NATURAL ENVIRONMENT

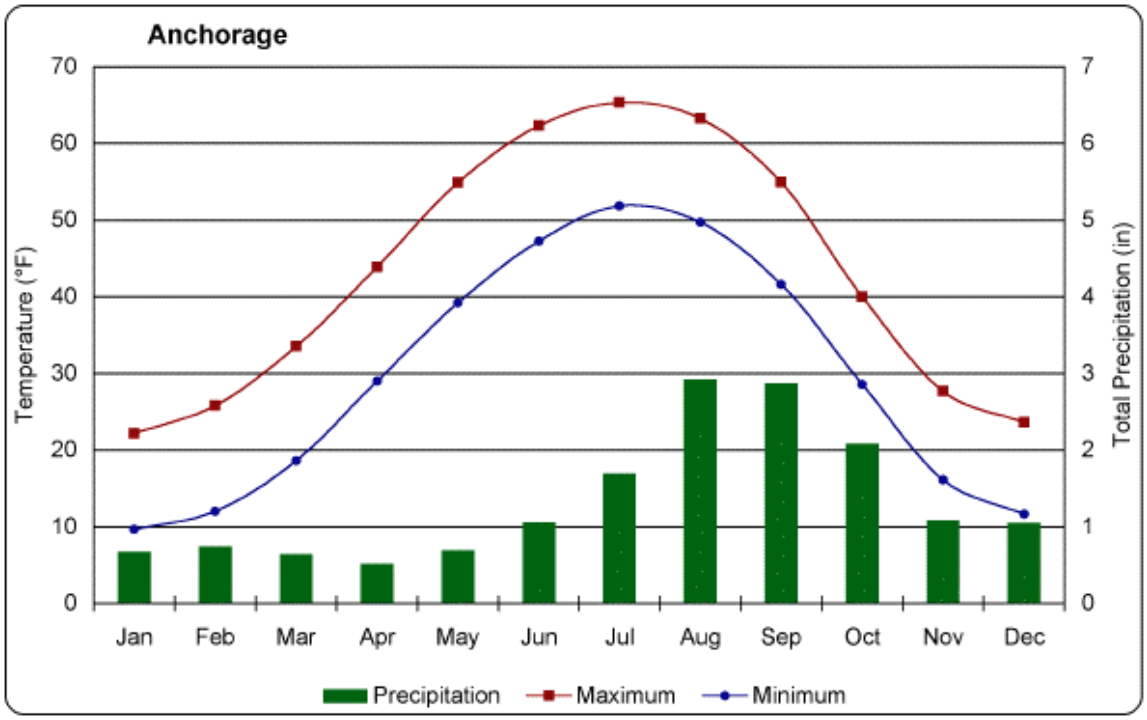
An important goal of municipal land use policy is to balance community needs and land uses with protection and enhancement of the natural environment. Notable environmental attributes of West Anchorage include areas of mature forest, mature neighborhood foliage, frequent wildlife spotting, the Anchorage Coastal Wildlife Refuge, and stocked lakes. Due to the presence of industrial activity in West Anchorage, there is potential for reduced air, noise, and water quality. Earthquake hazards are rated high on the coastal areas of Turnagain CC area. Bluff erosion on all West Anchorage shorelines threatens slope stability and coastal habitat.

Climate

Anchorage experiences a subarctic climate greatly influenced by the dramatic variation in sunlight throughout the year. Cold, dark winters are offset by bright, temperate summers. During the depths of winter, Anchorage receives less than six hours of sunlight, and average temperatures range from 8 to 21 degrees Fahrenheit. In summertime, the sun remains above the horizon for more than 19 hours at the summer solstice and average July temperatures range from 51 to 65 degrees Fahrenheit. Figure G-1 shows average monthly temperatures and precipitation in Anchorage. Cook Inlet plays a moderating effect on the local climate. On average, West Anchorage is 10-20 degrees Fahrenheit warmer than East Anchorage in the winter.

MOA receives nearly a third of its precipitation during the months of August and September. Most storm fronts move in from Prince William Sound, and the Chugach Mountains to the east form a partial barrier which creates a rain shadow effect over the Bowl. As a result, precipitation decreases from west to east. Winter storms coming from the south can result in heavier snowfall in West Anchorage than elsewhere.

Figure G-1. Anchorage Climate



Source: Alaska Climate Research Center, 2009

Air Quality

MOA strives to achieve and maintain minimum National Ambient Air Quality Standards (NAAQS). Federal funding of transportation projects is tied to achieving NAAQS. The Bowl is currently considered in "maintenance" for carbon monoxide (CO), a "criteria pollutant" and important indicator of air quality. This means MOA has been successful meeting air quality standards for CO and continues to monitor pollutant levels.

