Interior Alaska Elodea Eradication Project

Draft Environmental Assessment

Alaska Department of Natural Resources
Division of Agriculture

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1. Purpose and Need

1.1 Introduction

This draft Environmental Assessment (EA) has been prepared to address management of the invasive freshwater aquatic plant, *Elodea* spp. (Elodea), in four interior Alaska waterbodies: Chena Slough, Totchaket Slough, Chena Lake, and the Chena River. The objectives of this draft EA are to (1) present and evaluate three alternative approaches for freshwater invasive plant management, (2) propose selection of the alternative that best meets State of Alaska Department of Natural Resources (DNR) eradication objectives while minimizing potential environmental impacts, (3) provide an opportunity for public and state and federal agency input (throughout the development of the draft EA) on planning options; and (4) determine whether the scope and magnitude of impacts expected from implementation of the proposed action alternative warrant preparation of an environmental impact statement (EIS). If significant impacts are expected, an EIS would be prepared. If not, DNR would implement the proposed (preferred) action alternative. In either case, the EA would be reviewed by the United State Fish and Wildlife Service (USFWS) which would then disclose its final decision and supporting rationale in a separate decision document.

Our conservation concern with Elodea regards its high potential to successfully propagate, spread, establish and displace native plants, disrupt ecosystem function, and degrade fish and wildlife aquatic habitat throughout the Yukon River drainage, and other areas of Alaska, and thus the (DNR) initiated an exterior quarantine March 2014 to prohibit the import, transport, purchase, sale, distribution and intentional transplant of Elodea species (*Elodea canadensis*, *Elodea nuttallii*, and hybrids) and three other aquatic invasive species within the State of Alaska.

To avoid an adverse outcome, DNR and supporting agencies are implementing a comprehensive management strategy (Stewart et al. 2015) working towards eventually eradicating Elodea from the entire State of Alaska including infested water bodies in interior Alaska. This EA presents and evaluates three alternative approaches for management of Elodea. The first, the no action alternative, would discontinue management of Elodea in the infested waterbodies. This would entail halting all public education and outreach efforts, and monitoring. No methods for containing the spread of Elodea would be attempted, and existing infestations would be left uncontrolled. The second and third alternatives would entail an Integrated Pest Management Plan (IPMP) approach. An IPMP is a systematic planning, evaluation, and decision-making process incorporating adaptive management used to guide and direct management of pests such as invasive plant species (USFWS 2004). The second alternative is mechanical removal of Elodea using diver-assisted suction harvesting. The third alternative is treatment of Elodea infestations with fluridone, a systemic herbicide. Fluridone has proven effective at eradicating

Elodea from other infested waterbodies in Alaska on the Kenai Peninsula (J. Morton, pers. comm.) and in Anchorage.

1.2 Background

Elodea species are well documented as invasive aquatic plants that have successfully invaded many areas throughout Europe and Asia (Nichols and Shaw 1986), as well as New Zealand, Australia (Cook and Urmi-Konig 1985) and parts of Africa. In Europe, Elodea infestations have spread extensively across the landscape over the last 140 years, likely because of human movements inadvertently transporting plant fragments. Elodea has spread from Ireland to Lake Baikal, Russia, and crossed two continental divides. Elodea species are capable of causing large-scale changes to freshwater ecosystems, including changes in stream-flow dynamics, water nutrients, dissolved oxygen content, and invertebrate assemblages (Buscemi 1958, Pokorny *et al.* 1984). Elodea's rapid growth often results in the displacement of native plants, which can significantly alter fish and aquatic invertebrate habitat. Dense Elodea growth also interferes with recreational activities, such as fishing, swimming, floatplane operations, and boating.

1.2.1 Elodea in Alaska

In 2009, the USFWS Coastal and Aquatic Invasive Species Programs and Alaska Department of Fish and Game (ADF&G) published an introduction to common native and potential invasive freshwater plants in Alaska identification manual (Morgan and Sytsma 2009). At that time the authors determined *Elodea canadensis* (Elodea) as invasive to Alaska. The determination was based on herbarium specimens collected for over 100 years throughout the state of Alaska and archived at the University of Alaska Fairbanks (UAF) Arctos database. Of the 1500 aquatic plant specimens, only one was Elodea, reported in Eyak Lake in 1982. The authors also conducted vegetation surveys to validate the determination of invasive aquatic plants listed in the publication. In September 2010, rooted and floating fragments of Elodea were found in the Chena Slough. The discovery of Elodea in Chena Slough launched an intensive effort to document the distribution of Elodea in the Fairbanks North Star Borough and to control the spread of this invasive plant to other regions of the state.

Currently, in Alaska, Elodea is found in a total of ~18 waterbodies (Figure 1); and is currently either being treated, or eradicated in 8 locations: Stormy, Daniels, Beck, Sand, Little Campbell, DeLong Lakes, Alexander Lake, and Lake Hood. In these locations it is an aggressive invader that is expected to have impacts on aquatic ecosystems including: loss of habitat to wetland obligate species such as moose, waterfowl, and furbearers as well as salmon and other resident fish, reduced biodiversity, increased sedimentation, degradation of water quality, and displacement of native vegetation. Dense surfacing plants also impede navigability and risk safety for boat and floatplane operators, and inhibit recreational opportunities. Several Elodea infestations are likely to result in economic impacts to tourism, sport & commercial fishing, waterfront property value, and other stakeholders if not managed.

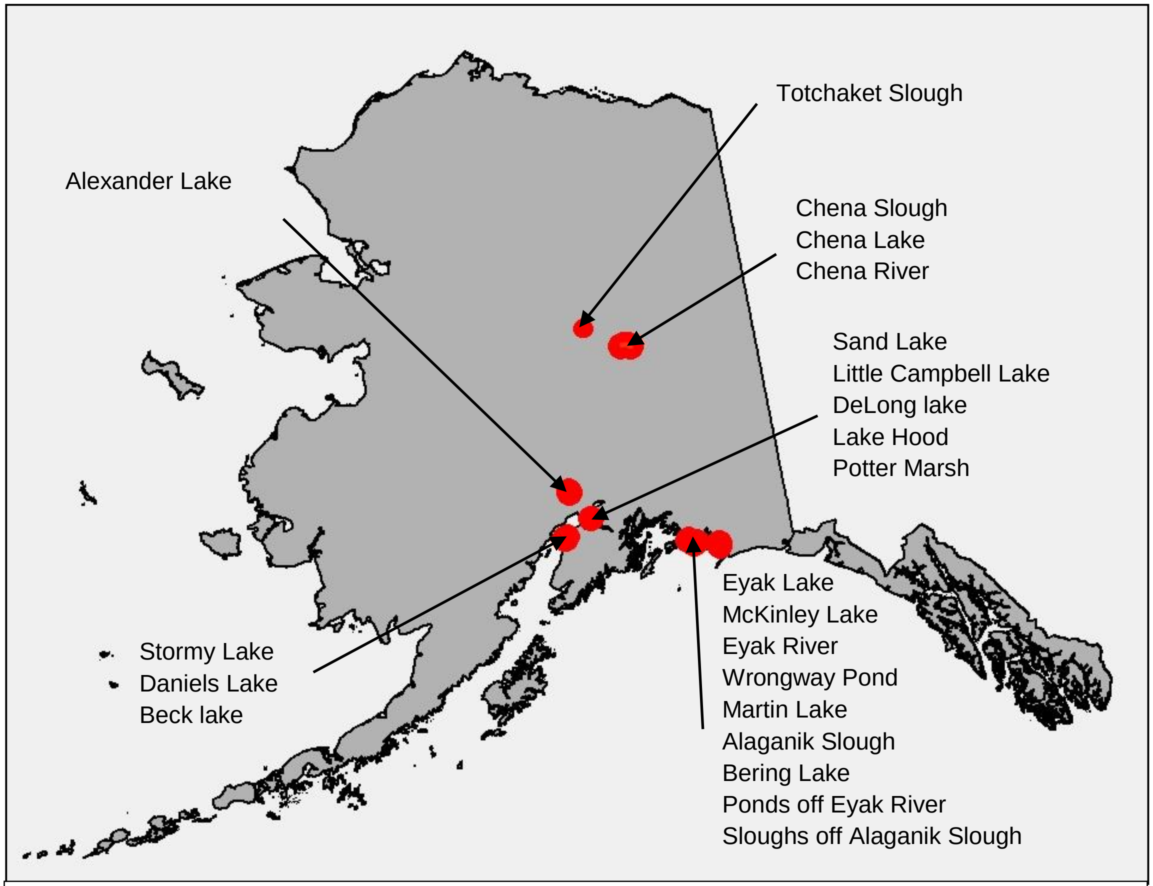


Figure 1. Known Elodea distribution in Alaska; however, Stormy, Daniels, and Beck lakes are thought to have been eradicated as of 2016, and Sand, Little Campbell, DeLong and Lake Hood have all started treatment in 2015.

1.2.2. Elodea in the Interior

In the Interior of Alaska, Elodea is found in Chena Slough, Chena Lake, Totchaket Slough, and isolated parts of Chena River. The Elodea infestations in Chena and Totchaket Sloughs are a high priority management issue in the state because of the density and distribution of the infestations, and the sloughs' connectivity to downstream river systems. These river systems include critical rearing and migratory habitat for Chena, Tanana, and Yukon River Chinook salmon, Arctic grayling, and other important subsistence and sport fish species (Dion 2002, Ihlenfeldt 2006). Luizza et al. (2016) modeled Elodea habitat suitability for the entire state of Alaska using current known infestations (green dots in Figure 2). Based on the model, a large portion of the Interior has high Elodea habitat suitability. Before this model was created, the Totchaket Slough infestation was not yet discovered; however, the model confirms that this area is susceptible to Elodea invasion.

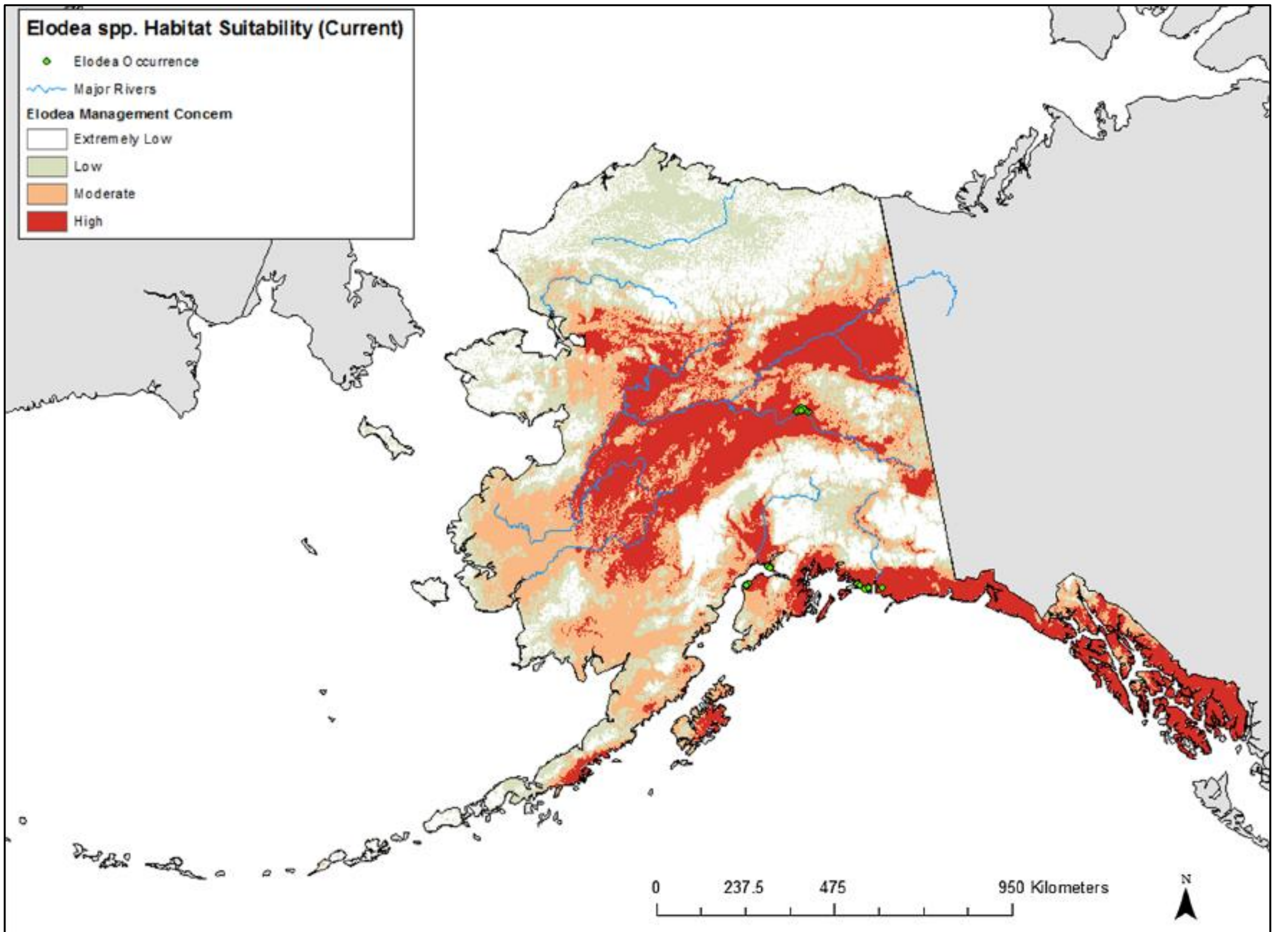


Figure 2. Habitat suitability ensemble showing the management concern for Elodea across Alaska (taken from Luizza et al. 2016). Areas in red denote high habitat suitability and high management concern. Green dots indicate Elodea occurrences as of the beginning of 2015.

The infested waterbodies in the Fairbanks and Nenana areas are used by a wide array of groups, including motorized and non-motorized boaters, anglers, hunters, float plane operators, and other recreational users. Due to the wide array of users and high potential for natural dispersion by fragmentation, there is a high potential for spreading this plant to non-infested water bodies throughout the state of Alaska. Because motorized boats are not allowed on Chena Lake, the risk of spread is low; however, there is still risk that Elodea fragments could be spread to other waterbodies on recreational equipment including paddleboards, canoes, kayaks, and paddles.

1.2.3 Proposed Project Area

All four infested waterbodies are within the Fairbanks North Star Borough and the Yukon River drainage just north of the Alaska Range (Figure 3). Chena Slough flows into the Chena River which drains into the Tanana River, a tributary of the Yukon River.

1.2.3.1. Chena Slough

The Chena Slough is a small tributary of the Chena River within the Fairbanks North Star Borough. Chena Slough is approximately 17 miles in length and runs from the city of North Pole to the Chena River, 5 miles east of Fairbanks, with the watershed encompassing approximately 26 square miles. The land is relatively flat with a 16-foot elevation difference between the headwaters and the confluence in the Chena River. Most of the channel is 65-99 feet wide and averaging about 3 feet deep. The gravel streambed is overlain with a thick layer of organic mud (Dion 2002). Current stream flow is mainly from groundwater upwelling from the Tanana Aquifer (Dion 2002) supplemented by runoff from roads and drainage ditches (Tetra Tech 2011, Hydraulic Mapping & Monitoring 2013). Some portions of Chena Slough remain open water during the winter due to upwelling of groundwater, making breakup on the river occur earlier and often well before the Chena River.

Originally a swift-flowing channel connecting the Chena River to the Tanana River, the Chena Slough was dammed by the U.S. Army Corps of Engineers at the Moose Creek Dike after a catastrophic flood in 1967. Structural components of the dam and levee system, located about 20 miles east of Fairbanks, operate massive concrete outlets and flood gates regulating flow into the Chena River system. The flood control structures have decreased the flow of water into the Chena Slough, thus changing habitat and fostering the growth of aquatic vegetation. Chena Slough is highly urbanized. Urbanization has increased growth of aquatic vegetation and eutrophication, resulting in increased suspended debris and thick deposits of organic mud (Dion 2002). An increase in vegetation and sedimentary depositional rates have resulted in impounded sediment and water upstream of many road crossings (Ihlenfeldt 2006). Emergent aquatic and terrestrial vegetation have also encroached on Chena Slough (Dion 2002).

1.2.3.2. Totchaket Slough

Totchaket Slough is a 7mile long clear water stream that enters the Tanana River 12 river miles downstream of the city of Nenana. The catchment area of the slough is approximately 5,265 acres of relatively undisturbed area. Totchaket Slough is a slow flowing stream that supports a dense population of submersed aquatic plants. The slough has a narrow riparian corridor composed largely of alder and willow. Totchaket Slough is an important area for subsistence users in Nenana, who frequent the slough to harvest pike, moose and waterfowl. The surrounding land is primarily owned by the state, with a large portion held by Toghotthele

Native Corporation and Minto Native Corporation. The slough can be accessed via boat from the Tanana River.

1.2.3.3. Chena River

The Chena River is a non-glaciated tributary of the Tanana River. The Chena River originates in the Yukon-Tanana Uplands approximately 90 miles east of the city of Fairbanks, AK and flows 155 miles to its confluence with the Tanana River southwest of the city of Fairbanks; draining an area of approximately 2,115 mi^2, with an elevation change from 3,675 feet at its origin to 430 feet at the confluence with the Tanana River (Tetra Tech 2011). The lower portion of the Chena River is heavily urbanized. The Chena River flows through Fort Wainwright Army Base, an area that is on the National Priorities List because of known or threatened releases of hazardous substances, pollutants or contaminants (Gilder 2011). The Chena River supports one of the largest Chinook salmon populations in the Alaska portion of the Yukon River drainage, with an average return of over 4,800 fish from 2004-08 (Brase 2009). All Chinook salmon spawning is thought to occur above the Moose Creek dam (Brase 2009). Other fish species present in the Chena River are chum salmon, Arctic grayling, burbot, round whitefish, humpback whitefish, longnose sucker, slimy sculpin, lake chub, Arctic lamprey, Alaska blackfish, sheefish, least cisco, and northern pike. The Chena River watershed has important breeding habitat for 93 species of birds and 35 other species are found during spring and fall migrations (Talbot et al. 2006). Waterfowl, shorebirds, raptors, and songbirds are represented (Talbot et al. 2006). Mammals present in the watershed include moose, wolf, coyote, Northern flying squirrel, red squirrel, snowshoe hare, beaver, mink, red fox, and lynx (Talbot et al. 2006).

1.2.3.4. Chena Lake

Chena Lake is located 17 miles east of Fairbanks on the Richardson Highway, and 3 miles from North Pole. Chena Lake is located on the Tanana Lowland, a wide floodplain underlain by thick beds of stratified gravels. Chena Lake has a surface area of 234 acres and a maximum depth of 38 feet. The lake is fed by upwelling groundwater and has no above-ground outflow. In 1979 when the Moose Creek Dam and Floodway became operational, borrow pits to form Chena Lake were also completed. In 1984 the designated Fairbanks North Star Borough recreational area at Chena Lake was completed. Local residents and visitors commonly use this area for non-motorized boating and fishing.

