Anderson and Kings Lakes Invasive Northern Pike Eradication: Environmental Assessment

Alaska Department of Fish and Game

Division of Sport Fish

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1.0 INTRODUCTION

Northern pike *Esox lucius* are an invasive species in Southcentral Alaska and have caused the decline of native fish populations throughout the region (Rutz 1999, Sepulveda et. al. 2013, Sepulveda et. al. 2014, Glick and Willette 2016, Patankar and Von Hippel 2006). Northern pike were first illegally introduced to the Susitna River basin in the late 1950s. Subsequent dispersal and continued illegal introductions over the decades have resulted in northern pike establishing populations in over 100 water bodies in the Matanuska-Susitna Valley (Mat-Su Valley).

Beginning in 2008, the Alaska Department of Fish and Game (ADF&G) initiated a program to eradicate northern pike from infested waters in Anchorage and on the Kenai Peninsula. Initial work began by removing northern pike from landlocked lakes (Massengill 2014a, 2014b) and progressed to removing northern pike from more complex open waterbodies within the Swanson River, Otter Creek, and Soldotna Creek drainages between 2012 through 2017. To date, the only known northern pike populations remaining south of the Mat-Su Valley are Lower Fire Lake and Fire Creek in Eagle River and a portion of the Vogel Lake/ Miller Creek drainage on the Kenai Peninsula. With the substantial progress made in removing northern pike populations from these areas of their invasive range, plans are now proposed to begin this work in the Mat-Su Valley. Infested waters in the Mat-Su have been impacted to varying degrees based on their extent of favorable pike habitat. For example, drainages with exceptional pike habitat (i.e. shallow, low gradient and vegetated throughout) such as the Alexander Creek drainage have experienced substantial losses in salmon and native fish populations. Conversely, other waters with more variable habitat conditions have thus far experienced less dramatic impacts because native fish can avoid predation in habitats not typically occupied by pike.

Within the Mat-Su Valley, ADF&G prioritizes water bodies for management actions based on the ability of the actions to prevent pike from spreading, the degree of impact to native fish populations caused by pike, the potential to restore fisheries, and the feasibility of the management actions. Invasive northern pike eradication from Anderson and King's Lakes within the Cottonwood Creek drainage is currently the highest eradication priority in the Mat-Su Valley because it could prevent northern pike from spreading throughout the Cottonwood Creek drainage as well as from dispersing into highly vulnerable Knik Arm drainages such as Jim Creek, Wasilla Creek, and other presently uninvaded waters in the Northern Cook Inlet region. Over the last ten years, the fisheries in both lakes have shifted from rainbow trout *Oncorhynchus mykiss* and coho salmon *O. kisutch* to almost entirely populations of northern pike. ADF&G believes that northern pike can be successfully eradicated from these lakes and that quality rainbow trout fisheries can be returned to them.

Anderson and Kings Lakes are within Township 18N; Range 1W Section 25 and Range 1E Sections 29 and 30. ADF&G first documented northern pike in these lakes in 2006, but anecdotal information suggests they were introduced in the 1990s. Survey work conducted between 2016 and the present has confirmed that pike are restricted to only these lakes within the Cottonwood Creek drainage. The Cottonwood Creek drainage is an area of the Mat-Su Valley that has great potential to be impacted by invasive northern pike because of the optimal pike habitat conditions found throughout much of the drainage. The Cottonwood Creek Drainage encompasses 70 mi.^{2} between Palmer and Wasilla and contains the following interconnected lakes: Kings, Anderson, Dry, Niklason, Little Niklason, Cornelius, Cottonwood, Mud, and Wasilla (Table 1; Figure 2). These lakes vary considerably in size and degree of northern pike habitat. Known size and habitat information for the drainage lakes is summarized below in Table 1. ADF&G has been blocking the outlets of Anderson and Kings lakes, first with fyke nets, then with a permanent grate barrier,

to contain their northern pike populations and prevent the pike from spreading. The native fish assemblage in the presently uninvaded drainage lakes include Chinook salmon O. *tshawytscha*, sockeye salmon O. *nerka*, pink salmon O. *gorbuscha*, coho salmon, chum salmon *O. keta*, rainbow trout, Dolly Varden *Salvelinus malma*, threespine stickleback *Gasterosteus aculeatus*, slimy sculpins *Cottus cognatus* and longnose suckers *Catastomus catastomus*. The salmon and trout in these lakes contribute substantially to sport fishing activities in the Matanuska Borough (Jennings 2015). To prevent northern pike from affecting the drainage's native fish populations, efforts to remove them from Anderson and King's lakes are proposed.

Table 1. Cottonwood Creek Drainage Lakes.

Lake	Pike Habitat	Littoral Area (Acres)	Surface Area (Acres)	Volume (Acre-Ft)	Max Depth (ft)	Notes
Kings	Good	65	112	793	23	East edge has good pike spawning habitat; known pike presence
Anderson	Good	70	104	808	28	East edge has good pike spawning habitat; known pike presence
Dry	Good	16	16	120	6	Pike spawning habitat may be limited
Niklason	Marginal	36	72	1,309	57	Poor pike spawning habitat except the west side
Little Niklason	Very Good	23	23	198	6	Potential strong hold; Good pike habitat throughout
Cornelius	Poor	29	48	1,088	54	Good rainbow trout habitat
Cottonwood	Poor	131	262	2,835	39	Good rainbow trout habitat
Mud	Unknown	55	55	181	17	Primarily a duck pond
Wasilla	Poor	187	374	6,412	48	Rainbow trout and sockeye salmon fisheries; SWHS records of pike

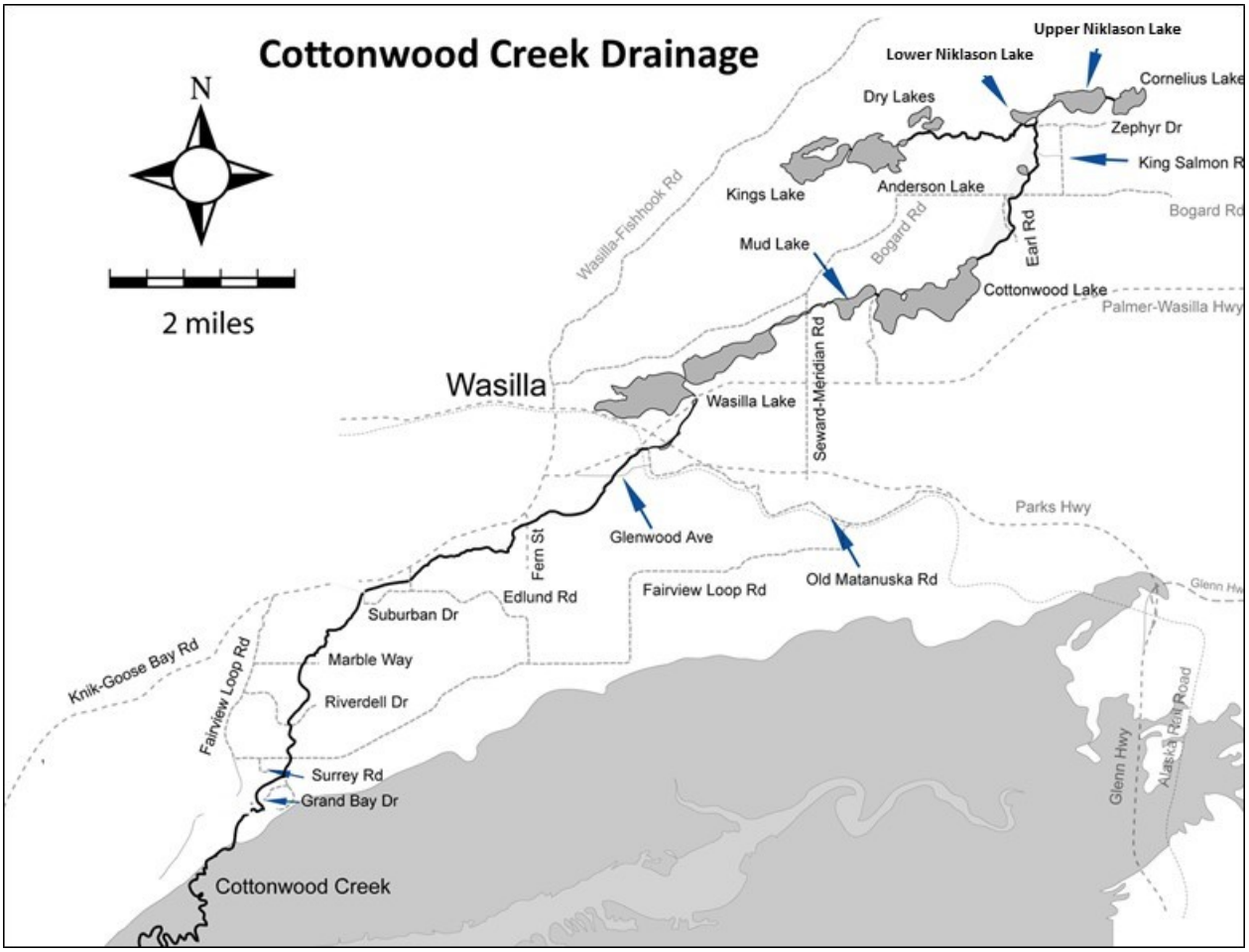

Figure 1. Map of the Cottonwood Creek Drainage.

The Alaska Department of Fish and Game (ADF&G) developed this Environmental Assessment (EA) to address eradicating the illegally introduced northern pike populations from Anderson and Kings lakes. The objective is to completely remove these northern pike populations and restock the lakes with rainbow trout, threespine stickleback, and longnose suckers. These efforts would restore native stickleback populations and ecosystem function to these waterbodies while providing a replacement sport fishery to the existing northern pike fishery. Three alternatives for accomplishing this are discussed in this EA. The first, the no action alternative, would not achieve the objective as the northern pike population would remain in the lakes. The second alternative would involve long-term gillnetting of both lakes to reduce the northern pike population and the third alternative would involve using a piscicide (rotenone) to remove all northern pike.

1.1 Purpose and Need for Action

The purposes of this EA are to: (1) present and evaluate alternative approaches for northern pike eradication in Anderson and Kings lakes; (2) propose selection of the alternative that best meets the needs of the Alaska Department of Fish and Game northern pike eradication objectives while minimizing potential environmental impacts; (3) provide an opportunity for public input on eradication options; and (4) determine whether the scope and magnitude of impacts expected from implementation of the preferred alternative warrants preparation of an environmental impact statement (EIS). If significant impacts are expected, an EIS would be prepared. If not, the ADF&G

would select the preferred alternative. In either case, the National Oceanic and Atmospheric Administration (NOAA; the agency tasked with granting Federal authority for the preferred alternative) will disclose its final decision and supporting rationale in a decision document.

1.2 Background

The northern pike is native to Alaska north and west of the Alaska Mountain Range and near Yakutat in southeast. Northern pike do not naturally occur in Southcentral Alaska (Figure 1) and first arrived there from an illegal introduction to Bulchitna Lake in the Yentna River drainage in the 1950's (ADF&G 2007).

Figure 2. Map of Alaska showing native (hash marks) and invasive range (solid red) of northern pike.