Volatile Organic Compounds

The community has expressed concern regarding odors in Kincaid Park, Pt. Woronzof Park, along the Coastal Trail, and neighborhoods adjacent to the airport. In 2002, MOA Department of Health and Human Services (DHHS) conducted an ambient air monitoring study in the winter to characterize "typical" concentrations for specific volatile organic compounds (VOCs or generally, air toxics) and compare these to other parts of town. A second study objective was to compare VOC concentrations during short-term odor events.

Sites with air toxics in concentrations above reporting limits where from the compounds benzene, toluene, ethylbenzene, m,p-xylene, and o-xylene (BTEX), and CO. Results suggested that the highest concentrations of BTEX compounds and CO were found where gasoline-fueled motor vehicles had the greatest influence.

No links were documented connecting airport activities to unacceptable levels of CO or air toxics in West Anchorage. TSAIA does not have any Clean Air Act Title V permitted facilities so the MOA handles all complaints concerning the airport and the

Bowl under a memorandum of agreement with the Alaska Department of Environmental Conservation (ADEC).

Carbon Monoxide

Air quality throughout the Bowl has improved since the early 1980s, when violations of the NAAQS for CO occurred as many as 50 days each year. In 1985, MOA implemented a number of programs to meet NAAQS, including the Vehicle Inspection and Maintenance Program (I/M). More recent programs include the Share-a-Ride/Vanpool Program and engine block heater promotion. CO levels declined dramatically over the past 20 years, and no violations have been measured since 1996. In 2004, Anchorage was reclassified as an "attainment area" for CO and the Municipality maintains this status through its *CO Maintenance Plan* (MOA, 2009a).

The primary sources of CO in the Bowl are automobile traffic, airport operations, and wood burning (see Table G-1). CO levels vary throughout the year, and are highest in the winter months. Cold starts and long morning idle times during the winter lead to increased vehicle emissions. Strong temperature inversions further compound the problem by trapping CO close to the ground. Even though traffic volumes are relatively low, the highest CO concentrations tend to occur in residential areas. Testing stations located in residential areas show a consistent diurnal pattern, yielding the highest results for CO during the mid-morning hours, corresponding to commuters without garages idling before leaving their neighborhoods. The Municipality currently operates three CO monitoring stations; the highest CO concentrations are measured in a residential area in Spenard. High CO concentrations tend to occur on days with low wind speeds, clear or partly cloudy skies, and cold temperatures (MOA, 2009d).

Table G-1. Sources of CO Emissions in the Anchorage Bowl - Typical Winter Weekday, 2007

Source Category	CO Emitted (tons/day)	Percent of Total
Motor vehicle – on-road travel	50.9	50.5%[a]
Motor vehicle – warm-up idle	16.1	16.0%[a]
Ted Stevens Anchorage International Airport Operations	12.4	12.3%
Merrill Field Airport Operations	0.7	0.7%
Wood burning – fireplaces and wood stoves	6.2	6.2%
Space heating – natural gas	3.8	9.2%
Miscellaneous (railroad, marine, snowmobiles, snow removal, portable electrical generators, welding)	9.3	9.2%
Point sources (power generation, sewage sludge incineration)	1.3	1.3%
TOTAL	100.7	100%

Source: (MOA, 2009b)
[a] A 2006 MOA Department of Health and Human Services (DHHS) study found 77% of winter CO emissions in the MOA come from motor vehicles.

TSAIA operates under an Owner Requested Limit under the State's air quality regulations for stationary sources (AS 46.14 and 18 AAC 50.225). Under this permit, TSAIA submits an annual report to the ADEC to document that it emits less than 100 tons/year of each criteria pollutant. CO emissions are expected to increase as aircraft operation increases (ADOT&PF, 2009). TSAIA implements the following measures to address CO emissions:

1) installed plug-ins for State vehicle parking areas

2) reduce single occupancy vehicle trips to the airport

3) request less use of auxiliary power units on aircraft ramps

PM_{10}

PM_{10} is microscopic airborne particulate matter that can cause adverse health effects including aggravation of existing respiratory disease and a decline in lung function (MOA, 2009d). Particulate matter levels are at the highest during spring breakup, especially near heavily traveled roads when sand applied to roads throughout the winter is freed up and disperses into the air. Natural incidents such as volcanic eruptions and windstorms can also impact air quality, such as the eruptions of Mt. Redoubt (1990, 2009) and Mt. Spurr (1992) that deposited ash over the entire Bowl.

Although Anchorage is currently considered in compliance with the PM_{10} NAAQS, concentrations occasionally approach the standard. Local studies suggest that elevated PM_{10} concentrations in Anchorage increase outpatient visits for asthma and other respiratory illness (Gordian et al., 1996; Chimonas and Gessner, 2006).

