecosystem located in the Nisqually Delta in southern Puget Sound. As part of its Shoreline Master Program, the City assigned appropriate environmental designations to help protect this important resource.

Intertidal & Subtidal Plants and Animals

Previous studies have identified 75 plant species growing on the bottom substrate in the intertidal zone (ranging from zero to nine feet above Mean Lower Low Water or MLLW). Over half of these species are red algae, while green algae make up the dominant portion of the biomass. In addition, more than 270 species of intertidal invertebrates, such as limpets, barnacles, and periwinkles, have been recorded in the area.

The lower intertidal area near the mouth of Sequalitchew Creek has been identified as the most productive intertidal area, in terms of number, diversity, and density of organisms. This makes it an ecologically significant area for marine life.

Eelgrass beds are considered some of the most productive areas in the marine environment, serving as a crucial food source for fish and waterfowl in shallow marine waters. A significant eelgrass bed has been identified southwest of the mouth of Sequalitchew Creek, and another is believed to exist near the northernmost city limits of DuPont. These eelgrass beds provide essential habitat and nourishment for various marine species, contributing to the ecological health of the area.

Climate and Climate Change

The Puget Sound region has already experienced measurable effects of a changing climate, and this trend will likely continue. According to Pierce County, average temperatures in the Pacific Northwest have increased by 1.3 degrees Fahrenheit since 1895. The County predicts that extreme heat events will become more likely in the coming years. Western Washington has also seen an increase in wildfires and according to the EPA, Washington has experienced an increase of 2.83 acres of burned land per square mile from 2002-2020, compared to 1984-2001 (EPA, 2022).

Impacts associated with climate change, which should be taken into account when planning, are rising sea levels, increased severe weather events, and more extreme precipitation. Increased water temperature and acidity and decreased air quality will likely affect wildlife in the region as well.

In 2023 the state legislature passed HB 1181 and added Climate Change and Resiliency as the 14th Growth Management Act goal. Under the new law, the city is required to have a "Climate" Element in the future and must:

- Add a greenhouse gas emissions reduction sub-element by June 30, 2029. The sub-element and implementing development regulations must identify actions DuPont will take that will result in reductions in overall greenhouse gas (GHG) emissions generated by the transportation and land use systems within the jurisdiction but without increasing emissions elsewhere; result in reductions in vehicle miles traveled within the jurisdictions but without increasing emissions elsewhere; and prioritize reductions that would benefit overburdened communities in order to maximize the co-benefits of reduced air pollution and environmental justice.
- Add a resiliency sub-element by June 30, 2029. This requirement can potentially be satisfied by adopting by reference a FEMA natural hazard mitigation plan that is in substantial conformance with this sub-element requirement.

- Update the Transportation Element by June 30, 2029, to include certain climate change related topics, including a prohibition on denying a development permit because a project may cause the transportation level of service to fall below the minimum standard where multimodal mitigation is possible.
- By June 30, 2034, update the land use, capital facilities, park and recreation, and utilities elements to include certain climate change related topics.
- Include consideration of environmental justice in order to avoid worsening environmental health disparities.

The City will fortunately be eligible for grant funding from the Department of Commerce to fund these future changes.

Hazard Mitigation Planning

The Disaster Mitigation Act of 2000 established a new federal priority for pre-disaster planning and mitigation as opposed to post-disaster assistance. FEMA leads this program through the provision of planning guidelines and grants. The state of Washington Department of Emergency Services manages the program.

The City is included in the Pierce County Region 5 Hazard Mitigation Plan, a multi-jurisdictional plan encompassing 77 jurisdictions including municipalities, fire districts, school districts, universities, and other special-purpose districts. The Plan is a natural hazard mitigation plan in which all jurisdictions worked together to develop shared goals and a foundation for mitigation measures. The Region 5 Hazard Mitigation Plan is maintained by the Pierce County Department of Emergency Management and the current 2020-2025 edition is available online at https://www.piercecountywa.gov/943/Emergency-Planning.

The City has plans and programs in place to address future impacts of potential natural hazards. The City is included a participant in the Pierce County Forum's development of the Region 5 All Hazard Mitigation Plan process. That plan contains an extensive city-specific mitigation strategy for avoiding and/or addressing impacts of natural hazards including floods, lahars, storms, and other events.