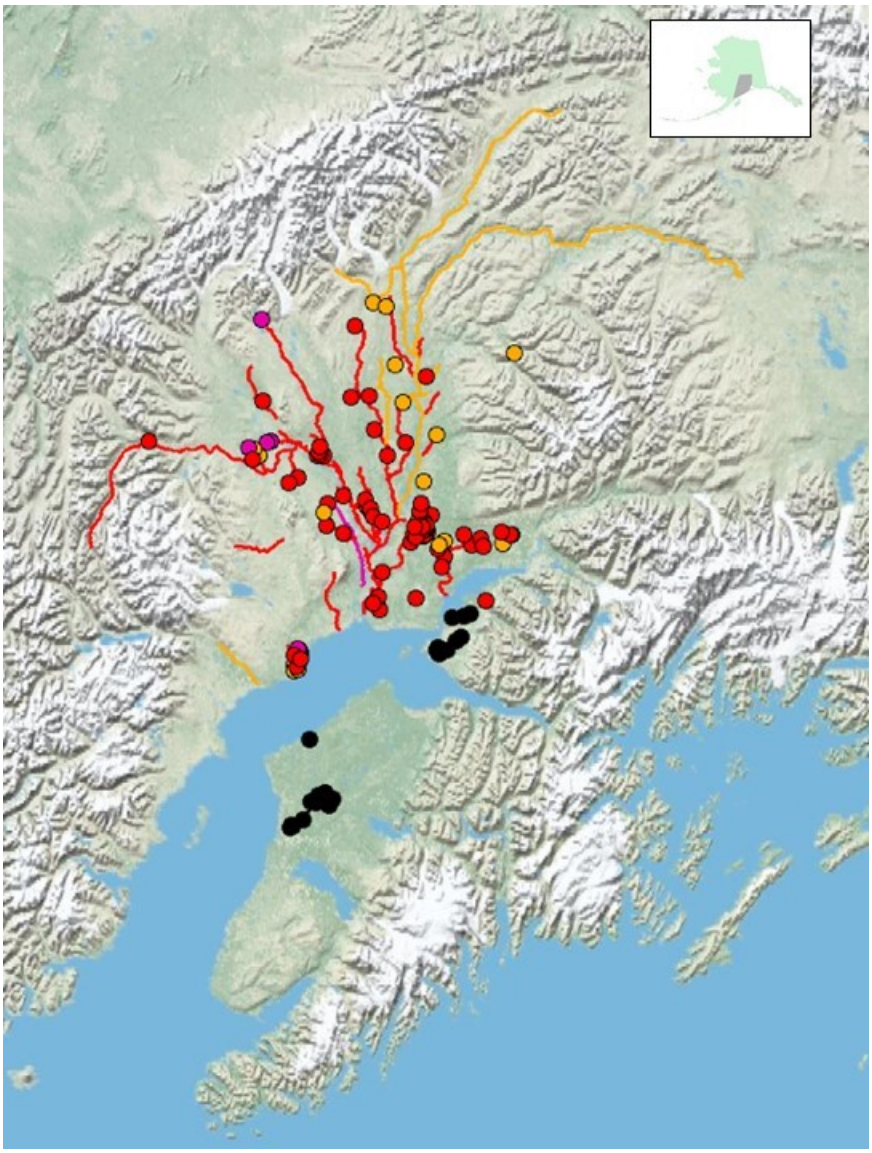

Figure 3. Status of waterbodies in Southcentral Alaska where self-sustaining populations of northern pike have occurred. Waters in red have current populations. Pink has on-going suppression, and black have had pike eradicated. Waters in orange have had unconfirmed pike reports.

Northern pike are considered an invasive species in Southcentral Alaska because they are not native to the region and their introduction can cause economic and/or environmental harm (ADF&G 2002). Northern pike predation is suspected of causing localized salmonid reductions in Southcentral Alaska (Sepulveda et. al. 2013, Sepulveda et. al. 2014, Glick and Willette 2016), and northern pike appear to prefer soft-finned juvenile salmonids over other available prey species (Sepulveda et. al. 2013). In the Alexander Creek Drainage, northern pike are implicated in the decline of the Chinook salmon fishery and the loss of a local multimillion-dollar sport fishing industry (Rutz et al. *in press*). Consumption of native juvenile salmonids by introduced northern pike has also been observed elsewhere in the northwestern United States (Rich 1992, McMahon and Bennett 1996, Schmetterling 2001, Muhlfeld et al. 2008, Dunker et. al. 2018).

In Southcentral Alaska, northern pike prey may be particularly vulnerable to predation because they evolved in the absence of these predators whereas in western and interior Alaska, northern pike share an evolutionary history with their prey which evolved adaptations for predator-avoidance (Oswood et al. 2000). Also, prevalent shallow lake morphology throughout much of southcentral Alaska offers less deep water refugia for northern pike prey to avoid predation. Northern pike habitat preference is for shallow vegetated waters (Cook and Bergersen 1988, Inskip 1982), and the influence of pike predation on salmonids appears greatest in these habitats (Dunker et. al. 2018). In addition to salmonids, introduced northern pike in the Mat-Su Valley have also reduced or eliminated native nongame fish populations such as sticklebacks from some waters (Pankatar et al. 2006).

1.3 Legal Authorities

By consent of the Alaska Board of Fisheries, the ADF&G is authorized to perform acts leading to the eradication of fish populations per Alaska Statute (AS 16.35.200). Further, ADF&G is mandated by law to "Manage, protect, maintain, improve, and extend the fish, game and aquatic plant resources of the state…" (Alaska Fish and Game Laws and Regulations, Section 16.05.020). Removing northern pike from Anderson and Kings lakes would serve to: restore native wild forage fish populations (i.e. sticklebacks) and aquatic habitat, create a rainbow trout sport fishery in the lakes, reduce the likelihood that northern pike expand elsewhere in the Cottonwood Creek and Knik Arm drainages, and support ADF&G' s long-term goal of eradicating northern pike from waters where it is feasible to do so. It is the ADF&G's legal responsibility to remove the threat imposed by northern pike when possible.

The ADF&G Division of Sport Fish has developed planning documents to guide the Department's actions regarding northern pike. These documents include the Management Plan for Invasive Northern Pike located online at: http://www.ADF&G.alaska.gov/static/species/nonnative/invasive/pike/pdfs/invasive_pike_management_plan.pdf and the Alaska Aquatic Nuisance Species Management Plan located online at: http://www.ADF&G.alaska.gov/static/species/nonnative/invasive/pdfs/ak_ansmp.pdf .

These plans aid in identifying specific threats from northern pike, lists the statues and regulations pertinent to invasive species, and outlines the processes to follow when planning projects that evaluate, prevent, control, and/ or eradicate northern pike. The Division's strategic plan has a specific objective to: "minimize impacts of invasive species on sport fish stocks and habitat: (http://www.ADF&G.alaska.gov/static/fishing/PDFs/sport/StrategicPlan2015Final.pdf). Finally, the Division's invasive northern pike strategic planning team has identified pike eradication within the Cottonwood Creek drainage as a priority for the Invasive Northern Pike program.

1.4 Issues

1.4.1 Issues Selected for Detailed Analysis

Beginning the fall of 2019, ADF&G began a public scoping process to solicit public input on plans to remove invasive northern pike from Anderson and Kings lakes. ADF&G biologists went door to door to visit with landowners and deliver them an introductory letter to explain the project need (Appendix 1). On 9 November 2019, ADF&G staff attended an Anderson Lake Homeowners Association meeting to introduce the project and answer questions from association members. An official public meeting was held on 14 January, 2020 at Teeland Middle School in Wasilla. A letter was sent in mid-December to lake residents and interested stakeholders to announce the meeting (Appendix 1), and a news release was issued on 7 January 2020 to advertise the meeting. Among the participants of the scoping process, most people were in general support of

the project but had several questions. Questions and concerns expressed during public scoping were considered in ADF&G's analysis of the alternative actions, and a summary of the public meeting scoping comments and questions can be found in Appendix 1. Waterfront landowners and interested stakeholders were also mailed courtesy notices in late early March 2020 notifying them of the opportunity to provide comments for the EA. Comments received for this environmental assessment during the commenting period will be added to Appendix 4.

Specific to rotenone, concerns mentioned during both the public scoping meetings and EA commenting period are detailed below. **[To be included following the written public comment period]**

1.4.2

1.4.3

1.4.4

2.0 ALTERNATIVES

In this section, a range of alternatives are described for management of northern pike from the Anderson and Kings lakes. A "no action" alternative and two eradication/control alternatives are presented.

2.1 Alternative 1: No Northern Pike Eradication (no action alternative)

Alternative 1 would take no management action for eradicating or controlling northern pike from Anderson and Kings lakes. ADF&G would not make any attempt to remove northern pike from either lake, restore their native stickleback populations, or provide an alternative fishery through the stocking of rainbow trout to these lakes.

2.2 Alternative 2: Mechanical Removal

This alternative would involve deploying gill nets and/or trap nets under the ice to remove northern pike. If all northern pike were removed, these lakes would be restocked with rainbow trout and sticklebacks.

Under specific conditions, gillnets have been used successfully to remove unwanted fish from lakes. Bighorn Lake, a 2.1 ha lake located in Banff National Park in Alberta, Canada, was gillnetted from 1997 to 2000 to remove an invasive population of brook trout (Parker et al. 2001). Over 10,000 net nights (1 net night = 1 net set overnight for at least 12 hours) were conducted over a four-year period to remove the population that totaled 261 fish. The researchers concluded that the removal of nonnative trout using gillnets was impractical for larger lakes (> 10 Ha). In clear lakes, fish have the ability to acclimate to the presence of gillnets and avoid them. These researchers reported observing brook trout avoiding gillnets within 2 hours of being set.

Knapp and Matthews (1998) reported that Maul Lake, a 1.6 ha lake in the Inyo National Forest in California, was gillnetted from 1992 to 1994 to remove a brook trout population. The population consisted of 97 fish that were removed after 108 net days of effort. Following the removal of brook trout, Maul Lake was mistakenly restocked with rainbow trout. Efforts to remove them using gillnets were implemented immediately. From 1994 through 1997, 4,562 net days were required to remove 477 rainbow trout from the lake. Knapp and Matthews (1998) reported that gillnets

could be used as an alternative to chemical treatment, but they acknowledged that the small size and shallow depth of Maul Lake leant itself to a successful fish eradication using gillnets. Their criteria for successfully eradicating fish with gillnets included targeting lakes less than 1.6 ha, less than 5.8m deep, little or no inflow or outflow to perpetuate reinvasion, and no natural reproduction of the fish population.

ADF&G's experience using long-term gillnetting to remove northern pike from Kenai Peninsula lakes has yielded mixed results. During 2013 and 2014, ADF&G simultaneously gillnetted four lakes in the Soldotna Creek drainage (Union Lake (34 ha), West Mackey Lake (68 ha), East Mackey Lake (40 ha) and Derks Lake (15ha)). A total of 68 gillnets were fished in these lakes from fall ice-up to spring ice-out totaling 293,645 hours of netting effort. Subsequent sampling revealed that northern pike were still prevalent in all the lakes following this effort (Dunker et. al. 2016). Successful removal of northern pike in very small closed lakes with low northern pike populations (<30 individuals) did occur at three lakes (Tiny Lake (2.2 ha), Warfle Lake (3.04 ha) and Hall Lake (17 ha)) following intensive gillnetting effort totaling 17,895, 4,376 and 57,638 hours, respectively. It should be noted that at Hall Lake and Warfle Lakes no juvenile northern pike were detected suggesting northern pike reproduction had been unsuccessful in recent years (ADF&G Soldotna Office, unpublished data (b)). In the Mat-SuValley, ADF&G has been gillnetting pike in side-channel sloughs along Alexander Creek for nine spring seasons , and the pike population is just beginning to show signs of decreasing (Rutz et al. *in press*, ADF&G unpublished data for 2019).

Northern pike in Anderson and Kings lakes have been reproducing for many years. A 24-hour catch per unit effort (CPUE) survey of 18 gillnets set in Anderson Lake in 2016 caught 60 pike and 31 longnose suckers, and in 2017, a similar net set caught 58 pike and 10 suckers. In Kings lake, the CPUE from 24 hours of soaking 18 nets was 19 pike, 208 suckers, and 18 unidentified salmonids. CPUE in Kings Lake in 2017 was 19 pike and 192 suckers. It is unlikely long-term gillnetting could eradicate northern pike from these lakes as the total surface area (96 acres for Anderson and 112 for Kings) and volume (873 and 792 acre-feet for Anderson and Kings Lakes, respectively) is far greater than areas where gillnetting has been successful with eradication of non-native fish. In addition, CPUE from Kings Lake demonstrates significant bycatch which can reduce effectiveness for nets to recruit the target species.

2.3 Alternative 3: Rotenone Treatment (Preferred Alternative)

ADF&G's preferred alternative involves using rotenone (CFT Legumine™) (Appendices 5 and 6) to remove northern pike from Anderson and Kings lakes. Following a rotenone treatment, these lakes would be restocked with native threespine sticklebacks using individuals collected from nearby drainage lakes. Also, rainbow trout would also be stocked by the William Jack Hernandez Sport Fish Hatchery in Anchorage. Stickleback and longnose suckers populations will be re-seeded by relocating fish back into Anderson and Kings lakes from elsewhere in the Cottonwood Creek drainage. Once re-established, these populations are expected to establish and reproduce naturally. Rainbow trout will be stocked annually.

Alternative 3 offers the highest probability of achieving the goals of removing northern pike from Anderson and Kings lakes, restoring lost native fish populations and providing a replacement sport fishery.