Water Resources

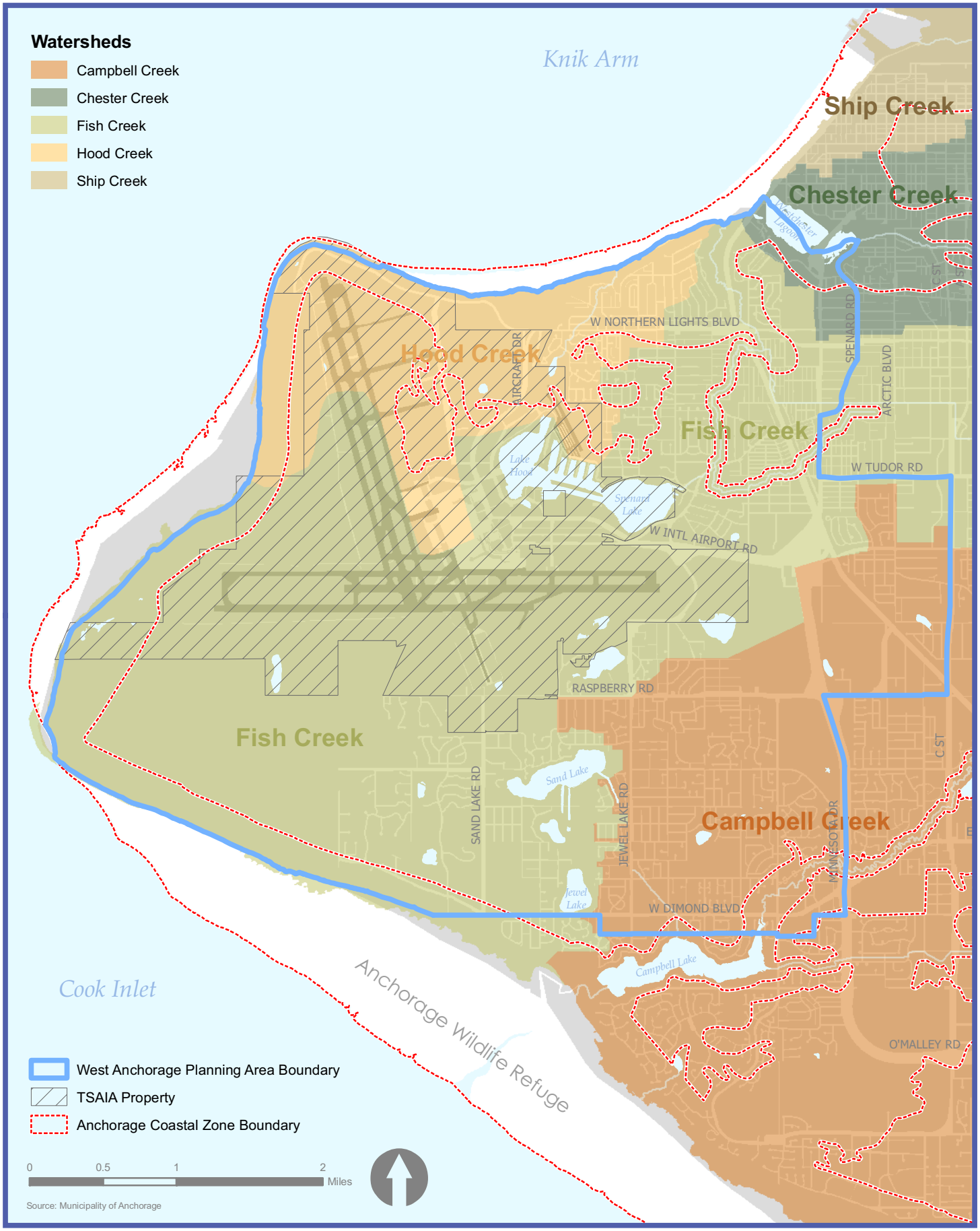
West Anchorage is dotted with many small lakes and ponds that serve important community functions. Most lakes in the area provide valuable wildlife habitat and year-round recreational opportunities. Sand Lake, Jewel Lake, and Campbell Lake are the centerpieces of subdivisions, while Lake Hood/Spenard Lake is the principal floatplane base in Anchorage.

The majority of the planning area is drained by the Fish Creek watershed. The northern portion of the planning area is drained by Hood Creek (Lake Hood drains to Jones Lake, then into the storm drain system that goes to Hood Creek). The northwest corner of the planning area contains a small portion of the Chester Creek drainage while Campbell Creek drains the southern portion of the planning area (see Figure G-2).