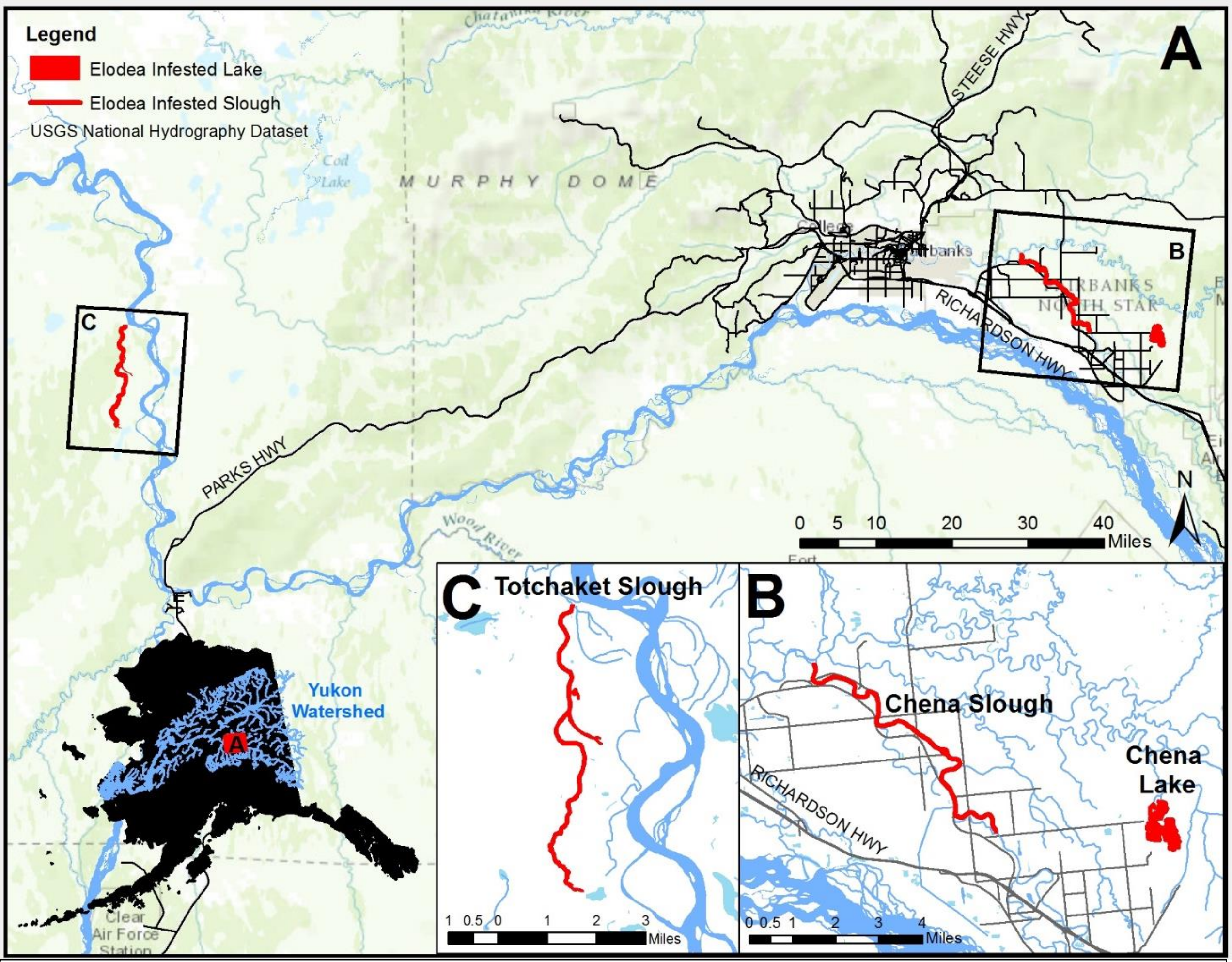


Figure 3. Proposed project area. Red waterbodies show extent of Elodea infestations in A: Interior Alaska, B: Chena Slough and Chena Lake, and C: Totchaket Slough.

1.3 Public Involvement

Since the proposed action (Alternative C – Herbicide Treatment, described in detail in Chapter 2 of this draft EA) involves the use of an herbicide approved for use in aquatic systems, to eradicate invasive Elodea infestations, there may be controversy surrounding this proposed action. DNR has engaged in extensive community outreach through public outreach and education events, posting to social media, presentations at various meetings open to the general public as well as inviting stakeholders to attend and participate in the Fairbanks Elodea Steering Committee monthly meetings during the initial stages of planning for this EA.

Between 2015 and 2016, four public scoping meetings were held in North Pole, Fairbanks, and Nenana. The public was notified of these scoping meetings via newspaper advertisements, articles in the Fairbanks Daily News Miner, flyers posted at various businesses in Fairbanks, North Pole and Nenana, notices posted on various social media and websites, and through public radio (KUAC 89.9 FM) public service announcements. Furthermore 500 postcards were sent to all Chena Slough residents and Fairbanks Soil and Water Conservation District (FSWCD) cooperators in Fairbanks and North Pole. A total of 250 scoping letters describing the issue of Elodea infestations, and the proposed treatment plan were sent to landowners with property adjacent to Chena Slough.

1.4 Public Scoping

The objectives of scoping are to identify significant issues and to translate these into the purpose for the action, the needs for the action, the action or actions to be taken, alternatives to be considered in detail, alternatives not to be considered in detail, and impacts to be analyzed. The result of scoping is to streamline our analysis and decision-making process by ensuring that we address all important issues and that unimportant issues are eliminated from analysis.

In general, issues are significant because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict. Non-significant issues are identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, or other higher level decision; 3) unrelated to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The CEQ NEPA regulations explain this delineation in Sec. 1501.7(a)3, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)."

Through internal DNR and external (federal and local agencies, tribal entities, organizations, and private citizens) scoping, a wide range of issues were identified. While there was broad support for eradicating Elodea with herbicide at the Fairbanks and Nenana public meetings, a small group of Chena Slough residents were concerned primarily about the human health and safety effects. A summary of relevant issues selected for detailed analysis include the following and are considered in detail in this draft EA.

1.4.1 Comments on Ecological Effects

- How fluridone effects wildlife feeding on vegetation in treated areas
- The project's goal to restore Chena Slough to improve wildlife habitat, and water quality
- Effects of fluridone to aquatic ecosystems downstream including salmonids
- Effects on non-target riparian vegetation during high water events in Chena Slough
- If left unmanaged, the effects of invasive Elodea on native species, including salmonids
- Efficacy of fluridone treatment in flowing water and/or during fluctuating water levels
- Persistence of fluridone in the benthic layer
- Concern of fluridone treatment contaminating ground water
- The need to conduct additional Elodea surveys in the area and downstream of current infestation
- Future planning to prevent re-infestation of treated waterbodies

1.4.2 Comments on Impacts to Recreation, Land Use, Human Health and Safety, and Subsistence

- Concern that fluridone will move into the ground water and contaminate drinking wells of Chena Slough residents
- Effects of fluridone on human health if it migrates into drinking wells
- Removing Elodea to increase recreational opportunities
- Effects of fluridone on non-target vegetation including lawns, ornamental shrubs/trees and gardens (organic/non-organic) when irrigated with treated slough water
- Consumption of vegetables and berries irrigated with treated slough water
- Improvement of aesthetic character of the slough after treatment
- Bioaccumulation in animals that feed on treated vegetation which Native Alaskans harvest for subsistence

1.5 Purpose and Need of the Proposed Action

The purpose of the proposed action is to reach a goal; the primary goal is to eradicate Elodea, and the secondary goal is to restore habitat. The overall need to meet these goals is to initiate discussion and create an action plan; the secondary need is to implement action to preserve our natural resources.

1.5.1. Need for the Proposed Action

The need for implementation outlined in the proposed action alternative (Alternative C – Herbicide Treatment) is based on Elodea surveys across the Fairbanks North Star Borough and an extensive landscape-scale survey of waterbodies along the Tanana River from 2010 to July 2016. The survey data indicated Elodea fragments are likely to have dispersed downstream from Chena Slough into the Tanana River drainage and become established in the slow moving waters of Totchaket Slough. Prevention of spread and further establishment of Elodea into the Yukon River drainage is important because Elodea has been shown to affect water quality and quantity, degrade aquatic fish habitat, increase sedimentation, and impede access to subsistence hunting areas affect recreational opportunities and pose a threat to safe operations of floatplane aircraft. Continued introduction and spread is expected with the wide array of users of these infested waterbodies.

There are only four waterbodies that are known to be infested with Elodea in the Interior: Chena Slough, Chena Lake, Totchaket Slough, and Chena Lake. But hundreds of thousands of pristine waterbodies that are vulnerable to infestation, thus presenting the opportunity to effectively eradicate existing infestations. The spread of Elodea from an urban lake in Anchorage (Sand Lake) to remote Alexander Lake in the Matanuska-Susitna Borough indicates how easily this plant can spread via fragments, and this threat of spread via boats and floatplanes will extend into the future. Given the current rate of spread, it can be expected that, without intervention, infestations will continue to expand downstream from the source and if Elodea is inadvertently introduced in to local area floatponds we can expect Elodea to spread north to floatplane accessible lakes, exceeding agency response rate.

Of particular concern is the potential for spread away from urban area waterbodies, centered on the road system and into natural, undisturbed areas. Specifically, the threat of spread away from the road system, along river corridors, and into adjacent Federal Conservation Units is an issue of high importance. At the current level of infestation strong efforts dedicated to eradication, prevention, early detection, and rapid response is still feasible in this region. The underlying premise of the Proposed Action is that the risk of allowing Elodea to spread into river and lake systems is likely greater than risks associated with careful applications of an approved aquatic herbicide. Given the high economic cost of controlling invasive aquatic plants and the associated damage to other resources, it is recommended that the proposed action to treat Elodea infestations with herbicide be implemented now.

1.5.2. Purpose of the Proposed Action

The purpose of the proposed action is to eradicate Elodea from four interior Alaska infested waterbodies to prevent the further spread and introduction of Elodea within the Yukon River drainage. The goal of the proposed action is to protect fish and wildlife habitat, and other resource values in the area.

1.6 Decision to be Made

The State of Alaska Department of Environmental Conservation (DEC), DNR, and USFWS will decide whether or not to eradicate Elodea using herbicides. This draft EA considers three alternatives, Alternative A – No Action Alternative, Alternative B – Mechanical Removal, and the proposed action, Alternative C – Herbicide Treatment. The selected alternative from this draft EA will be implemented following official approval.

1.6.1 Relationship to Other State and Federal Conservation Plans

As of June of 2016, there are three existing approved EAs in the State of Alaska for projects similarly proposed: herbicide treatment of Elodea for ultimate eradication. In 2013 the USFWS Kenai National Wildlife Refuge, Homer Soil and Water Conservation District, and DNR worked together to implement the first eradication effort on the Kenai Peninsula for Daniels, Beck, and Stormy Lakes. The USFWS National Wildlife Refuge System manages 16 national wildlife refuges, six of which are downstream or north of the interior Alaska infestation. Since these refuges are dominated by wetlands and aquatic habitats they are at risk of infestation. National Wildlife Refuges are required by law, policy and purposes to conserve fish, wildlife, plants and their habitats while also ensuring that biological integrity, diversity and biological health are maintained thus the proposed action would help meet the mandates and purposes of adjacent conservation units by preventing the further spread of this aquatic invasive into refuge aquatic habitats. In 2015, Citizens Against Noxious Weeds Invading the North, DNR, and USFWS Alaska Regional Office (Region 7) collaborated to start eradication treatments of Elodea from

Anchorage in DeLong, Little Campbell, and Sand Lakes. Also in 2015, DNR worked with USFWS Region 7 and the ADF&G to initiate eradicating Elodea in remote Alexander Lake in the Matanuska-Susitna Valley. The proposed action also conforms to the goals of the ADF&G Aquatic Nuisance Species Management Plan (ADF&G 2002), which includes coordinating with other programs, agencies and tribal entities to prevent the introduction and spread of aquatic invasive plants in Alaska and detecting, monitoring, containing and eradicating populations of aquatic nuisance species as quickly as possible with minimum environmental impacts. All of the noted projects produced an EA for the use of fluridone and/or diquat to treat Elodea.

1.6.2. Legal Authorities

Alaska Statute 03.05.027 states that DNR shall oversee the enforcement of regulations regarding noxious weeds, invasive plants, and coordinate with other agencies, public groups, and private organizations to control noxious and invasive plants. It also mandates that a state coordinator implement a comprehensive plan including early detection and rapid response to regulate and control the entry of prohibited noxious and invasive plants into the state. In 2013, DNR formally recognized Elodea as a noxious aquatic plant in Alaska through the quarantine process. It is DNR’s legal responsibility to remove the threat imposed by invasive Elodea and develop a plan to coordinate an effective interagency response, to delineate, contain, and when feasible, implement a plan to eradicate Elodea. The FSWCD, in collaboration with the State of Alaska and the Fairbanks Elodea Steering Committee, has drafted an Integrated Management Plan for the local Elodea eradication efforts for the proposed project area (Appendix 8.1).

2. Alternatives

2.1 Introduction

In this section proposed alternatives are described which will enable reviewers to compare and contrast the environmental effects associated with each of the three alternatives presented. Implementation of alternatives B (Mechanical or Manual Removal) and C (Herbicide Treatment) would entail application of an IPMP approach. The No Action (Alternative A) describes effects on resources when no action is taken to contain or eradicate Elodea from infested waters. Alternative B, Mechanical or Manual Removal responds to concerns about using an U.S. Environmental Protection Agency (EPA)-approved aquatic herbicide in Chena Slough, a densely populated area. Alternative C – Herbicide Treatment and the proposed action responds to the need for eradicating Elodea to prevent its further spread and the need to maintain the function of intact aquatic ecosystems in interior Alaska. Other alternatives were considered but have been eliminated from consideration because they did not meet the purpose and need of the project.

2.2 Alternatives Considered

2.2.1 Alternative A: No Action

Under the No Action alternative, DNR would not implement invasive plant management in the infested waterbodies. All monitoring and education efforts would be discontinued. No methods of containing the spread of Elodea would be attempted, and the existing infestations would be left uncontrolled.

The infestation in the Chena Slough and Totchaket Sloughs have a high risk of spreading to other locations because of their connectivity to downstream river systems and the wide array of users who could potentially transport Elodea fragments to other waters. Spread of Elodea could be very detrimental to the ecological and recreational values of water bodies throughout the region due to the prevalence of vectors of transport, thus, the no action alternative is not a viable alternative and would not meet the Purpose and Need described in this draft EA. Furthermore, the Chena Lake and Chena River infestations would be left to continue to proliferate, thereby likely reducing recreational values for which Chena Lake was created. In the Chena River rooted fragments would continue to grow, posing a possible safety hazard to boaters and floatplane traffic as well as a source of invasive plant propagules.

2.2.2 Alternative B: Mechanical or Manual Removal

Under Alternative B, actions would include use of mechanical or manual means to remove Elodea biomass in all four waterbodies and may include diver-operated suction harvesting, cutting, shredding, or hand-pulling. Suction harvesting and raking control methods were tested in a single location in Chena Slough for their efficacy in controlling Elodea in the summers of 2013 and 2014 (Lane 2014). A diver stationed on the river bed feeds the plant material into the intake hose. The trials were conducted by FSWCD in conjunction with partners from Test the Waters Dive Shop. In shallow areas, teams of volunteers used spaded pitchforks to remove Elodea in 66 feet by 66 feet quadrats. Suction harvesting and raking were found to be extremely labor-intensive, taking approximately 400 hours of labor for 1 acre of removal (Lane 2014). In addition, these methods inevitably resulted in large scale fragmentation of Elodea, making collection of fragments a major challenge, and increasing the risk of spread downstream to uninfested areas. By 2015, after two seasons of mechanical and manual removal, Elodea had regrown in the four treated patches in Chena Slough. It was difficult to determine whether this regrowth was due to roots that were missed by the removal methods, or due to fragments rooting from upstream. While suction harvesting may be a good tool for removing small, isolated patches of Elodea, it is unlikely to be an effective means of eradication in large infestations such as the ones in Chena Slough, Totchaket Slough and Chena Lake. However, the relatively small, isolated patches of Elodea in the Chena River will be removed via diver-assisted suction dredging.

2.2.2.1 Mechanical Removal of Elodea in the Chena River

The suction harvesting system consists of a sluiceway box with an attached intake hose and dredge motor mounted on top of a pontoon boat. Mesh bags, each with a capacity of 2ft^2, are attached to three output terminals on the sluiceway box to collect plant and sediment material. For suction harvesting, a SCUBA diver stays anchored and feeds Elodea into the 4-inch diameter suction hose nozzle. The plant material along with sediment gets sucked through the hose into the sluiceway box where it is distributed out of the three terminals into the mesh bags. The bagged plant material will be transported to a secure upland location and buried or composted. In 2015 and 2016, a section of the Chena River between its mouth (where the Chena River flows into the Tanana River), and the mouth of Chena Slough (where the Chena Slough flows into the Chena River) was surveyed for Elodea. The survey team searches for Elodea in the river channel by visual observation, rake throws, and divers scouring the river bed for rooted Elodea. Surveying could only be conducted when conditions were appropriate for diving, and high water events in both seasons resulted in only a portion of the river being surveyed. The Chena River is a conduit for Elodea fragments originating in Chena Slough, but in most parts has a high enough flowrate that fragments are less likely to become established. As of 2016, one established patch of Elodea has been found, located at 64°50'22.97"N, 147°50'57.72"W. This patch was removed using a combination of suction harvesting and hand pulling in 2016, and will be monitored closely in subsequent years to mechanically and/or manually remove any regrowth. Any other small patches (>5ft^2) that are found in the Chena River during subsequent dive surveys will be mechanically and/or manually removed.

2.2.3 Alternative C: Herbicide Treatment (Proposed Action)

The proposed action involves eradicating established populations of Elodea from Chena Slough, Totchaket Slough and Chena Lake using the systemic herbicide fluridone with a combination of the following formulations: Sonar Genesis (liquid), SonarOne (pelleted), and/or SonarH4C (pelleted). Multiple treatments spanning 3 to 4 years may be necessary to completely eradicate Elodea populations from the proposed waterbodies. This alternative offers the highest probability of achieving the goal of completely eradicating Elodea from all three waterbodies and preventing it from spreading to other waterbodies in the State while maintaining the ecological integrity of Alaska's waterways by having minimal non-target impacts. Alternative C actions also include the use of suction harvesting, but only for the small (>5ft^2) isolated infestations in Chena River.