2.3.1 Description of Rotenone

Rotenone is a naturally occurring substance derived from the roots of tropical plants in the bean and pea family including jewel vine (*Derris* spp.) and lacepod (*Lonchocarpus* spp.).These species

are found in Australia, Oceania, southern Asia, and South America (Ling 2003). People have used rotenone for centuries to capture fish for food in areas where these plants are naturally found (Quigley 1956, Bearez 1998, Robertson and Smith-Vaniz 2008), and it has been used in fisheries management in North America since the 1930s (Finlayson et al. 2000).

Rotenone acts by inhibiting oxygen transfer needed for cellular respiration. The biochemical process affected by rotenone takes place within the cell mitochondria and involves blocking electron transport by inhibiting NADH-ubiquinone reductase, resulting in the uncoupling of the metabolic pathway oxidative phosphorylation (Singer and Ramsay 1994, USEPA 2007). Fish die from tissue anoxia due to cardiac and neurological failure (Ling 2003). It is effective at low concentrations with fish because it is readily absorbed into the bloodstream through the thin cell layer of the gills. Mammals and other non-gill breathing animals do not have this rapid absorption route into the bloodstream and can tolerate exposure to concentrations much higher than those used to kill fish. Most non-target organisms that do not have this rapid absorption route are not negatively affected at rotenone concentrations used for fish management (Finlayson 2000, Ling 2003, NPS 2006, USEPA 2007, MFW&P 2008).

2.3.2 Description of the Proposed Rotenone Treatment

The boundary for this treatment area would be all waterbodies containing northern pike within the Cottonwood Creek Drainage in Wasilla. At the writing of this EA, those waters included Anderson and Kings lakes only and a small outlet stream from Anderson Lake. In 2016, ADF&G conducted an extensive survey using both gillnets and eDNA to document pike distribution in the drainage. It is possible more waters could be included in the treatment area if future pre-treatment fish surveys discover new populations of northern pike. However, this is not anticipated, and the overall treatment area is not expected to exceed 220 surface acres.

All waters would be treated with CFT Legumine™ (EPA reg# 75338-2) (Appendices 5 and 6), which is a liquid rotenone formulation containing 5% rotenone (ingredients described in detail in section 4.3.3). The proprietary formulation of CFT Legumine™ increases dispersion and emulsification in water with minimal petroleum distillates. The target concentration for the treatment would be within the product label guidelines for both liquid and powder rotenone and is anticipated to be about 0.8 parts per million (ppm) of formulated product (.04 ppm active ingredient/rotenone).

The entire treatment is anticipated to take about two days to complete and ideally would occur just prior to ice-up during October 2020. This timing is preferred because the relatively cold water available at that time of year will prolong the rotenone persistence (i.e., 3-7 months) ensuring a long exposure period for northern pike while minimizing impact to recreationists. There is a possibility that piscivorous birds present in these lakes during October could be temporarily displaced because of the removal of the northern pike prey base. However, there are many nearby lakes for these animals to relocate to, and it is expected any impact would be temporary in nature.

Prior to the treatment, signage would be placed at all common access locations to Anderson and Kings lakes in compliance with all applicable legal requirements. All landowners with property adjacent to treatment waters will be notified beforehand. Materials and equipment required to conduct the rotenone application would be transported to the lakes by highway vehicles. Secured onsite storage of all rotenone products would be accomplished by containing them inside an enclosed locked cargo trailer. To control any spill onsite, an impermeable ground liner that has a berm around its perimeter would be used to store rotenone product lakeside while an application is occurring. No overnight or unattended rotenone storage would occur at either lake.

Rotenone would be primarily applied by applicators using an outboard-powered motorboat. The application boat(s) would be equipped with a gas-powered pumping system that would premix lake water with the rotenone product and discharge the premixture to the surface waters and propeller wash of the boat. Applicators would also utilize backpack sprayers to apply rotenone to heavily vegetated nearshore areas and adjacent inundated wetlands. Backpack sprayers would apply rotenone to any streams or boggy shorelines connected to Anderson and Kings lakes. Battery-powered drip stations and/or backpack sprayers would be used to treat areas inaccessible by boat. All applicators will be state of Alaska-certified aquatic pesticide applicators.

Post-treatment, periodic lake water and well water samples would be collected and analyzed for rotenone content by a laboratory at the University of Alaska Anchorage. Rotenone product labeling states that recreational contact with treated water (<90 ppb rotenone) is allowed after the rotenone is applied, however, the Department would advise, via landowner notices and signage, that all such contact be avoided until the rotenone is no longer present as determined by analytic lab results of water samples and/or twenty-four hour survival of caged sentinel fish held in the treated waterbodies. After the rotenone completely deactivates, an evaluation of the treatment's success would be done by conducting gillnet and environmental DNA (eDNA) surveys. To ensure compliance with the Migratory Bird Treaty Act, gillnets would be set at ice-up in 2020 and removed immediately at ice-out in 2021 to reduce the chance that waterfowl or other birds could be caught.

Water quality and macroinvertebrates would be sampled periodically before and after the treatment to document any major changes in species diversity or water quality. If the Anderson and Kings lakes treatments successfully eradicates the northern pike population (as determined by post-treatment evaluations) the lakes would be restocked with wild threespine stickleback and longnose suckers collected from the Cottonwood Creek drainage and with hatchery-reared rainbow trout. If live northern pike are detected in either lake post-treatment, the affected lake will be retreated with rotenone as soon as feasible.

3.0 AFFECTED ENVIRONMENT

3.1 Land Status

The Anderson and Kings Lakes Restoration Project is located within Township 18N; Range 1W Section 25 and Range 1E Sections 29 and 30.

Latitude: 61.620686

Longitude: -149.336494

Both lakes can be accessed via the following driving directions:

- Mile 41.8 Glenn Hwy
- East on Palmer/Wasilla Hwy
- 4.0 miles to Trunk Rd, Right on Trunk Rd.
- 1.1 miles to Bogard Rd, Left on Bogard Rd.
- 2.3 miles to Caribou St., Right on Caribou St.
- 0.5 mile to Charley Dr., Left on Charley Dr.
- 0.5 mile to E. Echo Ave., Left on E. Echo Ave.
- 0.5 mile to N. Sierra, St. Left on N. Sierra St.
- 0.2 miles to access site.
- NOTE: Access is limited to a 20-foot-wide public use easement that is marked with Telspar posts and signage.

The lands surrounding the lakes are mostly privately owned with one parcel of state land north of Kings Lake (Figure 3).

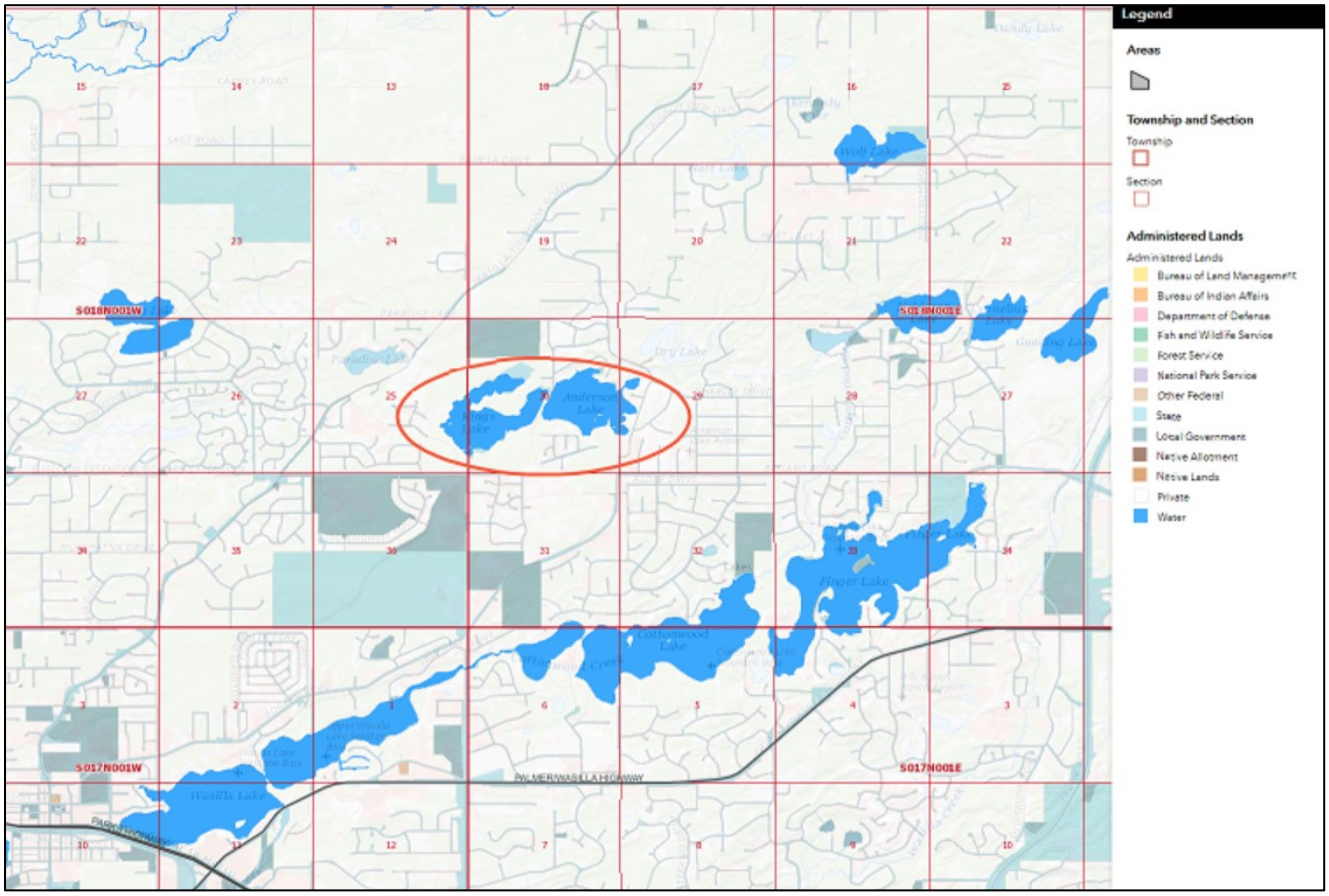

Figure 4. Mat-Su Borough land ownership map depicting Anderson and Kings lakes.

3.2 Physical Environment

There are two natural lakes in the Cottonwood Creek drainage that contain northern pike covering a total of 208 acres, have maximum depths of 23 and 28 feet for Kings Lake and Anderson Lake, respectively, and a cumulative water volume of 1,665 acre-feet. Anderson Lake also has a short ephemeral outlet that during high water can link to Cottonwood Creek. (Figure 4).

Figure 5. The Anderson and Kings lakes treatment area indicated by red shading.

3.3 Biological Environment

3.3.1 Vegetation

Vegetation within the area of Anderson and Kings lakes consists mostly of lowland boreal forest and wetlands interspersed with some low-relief ridges. Most lakes have lily pads in shallow areas (< 3 meters) and lake shorelines consist of a mix of floating bog and boreal forest. Residential development has caused some lakeside vegetation changes (i.e., grass lawns, timber/brush removal, dock installation).

3.3.2 Aquatic resources

Fish

Fish native to Anderson and Kings lakes include rainbow trout, coho salmon, longnose suckers, and threespine stickleback.

Invertebrates

There are robust populations of numerous aquatic invertebrate species in the lake. Evaluations of the aquatic invertebrate diversity are planned for the summer of 2020.

Amphibians

The wood frog is the only amphibian found in the vicinity of these lakes.

3.3.3 Wildlife

Mammals found in the area surrounding Anderson and Kings lakes include black bears, moose, coyotes, snowshoe hare, lynx, muskrats, beaver, river otter, weasel, red squirrels, porcupine, flying squirrels, shrews, voles and domesticated dogs and cats. Piscivorous birds common to the area include bald eagles, herring gull, Bonaparte's gull, belted kingfisher, parasitic jaeger, common loon, horned grebe, red-necked grebe, crow, raven, magpie, stellar jay, and gray jay. In addition, several non-piscivorous species of birds including various passerines, woodpeckers, geese, ducks, plovers, owls, etc. are present in the area.

3.3.4 Threatened and Endangered Species

To identify the existence of potential EPA pesticide use limitations for endangered species protection within a treatment area, and to help address those concerns if any exist, an EPA resource called the "Endangered Species Protection Bulletin" can be accessed online at: http://www.epa.gov/oppfead1/endanger/bulletins.htm 3. A query of this site yielded no rotenone use limitations. The USFWS also provides an online tool for determining whether endangered or threatened species are present in an area which can be viewed online at: http://ecos.fws.gov/ecp0/reports/species-listed-by-state-report?state=AK. No threatened or endangered species are listed for Anderson and Kings lakes area although threated Beluga whales can be present in nearby Knik Arm.