Fish Creek has its headwaters in Midtown and runs through culverts for large segments of its reach. Efforts are underway to restore it to a free-flowing waterway because channelized streams are less able to mitigate the impacts of large runoff events and can result in erosion and degradation of fish habitat. Hood Creek runs north from Lake Hood to Cook Inlet, while Chester Creek originates in East Anchorage and empties into Cook Inlet at Westchester Lagoon. Both have been modified from their natural states to accommodate urban development. Campbell Creek also originates in the Chugach Mountains in East Anchorage, emptying into Cook Inlet within the Anchorage Coastal Wildlife Refuge. It remains the least impacted of all the waterways in the area, due to the lower density development and a greenbelt system at the southern end of the Bowl.

Anchorage Coastal Wildlife Refuge

The Anchorage Coastal Wildlife Refuge extends south from Pt. Woronzof to the southern terminus of Potter Marsh along the shores of Cook Inlet. It was established in 1988 to protect waterfowl, shorebirds, salmon and other fish and wildlife species and their habitat for the use and enjoyment of residents. The refuge sees most of its visitors at Potter Marsh, a popular and accessible area outside the planning area. The portion of the refuge in West Anchorage is less accessible as it mostly abuts private land. Kincaid Park is a notable exception, with public beach access from established trails.



West Anchorage District Plan

Exhibit G-2: Watersheds and Coastal Zone

Anchorage Coastal Zone

The Anchorage Coastal Zone/Designated Recreation Areas include coastal floodplains and the upstream floodplains of creeks draining into coastal waters. The coastal zone boundary is depicted in Figure G-2. The Anchorage Coastal Zone was established to ensure the preservation of coastal habitat and the maintenance of recreational use of coastal areas, both seen as critical to the quality of life in MOA (MOA, 2007). Any activities with potential to impact the Anchorage Coastal Zone or the underlying physical, biological, and cultural resources of a Recreation Use Area are required to undergo a review process. In West Anchorage, the MOA has designated Kincaid Park, the Tony Knowles Coastal Trail, and the Chester Creek Trail as Recreation Use Areas within the coastal zone. Other features within the coastal zone include Earthquake Park, a strip of land bordering Cook Inlet, the Fish Creek estuary, and Westchester Lagoon (Figure G-2).

For further information regarding the Anchorage Coastal Wildlife Refuge and the Anchorage Coastal Zone Boundary, refer to the *2007 Anchorage Coastal Management Plan* and the *Anchorage Coastal Wildlife Refuge Management Plan* (1991).

Water Pollutants

Lakes and waterways in West Anchorage experience impacts related to their location in an urban environment, primarily from runoff. Storm water runoff collects contaminants from roads, lawns, and paved surfaces on its path to the waterways. These can include fuel spills, oils, and grease associated from vehicle operations.

Low levels of dissolved oxygen are typical in northern bog lakes such as those found in West Anchorage because bog lakes are shallow with high organic content that consume oxygen. However, runoff adds organic matter and fertilizer further depletes oxygen, especially in winter when covered by ice caps. West Anchorage lakes that permit float planes experience direct contamination from aviation-related fuels and grease. The MOA is covered by a National Pollutant Discharge Elimination System (NPDES) water quality permit, which is managed and monitored by the MOA-Watershed Management Section of the Project Management and Engineering Department.

Lake Hood and Lake Spenard were listed by ADEC as "impaired" because of impacts by limited inflow, high fecal coliform, lead, nitrates, phosphates, and low dissolved oxygen. Extensive aviation operations and urban runoff add contaminants to Lake Hood and Lake Spenard including fuel, oils and grease, and deicing agents (urea, potassium acetate, propylene, and ethylene glycols).

TSAIA has seven facilities where industrial activity has the potential to introduce hydrocarbon pollutants to storm water. TSAIA maintains its Storm Water Pollution Prevention Plan with Best Management Practices required as part of their NPDES general permits. Some Best Management Practices described in the TSAIA Master Plan Study include:

- Materials stored away from steep slopes and waterbodies
- Tank checks for leaks
- Spill response plans

- Outfall containment boom
- Secondary containment berms
- Catch basin protection (ADOT&PF, 2009).

TSAIA Airfield Maintenance is a four time recipient of the Palchen Post Award for excellence in airport snow and ice control. Glycol recovery operations have improved water quality in Lakes Hood and Spenard. An active vegetation harvesting program alleviates deicing chemical impacts to the lakes consistent with the Airport's Waterbody Recovery Plan (TSAIA, 2008 Presentation to Chamber of Commerce).

Commentor request to add what the MOA does under its NPDES permit.