2.2.3.1 Alternative C: Description of Herbicide (Fluridone)

Herbicides have been key tools in aquatic plant management, and for decades, have been used in controlling nuisance aquatic vegetation in water bodies in the United States (Gallagher and Haller 1990, Netherland et al. 2005). Several aquatic herbicides that are used for aquatic plant management were considered as a means of treating the Elodea infestations in interior Alaska (Table 1). Fluridone (Sonar™) was selected based on: 1) USAEPA approval for use in aquatic ecosystems, 2) the low risk posed to the environment, wildlife, and human health and safety, 3) its efficacy in treating aquatic plants at extremely low dosage, including long-term residue monitoring studies by USEPA, SePRO Corporation, as well as non-governmental, and non-industry entities, 4) DEC approval of several different formulations including liquid and time-released pellets noted above, and 5) its effectiveness in selectively eradicating Elodea from waterbodies in other areas of the state (Anchorage and the Kenai Peninsula).

Fluridone is a tan to off-white odorless crystalline solid, chemically formulated as 1-methyl-3-phenyl-5-[3-(trifluromethyl) phenyl]-4(1*H*)-pyridinone, and applied as either a pellet or liquid (Bartels et al. 1978, McCowen et al. 1979). Fluridone is the active ingredient of Sonar products, a commercially available herbicide used to selectively manage undesirable aquatic vegetation in freshwater ponds, lakes, reservoirs, rivers, and canals. The following fluridone formulations: SonarGenesis - liquid (6.3% active ingredient), Sonar H4C – pellets (2.7% active ingredient) and SonarONE – pellets (5% active ingredient) are proposed for treating the Elodea infestations in interior Alaska.

Aquatic Herbicide	LD-50 in rats (mg/kg body weight)	Mode of action	Further considerations
2,4-D	375-666	Systemic	Some formulations are highly toxic to fish. Potentially carcinogenic and an endocrine disruptor.
Acrolein	50	Contact	Non-specific, highly toxic biocide. Not appropriate for use in natural waters.
Copper sulfate pentahydrate	300	Systemic	Toxic to fish.
Diquat	120	Contact	Swiftly diluted in moving waters.
Endothall	51	Contact	May kill native plants. Cannot be applied within 600 feet of a drinking water well. Some formulations highly toxic to fish.
Flumioxazin	>5,000	Systemic	Not effective on Elodea (Glomski & Netherland 2013).
Fluridone	>10,000	Systemic	May injure some susceptible aquatic plants. Irrigation restrictions apply.
Glyphosate	5,600	Systemic	Effective only on plants that grow above water, non-specific to Elodea.
Imazamox	>5000	Systemic	Sensitivity of Elodea and native plants unknown.
Imazapyr	>5000	Systemic	Not effective on submerged plants.
Penoxsulam	> 5,000	Systemic	Likely to move into groundwater, some evidence of carcinogenic effects.
Triclopyr	630-729	Systemic	Ineffective in moving waters.

Table 1. Comparison of herbicides used in aquatic plant management.

Fluridone is a systemic herbicide that is absorbed through leaves, shoots, and roots of susceptible plants and interferes with the synthesis of RNA, proteins, and carotenoid pigments in plants, thereby disrupting photosynthesis. Disruption of photosynthesis prevents the formation of carbohydrates that are necessary to sustain the plant (Durkin 2008). Field tests in mixed invasive and native submersed aquatic vegetation showed 95% to 100% reductions in a year in invasive populations with native plant cover retention of approximately 70% (Madsen et al. 2002). Treatment of Michigan lakes resulted in drastic reductions in invasive Eurasian watermilfoil, increases in native submersed aquatic vegetation, and increases in size and abundance of native fish populations (Schneider 2000).

All U.S. EPA approved herbicides have undergone extensive testing to determine toxicity levels through acute (high doses for short periods of time) and chronic (long-term exposure) studies on animals (USEPA 1986). Fluridone has been tested in both acute and chronic toxicity studies, as well as studies examining potential genetic, cancer, and reproductive effects. Fluridone has not been shown to result in the development of tumors, adverse reproductive effects and offspring development, or genetic damage (USEPA 1986). USEPA has approved the application of fluridone in water used for drinking as long as residue levels do not exceed 0.15 parts per million (ppm), which is equivalent to 150 parts per billion (ppb). One ppm is equivalent to approximately one second in 12 days or one foot in 200 miles. Concentrations of the active ingredient fluridone up to 150 ppb are allowed in potable water sources. The proposed treatment concentrations of 5-10 ppb are well below the 150 ppb allowable limit in water used for drinking (USEPA 1986).

Fluridone is removed from treated water by degradation from sunlight, adsorption to sediments, and absorption by plants, or dilution from moving water. In partially treated water bodies or moving waters, dilution reduces the herbicide concentration more rapidly following application, thus, reducing its effectiveness. However, DEC approved special local needs label was issued for Alaska to include flowing water sites (Appendix XX). In field studies, fluridone (various formulations) decreased logarithmically with time after treatment and was undetectable between 64 and 69 days after treatment (Langeland and Warner 1986). In other studies, fluridone levels decreased rapidly to values below detection levels after 60 days, with a half-life 7-21 days or less (Kamarianos et al. 1989; Osborne et al. 1989; Muir et al. 1980; McCowen et al. 1979). Fluridone can persist in hydrosoils (sediments) with a half-life exceeding one year (Muir et al. 1980).

Complete eradication with fluridone products generally require treatment of 45—90 days per growing season for two or more growing seasons, depending on the site and flow rate of treatment sites. The ideal time for application is shortly after ice out when plant biomass is relatively low, turbidity is low, water volume is low, and the plant is actively growing. However, later growing season (August and Spetember) applications in Kenai and Anchorage have proven to be effective in reducing or eliminating Elodea.

2.2.3.2 Proposed Herbicide Treatment

The success rate of fluridone for treating Elodea exceeds 95% (DiTomaso et al. 2013). Treating Chena Slough, Chena Lake, and Totchaket Slough during the growing season in warmer temperatures would be most effective because herbicides translocate fluridone through the plant's tissues while actively growing. Similar to the Kenai and Anchorage Elodea eradication plans and a thorough survey of the interior treatment sites, the proposed application strategy for the Fairbanks area's fluridone application is to combine an initial treatment of a liquid formulation with a subsequent treatment of a pelleted formulation. This helps ensure the desired target concentration is reached quickly and maintained long enough for effective eradication. The projected time necessary to eradicate Elodea is approximately 2-3 years in Totchaket Slough and Chena Lake, and 3 -4 years in Chena Slough. In Chena Slough, Chena Lake, and Totchaket Slough for the first year of the project, an additional fall application of pelleted slow-release fluridone will be applied to maintain target concentrations under the ice during winter for the first year of treatment. Table 2 summarizes the ideal application schedule for each of the treatment areas.

	Year 1		Year 2		Year 3		Year 4	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Chena Slough	Liquid and pellet	Pellet	Liquid and pellet	Pellet (if needed)	Liquid and pellet	Pellet (if needed)	Liquid and pellet	Pellet (if needed)
Chena Lake	Liquid and pellet	Pellet	Pellet		Pellet (if needed)			
Totchaket Slough	Liquid and pellet	Pellet	Liquid and pellet	Pellet (if needed)	Liquid and pellet	Pellet (if needed)		

Table 2. Ideal application schedule for the proposed project.

The project proposes to treat a 119-acre section of the Chena Slough from the vicinity of Plack Road to the mouth in 5 different "zones" (Figure 4). Pelleted and liquid formulations of fluridone will be applied in Chena Slough over a 3 to 4-year period. The first application of fluridone in Chena Slough is SonarGenesis (6.3% active ingredient), a liquid applied by a stationary metered injection system, over a 12-week period for each scheduled year of treatment. The injection system will help maintain the concentration of fluridone in the flowing water during the active growing season, and will be adjusted according to Chena Slough flow rates. For example, if flow rates decrease due to lack of rain, the injection system will be adjusted to lower the rate of fluridone applied to the slough. In addition, two treatments of

Sonar H4C (2.7% active ingredient), a pelleted fluridone formulation, are proposed in each year of treatment; one during the early part of the growing season, the other before ice forms on the slough. The pelleted Sonar H4C will be applied to the entire treatment area to maintain target concentrations. The application of the smaller Sonar H4C pellets will be distributed by hand spreaders from the shoreline. The combination of SonarGenesis and Sonar H4C would maintain an in-water concentration of 5 – 10 ppb of fluridone during the duration of the project until Elodea is eradicated. If eradication is achieved by the third year of treatment in the Chena Slough, a fourth season of application may be deemed unnecessary.

The proposed treatment of 3 years to the 232 acres of Totchaket Slough (Figure 5, B) will also utilize SonarGenesis for the first application. Due to the remote access and lack of a secure site or real-time metering for an injection system, SonarGenesis will be applied directly by boat with calibrated pump and tank with trailing hoses. The Totchaket Slough application will also utilize a pelleted fluridone formulation, SonarONE (5% active ingredient). SonarONE is being used in Totchacket Slough because it has larger pellets than the Sonar H4C formulation. While the same target concentration is being applied to both sloughs, the smaller pellets in Chena Slough allow for greater coverage in hard-to-reach-by-boat areas. The combination of SonarGenesis and SonarONE in Totchaket Slough would maintain an in-water concentration of 5 – 10 ppb of fluridone during the duration of the project until Elodea is eradicated.

This project proposes to conduct a whole lake treatment in Chena Lake (Figure 5, A); a total of 234 acres for up to 3 years in duration. The first year of applications will include one SonarGenesis application by boat followed by two SonarONE applications; again, one during the early part of the growing season, the other before ice forms on the slough. During successive years of treatment, a single follow-up treatment of SonarOne is proposed.

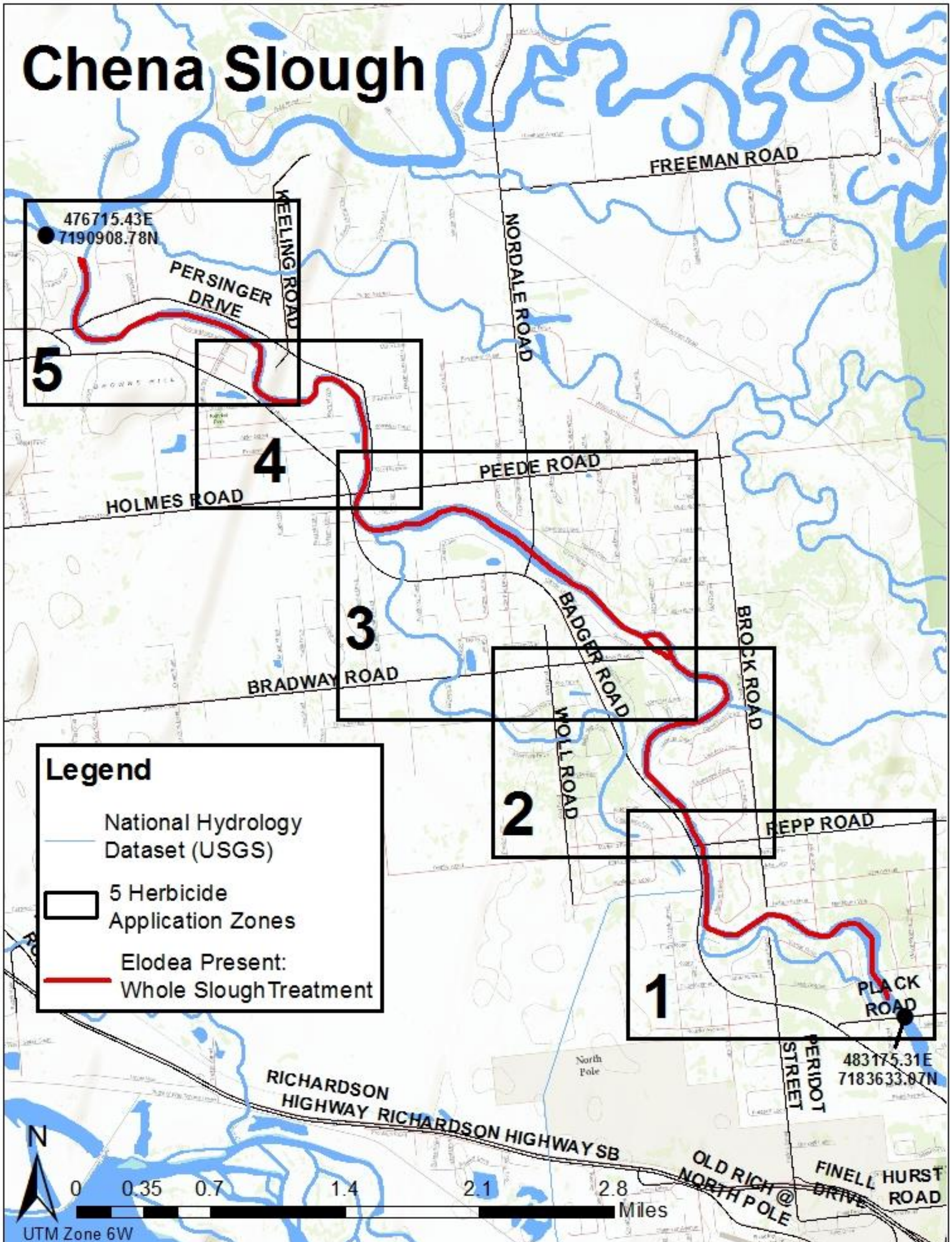
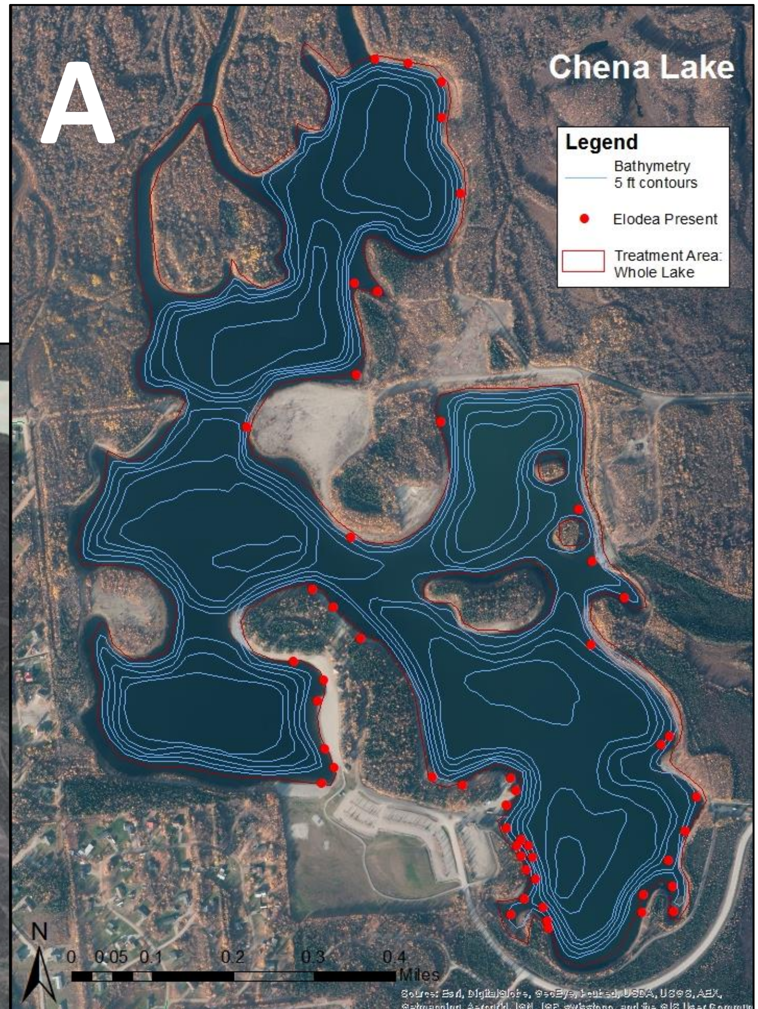


Figure 4. Overview of Chena Slough application area. The proposed treatment area is broken up into 5 application zones, and constrained to the coordinates noted on the map of Chena Slough.



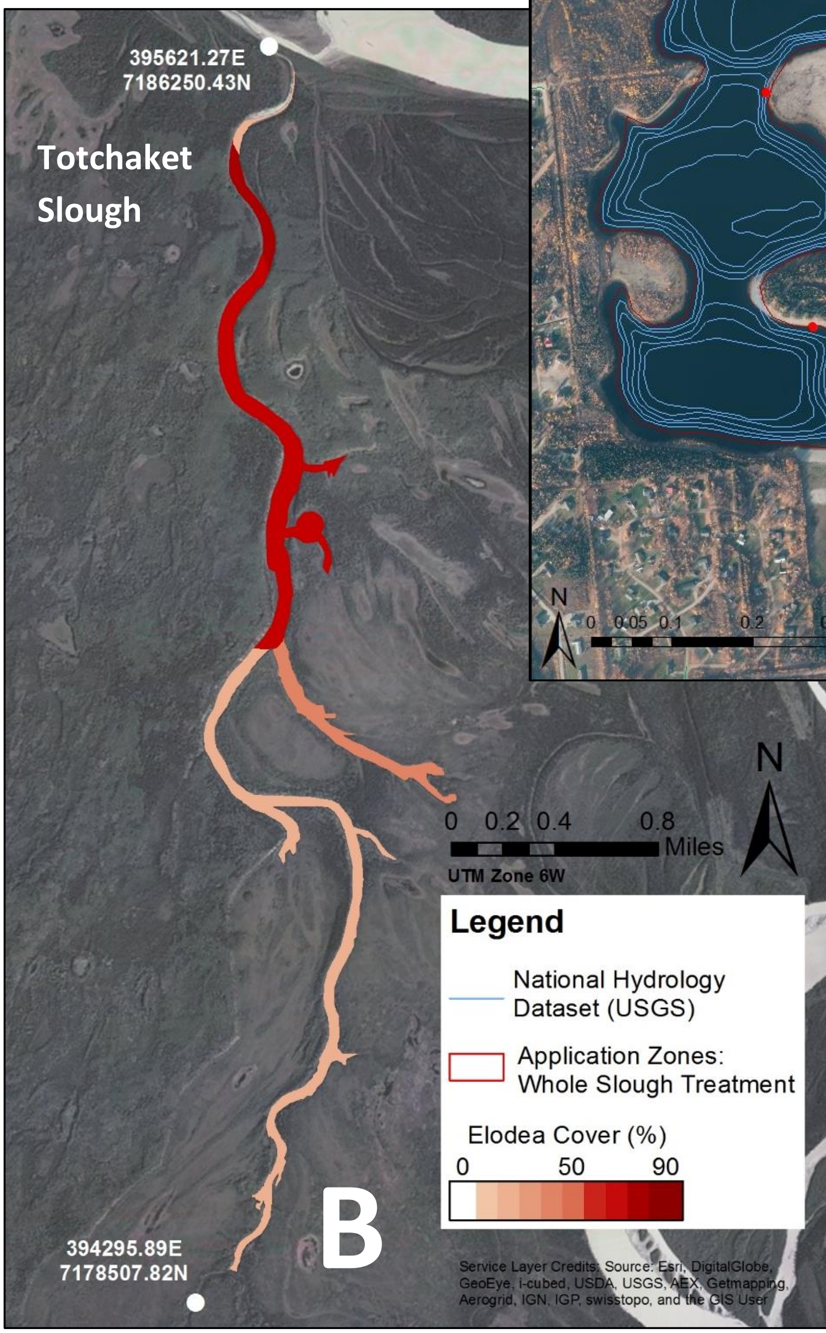


Figure 5. Treatment areas A: Chena Lake, and B: Totchaket Slough. Chena Lake is a proposed whole lake treatment. Totchaket Slough is a proposed treatment between the mapped coordinates.