3.4 Human Environment

3.4.1 Economy

The nearest municipality to Anderson and Kings lakes is Wasilla. This area supports a diverse economy that includes tourism, fishing, and numerous service and retail businesses.

3.4.2 Recreational Use

Public access to the lakes exists via road right-of-way. Sport fishing for northern pike in the lakes generates modest effort and is important for some anglers who appreciate such fishing opportunity. Water recreation, such as swimming and canoeing, also occur in the lakes.

4.0 ENVIRONMENTAL CONSEQUENCES

The purpose of this section is to identify and describe the ecological and human health impacts of the alternatives. Potential impacts are discussed within three broad subject areas: physical environment, biological environment, and human environment. The discussion, especially pertaining to the preferred alternative, focuses largely on issues that were identified during public scoping from this or similar restoration projects or that ADF&G recognizes as potential concerns likely to arise.

4.1 Physical Environment

4.1.1 Impacts from Alternative 1 to Soils

The soils underlying Anderson and Kings lakes would not be affected if the northern pike population remained in the lake.

4.1.2 Impacts from Alternative 2 to Soils

No impacts to Anderson and Kings lakes area soil would be expected from Alternative 2 (gillnetting).

4.1.3 Impacts from Alternative 3 to Soils

No rotenone contamination of soils and/or groundwater is anticipated from this project. Rotenone binds readily to sediments and is ultimately broken down in soil and water (Skaar 2002; Engstrom-Heg 1971, 1976; Ware 2002). Rotenone is not expected to leach from soils (Augustijn-Beckers 1994) and it penetrates approximately one inch vertically in most soil types (Dawson 1986). The only exception is sandy soil where movement is about three inches (Hisata 2002). Long-term monitoring of groundwater wells in treatment areas in California (10 years) and short-term monitoring of wells in Montana never detected rotenone, rotenolone, or any formulation products (Skaar 2002; Ridley et al. 2007; McMillin and Finlayson 2008) after application in nearby waters. The primary soil types in the area of Anderson and Kings lakes are generally classified as Knik silt loam by the National Resource Conservation Service Soil Survey. Soils in the classification typically exhibit a shallow layer of organics (0-2 inches depth from surface) overlaying two feet of silty loam (2-26 inches deep). Below this level is a an extremely gravelly coarse sand to a depth of 5 feet (26-60 inches deep). The deep layer of gravelly sand is confirmed in several of the well logs, though some indicate intermittent layers of dense silty sand (hardpan), clay and even some large boulders and bedrock. The gravelly sand layer contains the static water level in the shallow wells, and this type of soil is well-draining with a soil permeability ranging from 0.57 to 1.42 inches/ hour (USDA 2005). It is expected that, at the very maximum, given the overlying organic material, rotenone would only penetrate about three inches total (extending about an inch into the silty loam layer).

Rotenone degradation rates in soil are dependent on soil temperature, soil physicochemical properties and sunlight exposure. Rotenone embedded on soil surfaces but exposed to sunlight has been shown to degrade 50% after five to seven hours (Cavoski et. al. 2007). Rotenone embedded in soil without sunlight exposure was shown to degrade 50% in 8 days at 20C° and 25 days at 10C° (Cavoski et. al. 2008).

4.1.4 Impacts from Alternative 1 to Water Quality

Allowing northern pike to remain in Anderson and Kings lakes would not negatively affect water quality. However, eventual northern pike extirpation of native stickleback and in these lakes may have increased zooplankton abundance (zooplankton serve as food for stickleback) leading to a corresponding decrease in phytoplankton abundance which can increase water clarity. Although anecdotal, lakeside residents at other northern pike lakes have reported water clarity increased following the introduction of northern pike. Trophic cascade effects, including water quality changes and changes in zooplankton communities, are known to result from fish introductions (i.e. Tanner 2006, Duggan 2015, Walsh et. al. 2016, Skov and Nilsson 2007).

4.1.5 Impacts from Alternative 2 to Water Quality

Alternative 2 (under-ice gillnetting) could temporarily increase nutrient availability in Anderson and Kings lakes from fish carcass decomposition, similar to that described in the next section (4.1.6). Fish carcasses can act as fertilizer to stimulate production of phytoplankton and ultimately zooplankton. No drastic changes in water quality have been observed by ADF&G following other northern pike eradication projects (Massengill 2014 a, b).

4.1.6 Impacts from Alternative 3 to Water Quality

This project would intentionally introduce rotenone, a botanically based piscicide, to surface waters to kill invasive fish, but impacts would be short-term. CFT Legumine™ (5% rotenone) is registered by both the Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation and is deemed safe to use to eradicate invasive fish when applied according to label instructions. The proposed treatment would result in a maximum rotenone concentration 0.04 ppm active ingredient (rotenone), but likely less. According to the EPA's re-registration of rotenone, there are no adverse environmental or human health effects expected from rotenone when used at this concentration (USEPA 2007).

There are three ways in which rotenone can be detoxified once applied. The first detoxification method involves dilution. This may be accomplished by groundwater or surface water inputs diluting the rotenone below 2.0 parts per billion (ppb), a concentration threshold requiring deactivation if the rotenone leaves a treatment area (i.e., flushing downstream) (Finlayson et al. 2010). Because the lake connections are ephemeral and low flow (<1 cfs), water inputs causing dilution would not be expected to contribute significantly to detoxification.

The second method of detoxification involves the application of potassium permanganate ($KMnO_4$) which is an oxidizing agent. Detoxification using $KMNO_4$ is typically used for flowing waters where rotenone must be detoxified before traveling downstream and outside of a treatment area (Finlayson et. al. 2010). Detoxification is normally accomplished within 60 minutes after $KMN0_4$ is in contact with rotenone at a 1:1 ratio. Less contact time is required with higher water temperatures or higher ratios of $KMNO_4$ to rotenone. $KMN0_4$ detoxification of rotenone in Anderson and Kings lakes is unlikely to be needed because rotenone will be confined to the treatment area and not flow into other waters supporting wild fish populations. However, there is an ephemeral outlet stream from Anderson Lake that is subterranean in places, but if water is high following treatment, could result in a direct surface connection to Cottonwood Creek. In the event this occurs, a precautionary deactivation station will be set up in advance of the treatment and ready to operate should conditions necessitate it.

The third and most common method for rotenone detoxification is through natural environmental processes. Rotenone is susceptible to natural degradation through a variety of mechanisms; however, warm temperatures and sunlight exposure are the two factors with the greatest influence (Ware 2002; ODFW 2008; Loeb and Engstrom-Heg 1970; Engstrom-Heg 1972; Gilderhus et. al. 1986). Rotenone released into relatively warm water (~15°C) is expected to fully detoxify within two to four weeks (Dawson et al. 1991; Brian Finlayson retired California DFG rotenone specialist, personal communication). However, ADF&G's experience with cold water rotenone applications, when rotenone has been applied to other pike lakes just days or hours before ice cover forms, resulted in the persistence of rotenone for 3-7 months (Massengill 2014 a, b). The degradation of rotenone can result in at least 20 different byproducts of which only one is considered toxic (rotenolone) (Cheng et al. 1972). Rotenolone is approximately one order of magnitude less toxic than rotenone (CDFG 1991).

CFT Legumine™ is a liquid rotenone formulation. Its additives facilitate the emulsification and dispersion of rotenone in water. The formulation of CFT Legumine™ was analyzed for the California Fish and Game Department (CDF&G) in 2007 (Environ 2007). This analysis showed that the primary ingredients (carrier compounds) are soluble organic compounds (SOCs) such as diethylene glycol ethyl ether (DGEE) (61.1%), Fennedefo 99™ (17.1%), N-methyl 2-pyrrolidone (9.8%), rotenone (5.12%) and rotenolone (0.72%). Some additives would naturally biodegrade in Anderson and Kings lakes to undetectable levels within a week to several weeks. However, N-methyl 2-pyrrolidone and DGEE would be expected to dissipate more slowly because they are water soluble and would not readily dissipate through volatilization. A thorough description of the toxicity or these compounds can be found in section 4.3.3. Studies indicate that the other compounds in liquid rotenone formulations have not been detected at harmful levels in groundwater associated with rotenone application (Finlayson et al. 2000; Ridley et al. 2006; Environ 2007).

Case studies in Montana have concluded that rotenone movement through groundwater does not occur (MFWP 2008). ADF&G collected representative well water samples from six residences in the Soldotna Creek Drainage on the Kenai Peninsula following rotenone treatments to the Mackey Lake system (2014) and Soldotna Creek (2016). Samples were collected periodically until the rotenone fully degraded in the treated waterbodies based on analytic testing. No rotenone or its less toxic degradation product (rotenolone) was detected in any well. Also, monitoring efforts of wells in conjunction with rotenone treatments in California, Oregon or Montana (Don Skaar, MFWP, unpublished data) have never detected rotenone. Nonetheless, water samples from a least one private ground water well near each lake will be analyzed for rotenone periodically to verify well water is not affected by the treatment.

Private water wells exist in the treatment area. Available well log data for the areas surrounding the lakes were evaluated by a Matanuska-Susitna Borough Capital Projects hydrologist for potential groundwater concerns related to treating Anderson and Kings lakes with rotenone (Appendix 7). This review summarizes surface and subsurface hydrology within the area of the lakes and assesses the risk of rotenone applied to surface waters to drinking water aquifers. This assessment indicates some well depths are shallow and above a confining layer, with the shallowest well found dug to a static depth of 8 feet. Because rotenone binds readily to organics in soils and does not penetrate more than 3 inches through the most porous soil type (sand), there is very minimal risk that any trace rotenone could enter well water sources. As a precaution, a shallow well will be included in regular rotenone sampling following treatment.

Following a rotenone treatment, there may be a substantial number of fish carcasses present. Bradbury (1986) reported that approximately 70% of rotenone-killed fish in Washington lakes immediately sink. Parker (1970) reported that at water temperatures of 5° C and cooler, dead fish required 20-41 days to surface. The most important factors inhibiting fish from surfacing are cooler water (<10° C) and deep water (> 5 meters). Anderson and Kings lakes have maximum depths ranging between 23 and 28 feet, and the desired treatment period (early-October) would likely result in water that is <10C°.

Bradbury (1986) reported that 9 of 11 water bodies in Washington treated with rotenone experienced an algae bloom shortly after treatment. This occurred from the input of phosphorus to the water as fish decayed. Bradbury further noted that approximately 70% of the phosphorus from dead fish would be released into the lake through bacterial decay. This stimulates phytoplankton production which in turn increases zooplankton production, providing prey for macroinvertebrates and fish. This change in water chemistry is viewed as a benefit to stimulate plankton growth (UDWR 2007). Any changes or impacts to water quality resulting from decaying

fish would be short-term and minor. Nonetheless, ADF&G personnel would recover and dispose of all feasibly recoverable dead fish following the rotenone treatments and monitor water quality for one year post-treatment.

In summary, the rotenone treatment would be confined to the Anderson and Kings lakes treatment area and natural degradation processes would fully detoxify rotenone over a period of months. As required by state regulation, ADF&G will apply for and comply with the Alaska Department of Environmental Conservation (ADEC) Pesticide Use Permit for this project. Similarly, this project would be conducted in compliance with Section 402 of the federal Clean Water Act (CWA), where permitting authority in Alaska has been transferred to the ADEC through the Alaska Pollution Discharge Elimination System (APDES) program.

4.2 Biological Environment

4.2.1 Impacts from Alternative 1 to Vegetation

Vegetation in and within the vicinity of Anderson and Kings lakes would not be affected if northern pike remain in the lakes.

4.2.2 Impacts from Alternative 2 to Vegetation

Most terrestrial vegetation in the area of the lakes would not be affected by long-term gillnetting. Some temporary vegetation trampling could occur at areas used to access the lakes with a boat. Any trampling effects are expected to be minimal and short-term and would occur at a time of year when vegetation growth is not occurring. In most of the lakes, emergent aquatic vegetation (i.e., lily pads beds) is prevalent and it is expected that some damage to aquatic vegetation may occur from boat propellers. However, nets would be deployed near freeze-up and removed immediately at ice out which would reduce the amount of damage to actively growing vegetation. Lily pads and most other emergent aquatic plants undergo senescence in which they seasonally die-back. Lily pads have both root rhizomes and seeds in the lake substrate capable of regenerating new plants each year.