Wetlands

Two types of wetlands are found in West Anchorage: freshwater and saltwater. Saltwater wetlands are located in coastal areas along the edge of the mudflats. Freshwater wetlands are scattered throughout the Bowl and consist mostly of peat. There are over 1,100 acres of freshwater wetlands in West Anchorage and 6,720 in the Bowl.

The *Anchorage Wetlands Management Plan* (1996) assigns formal designations for the fresh water wetlands within the planning area. These designations describe varying ecological function and social value of wetlands depending upon the category. Class A wetlands are high value wetlands. If they cannot be avoided during development, they require substantial compensatory mitigation in order to minimize the impact to the function and value of these wetlands. Class B and C wetlands are of less value but may still require permits and mitigation before development can be considered (Figure G-3).

A large proportion of the historical wetland acreage in the planning area has been filled for development. Aerial photography estimated almost 10,000 acres of wetlands were filled between 1950 and 1990 in the Bowl. The *1982 Wetlands Plan* was successful directing wetland fill projects to lower value sites and minimized fill to higher value areas during the boom construction period in the Bowl. Today, large intact bog and patterned ground wetlands are intact in West Anchorage in the TSAIA complex, Connors Bog, and the Sand Lake-Jewel Lake complex. Many of these wetlands are in public ownership or located on TSAIA property.