Liquid fluridone will be applied from motorboats or an injection system by DEC-certified pesticide applicators. Pelleted fluridone will be distributed to the water by a hand spreader or forced-air engine blower. With all application methods, the application rate will be calibrated to ensure that desired concentrations are achieved.

2.2.3.3. Determination of Fluridone Concentration

Controlled lab tests have been conducted with Elodea samples from a lake on the Kenai Peninsula to calculate optimal fluridone concentrations required for effective eradication in Alaska. The lab results concluded that Alaska Elodea is more susceptible to fluridone than Elodea taken from other locations in the lower 48, and that 10ppb is the most lethal after 28 days after treatment (Figure 6). The lab test results, and success in the Anchorage area have guided treatment concentrations for the proposed Fairbanks area infestations. The target concentration is 5-10 ppb, and as the label of Sonar products state, the maximum application rate or sum of all application rates is 150 ppb per annual growth cycle. The maximum concentration is the amount of product calculated as the target application rate, not determined by testing the concentrations of the active ingredient in the treated water. The treatment plan is to maintain the target concentration of fluridone for the duration of the

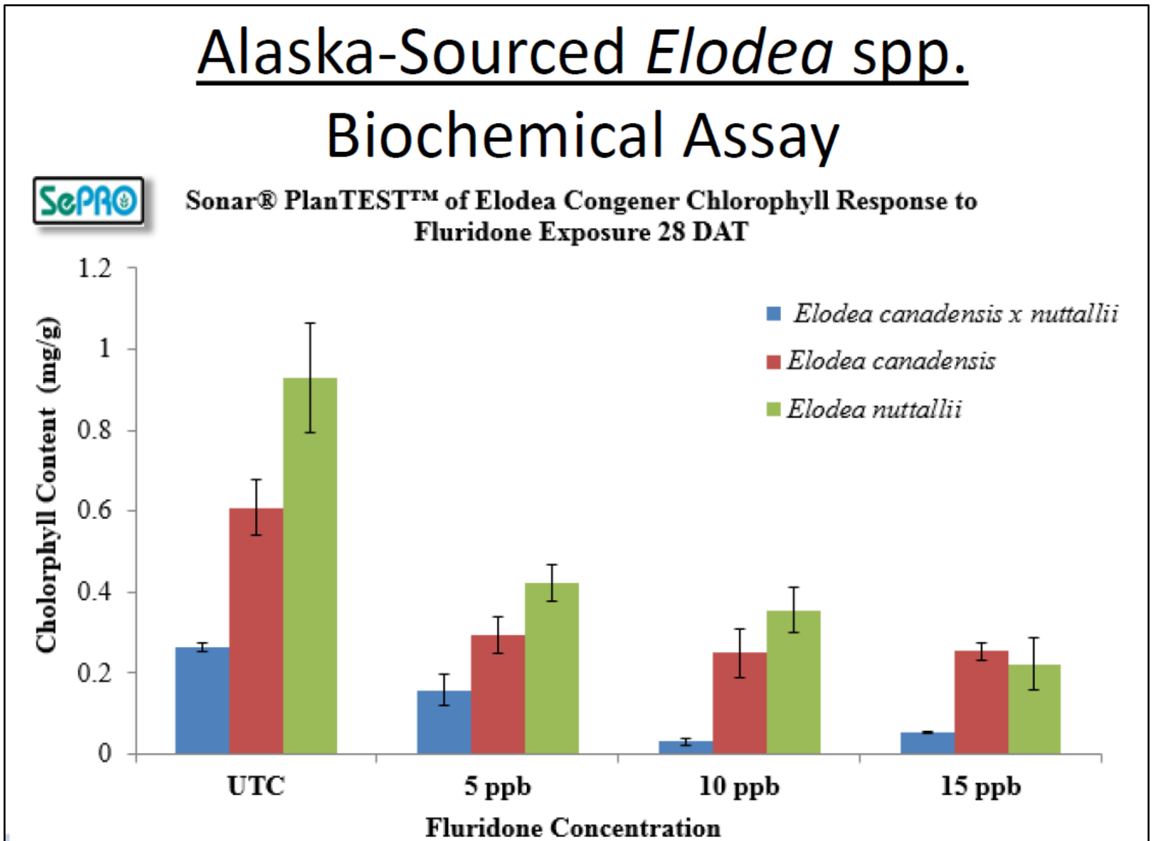


Figure 6. Controlled lab test results to determine most susceptible fluridone concentrations to eradicate Elodea found in Alaska.

project until Elodea is eradicated. To ensure that concentrations are maintained, water samples will be collected from test sites, distributed spatially to represent the full treatment areas. All project collaborators will follow the water sampling stipulations as noted in the DEC Pesticides Use Permit (Appendix 8.2). Samples will be taken at approximately 2, 4, 8, 12, and 16 week intervals, and during winter months at locations based on waterbody morphology in the waterbodies themselves, and in selected drinking water wells, pending landowner/water rights approval. All water samples will be collected using protocols established by, and sent by overnight delivery to SePRO Corporation's analytical laboratory, and a third party for immunoassay following the techniques described by Netherland et al. (2002). If mean fluridone concentrations fall below 75% of the target amount for two consecutive samples, then supplemental fluridone in either liquid or pelleted formulations will be added to maintain target concentrations (but not to exceed 150 ppb in one annual growth cycle).

2.2.3.3. Herbicide Treatment Standard Operating Procedures

Due to the potential risk of exposure to applicators, safety protocols for storing, mixing, transporting, spill clean up, and disposing of containers will be formalized in a worker safety plan. The operating procedures will be debriefed to all applicators and product handlers before any scheduled applications, and given on a yearly basis. Fluridone used according to label instructions minimizes risk to applicators. There is no expected risk of exposure to the public from drift since liquid fluridone will be applied below the water's surface by direct injection or boat trailing hoses, at or near the waters surface with backpack sprayers. Applicators have the highest risk to exposure to fluridone, so they must avoid breathing spray mist, and avoid contact with skin, eyes, or clothing, and must wash thoroughly with soap and water after handling and wash exposed clothing before reusing. Fluridone labels contain additional requirements for safety and minimizing risk to exposure. Sonar Genesis, Sonar One, and Sonar H4C labels are included in Appendix 8.3 and the Safety Data Sheet (SDS) is available in Appendix 8.4.

2.3 Alternatives Considered but Eliminated from Detailed Analysis

This section includes descriptions of alternative actions identified through interagency and public scoping that were considered but eliminated from further analysis because they either did not meet the purpose and need of this project and or the treatments proposed are not proven effective or feasible at this time.

2.3.1 Drawdown or Draining

Lowering the water level of a lake or reservoir can be a successful solution to remove invasive and nuisance aquatic vegetation in specific situations when water control structures are present. Chena Slough, Chena Lake, and Totchaket Slough do not have water control structures established to lower water levels enough for this proposed alternative to become feasible. With the Chena Slough's connectivity to shallow groundwater, between 10 and 5 feet (Glass et al., 1986), it would be difficult to drawdown even if such a structure were to be put in place because the recharge rate would be faster than the drawdown rate (Beattie et al. 2011). Because the groundwater substrate is highly permeable, unconfined, and unconsolidated, other impacts such as surface subsidence, or shallow water wells becoming dry may occur if drawdown were feasible.

Given the remote area of Totchaket Slough and its attachment to surrounding wetlands, installing a water control structure and draining the slough would be logistically difficult, not cost feasible, and unrealistic. Likewise, with Chena Lake, drawdown or draining would be logistically difficult, and would defeat the original purpose of why the lake was created; flood control. The deepest part of Chena Lake is 38 feet, thus making a water control structure nearly impossible to install to be effective. If pumping were needed to fully drain the Chena Lake, there would be a chance that Elodea could be displaced by the pumping system and infest a surrounding area.

Drawdown or draining of the proposed areas would have many unwanted long-term side effects such as negative impacts to adjacent wetland habitat, fish and wildlife becoming displaced, and extended loss of recreational and subsistence use while the waterbodies refill. Draining the sloughs or lake could still require chemical treatment or manual removal of all plant fragments to ensure Elodea is eradicated from the water body.

2.3.2 Benthic Barriers

A benthic barrier covers the sediment like a blanket, compressing aquatic plants while reducing or blocking light they require to grow. Examples of benthic barriers include burlap, plastics, Mylar, and woven synthetics. Placing benthic barriers over aquatic plant infestations can be a successful method of suppressing growth in small, shallow water bodies, and could potentially eradicate Elodea in areas where stands are sparse. However, benthic barriers would not be possible in the proposed waterbodies due to the large areas infested; Chena Slough alone is 118 surface acres. Also, in areas with dense biomass, benthic barriers would not be effective in controlling Elodea. Since the majority of the Chena Slough and Totchaket Slough have infestations which cover up to 90%, benthic barriers would not be realistic.

Additionally, gas production that results from decaying organic matter under the barrier may affect the long-term functioning and stability of the method (Gunnison and Barko 1992). Limited permeability of a bottom barrier has been shown to create anoxic conditions and increased ammonium concentrations beneath the barrier. This can result in the elimination of native aquatic macroinvertebrate communities (Eakin and Barko 1995). This method is not species-specific and could impact benthic organisms and native plant species.

Additionally, the expense of treating the areas infested in interior Alaska is prohibitive. To cover only Chena Lakes, an area of 234.3 acres, with a standard benthic barrier ($425 per 700 sq ft) would cost approximately 6.2 million dollars. The addition of Chena Slough (118 acres) and Totchaket (232 acres), would raise the expense to a minimum total of 15.4 million dollars, not including installation costs.

The price, difficulty of installation over large areas, and the fact that benthic barriers are not effective at eradication for such large and dense infestations, indicates that this option is not a feasible one to consider.

2.3.3 Biological control

Biological control of Elodea has typically been attempted with the introduction of grass carp (*Ctenopharyngodon idella*), an herbivorous fish native to Asia. Biological controls will never eradicate a species, only control populations. The introduction of any non-native fish species to Alaskan waters is illegal, and therefore not considered feasible.

3. Affected Environment

3.1 Introduction

This chapter describes the present condition of the environment that we are proposing to treat. The key issues generated through the scoping process, and the requirements of National Environmental Policy Act (NEPA), define the general scope of the environmental concern for this project. This chapter forms the scientific and analytic basis for the comparison of alternatives.

The following critical elements have been considered for this EA, and unless specifically mentioned later in this document, have been determined to be unaffected by the proposed action: climate, threatened and endangered species, environmental justice, hazardous waste, prime/unique farmlands, and designated wild and scenic rivers.

3.2 Resources

3.2.1. Air Quality

Portions of the cities of Fairbanks and North Pole fall under the Particulate Matter 2.5 Non-Attainment Area, as designated by the EPA. This area contains Chena Slough and Chena Lake, but not Totchaket Slough. Particulate matter levels in the area are primarily influenced by the use of wood and coal-burning stoves in winter, and should not be influenced by any treatment options. Drift is likely not to occur because liquid fluridone will be directly injected or applied at or just below surface waters. Minimal dust from the pelleted formulations may be deposited from the inactive ingredients while forced air is used to distribute pellets.

3.2.2 Water

Baseline water quality data exists for the Chena Slough; collected during a survey completed by DEC and USFWS in 2013. Currently, the Chena Slough is listed by DEC as an impaired waterbody in Category 5 section 303(d) due to sediment from urban runoff. However, it has been delisted for hydrocarbon contamination (Tetra Tech, 2011). There are no known contamination issues for Totchaket Slough or Chena Lake, however, baseline water quality information will be gathered by local Fairbanks area collaborators before the fluridone application.

3.2.3 Soil

Soil in the treatment areas are dominated by silt. Upland areas are covered by wind-blown loess that originate from glacial outwash, whereas the lowlands are dominated by water-laid silty sediments that are derived from glaciers or washed down from hillside. There is discontinuous permafrost throughout the region.

3.2.4 Vegetation

3.2.4.1 Native Plant Species

Aquatic vegetation in Chena slough consists of *Hippuris vulgaris, Potomageton alpinus, Sparganium* sp., and *Ranunculus aquatilis* (Dion 2002). Diatoms, *Nostoc* sp., and filamentous algae are also present in Chena Slough. Terrestrial stream and lakeside communities include wetland vegetation that includes black spruce/tamarack, blueberry, willow species, and sedges. Permafrost-free areas have well-drained soil that is dominated by deciduous trees such as paper birch and aspen.

Spruce, tamarack, and birch forest surrounds Chena Lake (ADFG 2011). Open land, marshes and sloughs also provide habitat (ADFG 2011). Several native and non-native terrestrial plants were introduced for re-vegetation and to control erosion from 1977-79 (Johnson et al. 1981).

3.2.4.2 Non-native Plant Species

Elodea is the only known submerged invasive non-native aquatic plant present in interior Alaska. Many cultivated species, such as turf grass and ornamental trees, can be found along the riparian buffer of Chena Slough along with other terrestrial invasive species.

3.2.5 Wildlife

Goldeneye ducks, grouse, moose, beaver, red fox, brown bear, kestrels, kingfishers, ospreys, shorebirds, swallows, muskrat, otter, mink, woodpeckers, rough-legged and sharp-shinned hawks, northern harriers, songbirds, mice, voles, hares, squirrels, lynx, wolves and black bears are all found in the surrounding areas (ADFG 2011).

3.2.6 Fish

Chena Slough was recognized in the 1990s as a world-class catch-and-release sport fishery for Arctic grayling (*Thymallus arcticus*) that provided important spawning and rearing habitat for Arctic grayling (*Thymallus arcticus*) (Dion 2002); other fish species documented in the slough include Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), northern pike (*Esox lucius*), round whitefish (*Prosopium cylindraceum*), Arctic lamprey(*Lampetra camtschatica*), Alaska blackfish (*Dallia pectoralis)*, long-nose sucker (*Catostomus catostomus*) and slimy sculpin (*Cottus cognatus*) (Ihlenfeldt 2006). Planktonic organisms include copepods, daphnids, ostracods, Ephemoptera, Plecoptera, and Tricoptera (USACE 1997). In 1997 it was estimated (U.S. Army Corps of Engineers 1997) that 30 to 50% of the arctic grayling in the entire Chena River system were spawned in Chena Slough. Though the ADF&G has not released data on Chena Slough alone, mean annual grayling catch in the Chena River below Moose Creek Dam (combined with Chena Slough and Noyes Slough) declined between 2000 and 2010. Chena Slough is listed only once in the Anadromous Waters Catalog and Atlas and this is for Chinook salmon rearing documented at about the midpoint of the length of the slough. In the Chena River, at the point Chena Slough flows into it, chum salmon and Chinook salmon are present, and chum and Chinook spawning and rearing have been documented to occur, and a second record exists at the same location for juvenile Chinook salmon rearing.

Chena Lake has been stocked by ADFG with rainbow trout, silver salmon, and arctic char since 1982 (ADF&G 2016).

Northern pike (*Esox lucius*) are known to inhabit Totchaket Slough itself and the slough is close in proximity to Minto Flats State Game Refuge a well-known productive breeding area for Northern Pike in Interior Alaska. However, no systematic fisheries surveys have been conducted in Totchaket Slough. ADFG indicated that along with Northern pike the slough is likely inhabited by whitefish, burbot, juvenile coho salmon, and Alaska blackfish based on the known fish assemblages of the nearby river and sloughs Chinook, chum and coho salmon have been documented to be present in the Tanana River downstream of the Totchaket Slough mouth at Swanneck Slough and these records are recorded in the State of Alaska Anadromous

Water Catalog and Atlas. Upstream of the Totchaket Slough at the confluence of the Nenana and Tanana Rivers near the town of Nenana Chinook, chum and coho salmon have also been documented. Based on the juxtaposition of these records it is anticipated that juvenile anadromous fish of these salmon species are present in Totchaket slough although the presence of Northern pike (a predator of small-sized and juvenile fish) suggests that this would be sub-optimal habitat for juvenile salmon.

3.2.7 Threatened and Endangered Species

There are no threatened or endangered species present in interior Alaska.

3.3 Resource Uses

3.3.1 Human Health and Safety

Although herbicides are widely used to control unwanted species, public concerns have been raised regarding health and human safety. Fluridone is an EPA-registered herbicide that has been approved for use by ADEC. Any risks to human health during application (particularly to applicators) will be minimized by following a safety plan, including proper use of safety equipment. Orientation meetings will be held prior to all applications to cover planned activities, as well as spill prevention and response. People recreating in the area would not be at risk from chemical toxicants when the lakes are being treated.

3.3.2 Recreation

Chena Slough is used for recreational boating, and fishing. Totchaket Slough receives recreational boat use. Chena Lake is managed by the Fairbanks North Star Borough as a recreation area, and is a popular local site for swimming, non-motorized boating and camping. Chena Lake is also stocked with several fish species, and is used for sport fishing year round.

3.3.3 Land Use

Chena Slough is highly urbanized with private residences, many of which irrigate their lawns and gardens with slough water. Chena Lakes is managed as a borough recreational area. The land surrounding Totchaket Slough is used primarily for subsistence hunting or fishing.

3.3.4 Economics

The Fairbanks North-Star Borough occupies 7,444 square miles of interior Alaska, and is home to approximately 100,000 people, with a mean per capita income of $45,313 in 2013 (AKDOL, 2015). Major economic drivers are the Army and Air Force bases, production and refinery support for oil and mining industries, as well as the university, tourism and service industries. Nenana is in the Yukon-Koyukuk Census area, part of the unincorporated borough, with a population of 378 as of the 2010 census. The largest year-round employers in Nenana include the Nenana City School District, City of Nenana, the Nenana Native Council, and the Tanana Chiefs Conference (Nenana Native Village, 2013).