4.2.3 Impacts from Alternative 3 to Vegetation

Rotenone does not cause adverse effects to vegetation (Finlayson et. al. 2010). Impacts to terrestrial and aquatic vegetation would be similar to Alternative 2 as temporary foot and boat access to each lake will be needed. At least one application boat will have a high-pressure application spray hose capable of spraying rotenone up to 10 meters horizontally. This will increase the coverage swath reducing the need to operate in emergent beds of aquatic plants.

4.2.4 Impacts from Alternative 1 to Wildlife

Northern pike are apex predators in aquatic environments, and they are very opportunistic in their diet. Besides fish, northern pike will prey on invertebrates, frogs, mice, muskrats, ducklings and small birds. Northern pike are non-native predators in Anderson and Kings lakes, so if their population remains, predation on native animals will continue. It is anticipated that eventually, northern pike would be the only fish left in the lakes and that the native sticklebacks and suckers will be extirpated.

4.2.5 Impacts from Alternative 2 to Wildlife

Wildlife species characteristic to the area are described in 4.2.6. Netting the lakes could displace wildlife such as piscivorous birds (e.g., loons, terns, etc.) because there would be fewer or perhaps no fish left after the netting is completed. Despite that the netting would mostly occur

under the ice, there would remain some risk for the incidental take of birds and small mammals (muskrat, otter, etc.), especially in the period before the lakes freeze above the nets and during ice out when ice conditions are unsafe to access but there is open water. It could take years to eliminate northern pike from Anderson and Kings lakes by netting alone. Also, long-term changes in the abundance of some animals that utilize the lakes (invertebrates, birds, small mammals) could occur from direct or indirect effects related to netting efforts.

4.2.6 Impacts from Alternative 3 to Wildlife

Large Mammals: Black bears are occasionally found in the Anderson and Kings lakes area but are not dependent on these lakes for food. The removal of exposed dead fish resulting from this project would reduce the potential for dead fish serving as an attractant for bears or for scavengers to consume rotenone-killed fish. Even if rotenone-killed fish were consumed by mammals, there likely would be no adverse effects because rotenone at low dosage is expected to be degraded by enzymes in the animals' digestive tracts (Finlayson et al. 2000; USEPA 2007. Rotenone residues in dead fish are generally very low (<0.1 ppm), unstable, and not readily absorbed through the gut of the animal eating the fish (Finlayson et al. 2000). Based on EPA calculations (USEPA 2007), the rotenone dosage that a 100kg (220 pound) mammal might receive by eating 3.4% of its bodyweight (3.4kg) in rotenone-killed fish would be 3.7mg, which is about 824 times below the calculated median lethal dose (3040mg). No evidence of carcinogenicity from rotenone exposure has been documented in mice/rat studies (National Toxicology Program 1986).

There is a year-round presence of moose in the area. It is possible that moose may ingest water from the lakes during the treatment period or that they feed on aquatic vegetation in the treated waters. EPA-approved bioassays indicate that, at the proposed concentrations, rotenone would have no effect on mammals that drink the treated water (Schnick 1974a, 1974b; Herr et al. 1967). Ingestion of treated waters by terrestrial wildlife would have no adverse effects because of the low rotenone concentration found in the lake water and the enzymatic action in the animals' digestive tracts. Particularly, the gastrointestinal absorption of rotenone is inefficient (Finlayson et al. 2000).

Finally, rotenone has a low acute toxicity via the dermal route of exposure and receives a toxicity category IV rating; in rabbits, the lethal dose that kills half the test animals (LD50) is >5000mg/kg (USEPA 2007). Risk of inhalation exposure to rotenone from the liquid CFT Legumine™ to wildlife is nonexistent because the vapors rapidly dissipate. In conclusion, this project would have no significant impact on game mammals.

Other mammals: Coyote, lynx, muskrat, beaver, mink, otter, weasel, snowshoe hare, red squirrel, porcupine, flying squirrel, shrew, vole and domesticated dogs and cats are present in the area. Some of these mammals could scavenge on rotenone killed fish or drink treated water. The effects of rotenone on non-target organisms have been studied extensively. Again mammals, in general, are not affected by rotenone in fisheries treatment concentrations because they neutralize rotenone by enzymatic action in their stomach and intestines (Finlayson 2000: AFS 2002; USEPA 2007). Laboratory tests have been conducted in which rats and dogs have been fed forms of rotenone as part of their diet for periods of six months to two years (Marking 1988). Observed effects included diarrhea, decreased food consumption, and weight loss. Researchers reported that despite the unusually high concentrations of rotenone fed to rats and dogs, the chemical did not cause tumors or reproductive problems in these mammals. A notable exception for rotenone tolerance is that swine have been shown to be more sensitive to rotenone compared to cattle. (Thompson 1985).

The State of Washington reported that a half-pound mammal (red squirrel size) would need to consume 12.5 mg of pure rotenone to receive a lethal dose (Bradbury 1986). It is important to note that nearly all the aforementioned examples were based upon subjecting laboratory specimens to unusually high concentrations of rotenone that are far above concentrations used in fisheries management uses. For this project, ADF&G would use a rotenone product containing 5% active rotenone. Assuming the primary way an animal may consume the compound under field conditions is by drinking lake water, a half-pound animal would need to drink over 80 gallons of lake water treated at 0.04 ppm rotenone within 24 hours to receive a lethal dose. Based on this information, the Department expects the impacts to non-target organisms to range from non-existent to short-term.

Migratory Birds: Birds that could potentially consume dead fish following treatment include bald eagle, artic tern, herring gull, Bonaparte's gull, parasitic jaeger, common loon, pacific loon, red-throated loon, horned grebe, red-necked grebe, crow, raven, magpie, stellar jay, and gray jay. Additionally, non-piscivorous birds such as passerines, woodpeckers, geese, ducks, plovers, owls, etc. are present in the area. During the proposed treatment period, some piscivorous birds will have migrated from Anderson and Kings lakes, others may be temporarily displaced by application activities for a day or two, but the availability of non-treated waters in close proximity to the project area should minimize any impacts. Following the treatment, it is likely that some birds would remain and forage on rotenone-killed fish; however, research has indicated it is not physiologically possible for birds to consume sufficient quantities of rotenone-killed fish to result in a lethal dose (Finlayson 2000: USEPA 2007).

A bird weighing 4 ounces would have to consume 100 quarts of treated water or more than 40 pounds of fish and invertebrates within 24 hours to receive a lethal dose. This same size bird would normally consume 0.2 ounces of water and 0.32 ounces of food daily, thus a safety factor of 1,000 to 10,000 fold exists under normal conditions for birds and mammals. The LD50 values for mallard ducks and ring-necked pheasants were 2200 mg/kg and1680 mg/kg, respectively, as found online at: http://pmep.cce.cornell.edu/profiles/extoxnet/pyrethrins-ziram/rotenone-ext.html. Regardless, ADF&G efforts to remove rotenone-killed fish that surface following treatment would minimize risks to these birds; thus, impacts should be negligible.

Human activity associated with the application of rotenone in Anderson and Kings lakes and subsequent monitoring work could temporarily disrupt bird use in the area. Specifically, during pre and post-treatment evaluations using gillnets, some birds could be drowned by net entanglement. To reduce this possibility, netting will be conducted primarily under the ice to reduce the incidental take of birds. Northern pike are known to opportunistically prey on birds (Solman 1945, Brown 2005) so eradicating northern pike from these lakes should actually benefit avian populations in the long-term. Restocking both lakes with native sticklebacks following the rotenone treatments would supply new prey for piscivorous birds over the long-term.

Threatened or Endangered Species: The Cook Inlet beluga whale is the only endangered species found in the Cook Inlet area. No direct impacts to beluga whales are expected because the treatment area is not accessible to beluga whales. Rotenone will remain within the treatment area and will not enter Cook Inlet.

4.2.7 Impacts from Alternative 1 to Aquatic Resources

Though northern pike are opportunistic feeders, their preference is for fish. Northern pike have decimated fish populations in Anderson and Kings lakes. As long as northern pike remain in the

lakes, these impacts are not correctable. Without northern pike eradication ADF&G fisheries restoration activities cannot occur.

4.2.8 Impacts from Alternative 2 to Aquatic Resources

Netting the lakes would not pose a threat to sticklebacks remaining in the lakes, but longnose suckers would likely be caught incidentally. Aquatic invertebrates and wood frogs would not be impacted because their small size prevents efficient gillnet recruitment.

4.2.9 Impacts from Alternative 3 to Aquatic Resources

Fish: This project is designed to eradicate northern pike using rotenone. It is anticipated that all northern pike within Anderson and Kings lakes will be killed including any sticklebacks and suckers that are in the lakes. The present sport fishery in these lakes is only for northern pike, although salmonids were present in them recently. Sport fishing in the lakes would be temporarily impacted by this project. Removing northern pike would result in the permanent loss of fishing opportunity for that species and a temporary delay before an alternative stocked salmonid fishery becomes viable.

Following the rotenone treatment, native threespine stickleback and longnose suckers will be introduced to the lakes. ADF&G proposes to stock hatchery-reared catchable rainbow trout annually following the removal of northern pike. Stickleback and longnose sucker populations are expected to become naturally self-sustaining in the lakes after their reintroduction to each lake.

Invertebrates: Generally, adult zooplankton are more vulnerable to rotenone than fish or macro invertebrates (Bradbury 1986, Melaas et al. 2001, Vinson et al. 2010). However, many zooplankton species have life stages (eggs, resting stages) that are very rotenone resistant so complete eradication following a rotenone treatment is unlikely (Kiser et al. 1963, Melass et al. 2001). Zooplankton populations have been observed to fully recover to pre-treatment levels within one to three years of post-treatment in Southcentral Alaska with no observed loss of species (Chlupach 1977). Recent rotenone treatments on the Kenai Peninsula indicate invertebrate diversity remained comparable to pretreatment levels less than one year post-treatment, but zooplankton abundance was temporarily reduced (Massengill 2014a,b). Chandler and Marking (1982) found that clams and snails were between 50 and 150 times more tolerant than fish to rotenone. Because of their short life cycles (Anderson and Wallace 1984), good dispersal ability (Pennack 1989) and generally high reproductive potential (Anderson and Wallace 1984), aquatic invertebrates are capable of rapid recovery from disturbance (Jacobi and Deegan 1977; Boulton et al. 1992; Matthaei et al. 1996). Recolonization would be assisted by aerial dispersal of adult invertebrates from adjacent areas near the project area (e.g., mayflies and caddis flies).

Amphibians: Wood frogs are the only amphibians in the area and presumed to be common to the Anderson and Kings lakes area. Wood frogs mate in the spring, and their offspring quickly develop from egg to tadpole to frog. This northern adaptation helps ensure complete metamorphosis before fall freeze-up (ADF&G Wildlife Notebook Series: Frogs and Toads http://www.ADF&G.alaska.gov/static/education/wns/frogs_and_toads.pdf). Adult frogs are generally more resistant to the effects of rotenone than fish. Grisak et al. (2007) conducted laboratory studies on long-toed salamanders, Rocky Mountain tailed frogs, and Columbia spotted frogs and concluded that the adult life stages of these species would not suffer an acute response to rotenone, but larval and tadpole stages could be affected by rotenone at fish killing concentrations. These authors recommended rotenone treatments occur at times when the larva are not present, such as in the early spring or later in the fall. It is anticipated that surrounding

ponds and wetlands that are not treated would help restore any potential depletion of wood frog populations in the lakes. Active wood frog tadpoles were captured and observed in Scout Lake (Sterling, Alaska) in the spring of 2010 following a fall 2009 rotenone treatment (Massengill 2014 (b)).

4.3 Human Environment

4.3.1 Impacts from Alternative 1 to Public Safety and Health

Leaving the northern pike population in Anderson and Kings lakes would not result in any human health or safety impacts.

4.3.2 Impacts from Alternative 2 to Public Safety and Health

Netting northern pike in Anderson and Kings lakes would likely not result in significant public safety and health impacts because the nets would be deployed mostly under the ice to avoid conflicts with water recreationists and other users.