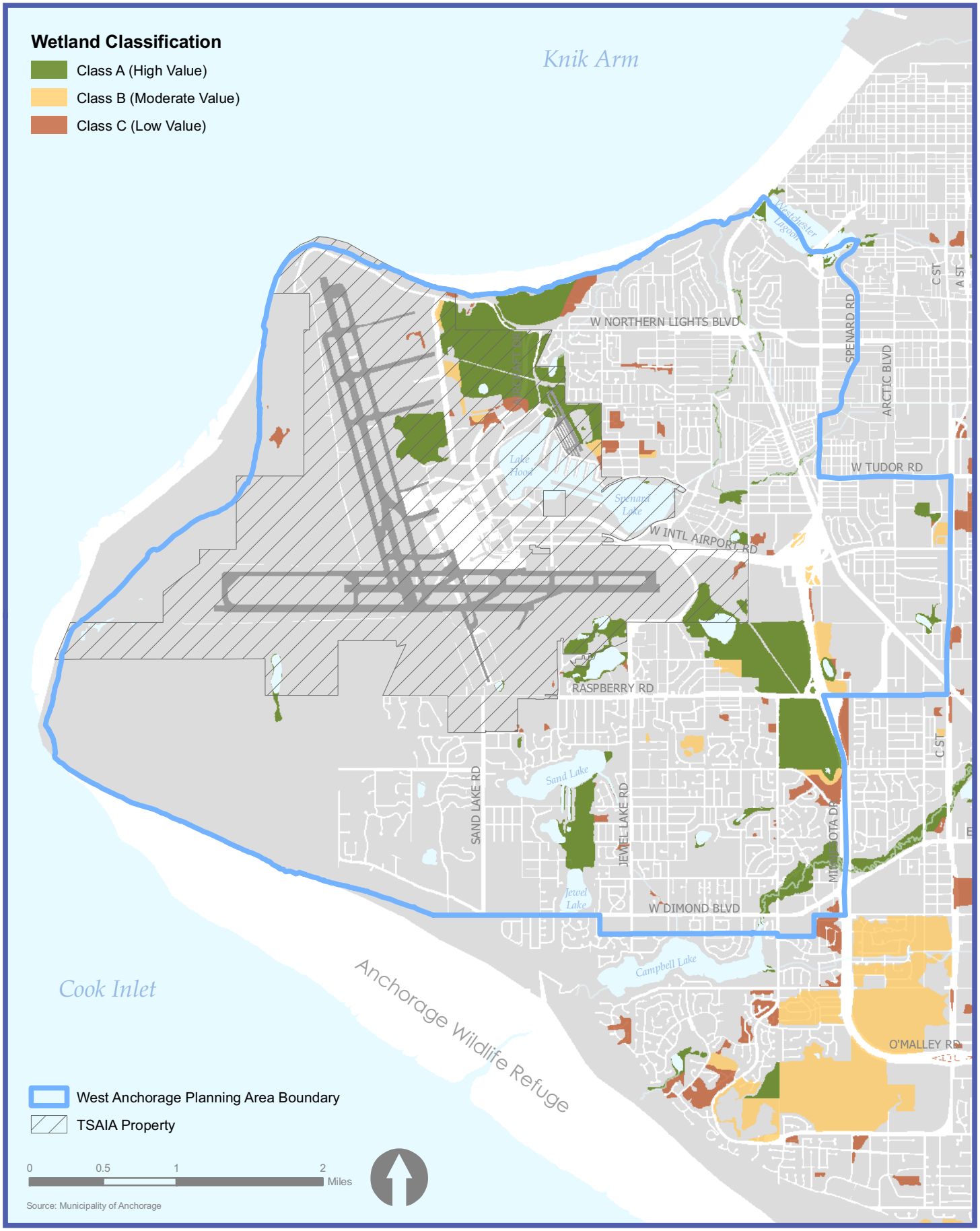
Geology and Soils

The Bowl is a gently sloping lowland area that has been greatly influenced by glaciation. The underlying formations are dominated by alluvial deposits from repeated glacial advances and retreats, and prominent moraines are present at the base of the Chugach Mountains and across Elmendorf Air Force Base (Scmoll et al., 1981). West Anchorage borders Knik Arm along its western edge, where large mudflats give way to 50- to 150-foot bluffs. The area is underlain mostly by sand and gravel alluvium, combined with deposits of clay. One such formation is Bootlegger Cove clay, which is particularly susceptible to landslides and was responsible for most of the damage during the Good Friday Earthquake of 1964 (Miller and Dobrovolny, 1959). The mudflats

are composed of glacial sediment consisting chiefly of silt and very fine-grained sand. They are soft, water-saturated, and very unstable.

Soil formation in West Anchorage is largely dependent on the local topography and winter weather patterns. Constant exposure to winds and regular melting periods during winter months resulted in poor soil development over large portions of Kincaid Park, as snow cover is lost and erosion is common. In more protected terrain, such as low-lying and forested areas, more productive soils are generated (National Resources Conservation Service [NRCS], 2001). Soils found throughout the area are identified as being not suitable for farmland, due to their low productivity. (This was demonstrated by unsuccessful homesteading activity in the 20s-30s.) Bluff areas are susceptible to erosion due to human disturbance, winds, and ocean undercutting.

Although there is gravel from alluvial deposits in West Anchorage, the majority of gravel for new development is brought in by train from the Matanuska-Susitna Valley. Alaska Sand & Gravel (AS&G) scale house is in South Anchorage, outside the project area. AS&G operates the Sand Lake Disposal Site at 9100 Sand Lake Road near West Dimond Boulevard. It is permitted as a "clean fill site" where clean asphalt and concrete demolition materials with wire mesh, rebar and concrete fiber are accepted as well as peat, vegetation, soil, and clay. The Sand Lake Disposal Site does not accept any contaminated materials, therefore debris from TSAIA, Merrill Field, or the POA (all designated as contaminated sites by ADEC) are not accepted.



West Anchorage District Plan

Exhibit G-3: Wetlands

Natural Hazards

Natural hazards known to affect West Anchorage include earthquakes, wildfires, flooding, severe winter storms, and volcanic eruptions.