3.3.5 Viewshed/Aesthetics

Chena Slough is part of the viewshed for many residents, but has been altered from its natural state to an urbanized area for many years (see the history of Chena Slough in section 1.5.1). Chena Lake is a popularly visited borough recreational area, but is man-made (see section 1.5.2). Totchaket Slough's veiwshed is almost completely in its natural state, and recreationalists use it for subsistence.

3.3.6 Subsistence

Chena Slough and Chena Lake are located in urban areas where subsistence activities do not occur. Totchaket Slough is the only Elodea-infested waterbody, considered in this EA, used primarily for subsistence (adjacent lands are privately owned by the Toghotthele Village Corporation). Nenana residents access various waterbodies in traditional harvest hunting areas including Totchaket to fish for pike and harvest waterfowl and moose beginning in spring through late fall.

4. Environmental Consequences

4.1 How to Read This Chapter

The NEPA requires that environmental documents disclose the environmental impacts of the proposed action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided for the alternatives considered. Whenever federal funds are used for purchase of herbicides, as is the case for this proposed project, the project must assess the extent of impacts on resources as defined by the context (type and extent), duration, and intensity of the effect, based on an understanding and analysis by resource professionals and specialists. This chapter identifies the impacts to the physical, biological, and human aspects of the environment that could be *affected by the alternatives*.

4.2 Introduction

Environmental consequences are explained in full within the following text. Summaries of those consequences are presented in a table at the end of the chapter. Each resource and resource use was identified in Chapter 3: Affected Environment. Scoping Issues relevant to the purpose and need and will be addressed relative to effects of the alternatives on physical and biological resources and the human environment at the end of this EA. Because herbicide use is often controversial and the impacts of herbicides are varied, Table 1 provides basic information on the herbicide likely to be used in Alternative C: Herbicide Treatment.

4.3 Methods: Categories of Impact

Thresholds were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial, of the various management alternatives (NPS 2015). Whereas issues describe the impact relationship between actions and resources, impact analysis predicts the magnitude of that relationship.

An environmental impact, relating to a topic, is expressed as the change in condition of the resources or environment under examination that can be attributed to the proposed action. Impacts are analyzed by considering the action relative to the resource baseline condition and the resulting effect. Impacts must be quantified as much as possible and interpreted in terms of their type, extent, duration, and intensity. For the purpose of this analysis, we will use the following terminology:

4.3.1. Type

- Beneficial impacts - a positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition; or
- Adverse impacts - in the context of most resources, an adverse impact refers to a change that moves the resource away from a desired condition or detracts from its appearance or condition.
- Direct impacts - impacts occurring from the direct use by or influence of invasive plant management; or
- Indirect impacts - impacts occurring from invasive plant management that indirectly alter a resource; it may also be a secondary effect of the initial action.

4.3.2. Extent

- Site specific – impacts apply to the immediate site of direct treatment and would not include surrounding watershed or landscape; or
- Local – impacts apply to the immediate site, but also extend to areas where the action was not directly applied.
- Regional – impacts would extend to adjacent waters.

4.3.3. Duration

- Short-term impacts – Those impacts occurring from invasive plant management in the immediate future (usually 1 to 6 months, or one growing season); or
- Long-term impacts – Those impacts occurring from invasive plant management and lasting for the next 10 years.

4.4 Resources

4.4.1 Air Quality

Summary of Effects

Impacts are similar for all treated water bodies. The No Action alternative would have no impact on air quality. Mechanical removal and herbicide treatment would have short-term, site-specific impacts on air quality, from emissions of vehicles and boat motors.

Alternative A - No Action

Ceasing management of Elodea would have no impact on air quality.

Alternative B - Mechanical Removal

Transportation to the sites, moving material to a disposal facility, and mechanical removal with suction harvester will produce a small amount of emissions from boat engines, which will dissipate rapidly.

Alternative C - Herbicide Treatment (Proposed Action)

Transportation to the site and use of four-stroke outboard motors will produce a small amount of emissions, which will dissipate rapidly.

Fluridone itself is not expected to cause air pollution. Fluridone is stable to oxidation and hydrolysis; volatilization of fluridone is not expected to be significant. Liquid fluridone will be applied at or just below the water surface and the pellets or granules will be applied with broadcast spreaders via boat, or via backpack spreaders in less accessible areas of Chena and Totchaket Sloughs. There is little concern regarding air drifting because liquid fluridone will be applied at or just below the water surface via weighted trailing hoses, and the pelleted/granular formulations are heavy enough that the wind speeds will not cause them to drift. Minimal dust from the pelleted fluridone may become airborne, but only in the vicinity of the application boat.

4.4.2 Water

Summary of Effects

Discontinuing management of invasive plants (No Action) is expected to have long-term, adverse impacts on the water quality in Chena Slough and Totchaket Slough, slowing the flow of water and increasing sedimentation. If no action is taken, long-term adverse impacts to other waterbodies in Alaska from natural and anthropogenic spread are likely to occur. Mechanical treatments would have a short-term adverse impact by increasing turbidity, but short-term beneficial impact by removing Elodea and would continue to grow as a long-term negative impact. Herbicide treatments would have a short-term, local impact: the presence of decaying plant matter could decrease dissolved oxygen during treatment. The intended herbicide will be applied at low concentrations, and should not be detectable in the water outside the treatment area, or post treatment. Post treatment, water quality will improve (beneficial, long-term impact) due to the lack of Elodea.

Alternative A - No Action

The continued presence of Elodea is expected to continue to slow the flow of water in Chena Slough and Totchaket Slough via its dense vegetative cover as well as by increasing rates of sedimentation and is a direct negative impact to water quality and quantity. If no action is taken, increased risk of natural and anthropogenic vector spread of Elodea is likely to occur around the State to other water resources outside of the Fairbanks area. Water resources in areas where Elodea eradication are currently underway will have to be perpetually monitored for the risk of re-infesting the water as long as Elodea is present in the interior.

Alternative B - Mechanical or Manual Removal

Operation of the suction harvesting system which is required for manual removal of Elodea, temporarily increases water turbidity due to disturbance of the streambed. Adverse impacts (both short and long-term as well as direct and indirect) can be expected by using mechanical or manual removal methods on large infestations because the actions of mechanical or manual removal will increase fragmentation and downstream dispersal of Elodea.

Alternative C - Herbicide Treatment (Proposed Action)

The preferred alternative would apply fluridone to target waters to eradicate Elodea, an invasive aquatic plant. The anticipated direct impacts of using fluridone in water resources would be short-term. In field studies, fluridone did not adversely affect water quality parameters such as pH, dissolved oxygen, color, dissolved solids, hardness, nitrate nitrogen, total phosphates, and turbidity (McCowen et al. 1979).

Fluridone is registered by both the USEPA and the DEC and are deemed safe for use to treat aquatic invasive plants when applied according to label instructions. The concentration in the liquid formulation in SonarGenesis is 6.3%. The pelleted formulation has a fluridone concentration of 5% in SonarONE and 2.7% in SonarH4C. Regardless of formulation, the maximum application rate or sum of all application rates is 150 ppb per annual growth cycle, and the proposed project will not exceed this amount.

Short term adverse impacts of herbicide application may include an increase in decaying and dead biomass within the waterbodies as the Elodea plants break down. This could result in temporary increases in organic material suspended in the waterbodies, and a decrease in dissolved oxygen levels (McCowen et al. 1979).

Long term water quality is expected to improve with the application of fluridone to Chena Slough, Totchaket Slough and Chena Lake. Long term beneficial impacts include improvement of water quality with the eradication of Elodea, and a restoration of native aquatic plant communities. When native plant communities are restored, water quality is expected to be maintained. Furthermore, eradication of Elodea from Chena Slough will allow removal of this waterbody from the State DEC Impaired Water's waterbody listing.

Water and wetlands outside of the treated areas should not be impacted by fluridone. Due to fluridone's ability to bind to organic matter and the proposed low concentration application rates, fluridone should be undetectable once the Chena Slough enters the Chena River and where the Totchaket joins an adjacent slough of the Tanana. Water sampling sites outside of the treatment area will be used to monitor fluridone's movement in flowing waters. Chena Lake has no outlet, and therefore areas outside of the treatment area should not be impacted.

Fluridone primarily degrades via photolysis (breakdown from solar energy) and secondarily through microbial degradation. A study summarizing field dissipation data for fluridone formulations found an average half-life of 20 days in pond water (ranging from 5 days to 60 days) and 3 months in pond hydrosoils (West et al., 1983). The half-life in open systems is considerably less and varied by dilution rates. In the San Joaquin Delta, fluridone applied at 20 ppb was measured at 1 ppb one week later (EDCP 2012).

Due to the soil binding properties of fluridone, it will not dissipate with groundwater. Fluridone's strong affinity for organic material means it binds to soil, and will not travel past the first 2-3 inches of hydrosoil in lakes and streams (Muir et al. 1980).

In field trials, fluridone did not negatively affect water quality parameters such as pH, dissolved oxygen, color, dissolved solids, hardness, nitrate nitrogen, total phosphates, and turbidity (McCowen et al. 1979). Effects on water quality parameters for EFH such as clarity, dissolved oxygen, and nutrient levels that may be impacted by dead and decaying plant matter are expected to return to normal over a short period of time (ADEC 2016). Also, the treatment is proposed during summer months when the stream flow would result in rapid return to normal oxygen levels. ADEC does not believe that short term addition of fluridone will cause any significant additional concern regarding the water quality in Chena Slough (ADEC 2016).

4.4.3 Soil

Summary of Effects

The No Action alternative would increase sedimentation long-term (adverse impact) in Chena Slough and Totchaket Slough, but have minimal effect in Chena Lake. Mechanical removal would have the short term adverse impact of disturbing the stream/lake bed in all three water bodies, but would have the beneficial long-term impact of reducing sedimentation in Chena and Totchaket Sloughs. However, because mechanical removal would not eradicate Elodea in the proposed areas, sedimentation rates would remain high unless mechanical removal happened in perpetuity. Herbicide treatment will lead to the presence of fluridone in stream and lake sediments in very low concentrations following treatment (short-term adverse impact). Due to eradicating Elodea, herbicide treatment would have the beneficial long-term impact of reducing sedimentation in Chena and Totchaket Sloughs.

Alternative A - No Action
Continued high sedimentation rates from excess vegetation and urbanization in river beds should be expected due to the presence of Elodea.

Alternative B - Mechanical or Manual Removal
Manual removal would lead to disturbance of the sediment during treatment, a short term adverse impact. Short-term sedimentation will be decreased due to the removal of Elodea (beneficial impact), but because mechanical removal will not eradicate Elodea in the proposed large areas, continued high sedimentation rates are expected in the long-term.

Alternative C - Herbicide Treatment (Proposed Action)
Fluridone binds to organic matter, and will not travel past an inch or two of lake or stream sediments (Muir et al. 1980). Soil samples will confirm fluridone concentrations in sediment profiles. The half-life for fluridone in lake hydrosoil can be up to one year (Muir et al. 1980). Given that application rates under 20 ppb will lead to concentration levels of 1 ppb in the water immediately after treatment in flowing water (EDCP 2012), residual fluridone in sediments will likely be below detectable levels in Chena Slough or Totchaket Slough after treatment ends.

Because fluridone binds readily to soils, organic matter, and suspended sediment in the water column, it has an estimated half-life in water of only 20 days (EPA 1986) and a hydrosoil half-life of approximately 119 days (NCBI 2005). Once it adheres to soil particles, fluridone is biologically inactive, unavailable to disperse, and unable to continue to act as an herbicide (WDNR 2012). As a result, fluridone remains present in the environment for only a limited time (ADEC 2016). Also, eradication of Elodea will provide for more efficient stream flow and reduce ponding and sedimentation (ADEC 2016).

4.4.4 Vegetation

4.4.4.1 Native Plant Species

Summary of Effects

Taking no action, Elodea would have a long-term adverse impact on native plant communities in the affected area, and threaten other native plant communities in the region. Manual removal of Elodea will have a short-term adverse impact on native vegetation, but a larger long term beneficial impact. Herbicide treatment would have a short-term adverse impact on native aquatic plants during treatment, but the communities are expected to shift completely to native plants post-treatment (long-term beneficial, due to the removal of Elodea). Impacts of each alternative are similar for all three water bodies.

Alternative A - No Action

Leaving Elodea unmanaged would have a significant impact on the native vegetation community of the three currently affected waterbodies, and has already threatened the native plant communities of downstream waters of the Yukon watershed. Native vegetation along the sloughs are already suppressed by the growth of Elodea, and the diversity of the sloughs have changed dramatically. Elodea density in Chena Slough and Totchaket Slough reaches 100% in some areas (Figures 5 and 7).

Alternative B – Mechanical or Manual Removal

Small patches of Elodea can be directly targeted by manual or manual removal. However, if manual removal were to occur in Chena Slough, Chena Lake, and Totchaket Slough, eradication would not be possible due the timeliness of labor and lack of resources. Positive short term impacts include the removal of some Elodea biomass for native vegetation recovery. Negative short term impacts include the removal of native vegetation since it is difficult to target one species in an area abundant with both native and invasive aquatic vegetation. Negative long term impact is the creation of Elodea fragments potentially establishing new infestations downstream of Chena Slough or Totchaket Slough.

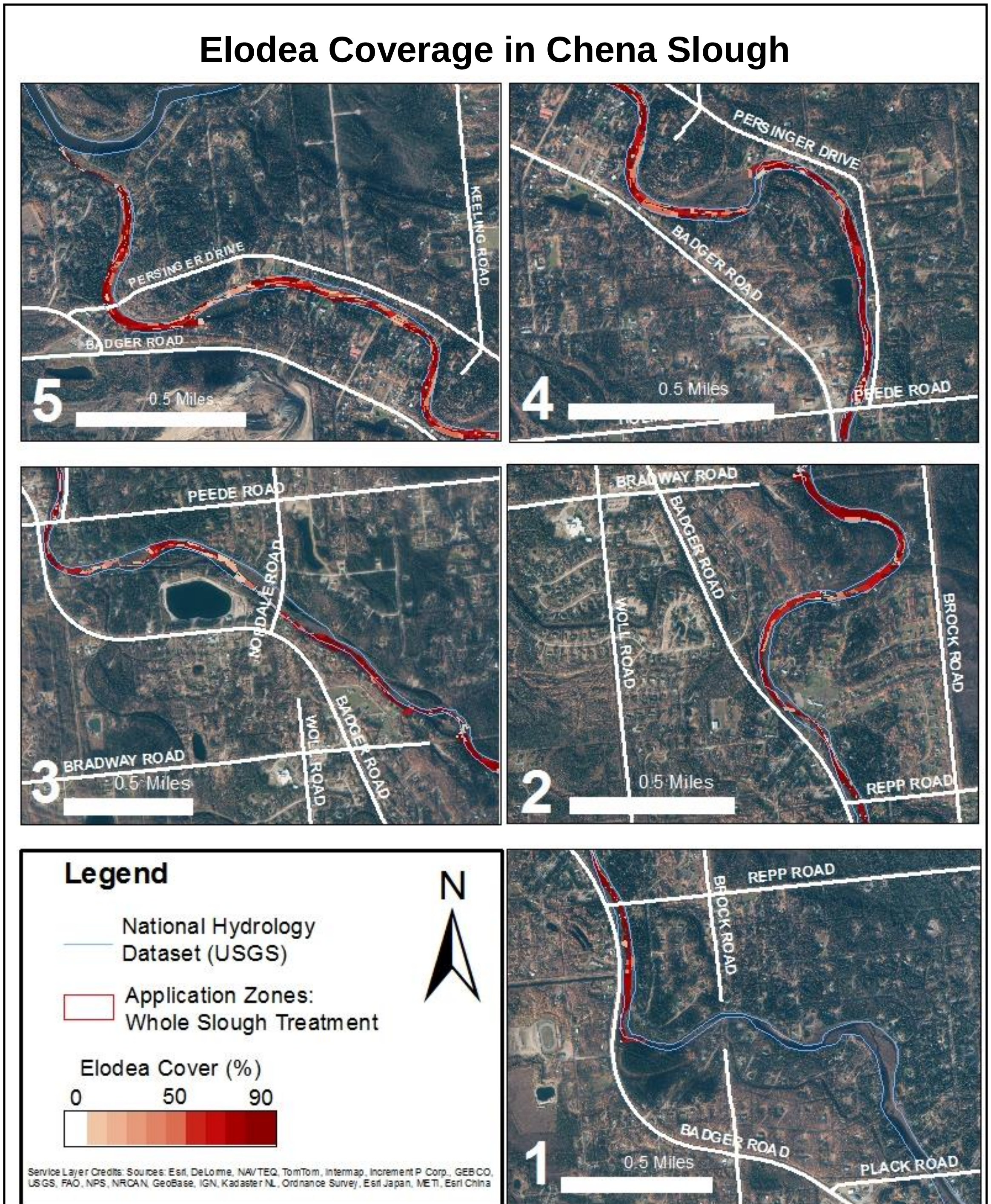


Figure 7. Elodea density in Chena Slough. Zones 1-5 are proposed treatment areas. Red color ramp represents percentage of Elodea density in the 2014 field season.

Alternative C - Herbicide Treatment (Proposed Action)

The desired outcome of the proposed project is the eradication of Elodea, but native submersed aquatic plants will be impacted as well. Madsen et al. (2002) evaluated non-target plant effects in three lakes in southern Michigan that were treated with low-dosages of fluridone (Sonar AS) to control Eurasian watermilfoil. Despite achieving >93% reduction in the frequency of watermilfoil, native plant cover (composed mostly of *Ceratophyllum demersum*, *Chara* spp., *Heteranthera dubi*, *Potamogeton* spp., and *Vallisneria americana*) was maintained at >70% in the year of treatment and 1-year post treatment. Floating leaf plants (such as yellow pond lily) exhibiting chlorosis (due to lack of chlorophyll) usually recover within the year of treatment or become re-established within the following year (Kenaga 1992).

On the Kenai Peninsula and in Anchorage, lakes treated with fluridone have seen chlorosis of yellow pond lilies (*Nuphar polysepala*) and mortality of Northern water milfoil (*Myriophyllum sibiricum*) (J. Morton, pers. comm.). However, native plants primarily reproduce through seed, and fluridone is not expected to affect the seedbank. Both yellow pond lilies and Northern water milfoil are abundant species, and are anticipated to make a full long-term recovery.

In Chena Slough and Chena Lake, Elodea grows both alone in monotypic stands and in mixed assemblages with other native aquatic species as the dominant species. At the low concentrations proposed for the application (≤15 ppb), fluridone is expected to be lethal only to Elodea. The aquatic plant community is expected to shift back to one comprised entirely of native species.