4.3.3 Impacts from Alternative 3 to Public Safety and Health

Although pesticides are widely used to control unwanted species, legitimate public concerns have been raised regarding health and human safety. As with any pesticide, direct exposure or consumption of piscicides can potentially have harmful or sometimes fatal effects on humans. Rotenone is an EPA-registered pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (USEPA 2007). Rotenone is also registered for use in Alaska by the Alaska Department of Environmental Conservation. Although Alaska does not have established water quality criteria for rotenone, the EPA's re-registration eligibility decision for rotenone (USEPA 2007) provides human health risk conclusions.

An EPA assessment of acute dietary risk to humans was based on the maximum solubility of rotenone in water (200 ppb). The EPA concluded that acute dietary exposure estimates for drinking water and eating fish from rotenone treated waters was below the EPA's level of concern. The EPA's chronic dietary exposure assessment of rotenone was performed for only drinking water because rotenone degrades rapidly and has a low propensity to bioaccumulate in fish (the mechanism of potential exposure to human consumers of the fish). The EPA estimated the drinking water level of concern (DWLOC) to be 40 ppb (rotenone) for the most sensitive subgroup (infants and children). Therefore, at the maximum rotenone concentration planned for Anderson and Kings lakes (40ppb), the DWLOC would not be exceeded. The DWLOC (40 ppb) is for chronic long-term dietary exposure and is a scenario not likely to occur at Anderson and Kings lakes because there are no drinking water intakes in the lake and the timing of the treatment (just prior to freeze-up) greatly reduces water recreation and incidental ingestion of lake water. As a precaution, signage will be posted in the treatment area to warn the public to avoid drinking rotenone-treated water or eating rotenone-killed fish from the lake and to avoid contacting treated water until monitoring ensures the rotenone has completely degraded. However, as an example of rotenone toxicity relative to levels of concern, a 160-pound adult would have to drink thousands of gallons of treated lake water at one sitting to receive a lethal dose (Gleason et al. 1969).

Studies have indicated that rotenone is a strong mitochondrial inhibitor and, under some conditions, produces features of Parkinson's disease (PD) (Betarbet et al. 2000). A review of published data since the initial study by Betarbet et al (2000) suggests that the rotenone-treated rat models used in the Betarbet study are based on atypical parkinsonism rather than idiopathic Parkinson's disease (PD), and that such studies are not applicable to piscicidal uses of rotenone (Höglinger et al. 2006). Hollingworth (2001) in his chapter on inhibitors of oxidative

phosphorylation (including rotenone) does not consider rotenone a cause of PD. A study by Montojo et al. (2010) suggests that mice exposed to rotenone mixed with chloroform and injected through a feeding tube developed Parkinson-like symptoms, however dosages were administered for three months at dosages far exceeding those used in fishery applications.

Rotenone has a history of being used as an insecticide for agricultural uses but is no longer used in the United States for those purposes. Finlayson et. al. (2012) provides an assessment of the epidemiology evidence some studies have used for associating farmer's exposure to rotenone to developing PD as follows: "The Agricultural Health Study (Kamel et al. 2006; Tanner et al. 2011) evaluated the previous use of pesticides by farmers and their incidence of PD. Questionnaires were sent to American farmers to gain information on their pesticide use and medical history (Kamel et al. 2006). The study concluded that increased pesticide use was associated with increased PD risk in farmers, and that the use of personnel protection equipment (PPE) decreased this risk. From follow-up investigations of these data, Tanner et al. (2011) concluded that rotenone and paraquat use were associated with increased risk of PD. However, the study participants were exposed to all pesticides, not just rotenone and paraquat, and pesticide exposures were not actually measured, rather pesticide exposures were based solely on self-reporting methods. Raffaele et al. (2011) discussed the problems associated with using epidemiological data in environmental risk assessments, specifically citing as examples studies on pesticide exposure contributing to the increased risk of PD. They found inconsistent findings between studies, generic categorization of pesticide exposure, and the use of dichotomous exposure categories (e.g., ever versus never) as reasons for difficulty in applying the findings of these studies. They also noted the difficulty in using epidemiological studies to evaluate a disease such as Parkinson's where multiple causal factors (genetic susceptibility, age, and environmental exposures) are present. The authors concluded that standard operating procedures for fishery management uses of rotenone such as applicators wearing PPE and restricting public contact with treated waters until rotenone concentrations subside greatly reduces or eliminates human exposure risk.

As discussed in section 4.1.6, CFT Legumine™, the liquid rotenone mixture that would be used in Anderson and Kings lakes, contains additives to facilitate its emulsification and dispersion in water. CFT Legumine™ was analyzed for the CCDF&G in 2007 (Environ 2007), and the toxicities of the individual ingredients identified during that analysis are described below:

Diethylene glycol ethyl ether (DEGEE) is the primary ingredient of CFT Legumine™ contributing an average of 57% to the formulation. DEGEE is a solvent with a wide range of industrial applications including the manufacturing of coatings, cleaners and dyes. DGEE is also commonly used in manufacturing pharmaceuticals, cosmetics and food additives. With respect to the environmental fate of this compound, volatilization, photolysis, and hydrolysis are not expected to significantly occur in surface waters (SPECTRUM, Chemical Fact Sheet, 2008). Rather, biodegradation is the most likely degradation mechanism for the compound and 48-87% degradation would be expected in 20 days: Because DGEE is water soluble, it will not bind to sediments and it has a low ability to bioconcentrate in aquatic organisms: https://pubchem.ncbi.nlm.nih.gov/compound/Diethylene-glycol-monoethyl-ether#section=Environmental-Fate.

A product safety assessment for DEGEE by Dow Chemical is available online at: http://msdssearch.dow.com/PublishedLiteratureDOWCOM/dh_096d/0901b8038096db71.pdf?filepath=productsafety/pdfs/noreg/233-00344.pdf&fromPage=GetDoc. This assessment states: "Exposure to DEGEE may cause moderate eye irritation; however, corneal injury is

unlikely. Prolonged skin exposure is not likely to cause significant irritation or result in absorption of harmful amounts. No adverse effects are anticipated from single exposure to vapor and DEGEE has a low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. The effects of repeated exposure to DEGEE in animals have been reported on the following: blood, kidney, liver, testes. Studies in laboratory animals indicate that DEGEE is not a reproductive toxicant even when given in large amounts (a few percent in the drinking water). However, at the highest doses tested, it caused some toxic effects in the offspring of treated animals, such as: increased liver weight, decreased brain weight and reduced sperm motility. DEGEE did not cause cancer, birth defects or any other fetal effects in laboratory animals. In vitro genetic toxicity studies were predominantly negative. Animal genetic toxicity studies were negative.

In a lake treated to a concentration of 0.8 µl/L of CFT Legumine™, such as that proposed for Anderson and Kings lakes, the concentration of DEGEE would be 0.49 µl//L (0.8 µl//L X 61%). The oral dose LD50 value for a cat was 990ul/kg/bw while for rats and mice, the LD50 is 5,500-8,700 µl/kg body weight: https://pubchem.ncbi.nlm.nih.gov/compound/Diethylene-glycol-monoethyl-ether#section=Environmental-Fate. Utilizing the cat oral LD50 as a surrogate LD50 for humans and applied to a 70 kg person yields an estimated human oral LD50 of 69,000 µl . A 70-kg person drinking two liters of water from the lake (normal daily water intake) would consume 0.97 µl//L of DEGEE, which is about 0.00001% of a fatal dose (0.97 µl//L ÷ 69,000 µl//L), while for rats and mice, the LD50 is 5,500-8,700 µl/kg body weight.

Fennedefo 99™ is an emulsifier in the CFT formulation containing fatty acid esters and polyethylene glycol (PEG) mix. On average it represents about 17% of the CFT Legumine formulation. The fatty acid ester mixture is likely derived from “tall oil” and the tall oil is reportedly a byproduct of wood pulp (Environ 2007). PEGs are common ingredients in a variety of consumer products, including soft-drink syrups (as an antioxidant), lotions and antifreeze (Environ 2007). PEGs are highly soluble, have low volatility and rapidly degrade within days. The fatty acids in the fatty acid ester mixture do not exhibit volatility, are virtually insoluble, and are readily biodegraded, although over a slightly longer time period than the PEGs (Environ 2007). PEGs are not considered as hazardous substances, priority pollutants, or toxic pollutants under the Clean Water Act (CWA) or Toxic Substances Control Act (TSCA). (Environ 2007). Animal toxicological data for PEG compounds indicate there is mild to no irritation from dermal exposure, minimal eye irritation and it is not genotoxic or mutagenic. Rat oral toxicity LD50 ranges between 2g to >25g/kg body weight: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4505343/table/T002/

N-Methyl 2-pyrrolidone (NMP) represents 10% of the CFT Legumine formulation. It is typically used as a solvent for many applications including the manufacture of pharmaceuticals for oral ingestion (Ott 2008). Available results of short-term tests on aquatic species (fish, crustaceans, algae, and bacteria) and terrestrial species (birds) indicate that NMP has low acute toxicity and was reported to have no oncogenic potential (https://www.who.int/ipcs/publications/cicad/en/cicad35.pdf). The substance is not transformed by chemical hydrolysis but is rapidly biodegraded under aerobic conditions. The substance is expected to have a low ability to bioconcentrate in aquatic organisms: https://pubchem.ncbi.nlm.nih.gov/compound/13387#section=Environmental-Biodegradation.
The persistence of this compound in water has not been reported, but it has been found to have a half-life of 4.0, 8.7 and 11.5 days in clay, loam or sand, respectively: https://www.epa.gov/sites/production/files/2015-04/documents/methyl.pdf . NMP has been classified as readily biodegradable under aerobic conditions: http://www.inchem.org/documents/cicads/cicads/cicad35.htm).

For rats, the no-observed-adverse-effect (NOAEL) and lowest-observed-adverse-effect level (LOAEL) were 514 and 1028 mg/kg body weight, respectively: http://www.inchem.org/documents/cicads/cicads/cicad35.htm#8.3.2. The LD50 of NMP is similar to DGEE, but its concentration following lake treatment is expected to be only 1/6th that of DGEE, and acute toxic conditions should not arise for mammals drinking the water following treatment. The International Programme on Chemical Safety (IPCS) has evaluated the oral carcinogenicity data for NMP, and concluded that this chemical did not show any clear evidence for carcinogenicity in rats exposed to concentrations up to 400 mg/m3 and that the mutagenic potential is weak.

The CFT Legumine label (Appendix 5) states NMP has caused adverse effects on sexual function and fertility and/or development based on animal experiments. A 2008 study on rats demonstrated that sub-chronic exposure of male rats to NMP at 1000 mg/kg/day produces gonadotoxic effect and brings about infertility. Administration at lower doses of 100 and 300 mg/kg did not impair male fertility, but only the lowest dose of 100 mg/kg was found to have no influence on the prenatal development of the progeny https://www.ncbi.nlm.nih.gov/pubmed/18468972. Results from short-term tests on aquatic species (fish, crustaceans, algae, and bacteria) and terrestrial species (birds) indicate that NMP has low acute toxicity: http://www.inchem.org/documents/cicads/cicads/cicad35.htm#10.1

Other trace compounds The remaining compounds in CFT Legumine™ include polycyclic aromatic hydrocarbons, hexanol and alkylated benzenes. While these chemicals are more volatile than the primary carriers, they comprise less than one percent of the formulation and are not expected to significantly impact the overall fate and transport of CFT Legumine (CDFG 2007). None of the constituents identified appear to be at concentrations that suggest human health risks through water, or ingestion exposure scenarios and no relevant regulatory criteria are exceeded in estimated exposure concentrations (CDFG 2007).

Regarding exposure to the trace constituents in CFT Legumine™, trichloroethylene and naphthalene are known carcinogens. Both have been detected in CFT Legumine™; however, trichloroethylene was absent from most product lots analyzed (Environ 2007) and the estimated concentration of trichloroethylene and naphthalene at treatment concentration is ~0.0000073 mg/L and 0.000255 mg/L, respectively, which is far below the Human Based Screening Level (HBSL) for exposure to surface waters for a child (CDFG 2007).

A study of airborne drift associated with two rotenone products (a liquid and a powdered formulation) was conducted in California (CARB, 1997), and results showed that the rotenone levels adjacent to a treatment area immediately following a treatment, were, at the highest, 1,000 fold lower than the estimated no observed effect level (NOEL) of 0.43 mg. of rotenone per cubic meter collected over a 24-hour period.