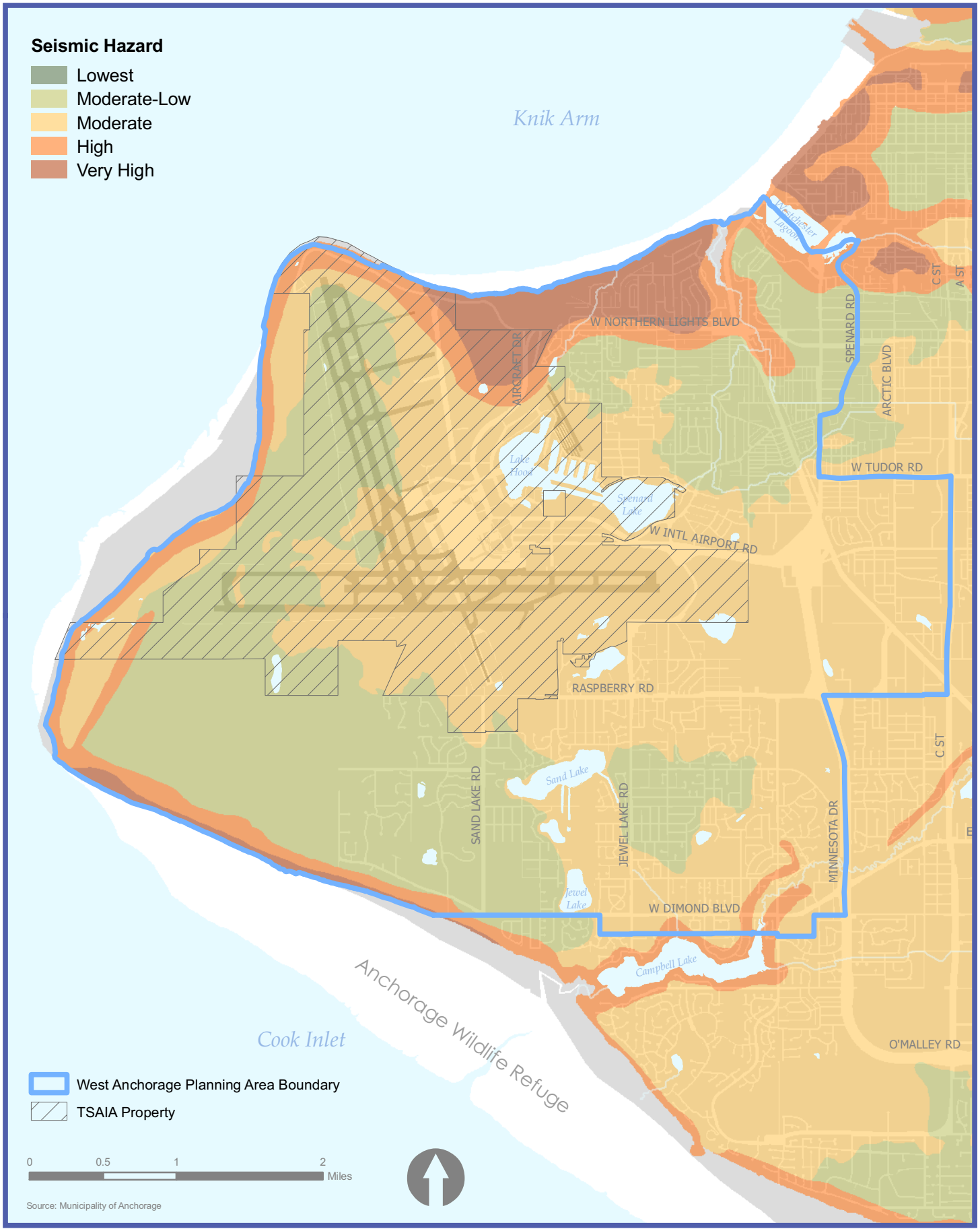
Earthquakes

Small earthquakes occur frequently in the Anchorage area. There have been 12 events having a magnitude greater than 4.0, with an epicenter within the MOA boundary since 1900. Of these, only the Good Friday earthquake of 1964 caused any lasting damage, with large sections of the bluff near Earthquake Park sliding into Cook Inlet.

Figure G-4 demonstrates the results of a seismic hazard risk analysis for the planning area based on the MOA's seismic risk maps. The area has been divided into five categories based on seismic hazard, with higher risk corresponding to a higher likelihood of being impacted by an earthquake event. In West Anchorage, the area of very high risk (Zone 5 – not suitable for development) is concentrated around Earthquake park and coincides with the Bootlegger Cove clay formation, while additional areas of high risk (Zone 4 – marginally suitable for development) can be found along the coast, Westchester Lagoon, portions of Chester Creek, and Campbell Lake. The percentage coverage of earthquake susceptible land in the planning area is calculated in Table G-2.

Table G-2. Earthquake Hazard Coverage in West Anchorage

Seismic Rating	Seismic Hazard Risk	Percent of Planning Area
Zone 1	Low	0 %
Zone 2	Moderate-Low	30 %
Zone 3	Moderate	58 %
Zone 4	High	9 %
Zone 5	Very High	3 %
Source: MOA GIS Services, 2009		



West Anchorage District Plan

Exhibit G-4: Seismic Hazards

Wildfire

The wildfire risk in West Anchorage is lower than in many other parts of Anchorage, particularly those bordering Chugach State Park. Wildfire risk exists mainly in large vegetated tracts, which are particularly susceptible to fires in late spring and early summer when large areas of dry vegetation are exposed. Most wildfires are human caused. The large forested area in and around Kincaid Park and TSAIA is most vulnerable in the planning area, with the potential to spread along established greenbelts throughout the area. Additionally, Connors Bog and the surrounding area would be susceptible to wildfire under certain rare conditions.

Flooding

Due to wide riparian corridors bordering many stretches of the creeks in the planning area, there is limited risk of flood damage in West Anchorage. Very little commercial or residentially zoned land lies within the 100- and 500-year flood plains because they are narrow bands within the Chester and Campbell Creek corridors. Flood hazard is highest immediately following heavy rainfall events, and during spring breakup, particularly after heavy snow years.

Long-term projections for flooding hazard due to climate change or isostatic rebound will not be discussed at this time, but pose the need for adaptive management in our land use policies.

Severe Wind Events

Typically, West Anchorage experiences lower average wind speeds than elsewhere in the Bowl. Severe winds impacting the Bowl typically come from the southeast, gusting along Turnagain Arm. These primarily impact areas directly bordering Turnagain Arm and the higher elevations on the Hillside, although the far southern areas of the planning area can also be affected.