4.4.4.2 Non-native Plant Species

Summary of Effects

Discontinuing management of Elodea (No Action) would have a major, long-term adverse by spreading invasive species throughout the region and possibly the State. Mechanical removal of Elodea would have a beneficial impact, with the adverse impact of creating fragments that could threaten regional waterways. Herbicide treatment would have a beneficial impact, by removing invasive species. Impacts are similar for all three water bodies, but potential regional impacts are most important for whichever treatment is chosen for Totchaket & Chena Sloughs, due to their connectivity to the Yukon watershed.

Alternative A - No Action

Making no attempt to remove Elodea from Interior waterbodies threatens the spread of this invasive plant to downstream waters. Additionally, Chena Slough and Chena Lake are used by recreational boaters, and Elodea could be spread to non-connected waterbodies in the State via recreational gear including boat trailers and floatplane rudders.

Alternative B - Mechanical or Manual Removal

A long term negative impact of manual or mechanical removal of Elodea is the creation of fragments. Fragmentation occurs during any manual or mechanical removal, which raises the risk to downstream waterbodies for a new infestation. Additionally, the labor-intensive nature of manual removal prolongs the treatment time necessary, increasing the probability every year that other waterbodies may be invaded. Patches of Elodea have re-grown in the Chena Slough after suction harvesting (Lane 2014).

Alternative C - Herbicide Treatment (Proposed Action)

Fluridone is currently being used successfully on the Kenai Peninsula and in the Anchorage area to eradicate Elodea. After just two years of treatment, Kenai surveyed hundreds of points in all three lakes and only found one Elodea plant. Within a 3 to 4-year time frame, treatment with fluridone will eradicate Elodea from Interior waters. To date, Elodea has only ben found in 18 waterbodies around the State with an estimated 270 lakes surveyed. With a quarantine established to make it unlawful to sell or trade Elodea within the State of Alaska, and concerted statewide eradication efforts between State, Federal and local collaborators, extensive surveying in the interior, complete eradication is possible with the proposed project.

4.4.5 Wildlife

Summary of Effects

A no action alternative will have several impacts on wildlife including the displacement of native food sources, and altering of habitat. Mechanical or manual removal will also temporarily displace native resident wildlife. Herbicide treatments using fluridone will not have chronic or acute impacts on wildlife.

The maximum non-toxic dose for humans is characterized by the "no-observed-effect-level" (NOEL) for herbicides. Fluridone has minimal to no toxic effects on mammals, fish and birds. Fluridone has been tested for acute and chronic toxicity, as well as reproductive effects on mammals (rats, mice, guinea pigs, rabbits, dogs), birds (bobwhite quail, mallard duck), insects (honey bees, amphipods, daphnids, midges, chironomids), earthworms, fish (fathead minnows *Pimephales promelas*, channel catfish *Ictaluris punctatus*, mosquitofish *Gambusia affinis*, rainbow trout *Oncorhynchus mykiss*, and other aquatic animals (Hamelink et al. 1986 Kamarianos et al. 1989; Muir et al. 1982; McCowen et al. 1979). Dermal exposure (skin contact) of test animals to fluridone has shown minimal to no toxicity in mammals from acute, concentrated contact. Chronic dermal exposure in mammals showed no signs of toxicity and only slight skin irritation. Mammals given varying fluridone doses up to 1,400 ppm per day excreted fluridone metabolites within 72 hours (McCowen et al. 1979). A dietary NOEL for fluridone was established for birds that feed on aquatic plants and insects. The risk to birds from fluridone via diet was considered negligible. The acute median lethal concentration of fluridone was 4.3 (+/- 3.7) mg/L for invertebrates and 10.4 (+/- 3.9) mg/L for fish. Fish in treated ponds showed no fluridone metabolites after treatment (Kamarianos et al. 1989). Chronic studies showed no effects on daphnids, midge larvae, fathead minnows, or channel catfish and rapid rates of metabolic excretion (Muir et al. 1982). Insects that fed on bottom sediments had higher rates of fluridone intake and persistence than other insects (Muir et al. 1982). Honeybees and earthworms were not particularly sensitive to fluridone, even when directly dusted or placed in treated soil (Kamarianos et al. 1989). Fluridone has low bioaccumulation potential in fish, bird, and mammal tissues. Irrigation of crops using water treated with fluridone led to only "residue" amounts in forage crops; containing 0.05 ppm after being fortified with 0.1 ppm (West and Day 1988). Livestock consumption of fluridone-treated water resulted in negligible levels of fluridone in lean meat and milk. Fluridone manufacturer recommendations indicate livestock can consume fluridone-treated water. The tolerance level for drinking milk is the same as for water: 150 ppb (West and Day 1988).

Alternative A – No Action

Wildlife is likely not to be significantly impacted if no action is taken to eradicate Elodea. Bird's food source may be different given the different vegetation, however, because they are not restricted to one location and may migrate freely, wildlife will spend varying amounts of time in different habitats.

Alternative B – Mechanical or Manual Removal

If mechanical or manual removal occurs, short-term displacement is likely with wildlife, particularly birds. Mechanical removal will likely allow for native vegetation to repopulate, allowing native food sources of wildlife to be more available. However, if Elodea is not eradicated and allowed to become a monotypic stand after its mechanical or manual suppression, then these beneficial effects will only be short-term.

Alternative C – Herbicide Treatment (Proposed Action)

Acute effects on birds

Only two species of birds: bobwhite quail (*Colinus virginianus*) and mallard duck (*Anas platyrhynchos*) have been used for acute fluridone toxicity studies. A single dose of 2,000 mg/kg (2,000,000 ppb) of fluridone, administered by gavage (tube feeding directly into the stomach) to adult quail, resulted in no mortality although control and treated birds appeared lethargic through the sixth day, suggesting that birds were responding to gavage, rather than the herbicide (Kehr et al. 1978a). An LD50 (concentration that causes 50% mortality) of > 2,000 mg/kg (2,000,000 ppb) was reported. Also during an eight-day dietary toxicity study with quail, an LC50 > 5,000 ppm (5,000,000 ppb) was reported by Zucker et al. (1982).

During another eight-day study, the diet fed to mallards included fluridone concentrations of 0, 1,250 (1,250,000 ppb), 2,500 (2,500,000 ppb), and 5,000 ppm (5,000,000 ppb; Kehr et al. 1978b). No mortality or signs of toxicity were reported in treated birds. However, the decline in body weight was likely due to birds rejecting the available food. An LC50 of > 5,000 ppm (5,000,000 ppb) was reported.

Chronic effects on birds

Similar to acute studies, only quail and mallards have been used in reproduction studies of birds (ENSR 2005). Continuous dietary exposure of adult male and female quail to 0, 100 (100,000 ppb), 300 (300,000 ppb), and 1,000 (1,000,000 ppb) ppm fluridone for one generation noted no significant differences between control and treated birds for: percent eggs set/eggs laid; percent visible embryos/eggs set; percent 2-week-old survivors/viable embryos; percent 2-week-old survivors/number hatched; and percent number hatched/number laid (Ringer et al. 1981a). Also, there were no signs of toxicity. A NOEL of 1,000 ppm (1,000,000 ppb) was reported.

Results for mallards from a replicate of the reproduction study for quail were the same (Ringer et al. 1981a). Also with mallards, treatment had no effect on food consumption or body weight, and no clinical or pathological effects were attributed to treatment. Feather loss, ataxia, and limping were attributed to aggressive behavior and effects from caging. A NOEL of 1,000 ppm (1,000,000 ppb) was reported.

Displacement by treatment activities

Waterbirds (e.g., waterfowl, loons, grebes), shorebirds, and other species will undoubtedly be present and could be displaced from the waterbodies due to proposed treatment activities (i.e., boats and personnel). Adults of these species will be able to fly to other waters that are in close proximity, but young of the year and molting adults that cannot fly will be limited in their ability to leave the area. However, treatment activities will be of short duration throughout the proposed treatment areas, causing short term, temporary displacement of adults and young of the year. Therefore, treatment activities will have minimal adverse effects.

Ingestion of treated water and food by birds

It is possible that waterbirds, shorebirds, raptors, and other species may ingest treated water or consume aquatic plants, fish, aquatic invertebrates, and sediments that have been exposed to treated water. Durkin (2008) used a hazard quotient to characterize the risk of harm to birds from ingesting treated water. Results indicated that at 150 ppb fluridone concentration, the highest labeled application rate, the hazard quotients for acute and chronic ingestion were below the level of concern by factors of 20,000 and 250, respectively. Also the hazard quotient for consumption of whole fish from treated waters by birds was below the hazard quotient level of concern by a factor of 10. Additionally, fluridone was not highly bioaccumulated in whole body catfish tissue (Hamelink et al. 1986), and 80-90% of the fluridone was excreted by adult rainbow trout during the first four days after exposure (Muir et al. 1982). Ingesting aquatic invertebrates from treated water may introduce trace amounts of herbicides to bird digestive systems (Durkin 2008). Based on results from acute and chronic toxicity studies, ingestion of treated water and consumption of fish or invertebrates exposed to fluridone would likely pose a small risk to consumers.

Mammals

Six genera of mammals: rats (*Rattus sp.*), mice (*Mus p.*), dogs (*Canis sp.*), cats (*Felis sp*.), and rabbits (*Oryctolagus sp.*) have been tested for acute fluridone toxicity studies.

In acute toxicity studies on male and female, adult rats subjected to oral, single dose gavage with fluridone concentrations ranging from 500 mg/kg body weight (500,000 ppb) to 10,000 mg/kg body weight (10,000,000 ppb), mortality was 30% of males at the highest concentration (Frick 1979a). At the other concentrations, no mortality was reported, and results noted leg weakness (Mauer 1985; Frick 1979a and 1979b), hypoactivity (inhibition of activity), diuresis (increased production of urine), ataxia (loss of body movements; Frick 1979a and 1979b), dyspnea (labored breathing), and ptosis (drooping eyelid; Frick 1979a) after 1 hour to 2 days post-dosing. Over the 7-14 day observation periods, surviving rats appeared normal after 24 hours post-dosing (Mauer 1985; Ansley and Levitt 1981; Ansley and Arthur 1980; Frick 1979a and 1979b). LD50's ranged from >500,000 ppb to 10,000,000 ppb (Mauer 1985; Frick 1979a and 1979b).

Single dose gavage at 10,000 mg/kg (10,000,000 ppb) body weight fluridone concentration was used with male and female, adult mice and resulted in 30% and 20% mortality, respectively (Frick 1979a and b). Leg weakness, hypoactivity, ataxia, dyspnea, and ptosis were noted after 48 hours, but mice appeared normal by 72 hours and remained through the 14-day testing period. LD50 was > 10,000 mg.kg (10,000,000 ppb).

A single dose capsule at 500 mg/kg (500,000 ppb) body weight fluridone concentration given orally to male and female adult dogs resulted in vomiting, but no mortality and no obvious signs of toxicity (Frick 1979a and b). LD50 was > 500 mg/kg. The same method using a 250 mg/kg (250,000 ppb) body weight fluridone concentration with adult domestic cats resulted in similar responses as dogs (Frick 1979a and b). LD50 was > 250 mg/kg (250,000 ppb).

A single dose subcutaneous injection with fluridone concentrations ranging from 1,000 mg/kg (1,000,000 ppb) to 5,000 mg/kg (5,000,000 ppb) body weight with adult male and female rats resulted in no mortality in both sexes and hypoactivity for 1-24 hours post-injection for females (Frick 1979a). No signs of toxicity were noted in males. LD50 was > 2,000 mg/kg (2,0000,000 ppb). A similar study with adult female mice that used the same method and dosages resulted in no mortality with toxicity signs of hypoactivity, leg weakness, ptosis, and clonic convulsions (muscle spasm) between 2-24 hour post dosing (Frick 1979a and b). LD50 was > 5,000 mg/kg (5,000,000 ppb). Using the same method, but with both sexes and fluridone concentrations of 2,000 mg/kg (2,000,000 ppb) body weight, another study reported 10% mortality for each sex with toxicity signs of signs of hypoactivity, leg weakness, and ptosis between 2-24 hour post dosing (Frick 1979a and b). LD50 was > 2,000 mg/kg (2,000,000 ppb).

Single dose fluridone concentrations ranging from 500 mg/kg (500,000 ppb) to 5,000 mg/kg (5,000,000 ppb) were topically applied to the shaved or clipped backs of adult male and female rabbits (Ansley and Arthur 1980; Ansley and Levitt 1981; and Frick 1979b). No mortalities were noted, and effects ranged from no signs of toxicity or dermal irritation to mild erythema (reddening of the skin) and mild edema (swelling) at the treated locations in 16% of both males and females. Rabbits that exhibited these effects returned to normal after 6 days post-treatment. LD50's ranged from > 500 mg/kg (500,000 ppb) to > 5,000 mg/k (5,000,000 ppb).

A single dose of one ml liquid fluridone, ranging from 5% (50,000,000 ppb) to 97% (970,000,000 ppb) concentration, was dripped into one eye of male and female adult rabbits (Ansley and Arthur 1980 and Frick 1979b). No mortalities occurred, and conjunctivitis ("pink eye") was noted within one hour in all rabbits. The irritation cleared within 72 hours for 50% of the test subjects. Conjunctival redness was noted after one hour in 75% of the rabbits, but cleared between 1-4 days post treatment. Corneal dullness was reported for 100% of rabbits after one hour with 67% exhibiting this sign through day 3. Slight to moderate iritis (inflammation of the iris) was observed in 100% of the animals after 1 hour. After 4 days, 17% of males exhibited pannus (extended tissue) of a portion of the corneal surface. No corneal lesions were noted, and corneal and iris membranes appeared unaffected.

The effects of fluridone through inhalation were tested by using one hour, single exposures of 2.13 mg/L (2,130 ppb) and 2.45 mg/L (2,450 ppb) to the noses and mouths of adult male and female rats (Frick 1979b). No mortality and no signs of toxicity were observed during the 14 day test. LD50's were > 2.13 mg/L (2,130 ppb) and > 2.45 mg/L (2,450 ppb), respectively. A four hour, nose-only inhalation study with adult male and female rats at a fluridone concentration of 4.12 mg/L (4,120 ppb) resulted in no mortalities with toxicity signs of hypoactivity, chromodacryorrhea ("bloody tears" around the eye), and ataxia among females (Rohland and St. Clair 1981). All rats appeared normal on day 5 post treatment. LC50 was > 4.12 mg/L ((4,120 ppb).

Subchronic effects in mammals

Adult male and female rats were tested using dietary concentrations ranging from 0 mg/kg/day (0 ppb/day) to 2,000 mg/kg/day (2,000,000 ppb/day) for 89-90 days (Frick 1979a). No mortalities occurred, and no treatment related effects on clinical chemistry parameters (analysis of bodily fluids) were noted. Half of the treated males exhibited decreased red blood cell counts and hemoglobin and hematocrit levels. Half of all treated rats exhibited reduced food consumption at 536 mg/kg/day (536,000 ppb) and decreases in body weight at concentrations between 300 mg/kg/day (300,000 ppb/day) and 536 mg/kg/day (536,000 ppb/day). All treated rats showed increased liver and kidney weights.

Adult male and female mice were fed dietary fluridone concentrations from 0 to 560 mg/kg/day (560,000 ppb/day) for 91-94 days (Frick 1979a). Concentrations of at least 330 mg/kg/day (330,000 ppb/day) caused morphologic liver alterations with 17% of the treated mice dying likely due to hepatic centrilobular hypertrophy (enlargement of the central part of liver). At 150 mg/kg/day (150,000 ppb/day) a slight increase in leukocyte (white blood cell) count was observed in half of females. Also, an increase in liver weights for half of all mice at concentrations from 1,000 mg/kg/day (1,000,000 ppb/day)to 2,000 mg/kg/day (2,000,000 ppb/day) were noted. The NOAEL (no-observed-adverse-effect level) was 15 mg/kg (15,000 ppb body weight/day) body weight/day.

Over 92 days, oral capsules with fluridone concentrations ranging from 0 mg/kg/day (0 ppb/day) to 200 mg/kg/day (200,000 ppb/day) were fed to adult male and female dogs (Frick 1979a). No mortality and no adverse effects on body weight, urinalysis, or organ weights were noted. Red blood cell counts and hemoglobin (blood protein that transports oxygen) and hematocrit (ratio of red blood cell volume to total blood volume) levels were slightly lower, but within normal ranges. Slightly elevated alkaline phosphatase (a phosphate removing enzyme) and blood urea nitrogen (BUN; a product of protein breakdown) levels were noted for the 200 mg/kg (200,000 ppb) doses. The study concluded that there was no clear dose related response. The NOEL (no-observed-effect level) was 200 mg/kg/day (200,000 ppb/day).

Subchronic dermal effects of fluridone were tested for 21 days on the clipped, weekly-abraded skins of adult rabbits (Probst et al. 1981). At doses of 192 mg/kg/day (192,000 ppb/day), 90% of the tested rabbits exhibited transient, slight erythema (reddening of the skin) and desquamation (peeling). Thirty per cent of the tested rabbits showed moderate, well-defined erythema, mild desquamation, slight swelling, and mild skin cracks at doses of 384 mg/kg/day (384,000 ppb/day). At 786 mg/kg/day (786,000 ppb/day), 80% of the rabbits tested exhibited moderate to severe erythema with skin cracks, but only slight swelling. There were no changes in body weights or food consumption.

For subchronic teratology (study of abnormalities present from birth) testing, pregnant rats were given daily gavage doses from 0 to 1,000 mg/kg/day (1,000,000 ppb/day) fluridone during days 6 to 15 of gestation (USEPA 2004). Mothers showed decreased body weight and food consumption at ≥ 300 mg/kg/day (300,000 ppb/day). The NOAEL was 100 mg/kg body weight/day (100,000 ppb body weight/day). Fetuses exhibited decreased weight, delayed ossification (bone formation) at 1,000 mg/kg body weight/day. The NOAEL was 300 mg/kg body weight/day (300,000 ppb body weight/day.

In another study, gavage doses ranging from 0 to 750 mg/kg/day (750,000 ppb/day) of fluridone were tested with pregnant rabbits during days 6 to 18 of gestation (Probst and Adams 1980). No mortality for mothers and no effects on body weights or food consumption by mothers occurred at the ≤ 125 mg/kg/day (125,000 ppb/day) dose from day 6-18. Two percent of treated rabbits died post treatment on day 23 from the 300 mg/kg/day (300,000 ppb/day) test, and 4% died on the same day from the 700 mg/kg/day (700,000 ppb/day) test. At 300 mg/kg/day (300,000 ppb/day), mothers exhibited a 29% incidence of abortions above control mothers and slight decreases in body weight and food consumption during days 6-12 with full recovery noted during days 7-18. The number of fetal resorptions/litter increased 2.5 times at this treatment concentration. At 750 mg/kg/day (750,000 ppb/day), mothers exhibited a 55% incidence of abortion above control mothers and a decrease in body weights during days 6-12 with partial recovery post treatment on day 27. There were also decreases in food consumption during the treatment and post treatment periods. The NOAEL for maternal toxicity was 125 mg/kg/day (125,000 ppb/day).