CFT Legumine™ formulation has a low solvent odor (Appendix 6). Compared to other liquid rotenone formulations, CFT Legumine™ contains fewer hydrocarbons resulting in less odor (USDA 2009). Nonetheless, relatively "heavy" organic solvent compounds tend to sink or remain close to the ground and move downwind. The California Department of Pesticide Regulation (CDPR 1998, cited in Finlayson et al. 2000) found no health effects from odors from rotenone formulations that consisted of greater solvent concentrations than those found in current supplies of CFT Legumine™. The northern pike carcasses resulting from this project may cause objectionable odors. Collecting and removing visible carcasses coupled with the likelihood many would sink (Bradbury 1986) should help mitigate odor concerns. Finally, because outboard motors would be used with the boat applications, there would be emissions from four-stroke outboard

motors, but these would dissipate rapidly. Any impacts caused by objectionable odors from the rotenone, fish carcasses, or outboard emissions are expected to be short-term and minor.

Recreational contact (swimming, wading, etc.) or drinking treated lake water would be advised against with ADF&G signage and issuance of a news release that would remain in effect until the rotenone fully deactivated which is expected to take 3-9 months. The product labeling states that recreational contact with treated water (<90 ppb rotenone) is allowed after the rotenone is applied; however, the Department would advise that all such contact be avoided until the rotenone is no longer present as determined by analytic lab results of water samples and/or 24- hour survival of caged sentinel fish held in the treated waterbodies. As mentioned, exposed dead fish would be collected and removed as practical from the treatment area. The lake closure and clean-up efforts would eliminate any reasonable route for rotenone exposure and subsequent human health concerns.

4.3.4 Impacts from Alternative 1 to Worker Safety and Health

There would not be any project activities with the “no action” alternative, so there would not be any impacts to worker safety and health.

4.3.5 Impacts from Alternative 2 to Worker Safety and Health

Impacts to worker safety and health from netting operations would be negligible and mitigated by workers adhering to standard safe boating practices and wearing personal floatation devices.

4.3.6 Impacts from Alternative 3 to Worker Safety and Health

Any potential threats to worker safety and health (i.e., the rotenone applicators) would be greatly reduced with proper use of safety equipment including personal protective equipment (PPE). PPE that would be worn at all times by applicators and handlers working in direct contact with the rotenone. The PPE includes Tyvek suits or raingear tops and bottoms (waders could substitute for bottoms), N-95 half-mask respirators, safety goggles, and rubber or nitrile gloves.

CFT Legumine™ is a liquid, and the product Material Safety Data Sheet (MSDS) states “do not breathe spray mist” and identifies appropriate respirators for use by the product handlers/applicators. Only individuals working with the concentrated product could be at risk, and they would be protected with the appropriate protective respirators. Although volatile and semi-volatile organic compounds and ethylene glycol-based compounds have been identified in the CFT Legumine™ formulation, when compared to Health Based Screening Levels (HBSL) values, no compound in CFT Legumine™ exceeded the HBSLs. This indicates there are no significant inhalation risks from the vapors of this product (CDFG, 2007).

In general, the greatest human health risks associated with a rotenone treatment are associated with the applicators because they work directly with the undiluted, concentrated rotenone products. To minimize exposure risk to applicators, all applicators will be supervised by a certified pesticide applicator that will ensure that all safety protocols are adhered to and PPE is properly utilized.

4.4 Conclusion

Although no decision has been reached, factors that led to the identification of a preferred alternative are discussed in this section.

The no action alternative would allow the status quo to continue. As long as northern pike remain in Anderson and Kings lakes, ADF&G would not have the ability to successfully restore fisheries and native fish populations in these lakes. Also, the northern pike populations in these lakes would continue to pose a threat to valuable fisheries elsewhere should individuals from these populations be used for new illegal introductions or expand on their own to other waters in the Cottonwood Creek Drainage or further into the Knik Arm Drainage. ADF&G has a legal responsibility to protect, maintain, and improve fishery resources, and choosing to leave northern pike in Anderson and Kings lakes is contradictory to this responsibility. The no action alternative was not identified as the preferred alternative.

Long-term netting within Anderson and Kings lakes would be an inefficient and far less reliable method to eradicate the northern pike from the lakes. The lakes' large cumulative area and habitat complexity would make complete removal by netting difficult, if not impossible. Netting has rarely been an effective eradication tool for unwanted fish and the scale of the lake area is beyond that where mechanical removal alone has been successful. Long-term netting is a costly and labor-intensive alternative and carries with it an increased risk for incidental take of birds and other wildlife. Long-term netting was not identified as a preferred alternative.

ADF&G's goal is to prevent the spread of northern pike from other waters in the Mat-Su and to restore impacted waters where feasible. This project would allow the Department to reintroduce native stickleback to the area to restore ecological lake functions and allow creation of a rainbow trout sport fishery. ADF&G has made solid progress at removing northern pike populations from the Kenai Peninsula and Anchorage areas, primarily by using carefully managed rotenone treatments. Anderson and Kings lakes contains the only known populations of northern pike in the Cottonwood Creek Drainage and their presence jeopardizes the drainage's wild native fisheries.

ADF&G evaluated the human health and ecological effects associated with the use of rotenone in this document and concluded that, in piscicidal concentrations and in accordance with label requirements and FIFRA, rotenone would not pose any unreasonable adverse ecological or human health risks. The treatment would be designed so that the peak rotenone concentration would be <40ppb, a level below which the EPA considers safe for drinking and far below the 90ppb concentration considered safe for swimming.

To further minimize risk, ADF&G would advise against contacting treated waters until the rotenone fully degrades. This would be accomplished with signage, landowner notices and media releases. The timing of the treatment (late fall) would reduce impacts to water recreationists as ice cover would be present shortly after the treatment. The only tangible human health risks associated with the rotenone treatment would be to the applicators because they would be working with the undiluted rotenone product. However, that risk would be minimized by proper use of personal protective equipment and by following best management practices. Several ADF&G pike biologists have been formally trained in the use of rotenone through the National Conservation Training Center or American Fisheries Society. In addition, several ADF&G personnel are also State of Alaska-certified aquatic pesticide applicators. If a rotenone application occurs, all assisting personal will be certified pesticide applicators. Emergency protocols would be established prior to the treatment activities in the event of an accident. Those protocols would be

described in a detailed “treatment plan” that would be reviewed by all assisting project personal before the project begins.

The ecological impacts from a rotenone treatment in Anderson and Kings lakes would be short in duration and pose less of a risk to wildlife than the second alternative. As described in detail in this document, rotenone naturally breaks down, ultimately into carbon dioxide and water, and does not impact most organisms without gills when used in fisheries management concentrations. Rotenone has been used on over 20 other waterbodies for northern pike eradication projects in Southcentral Alaska since 2008. In most of these treatments, rotenone was applied late in the fall prior to ice-up so as not to interrupt open water recreation for the public and to maximize the duration that rotenone would remain toxic to fish. In some cases, the rotenone persisted for eight months (mainly while the lakes were frozen).

Even with eight months of rotenone persistence, invertebrate populations were found to quickly rebound, and other species such as wood frogs and waterfowl also returned immediately after ice out. Based on the vast literature available on rotenone projects and the Department’s previous experience with the piscicide, ADF&G would expect no unreasonable long-term negative ecological impacts from treating Anderson and Kings lakes with rotenone. Therefore, the rotenone treatment alternative was identified by ADF&G as the preferred alternative to accomplish the goal of eradicating northern pike from these lakes and preventing their northern pike populations from spreading or being used for illegal introductions elsewhere.

5.0 CONSULTATION AND COORDINATION

As mentioned in section 1.4, ADF&G conducted a public scoping process to solicit input on the alternatives described in 2.0. The public scoping processes completed is found in Appendix 1. There was a 30-day public commenting period for this environmental assessment in which a record of the comments is presented in Appendix 4. For privacy protection, all names of those who submitted comments are with their initials and their contact information removed.

This document will be submitted to NOAA 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 alternative. Other major authorizations required to approve the preferred alternative include compliance with the Pesticide Use General Permit for rotenone issued by ADEC, issuance of an Alaska Department of Natural Resources Division of Mining, Land and Water Land Use Permit (LUP), compliance with the Alaska Pollutant Discharge Elimination System (APDES), and approval by the Alaska Board of Fisheries.

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Appendix 1. Summary report of public scoping and comments received during the Anderson and Kings lakes pike eradication public scoping period.

Anderson and Kings Lakes Pike Eradication

Public Meeting Scoping Summary

Scoping Meeting Process

In 2019, the Alaska Department of Fish and Game (ADF&G) initiated a public scoping process to gather input on the Department's response to northern pike in Anderson and Kings lakes. This memo presents a summary of public input gathered during that process:

- **Property owner mailing:** ADF&G obtained addresses of waterfront property owners that owned land adjacent to Anderson and Kings lakes. Each property owner was mailed letters notifying them of the public meetings and encouraging them to participate in the scoping process.
- **Stakeholder contacts:** In addition to mailings to waterfront property owners, a notice of the meeting was placed in public message board in Wasilla. Email notices were sent to individual, governmental and non-governmental organizations that were identified as having potential interest in general fishery issues or pike fishing, specifically.

  In October 2019, the project leader went door-to door to hand deliver courtesy notices to all residences adjacent to the lakes. The notices informed residents of ADF&G's interest in addressing the local northern pike issue and that public meeting announcements would be forth coming later in the year. The door-to-door contacts allowed for some direct contacts with residents and provided an informal opportunity to share information related to the project. The project leader was contacted several times by local residents who either called or emailed to express their viewpoints regarding the proposed pike removal program.

  Prior to the scoping meeting a news release was issued by ADF&G announcing the scoping meeting details and inviting the public to participate. The news release was made available on the ADF&G website.
- **Public meetings:** A public scoping meeting was held at Teeland Middle School in Wasilla, a location easily accessible to area property owners, interested citizens, and organizations. The meeting was held on January 14, 2020. 13 individuals attended the first meeting.

Meeting Agenda

1. **WELCOME, INTRODUCTIONS AND GROUND RULES** (≈ 8 minutes, facilitated by Rob Massengill, ADF&G Pike Program, Soldotna).

The meeting began with a statement of the meeting purpose, a review of ADF&G's meeting objective and agenda, meeting ground rules and how to provide verbal or written input.

Meeting Purpose: ADF&G's Objective

1) Exchange information with stakeholder about a proposed ADF&G project to remove northern pike from Anderson and Kings lakes.

Attendees were encouraged to ask questions, seek clarification, and provide thoughts following staff presentations. ADF&G staff and participants then all introduced themselves as follows:

a) Staff

Parker Bradley, Project Lead, Fisheries Biologist for ADF&G Sport Fish Division

Cody Jacobson, Fisheries Biologist for ADF&G Sport Fish Division

Rob Massengill, Fisheries Biologist for ADF&G Sport Fish Division

Kristine Dunker, Regional Invasive Species Coordinator for ADF&G Sport Fish Division

Tracy Smith, Access and Defense Coordinator for ADF&G Sport Fish Division

Sam Ivey, Northern Cook Inlet Area Management Biologist for ADF&G Sport Fish Division

b) Attendees

Scoping meeting attendees were asked to sign-in as they entered the meeting and to list their affiliation (i.e. landowner, interested angler, etc.).

MEETING AGENDA

PRESENTATIONS (≈ 45 minutes)

Three slide shows were presented. The first (approx. 15 minutes by Kristine Dunker) defined what an invasive species is and provided an overview of the history and environmental/economic consequences of northern pike in southcentral Alaska.

The next presentation (approx. 30 minutes by Parker Bradley) provided specific information about Kenai Peninsula invasive northern pike, details of the various alternatives to address the pike problem in Anderson and Kings lakes and emphasized the preferred action of chemically treating the lakes.

Finally, Terry Larson, a resident of Crystal Lake on the Kenai Peninsula, presented (approximately 5 minutes) on his experience as a landowner adjacent to a recent rotenone treatment.

2. INPUT AND INFORMATION OPEN HOUSE (≈ 40 minutes)

An open discussion was held where participants could ask questions, voice concerns or share information and experiences related to the proposed project. Notes summarizing stakeholder input were recorded manually during these scoping meetings.

- **Input forms/written comments:** 1

- **Scoping Meeting Public Input Summary**

During the scoping process several major categories of input and public inquiry emerged. The following is an aggregated summary, specific to broader categories, covering the issues and questions raised by members of the public. The text that follow are directly based from individual's questions and opinions provided over the course of the public scoping meeting.

Prior Rotenone Treatments

How do we prevent the reintroduction of pike?

Staff: Outreach, education, investigation, law enforcement, and forensics

What about Signs, postings, illegal introductions?