Occasionally, high wind events affect the planning area more severely than the rest of Anchorage. Known as "Bora winds", or "Matanuska winds", these are cold northerly winds that blow in from the Mat-Su valley and can cause severe damage to homes and structures. When combined with extreme cold, the impacts can be devastating, with frozen pipes and increased freeze depths commonplace. The most recent event occurred in 2003, when TSAIA recorded sustained wind speeds of 92-94 miles per hour (mph), and a peak gust of 109 mph (MOA, 2004).

Volcanic Eruptions

Anchorage lies within sight of a string of active volcanoes dotting the western shores of Cook Inlet. Distance and topography effectively buffer the city from direct impacts such as lava flows and mudslides, but ashfall regularly impacts the area. In the last 30 years, eruptions of Mt. Spurr, Mt. Augustine, and Mt. Redoubt have caused extended disruptions of airport activities at TSAIA and a reduction in air quality across all of the Bowl.

Vegetation

The majority of the undeveloped land in West Anchorage is a mix of tidal zones, forested uplands, wetlands, and riparian zones.

Forested and upland areas are dominated by paper birch, balsam poplar, and white spruce, while willows and alders are commonly found in gently sloping drainages. Intermixed through much of the forested zone are extensive lowland areas, such as Connor's Bog, where black spruce, ericaceous shrubs, sedges, and moss are the most prevalent vegetation. Grassy meadows cover many of the drier open areas, while sedge meadows can be found along the upper portions of the intertidal zones.

Fish and Wildlife

West Anchorage has an abundance of wildlife, largely resulting from the city's extensive network of open space and greenways. These interconnected corridors allow uninterrupted travel from the vast wilderness of Chugach State Park throughout the Bowl. High value urban wildlife habitat in West Anchorage includes the Chester Creek Trail corridor, the Coastal Trail corridor, Kincaid Park, the Anchorage Coastal Wildlife Refuge, Earthquake Park, the Fish Creek Estuary and large tracts of undeveloped land surrounding the airport, including Turnagain Bog.

The West Anchorage planning area is home to most of the 52 species of mammals identified in Anchorage including moose, black bears, brown bears, coyotes, and beavers. Large game populations fluctuate throughout the year. During the winter months, the moose population increases as food becomes scarcer at higher elevations, while bears leave for the mountains to hibernate until spring. At least 230 resident and migratory bird species have been confirmed in the Municipality, including bald eagles, magpies and ravens (Alaska Department of Fish and Game [ADF&G], 2000). Wetlands throughout the area provide important feeding and nesting habitat for sensitive migratory species, such as snow geese and sandhill cranes. No reptiles reside in the region, and only one native amphibian species, the wood frog, is present. Cook Inlet beluga whales are periodically observed along the coastline, traveling in and out of upper Cook Inlet. These whales were listed as a "species of concern" in 1988 and were listed as an Endangered Species in 2008. Designation of habitat essential for beluga whale conservation is under a final rule (National Oceanic and Atmospheric Administration [NOAA], 2009).

Anadromous streams in the planning area include Fish Creek, Chester Creek, and Campbell Creek, which see limited returns of king, silver and pink, chum, and red salmon. Recent habitat improvements have been undertaken at Westchester Lagoon in an attempt to restore robust salmon runs to Chester Creek. DeLong Lake, Jewel Lake, and Little Campbell Lake are stocked with rainbow trout annually for sport fishing. Invasive northern pike are present in many of the planning area's lakes, with ADF&G efforts to eradicate them achieving only moderate success. Other fish commonly found in area lakes include grayling, arctic char, and stickleback.

For a complete listing of fish and wildlife found within the MOA, including important bird areas and nearshore areas important to juvenile and adult salmon and beluga whales, refer to "Living with Wildlife in Anchorage: A Cooperative Planning Effort" (MOA, 2000) and the Municipal Planning Department's Coastal Zone Plan's resource data.

Anchorage 2020 (page 63) provides a map indicating where important wildlife habitats and community preference for natural open spaces are located, compiled by the Great Land Trust and MOA Planning Department.

Wildlife/Airport Interaction

Aircraft movement areas are not compatible with birds and other wildlife large enough to cause aircraft damage or create safety hazards. FAA adopted a wildlife hazard management plan in 1977 due to the high number of incidents and significant wildlife population in the vicinity of TSAIA (ADOT&PF, 2009). Hazing is a technique used to disperse wildlife without shooting; it can involve pyrotechnics, propane cannons and ultrasonic devices. Larger-bodied birds such as geese, ducks and cranes are hazed from Postmark Bog and moose are hazed from the Postmark Bog area as well as portion of Turnagain Bog near Lake Hood (ADOT&PF, 2009). TSAIA gives considerable attention to this continuing problem.