Natural Environment Goals and Policies

The Goals and Policies of the City's Shoreline Master Program are incorporated into this Element by Reference.

Goal NE-1 **Protect DuPont's natural environment by meeting the needs of today's citizens without compromising the needs of future generations.**

NE 1.1 Preserve environmentally sensitive areas, including wetlands, streams, and critical habitats, and protect them as valuable natural and aesthetic resources to the City.

NE 1.2 Regularly update development and construction standards to incorporate best practices and emerging technologies that minimize environmental impact and reduce greenhouse gas emissions.

NE 1.3 Facilitate and promote environmental stewardship through community-led invasive plant removal and habitat restoration projects throughout the City, providing resources and education to support these efforts.

NE 1.4 Collaborate with Joint Base Lewis-McChord (JBLM), the Department of Ecology, environmental organizations, and other stakeholders to restore and improve the flow and ecological health of Sequalitchew Creek.

NE 1.5 Promote sustainable urban forestry practices that protect DuPont's Oregon white oaks, enhance tree canopy coverage, and provide shade, air quality benefits, and stormwater management.

Goal NE-2 **Exercise responsible environmental stewardship by considering long range implications of city policies on the environment and directing development toward areas with fewer environmental constraints.**

NE 2.1 Limit uses within environmentally sensitive areas to those that minimize adverse impacts and promote passive recreation uses where mitigation measures are effective.

NE 2.2 Designate and maintain unique physical features and environmentally sensitive areas as passive open spaces to ensure long-term preservation and public enjoyment.

NE 2.3 Maintain the City's tree preservation ordinance to protect and retain significant trees and vegetation on public and private properties.

NE 2.4 Require landscaping in public areas and Rights of Way to consist of native, drought-tolerant, and low-maintenance plant species.

NE 2.5 Provide incentives for developers to incorporate energy-efficient building design, renewable energy systems, and low-impact development techniques.

NE 2.6 Ensure that any development adjacent to Sequalitchew Creek and the associated nature trail preserves and enhances its natural character through measures such as reduced lighting, noise control, and vegetation preservation.

NE 2.7 Align land use and transportation planning to reduce vehicle emissions and promote walkable communities.

Goal NE-3 Protect water resources for present and future generations.

NE 3.1 Adopt and enforce standards consistent with the most current Department of Ecology and Pierce County guidelines for stormwater management, grading, and erosion control.

NE 3.2 Encourage the use of stormwater management systems that prioritize aquifer recharge, protect groundwater quality, and control stormwater runoff from impervious surfaces.

NE 3.3 Partner with JBLM, Department of Ecology, and other stakeholders to restore pre-diversion flows through Sequalitchew Creek and improve watershed health.

NE 3.4 Promote public education programs on potential adverse environmental impacts of stormwater run-off to enhance community stewardship of local waters.

Goal NE-4 Minimize adverse effects of development on the environment.

NE 4.1 Ensure all development meets or exceeds applicable federal, state, regional, and local air and water quality standards.

NE 4.2 Incorporate performance standards into development regulations that encourage the use of low-emission industrial equipment, clean energy sources, and non-polluting fuels.NE 4.3 Minimize extensive grading during site preparation and establish clear guidelines to preserve significant trees and vegetation.

NE 4.4 Adopt lighting standards that minimize light pollution, reduce energy use, and protect nocturnal habitats.

Goal NE-5 **Restore historic stream flow, improve habitat conditions, and promote long term preservation efforts within the City.**

NE 5.1 Restore and enhance ecological functions of the Sequalitchew Creek Watershed, lakes, marshes, streams, wetlands, and bluffs while balancing opportunities for passive public access and recreation.

NE 5.2 Develop and implement an invasive plant species management plan with a focus on high priority areas such as Edmond Marsh, Old Fort Lake, Sequalitchew Creek, and the Puget Sound bluff.

NE 5.3 Protect wildlife habitats and maintain functional wildlife corridors connecting key natural areas, including Edmond Marsh and Sequalitchew Creek.

NE 5.4 Establish buffer zones and mitigation measures to minimize the potential for adverse impacts on the Nisqually Wildlife Refuge.

NE 5.5 Preserve and enhance the unique Oak Savannah habitat by identifying and designating high-value oak groupings as open space.

NE 5.6 Support research and monitoring efforts to track the health of local ecosystems and inform adaptive management strategies.