In the same study, analyses of the fetuses from the tested mothers identified no fetal mortality and no effects on fetal body weight at any dosages. At 750 mg/kg/day (750,000 ppb/day) dosage, fetuses were noted to have exencephally (malformation of the central nervous system), omphalocele (abdominal wall defects), rudimentary ears, and rudimentary forelimbs without digits. Increased incidences of thickened ribs and variations of the sternum were also noted. No internal organ abnormalities were observed. The NOAEL for fetal developmental toxicity was 125 mg/kg/day (125,000 ppb/day).

Chronic effects in mammals

A three generation reproduction study tested rats using dietary intakes of fluridone levels ranging from 0 to 131.4 mg/kg/day (131,400 ppb/day; Probst et al. 1980). The first generation was exposed to these fluridone concentrations for two months during the growth and pre-mating phase. The resulting two generations were fed diets with the same concentrations for approximately 125 days each through the growth, maturation, mating, gestation, and lactation periods. No mortalities, no adverse effects on maternal body weights, and no treatment related signs of toxicity occurred in all generations. The NOAEL's for both maternal and reproductive toxicity were > 112 mg/kg/day (112,000 ppb/day). Body weights of third generation offspring were decreased on lactation day 21 (overall day 118) at the 112 mg/kg/day (112,000 ppb/day) level. The NOAEL for offspring toxicity was 36 mg/kg/day (36,000 ppb/day). No evidence of embryo mortality, altered fetal growth, or developmental alteration was noted. The NOAEL for fetal developmental toxicity was > 112 mg/kg/day (112,000 ppb/day).

In a dietary study, adult rats, tested at fluridone intake levels ranging from 0 to 104.58 mg/kg/day (104,580 ppb/day) for 1 year, exhibited no mortality or clinical signs of toxicity (Probst 1980a). In another dietary study, adult rats, tested at fluridone intake concentrations ranging from 0 to 97.08 mg/kg/day (97,080 ppb/day) for 2 years, did not exhibit an increase in tumor incidence (Probst 1980b). At mid-doses ranging from 25.06 (25,060) and 30.51

mg/kg/day (30,510 ppb/day), rats showed decreases in body weights and eosinophil (white blood cells that combat parasites and allergies) counts and increases in liver and kidney weights. At high doses ranging from 80.68 (80,680) and 97.08 mg/kg/day (97,080 ppb/day), mortality increased 87% in males and 37% in females. Body weights decreased 59-66% in males and 81-89% in females. Other clinical signs of toxicity from high doses were chromorhinorrhea (colored secretion from the nose), decreased food consumption, increased incidences of atrophied testes, skin nodules and cysts, opaque, cloudy, red, pale, or ulcerated eyes, and altered kidney, liver, and red and white blood cell functions. The NOAEL was 7.65 mg/kg/day (7,650 ppb/day).

A dietary study over two years using adult mice that were tested with fluridone concentrations ranging from 0 to 50 mg/kg/day (50,000 ppb/day) reported no treatment related effects on mortality, body weight, hematology, organ weights, eyes, muscle, or respiration (Probst 1981a). The NOAEL for systemic toxicity was 15 mg/kg/day (15,000 ppb/day).
Over one year, adult dogs were used in a dietary study of fluridone concentrations that ranged from 0 to 400 mg/kg/day (400,000 ppb/day; Probst 1981b). No mortality was reported, but a slight weight loss was noted for males at 150 mg/kg/day (150,000 ppb/day) concentrations, and liver weights increased at 400 mg/kg/day (400,000 ppb/day) concentrations for females. The NOEL was 75 mg//kg/day (75,000 ppb/day), and the NOAEL was 150 mg/kg/day (150,000 ppb/day).

4.4.6 Fish and Aquatic Macroinvertebrates

Essential Fish Habitat in Treatment Areas

Of the three waterbodies for the proposed action, Essential Fish Habitat (EFH) has only been identified in Chena Slough for juvenile Chinook salmon (Alaska Department of Fish and Game's Anadromous Waters Catalog nominations #96-026 and #97-038; attached). Nomination #96-026 documents juvenile Chinook salmon presence during June-September 1981, and nomination #97-038 documents presence during June and July 1996. More recent documentation of juvenile Chinook salmon presence in Chena Slough does not exist. The most upstream presence of juvenile Chinook salmon was at Nordale Road from nomination #96-026, approximately halfway between the upper most extent of the proposed treatment area and the mouth of Chena Slough.

Summary EFH

The application of fluridone in Chena Slough to eradicate Elodea will not have adverse effects on EFH but will temporarily affect EFH parameters, such as, water clarity, dissolved oxygen, and nutrients, due to the decomposition of dead and dying plant material. By eliminating Elodea, native plants will be able to reestablish themselves at pre-Elodea densities and distributions, and coupled with more efficient stream flow and less sedimentation, the treatment will result in long term improved EFH for juvenile Chinook salmon. Also, eradication of Elodea from Chena

Slough and other waterbodies is a priority for environmental agencies across the state (ADEC 2016) and will assist in maintaining EFH throughout Alaska.

Alternative A – No Action

The value of vegetation in maintaining diverse aquatic ecosystems has been well documented, and the influence of Elodea as an invasive aquatic plant species will and most likely has already have altered fish habitat since no action has occurred. Elodea, has the potential to degrade fish habitat by displacing native vegetation, changing nutrient and dissolved oxygen levels, and changing stream flow characteristics and sedimentation rates, (ADEC 2016; ADNR 2016; Carey et al. 2016; FESC 2016; Luizza et al. 2016; Pokorny et al. 1984; and Buscemi 1958). In addition to affecting water quality and reducing the density of native aquatic vegetation, Elodea can alter aquatic communities if continually left unmanaged. An intermediate level of native vegetation (20 – 40% cover) should be maintained for fisheries and wildlife; however, figures 5 and 7 demonstrates that no action has resulted in nearly 100% cover of Elodea in the Chena Slough and parts of the Totchaket Slough, thus not maintaining diverse aquatic ecosystems. While fluridone will also affect native plants, negative impacts are expected to be minor and short term with an overall expectation that the project will restore native plant communities and benefit fish habitat (ADEC 2016).

Alternative B – Mechanical or Manual Removal

Mechanical or manual removal of Elodea will temporarily alter fish habitat positively by reducing vegetation, and thus altering water quality to benefit fish and macroinvertebrates. However, unless mechanical or manual removal is completed in perpetuity, these alterations will only be long-term since mechanical or manual removal will not eradicate Elodea.

Alternative C – Herbicide Treatment (Proposed Action)

Toxicity in fish

Chinook salmon have been used for acute toxicity assay studies for the use of fluridone. Habig (2004) reported an acute LC50 value of 5.76 ppm (5,670 ppb) and a No Observed Effect Concentration (NOEC) value of 0.725 mg/L (725 ppb) for Chinook salmon smolts. No accumulation of fluridone residues (> 10 ppb) were detected in Chinook salmon smolt tissue after exposure to 50ppb over 2, 4, 8, 24, 48, 96, and 120 hour exposures (USDA and CDBW 2012).

Chinook salmon, rainbow trout, Arctic grayling (*Thymallus arcticus*), and Arctic char (*Salvelinus alpinus*) are the four species regularly stocked in Chena Lake (ADFG 2016). Also, a common fish species in Chena and Totchaket sloughs is Arctic grayling. Because the only two species tested, rainbow trout and Chinook salmon are the same species as two of the stocked species, the effects of fluridone on these stocked fish is expected to be similar to those on the tested fish. Similarly, Arctic grayling and Arctic char are closely related, taxonomically, to, rainbow trout and Chinook salmon and would be expected to respond similarly to fluridone exposure.

Therefore, because the acute LC50 for rainbow trout is 60.0 times and for Chinook salmon is 10.4 times higher than the maximum concentration (70 ppb) proposed for these waterbodies, it is highly unlikely that treatment levels will be acutely toxic to any of the four species. Another common species in Totchaket Slough is northern pike (*Esox lucius*). Although this species has not been tested for fluridone effects, and it is not closely related, taxonomically, to tested species, no adverse effects to this species are expected at the proposed treatment level.

Chronic tests have not been performed on fish species present in the proposed treatment areas. However, more information for the chronic effects of fluridone on other species such as common carp, channel catfish, and fathead minnows, can be found in Appendix 8.8.

ADEC is satisfied that use of fluridone in this project is not likely to result in unreasonable adverse impacts to fish, or other animal populations, vegetation, or other non-target organisms (ADEC 2016). As a result, no negative impacts to fish or their habitat are expected from the proposed pesticide use.

Toxicity in aquatic macroinvertebrates

Several taxa of freshwater macroinvertebrates: scuds (amphipods; Amphipoda), water fleas (cladocerans; Cladocera), midges (chironomids; Diptera), and copepods (Copepoda; Crustacea) have been used for acute and chronic fluridone toxicity studies.

Acute toxicity LC50 values for scuds (*Gammarus pseudolimnaeus*) ranged from 2.1 (2,100 ppb) to >32 mg/L (>32,000 ppb) across four tests, each of 96-hour duration (USDA and CDBW 2012; Durkin 2008 and Hamelink et al. 1986). In another test, the LC50 after 96 hours for amphipods was 2.1 ppm (2,100 ppb; Habig 2004). LC50 values for four genera of copepods ranged from 8.0 (8,000 ppb) to 13.0 mg/L (13,000 ppb) across seven tests of 48 hours per test per genus (USDA and CDBW 2012; Durkin 2008 and Naqvi and Hawkins 1989). A 96-hour test with water fleas resulted in an LC50 of 7.2 ppm (7,200 ppb), and a seven-day test resulted in an LC50 of 6.9 ppm (6,900 ppb; Riley and Finlayson 2004). The seven day NOEC for water fleas was 2.43 ppm (2,430 ppb; CDFG 2004). Neither hardness nor salinity appeared to have an effect on the acute toxicity of fluridone to these taxa (Hamelink et al. 1986).

For acute toxicity, the fluridone concentrations that caused death in 50% of the samples (LC50) in scuds ranged from 30 to 457 times the proposed fluridone concentration of 70 ppb. For similar testing with scuds, the LC50 was noted at 30 times the proposed concentration, and for copepods, the LC50's occurred at 114 to 186 times the proposed concentration. Additionally, the LC50's for water fleas occurred at 35 to 103 times the proposed concentration. Therefore, the proposed treatment is not expected to be acutely toxic to aquatic macroinvertebrate populations.

A 60 day continuously exposed toxicity study with scuds (*G. pseudolimnaeus*) resulted in significantly lower survival and mean length than controls at a concentration of 1.2 mg/L (1,200 ppb) of fluridone, but no significant effects on these two characteristics were observed during the 30 day trials at this concentration (Durkin 2008; Hamelink et al. 1986). Also, at concentrations ≤ 0.6 mg/L (600 ppb) survival and growth were not significantly less than controls for both 30 and 60 day trials. Habig (2004) noted a NOEC for growth of 0.6 ppm (600 ppb) over 60 days.

During 21 day continuously exposed trials with water fleas (Daphnia magna), adult survival ranged from 95% at 0.06 mg/L (60 ppb) and 0.1 mg/L (100 ppb) to 0% at 3.4 mg/L (3,400 ppb; Durkin 2008; ENSR 2005 and Hamelink et. al 1986). Also, during 21 day testing, the average number of offspring produced was significantly less than controls at concentrations greater than 0.4 mg/L (400 ppb). Habig (2004) determined the 21 day NOEC for water fleas was 0.2 ppm (200 ppb). Midge larvae (*Chironomus plumosus*) continuously exposed to fluridone at 1.2 mg/L (1,200 ppb) during 15, 20, 25, and 30 day trials resulted in cumulative adult emergence percentages that were significantly lower than controls (Durkin 2008; Hamelink et al. 1986). At concentrations ≤ 0.6 mg/L (600 ppb) for all time periods, there were no significant differences with controls. Habig (2004) noted a NOEC of 0.6 ppm (600 ppb) for a 30-day adult emergence test.

For chronic toxicity, the most dilute fluridone concentrations that caused lower survival and smaller mean length in scuds was 8.6 times the proposed concentration of 70 ppb. Although mortality of water fleas occurred at a concentration less than (0.86 times) the proposed concentration of 70 ppb, the mortality factor was only 5% and not significantly different than the mortality in the control sample. For midges the lowest concentration that adversely affected adult emergence was 8.6 times the maximum proposed fluridone level. Therefore, no expected negative impact on aquatic macroinvertebrate populations is expected.

Additionally, Arnold (1979) concluded that treatment at 1,000 ppb decreased benthic macroinvertebrate populations, but at 300 ppb, there was little impact. Sanders et al. (1979) also noted no substantial effects on benthic organisms when treatments ranged from 20-50 ppb. Haag and Buckingham (1991) used fluridone at concentrations of 4,600-9,200 ppb to test *Hydrellia* larvae, a fly (Ephydridae), with a two-week larval stage and noted significant mortality. However, this effect may have also been caused by loss habitat as leaflets of the targeted plant died.

Because of their high dispersal ability, high reproductive potential, and short life cycles with high generation turnover rates, aquatic macroinvertebrates are capable of rapid recovery from disturbance (Matthaei et al. 1996; Boulton et al. 1992; Anderson and Wallace 1984). Also, recolonization of flying aquatic invertebrates (e.g., mayflies and caddis flies) in the treated waterbodies would occur via aerial dispersal of adults from surrounding areas.

Concentrations of fluridone in water at averages of 900 ppb and 11,200 ppb and in sediment at averages of 37,000 ppb and 382,000 ppb resulted in approximately 10% mortality to midge larvae (Muir et al. 1982). The reasons for mortality were not clear, but it could not be attributed to the presence of the herbicide. Also, 80% of the fluridone was excreted by midge larvae within four hours, indicating a very low accumulation level. Also, after fluridone dissipates, it does not irreversibly accumulate in biological tissues (USDA and CDBW 2012).

4.4.7 Threatened and Endangered Species

Since there are no threatened or endangered species in the proposed project area, no consequences to these species exists.

4.5 Resource Uses

4.5.1 Human and Health Safety

Summary of Effects

Discontinued management of Elodea (No Action Alternative) would have minor short or long term risks on human safety, depending on the circumstance. Mechanical removal presents risks to divers and field staff. Likewise, some health and safety risks are presented to herbicide operators, but the risk to public health from this herbicide at proposed treatment levels is negligible.

Alternative A - No Action

If Elodea is left unmanaged, it can potentially cause human health and safety risks to those operating boats, floatplanes, or other motorized vehicles in infested areas. In 2015, the State of Alaska DEC issued an emergency exception to treat Elodea and excess aquatic vegetation in Lake Hood due to floatplane pilot's safety being at risk. Before herbicide treatment in Lake Hood, several occurrences of planes taxiing through aquatic vegetation and losing control became a hazards during busy airport operations. Given the abundance of Elodea in Chena Slough and Totchaket Slough, similar occurrences of human health and safety may occur with floatplane or motorized vehicles in the proposed waterbodies.

Alternative B - Mechanical or Manual Removal

The primary risks of mechanical or manual removal of Elodea in the Chena Slough, Chena Lake and Totchaket Slough are to divers operating the suction harvester. Minimal to no risk to the general public is expected for mechanical or manual removal of Elodea.

Alternative C - Herbicide Treatment (Proposed Action)
Human health and safety risks of a fluridone treatment is only applicable to those performing the treatment; negligible to no harm is expected for the general public. All fluridone applicators will be DEC certified, and wear the proper protective gear, required by the label.

The dietary NOEL (i.e., the highest dose ingested at which no adverse effects were observed in laboratory test animals) is approximately 8 mg of fluridone per kg of body weight per day (8mg/kg/day). A 70-kg (150 lb) adult would need to drink more than 1,000 gallons of water containing the maximum legal allowable concentration of fluridone in potable water, (150 ppb) for to receive an equivalent dose. A 20-kg (40 lb) child would need to drink approximately 285 gallons of fluridone-treated water in a day to receive a NOEL-equivalent dose. Therefore, the risk to humans and all mammals is negligible even if fluridone-treated water was ingested directly during or after treatment. Because fluridone degrades over time in the environment, chronic exposure for humans would not likely occur when the proposed action is completed (West et al. 1983, USEPA 1986). Additionally, human contact with fluridone can occur through swimming in treated waters, drinking treated waters, consuming fish from treated waters, or by consuming meat, poultry, eggs, or milk from livestock that were provided water from treated waters. There are no USEPA restrictions on the use of fluridone-treated water for swimming, fishing or consumption by livestock or pets when used according to label directions (USEPA 1986).

Fluridone has been in use in the US as an aquatic herbicide since 1986. There are no documented instances of human health impacts from application of fluridone according to label instructions. Fluridone is not considered to be a carcinogen or mutagen and is not associated with reproductive or developmental effects in test animals (WADOH, 2000).

4.5.2 Recreation

Summary of Effects
Recreation at Chena Lake would be unaffected by taking no action, and have short term adverse impacts from manual removal or fluridone treatment. Recreation at Chena Slough would be adversely impacted by taking no action to remove Elodea in the long-term, and with short-term impacts adverse impacts from manual removal or fluridone treatment, but beneficial long-term impacts. Totchaket Slough is generally not used recreationally.

Alternative A - No Action

The Chena and Totchaket Sloughs are currently overly abundant with vegetation; Elodea covering up 100% (Figures 5 and 7). Over abundant Elodea impedes navigation and slows water velocity. Additionally, the impacts of Elodea on fish habitat will decrease use of these waters for sport fishing as well as subsistence use. Not removing Elodea from Chena Lake would have an adverse impact on recreation, as navigability for non-motorized boats and swimming will be impacted by dense vegetation in the littoral zone.

Alternative B - Mechanical or Manual Removal

During mechanical or manual removal, use of boat launches and presence of work crews in waterbodies restricts the use and navigability, particularly in Chena and Totchaket sloughs. Recreation in Chena Lake would be temporarily impacted during the application. Due to the length of time necessary for manual treatment, this is a greater burden to access than some other potential treatments.

Alternative C - Herbicide Treatment (Proposed Action)

While the Chena and Totchaket sloughs are being treated, navigation of multiple boats would be limited because of the narrowness of the sloughs. Access to the boat launch in Chena Lake the days of treatment may be limited. Swimming in Chena Lake would be discouraged during days of treatment for public safety concerns around boats, not because of the risk to fluridone exposure. Fishing, swimming and boating are otherwise not restricted during application of fluridone to Chena Slough, Chena Lake and Totchaket Slough.

4.5.3 Land Use

Summary of Effects:

The no action alternative would have no impact on land use in Chena Slough, Chena Lake or Totchaket Slough. Mechanical and manual removal may have minimal impacts on land use around proposed treatment sites due to disposal of harvested vegetation. Herbicide treatment would have short-term adverse impacts on usage of water for irrigation, which is likely to be of particular importance for land use near Chena Slough.

Alternative A - No Action

If left unmanaged, it is likely that the Chena and Totchaket Sloughs will progressively fill in with sediment, due to the increase in sedimentation rates from vegetation and natural succession of shallow waterbodies. The reduction of the slough would negatively impact land use by eliminating water recreation, by reducing or eliminating the use of the slough for irrigation, and/or reducing the water-front aesthetics for land owners. The reduction of the slough could positively impact residents by increasing land use.

Alternative B – Mechanical or Manual Removal

Mechanical or manual removal may have limited short-term effects on land use, including the disposal of harvested vegetation. Lane (2013) and other FSWCD staff state that removal of material due to the excess weight of wet vegetation was difficult. Depositing or composting the vegetation for the mechanical or manual removal of Chena Slough, Chena Lake, and Totchaket Slough would impact the location of disposal.

Alternative C - Herbicide Treatment (Proposed Action)

Fluridone is a systemic herbicide that can negatively impact susceptible plants, including those irrigated or watered by proposed treated waterbodies. Where the use of Sonar treated water is desired for irrigating crops prior to the precautionary time frames on the label, the use of a FasTEST (fluridone concentration water samples) to measure the concentration is required in treated water before use. Where a FasTEST has determined that concentrations are less than 10 ppb, there are no irrigation precautions for irrigating established tree crops, established row crops or turf. However, Sonar treated water is not to be used if water concentrations are greater than 5 ppb for tobaccos, tomatoes, peppers or other plants within the Solanaceae family and newly seeded crops or newly seeded grasses.

There are no risks to human health from consuming plants treated with fluridone. One study in California on edible aquatic vegetation harvested directly from lakes treated for 10 years with fluridone found no observable levels (>1ppb) of fluridone in 17 out 20 samples, and less than 4 ppb of fluridone in the 3 plants where fluridone was detected (Monheit et al. 2008).

FasTESTs will be completed throughout the proposed project for all treated waterbodies, and include some drinking water wells per DEC Pesticide Use Permit stipulations. A list of all FasTEST results with locations will be maintained on the FSWCD Elodea website. Chena Slough property owners will be notified of any irrigation or water use restrictions by mail, and will also be posted on the FSWCD Elodea website. Restrictions according to fluridone labels would also be posted on the FSWCD project website and on project notice signs in public access areas around the proposed treated waterbodies.

4.5.4 Economics

Summary of Effects

The costs of controlling invasive and nuisance aquatic vegetation which include mechanical harvesting, underwater cultivation, diver hand-pulling, water level manipulation, biological control, and aquatic herbicide application, exceeds many millions of dollars annually in the U.S. (Eiswerth et al. 2000). In 2011 alone, Alaska spent over two million dollars on terrestrial invasive plants and almost $100,000 on freshwater invasive plants. However, since the management of Elodea has started around the State, this value has greatly increased; for example, the Anchorage project to treat the three smallest infestations cost ~$100,000 in just the product. If no action is taken to manage Elodea, the threat of property values being reduced could be significant. If mechanical or manual removal is completed to manage Elodea, expenses will be spent in perpetuity. If fluridone is utilized to eradicate Elodea, a relatively high initial cost of product would be spent, but countless amount of natural resources could be prevented from greater economic loss.

Alternative A - No Action

A study in New Hampshire found a 21-43% decline in property values associated with an infestation of variable milfoil, which also reproduces vegetatively, can clog water bodies, crowd out native aquatic plant species, and reduce recreational activities like boating and swimming (Halstead et al. 2003). In a Wisconsin study of 170 lakes infested with Eurasian watermilfoil, property values were reduced by an average of 13% (Horsch and Lewis 2009). A similar study in Washington also with Eurasian watermilfoil showed a 19% decline in property values (Olden and Tamayo, 2014). If no action occurs in Chena Slough, Chena Lake or Totchaket Slough, property values could be severely impacted.

Ecosystem services in Alaska provide natural resources that sustain economies, human health, cultural values, and quality of life. A natural state of Alaska's water resources can provide ecosystem services such as sustainable harvest of resident fish for consumption, or corridors to exploring an "untouched" camping spot. All ecosystem services have the potential for some quantitative economic value; however, Alaska has yet to determine the value of these services to the stakeholders and users. Therefore, quantified impact on Alaska's freshwater resources, and for the proposed project area is not yet known for Elodea.

Alternative B - Mechanical or Manual Removal

Mechanical or manual removal of Elodea in the Interior would positively impact local economies by creating a need for a specific market; divers, dredges, boats, laborers, etc. However, because mechanical or manual removal of Elodea will not reach the proposed project goal of eradication, the need for such work would be needed in perpetuity.

Alternative C - Herbicide Treatment (Proposed Action)

Initial cost of treating the proposed project waterbodies with fluridone is relatively high, even at low concentrations. However, quantified impact on Alaska's freshwater resources is not yet known for Elodea. Rapid timeliness for management of Elodea is worth preserving Alaska's profitable freshwater resources at the present state. If Elodea is given an opportunity to spread to other waterbodies, costs of management will most certainly increase and valuable, profitable resources will be lost indefinitely. Economic impacts to Alaska due to Elodea are preventable with rapid management action in Chena Slough, Chena Lake and Totchaket Slough.

4.5.5 Viewshed/Aesthetics

Summary of Effects

Impacts on all waterbodies are the same, though the viewshed impacts will be more noticeable in highly-visited Chena Slough and Chena Lake. The No Action Alternative will have a long-term negative impact by allowing Elodea to remain. All other alternatives will have an adverse impact during treatment, but will result in the restoration of these water bodies and a long-term beneficial impact in their aesthetic quality.

Alternative A - No Action

There are long-term negative impacts on the viewshed of waterbodies due to presence of Elodea, which leads to waterbodies choked with a monoculture of vegetation. Lateral top growth of excess vegetation decreases the flow of water, and harbors increased growth of filamentous algae.

Alternative B - Mechanical or Manual Removal

Mechanical removal should have a long-term beneficial impact on the viewshed by clearing vegetation from the waterbodies, though the presence of work crews during the lengthy removal period could have a negative impact. Additionally, the lack of complete eradication of Elodea from this treatment means the viewshed would only slightly improve, and without continuous management, return of Elodea to pre-treatment levels is likely.

Alternative C - Herbicide Treatment (Proposed Action)

Herbicide treatment might have a negative impact during treatment, due to the presence of decaying vegetation. However, fluridone is a systemic herbicide and slowly kills Elodea, so decaying vegetation may not be visible. It will result in a positive impact in the long run, due to the removal of Elodea.

4.5.6 Subsistence

Summary of Effects

Impacts are similar for Totchaket and Chena sloughs, since Chena Lake is not utilized for this subsistence use. Taking no action would allow the long-term degradation of fish habitat, impede navigability for subsistence purposes, and threaten many other downstream waters used for subsistence. Mechanical removal will improve navigability and fish habitat, but produces fragments that could spread Elodea to other waterbodies downstream. Herbicide treatment may have the indirect effect of reducing available aquatic forage plants during treatment, with the long-term beneficial impact of removing Elodea (restoring navigability, subsistence fishing and the native plant community).

Alternative A - No Action
Taking no action would allow the long-term degradation of fish habitat, impede navigability for subsistence purposes, and threaten many other downstream waters used for subsistence.

Alternative B - Mechanical or Manual Removal
Mechanical removal will improve navigability and fish habitat (though not eradicate Elodea), but produces fragments that could potentially spread Elodea to other downstream waterways.

Alternative C - Herbicide Treatment (Proposed Action)
Herbicide treatment at the proposed levels would have no direct effects on fish and wildlife during treatment (see sections 4.4.5 and 4.4.6). The biomass of some native aquatic plants, such as Northern watermilfoil, may be reduced during treatment, indirectly affecting abundance and location of mammals or waterfowl that feed on those plants. Eradicating Elodea has the long-term beneficial impact of improving navigability in infested waterways, improving fish habitat and restoring native aquatic plant communities.

No aquatic plants in the treated area are directly consumed for subsistence purposes although wildlife subsistence resources such as moose, muskrat and waterfowl do consume aquatic plants, their tubers and or seeds. Based on a bioconcentration factor (BCF) of 3.01, fluridone is not expected to bioaccumulate (concentrate in the tissues) of any animals that consume water or affected plants (WADOH, 2000). A BCF of 1000 is the threshold for which a substance is considered bioaccumalitive under the USEPA Toxic Substances Control Act. We can expect treatment to have a beneficial impact to native aquatic plant populations as they will increase in cover after treatment and eradication of Elodea. Fluridone is not expected to accumulate in any terrestrial plants, even if treated waters flood terrestrial habitats.

4.6 Environmental Consequences Summary

RESOURCES			
Resource	**No Action**	**Mechanical or Manual Removal**	**Herbicide Treatment (Proposed Action)**

Air	No impact.	Short-term adverse impact due to use of gas-powered motors.	Short-term adverse impact due to use of gas-powered motors.
Water	Long-term adverse impact in the infested area, with potential of spreading throughout the region, due to the presence of Elodea slowing flow, lowering water quality and increasing sedimentation.	Short-term beneficial impact (controlling Elodea, lessening sedimentation and reduced water flow).	Short-term adverse impact (possibly decaying vegetation and reducing dissolved oxygen) with long-term beneficial impact (eradicating Elodea, slowing sedimentation and incresing water flow).
Soil	Long-term adverse impact: increased sedimentation due to the presence of Elodea.	Short-term adverse impact (disturbing streambed) with short-term beneficial impact (temporarily controlling Elodea, lessening sedimentation).	Short-to-mid-term adverse impact (fluridone binding to soil) with long-term beneficial impact (eradicating Elodea, slowing sedimentation).
Vegetation (Native and Non-native)	Long term adverse impact to local native plant communities outcompeted by Elodea, and substantial risk of spread to regional native communities or areas that are already being managed.	Short-term adverse impact (disturbing streambed) with long-term beneficial impact (controlling Elodea, lessening competition). Increased risk to regional plant communities due to creation of Elodea fragments during control. Eradication not possible.	Short-term adverse impact (injuring native plants with fluridone) with long-term beneficial impact (eradicating Elodea, allowing complete regrowth of native plant communities). Removes risk to regional plant communities by eradicating all Elodea at the sites.
Wildlife	No impact.	No impact.	Short-term adverse impact (Potential reduction in aquatic forage plants during treatment).

Fish and Aquatic	Long term degradation of fish habitat, threatening other waterbodies.	Short-term impact to macroinvertebrates.	Potential short-term adverse impacts to aquatic invertebrates due to treatment with fluridone, long term improvements to fish habitat.
Threatened and Endangered Species			
RESOURCE USES			
Recreation	Long-term adverse impacts to sport fishing and recreational boating.	Long term beneficial impacts by improving navigability and sport fishing habitat. Short term adverse impacts due to decreased access during treatment.	Long term beneficial impacts by restoring navigability and sport fishing habitat. Short term adverse impacts due to decreased access during treatment.
Land Use	No impact.	Short-term impact by Elodea material being removed.	Short-term adverse impact: water from the Sloughs and Lake should not be used to water sensitive crops during treatment. No long term impacts.
Human Health and Safety	Potential to tangle boat motors, and spread by floatplanes.	Potential safety risks to divers and boat operators.	Potential risks to herbicide applicators.
Economics			
Viewshed/Aesthetics			
Subsistence	Obstruction of navigability in Totchaket and Chena Sloughs, and potential to spread to	Long-term beneficial impact by improving fish habitat and navigability.	Long-term beneficial impact by restoring fish habitat and improving navigability.

	other downstream waterways. Degradation of fish habitat.		

5. Consultation and Coordination

5.1 Specific Consultation and Coordination

Following several public meetings in Fairbanks, North Pole and Nenana and notice for this EA, DNR will incorporate public comments received and subsequent DNR responses into the final EA document. The revised document will then be submitted to USFWS to comply with the NEPA process to determine whether a Finding of No Significant Impact (FONSI) will be issued for the preferred action. Other major authorizations required to approve the preferred action include DEC issuance of a Pesticide Use Permit, compliance with the Alaska Pollutant Discharge Elimination System (APDES), and approval by DNR.

5.1.1 Tribes

The lands adjacent to Totchaket Slough are owned by the State of Alaska, Toghottele Native Corporation, and Minto Native Corporation. The Fairbanks Elodea Steering Committee held a public meeting in May 2016 in Nenana to discuss the issue of Elodea and the proposed treatment plans in Totchaket Slough. The FSWCD presented these issues to the CEO of the Toghottele Native Corporation, and the Nenana Native Council, and provided outreach materials and signage on the importance of preventing the spread of Elodea. The IGAP (Indian General Assistance Program) coordinator in Nenana was educated on Elodea identification, and outreach materials were provided to the Native Council. FSWCD staff attended a workshop for IGAP Coordinators from throughout the Yukon River watershed and provided a training on Elodea identification in an attempt to incorporate monitoring for Elodea into the existing program (conducted by Yukon River Intertribal Watershed Council) for monitoring water quality at 70 villages along the Yukon River. The Nenana Native Council has been forthcoming in providing assistance for accessing Totchaket Slough.

5.1.2 Federal and State Agency

The DNR, Plant Materials Center's Invasive Plant Program has worked closely with federal agencies interested in helping reach the goal of eradicating Elodea statewide, as well as prioritizing surveys and prevention methods to user groups. On the Kenai Peninsula, the USFWS's Kenai Wildlife Refuge office initiated the first fluridone application in three infested lakes with great success. In Anchorage, DNR received funding and approval from the USFWS to use fluridone in three infested lakes to eradicate Elodea. For Lake Hood, DNR worked in collaboration with the State of Alaska Department of Transportation (DOT) maintenance and environmental staff to manage and eradicate Elodea and other nuisance vegetation causing safety concerns with both diquat and fluridone. In the Copper River Delta area, DNR is working in collaboration with the United States Department of Agriculture Forest Service (USDA FS) and a local non-profit group, Copper River Watershed Project, to start fluridone treatments on several infested ponds and a slough in 2016.

5.1.3 Interest Groups

In the Interior area, an Elodea Steering Committee was formed to include the FSWCD, USFWS, USDA FS, DNR, ADF&G, DEC, and other interested parties to discuss and collaboratively make management decisions about Elodea in the current infested waterbodies. Recently, members of the public have joined the monthly Fairbanks Elodea Steering Committee meetings, and been able to voice their opinions and ask questions about the management process. In particular, the Harding Lake community members have been publically in support of using fluridone for Elodea eradication. Pilot groups have also been active in the statewide Elodea eradication effort by participating in trainings for identification and surveying of remote access waterbodies, and allowing DNR and FSWCD speak at to their group meetings about the threat of Elodea.

5.2 Public Outreach

Public outreach and education have been essential since the discovery of Elodea in Chena Slough in 2010, and will continue to be an integral part of the Elodea eradication project. The prevention of spread of Elodea through public education and stakeholder involvement activities are being carried out simultaneously with eradication efforts over the course of the project. The Elodea Steering Committee has held numerous public meetings in North Pole and Fairbanks between 2010 and 2015, to discuss the issue of Elodea in interior area waterbodies, and strategies to control and eventually eradication. In 2016, public meetings were held in Nenana, in addition to North Pole and Fairbanks, due to the discovery of an Elodea infestation in the remote Totchaket Slough, which is heavily used for subsistence activities. Key stakeholder groups such as floatplane pilots, boat owners, and waterfront land owners are now being educated and incorporated into the effort to detect potential new infestations of Elodea in other waterbodies in interior Alaska. Public outreach and education on cleaning of boats and equipment at boat launches is being conducted in the interior in order to minimize the risk of spreading Elodea to un-infested water bodies. Clean-Drain-Dry signage that alerts users about invasive species transfer, and provides instruction on boat and gear decontamination are being installed at high-use and other key boat launches and floatplane ponds in the greater Fairbanks area. Public outreach events with educational activities for all ages are held periodically throughout the year. Public meetings will be held each year of the eradication program in spring and fall, to discuss the herbicide application plans for the season, and to present the results of the treatments respectively. Additionally, slough water, well water, and sediments in Chena Slough will be tested for fluridone concentration after treatment, and the results will be shared with the Chena Slough landowners and other interested members of the public.

Informational brochures and mailings regarding Elodea are sent to all Chena Slough landowners to keep them informed. Public presentations to interested groups such as the Harding Lake Association, Fairbanks Chamber of Commerce, Chena Riverfront Commission, seaplane pilot's associations, Alaska State Legislature, are given throughout the year, to keep these groups informed about Elodea, and apprised of the progress of the eradication program.

5.3 List of Preparers

Heather Stewart: Alaska Department of Natural Resources, Invasive Plant and Agricultural Pest Coordinator

Aditi Shenoy: Fairbanks Soil and Water Conservation District. Invasive Plant Specialist

Delia Vargas Kretsinger: U.S. Fish and Wildlife Service, Yukon Flats National Wildlife Refuge, Wildlife Biologist

Jeff Adams: U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Branch Chief-Fisheries and Habitat Restoration

6. Permitting

Following the public meeting and notice for this EA, DNR will incorporate public comments received and subsequent DNR responses into this document. The revised document will then be submitted to USFWS to comply with the National Environmental Policy Act (NEPA) process to determine whether a Finding of No Significant Impact (FONSI) will be issued for the preferred action. Other major authorizations required to approve the preferred action include ADEC issuance of a Pesticide Use Permit, compliance with the Alaska Pollutant Discharge Elimination System (APDES), and approval by ADNR.

The following permits and approvals are needed prior to the proposed treatment:
Alaska Department of Environmental Conservation: Alaska Pollution Discharge Elimination System (APDES) Permit (Appendix 8.5) and Pesticide Use Permit
ADF&G (Alaska Department of Fish and Game) Fish Habitat Permit (Appendix 8.6)
ADNR Division of Mining Land and Water Land Use Permit (Appendix 8.7)

These permits will be added to the Appendix in this EA as they are approved.

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8. Appendix

1.1. Integrated Management Plan
1.2. DEC Pesticide Use Permit
    1.2.1. Decision Document
1.3. Sonar Labels
    1.3.1. Special Local Needs Label
1.4. Sonar Safety Data Sheets
1.5. APDES Permit
1.6. ADF&G Fish Habitat Permit
1.7. DNR Land Use Permit
1.8. Additional Information on Fluridone Toxicity to Fish