Staff: Illegal introductions of fish is a Class A misdemeanor, signage exists and is being added, if caught individuals could have to pay for restoration, detecting new and/or re-introductions early may allow us to treat them with nets and under ice netting

Cheney lake in anchorage, has it been treated twice?

Staff: No, it was treated once, second introduction of pike was luckily eradicated with nets

Was Stormy lake treated twice?

Staff: Not for pike, it was additionally treated for elodea; with several treatments

Illegal Pike Introductions/ Pike Movements

Do you believe that pike were introduced by float planes picking up eggs?

Staff: No, pike eggs are indeed sticky, however during takeoff the water sheer would likely take off the eggs, additionally the shock and pressure change would kill them, also the air current would dry them out and going from water to air temperate change would also kill them; even in ideal conditions there is a very high mortality rate of pike eggs in nature.

Can pike migrate over dry land?

Staff Ans: No, they cannot breathe air, some fish are specialized for this, but NOT Pike

Let's revisit the pike eggs are not spread by float planes question/scenario? What are other biologist opinion?

Staff: We do not think that pike eggs are likley spread through this mechanism

How long are the eggs viable in the float plane floats? You need to educate the float plane people.
Member of public in aviation field (self-identified as such) comment to her: Working on Lake Hood, never seen a pike in Lake Hood, we operate(d) on Alexander all the time and know what the eggs looks like and never once saw eggs present on the floats.
Staff: Eggs will not be likely be viable in a dead fish, only females have eggs, we need both male and female to alive and vialble to reproduce

Alexander Creek Pike

How do you determine a "Multimillion-dollar sport fishery" (referring to Alexander lake in the presentation) they have no fish to sell?

Staff: The closing of multiple lodges operating to sportfish, charter operations, businesses for the fishery, revenue lost when King salmon sport fishery crashed.

What is this Tagging program for a reward?
Staff: Yes, Alexander Lake has about 100 pit tags in pike, anglers are encouraged to bring pike heads to the Palmer ADF&G office for scanning. Individual tagged pike are worth $100 in a gift card, and each tag entry makes an individual eligibility for a $1,000 grand prize random drawing for a gift card. This program should increase harvest after the fishery closure due to elodea infestation this past summer, collect more data on cost, age, otolith microchemistry, etc. This is for Alexander Lake Only, please do not freeze pike in a ball, they will not be able to be scanned.

Fishery Management History in Anderson and Kings Lakes

Has rotenone been used on Kings or Anderson lake before?

Staff: To our knowledge, no; in the 1950s,60s,and 70s several lakes were treated throughout the Mat-Su valley for sticklebacks prior to stocking with game fish.

When were they stocked prior? I heard that Rainbows were stocked in the early 1980s – lake resident comment.

Staff: Sam Ivey, as a youngster, part of the Cottonwood Creek drainage was stocked; today policy is that stocked fish must be triploid (incapable of reproducing); currently the lakes are intermittent connection to Cottonwood creek, and often underground, allowing us to restock with rainbow trout.

Kings lake is now land locked and water exchange is only through the gravel, the culvert predates plot map, can pike migrate other than water?

Staff Ans: Only through direct water connection or illegal stocking

Are the lakes documented for salmon in the anadromous waters catalog?

Staff: Not documented for spawning, documented for rearing so they still get in there from time to time and anyone can check the anadromous catalog, there is a comment and review period for both nomination and denomination, anyone in the public can do this.

Kings lake stocked with rainbows and landlocked salmon “that is what I was told”, I have been on the lake a really long time and have spent hundreds of hours on the lake and not seen salmon

Staff. Often people miss the juveniles, see the big salmon, and there was a pretty big connection between the two lakes, Lakes were connected four years ago

Tracy Smith added: Early 2000 habitat assessed / trapped both Kings and Anderson lakes and observed Coho smolt present. Anderson lake assessment records from November 1959 SF div. Anderson lake was documented with suckers, red salmon, silver salmon, stickleback

Is the number of pike in Anderson lake greater than in Kings lake?
Staff: From our netting results – most likely Yes

Permitting Process for this Project

This project is already funded, correct? 180K, is this a fore gone conclusion at this point?

Staff: The AK salmon grant fund is up to federal review, the funding is there, however the money goes back to NOAA if not permitted

What would happened if the public comment is to not continue with the project?

Staff: Per NEPA the comments are part of the EA (environmental assessment) and are considered under the application, there is opportunity for ADFG staff to respond to the public comments, and up to the federal reviewers to proceed with the project.

Anderson and Kings Treatment Specifics

What is Pretreatment salvage during this winter?

Staff: We reduce abundance and use the fish for education purposes and reduce the number dead fish during the treatment, we try to avoid birds in gillnets in open water, to avoid any bird bycatch we willset nets in late winter

How many fish can you reduce in the lake by this pretreatment netting, how many pike are in the lakes?

Staff: It varies with conditions, ADFG is starting to do a tagging and population estimates in other areas, in areas of heavy netting as much as 50 to 80 % of pike population reduction has been demonstrated ; under icenetting is a new approach we are using, and greatly mitigates or even eliminates the bird and mammal bycatch

What about reproduction cycle (of pike)?

Staff: With this late winter under ice netting we are removing some of the breeding population to reduce the spawning abundance, this will leave fewer fish to deal with during treatment especially young of the year juveniles

How many fish will you remove (in the treatment)? And how many float?
Staff: Generally, about half sink and the other half float; we will begin to remove any dead fish we observe immediately; and we will continue to remove dead pike several days after the treatment

When do pike start smelling? Working against weather (in October)?
Staff: (Our) Idea is we will allow natural decomposing over the winter…..Terry Larsen adds: "that nobody smelled any in the spring, I helped with the early netting, not too concerned about dead fish, never became an issue"

Landowner "I lived near Valdez and it stinks, fish will be all over the swallows, lots of fish , how long before the fish decompose and when we can begin swimming and not stepping on them and squishing and smelling, stinking"?

Staff: If we can see dead fish , we will collect them. Rob Massengill adds "had lots of sticklebacks on windrow during the Scout Lake treatment and raked all the sticklebacks up, when the lakes freeze the odor goes away, by spring odor is gone"

Suckers in the lake, living in lake, any plans to put them back into the lakes? Are you going to put Coho back into the lakes?
Staff: There are stocking plans and we have ability to adjust them, and we are not opposed to putting suckers back into the lake, and the AAMB is open to put Coho back into the lakes, it is flexible at this point what is restocked to some degree
Response: Kings lake is extremely clean, suckers all around and very clean, I broke my arm with a compound fracture while skiing on Kings lake, went to Mat Valley hospital and kept the wound open for days due to infection risk, but there was none. I dipped water out of the lake in 2008 and had Matsu Water test it-pretty good lake, really-really clean. High population of suckers is keeping it very very clean, and I do not want to lose the suckers.
Staff: Sam Ivey has the stocking plan and RBT are popular, live long, live longer and grow well, it is a starting point, catchables will be stocked into Anderson; Kings will be stocked with fingerlings. Statewide stocking plan takes public input, just call our office and talk to the management biologists. Suckers and sticklebacks will be put back from other waters in the Cottonwood Creek drainage.

After the fish are treated will there be a sign when the people can fish?
Staff: I don't think we will close it to fishing after all treatment, but once the all clear is given from rotenone degradation, we will provide information about the stocking in the spring.

Response: Some people will be completely unaware, signs at public access will be a good idea

Health Concerns with Rotenone

Do not irrigate with treated water, is a point of concern.
Staff: The specific label concern is with irrigating crops, we choose the October timeframe for treatment, in part, due to the lack of folks using water for irrigation.

Concerned about rotenone, I have more recent studies, Tokyo study, very concerning, trace rotenone with Parkinson's Disease, do want to say for the record and begins reading: The limited lethal level, 160lb man drinking 23000 gallons at one sitting, this is a 2000 quote for 1969, 50 years ago agent orange was used , agency are lying to Vietnam soldiers that that (agent oragen)was ok: and there are more current studies, and your studies need to be more current, a lethal dose is quite different than the triggering dose , Paraquat in trace amounts and there is a lot of information out there on this

Staff: Not aware of any evidence that rotenone causes PD. Concentrations used for fisheries purposes are not comparable with those used in neurologic studies. Rob added: EPA reviews the pesticide about every 15 years, reviewed in 2007 and it is being reviewed and renewal this year. They (EPA) makes the final call based on best available science.

Response: I will send links to staff of all these Japanese studies

Staff: We appreciate you sending this. It can be the biggest risk to the applicators, and we are following the most recent EPA guidelines, Finlayson has summarized the more recent medical research on the back table (handouts located at the back of the meeting hall).

Elodea

What is it?
Staff: It is an aquatic plant and is very invasive, it can grow from fragments, can be caught and moved on floatplane rudders, grows extremely dense, Alexander/sucker lakes were closed due to elodea infestations

How is elodea eradicated?

Staff: Two products, it will be difficult, diquat and fluoridone, there are plans to treat Alexander and Sucker lakes, Big lake has already been initially treated

Written (Comment Box):

Anderson Lake has become a very hot spot for catching pike – people come from all over to fish this lake for pike. I am concerned that this will continue unless the public is notified by signage down at the launch area. Many are unaware of your efforts. Because so many enjoy catching pike, there should be a large sign explaining the pike are gone and reintroduction is illegal.

Proposed Rotenone Treatment to address Pike in Anderson and Kings lakes

The public scoping meeting process focused to a large extent on ADF&G sharing what they believe to be the only potentially effective pike eradication option for Anderson and Kings lakes: a rotenone treatment combined with measures to introduce native sticklebacks and longnose suckers and hatchery-reared rainbow trout to re-populate the lakes. Eradication and other measures to eliminate pike risks are being considered by ADF&G in response to the departments' legal mandate to:

- Protect Alaska's fisheries within Alaska Fish and Game Laws and Regulations (Section 16.05.020);
- Control invasive species in its current *Sport Fish Division Strategic Plan*; and
- Provide sustained yield fisheries within the State of Alaska Constitution.

Appendix 2. Anderson and Kings lakes environmental assessment public notice affidavit.

Appendix 3. ADF&G press release announcing the public commenting period for the Anderson and Kings lakes environmental assessment.

Appendix 4. Comments received during the Anderson and Kings lake Environmental Assessment public commenting period and department responses.

Appendix 5. CFT Legumine™ FishToxicant Safety data Sheet.

Safety Data Sheet

Section 1: Identification

Product identifier

Product Name • **Prentox CFT Legumine Fish Toxicant**

Synonyms • 100209000; 100209001; EPA Reg. No.: 89459-48

Product Description • Orange viscous liquid.

Relevant identified uses of the substance or mixture and uses advised against

Recommended use • Piscicide.

Restrictions on use •

KEEP OUT OF THE REACH OF CHILDREN. Avoid contact with eyes, skin and clothing. Do not use or store near heat or open flame. Avoid release to the environment. Use in well ventilated area. Avoid inhalation of vapors or fumes. For use by certified applicators or persons under their direct supervisionand only for those uses covered by the Certified Applicator's certification.

Details of the supplier of the safety data sheet

Manufacturer • Central Garden & Pet Company

1501 E. Woodfield Road, Suite 200W
Schaumburg, IL 60173
United States

www.central.com

Emergency telephone number

Manufacturer (Transportation) • 1-800-424-9300 - CHEMTREC

Manufacturer (Transportation) • 1-703-527-3887 - Chemtrec - Outside US collect calls accepted

Manufacturer • 1-800-248-7763

Section 2: Hazard Identification

United States (US)

According to: OSHA 29 CFR 1910.1200 HCS

Classification of the substance or mixture

OSHA HCS 2012 •

Eye Irritation 2A
Flammable Liquids 4
Skin Irritation 2
Acute Toxicity Oral 4
Acute Toxicity Inhalation 2
Reproductive Toxicity 1B
Specific Target Organ Toxicity Single Exposure 3: Narcotic Effects

Label elements

OSHA HCS 2012

DANGER

Hazard statements •
Causes serious eye irritation
Causes skin irritation
Combustible liquid
Fatal if inhaled
Harmful if swallowed
May damage fertility or the unborn child.
May cause drowsiness or dizziness

Precautionary statements

Prevention •
Wash thoroughly after handling.
Wear protective gloves/protective clothing/eye protection/face protection.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat, sparks, open flames and/or hot surfaces. - No smoking.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Do not breathe dust, fume, gas, mist, vapours and/or spray.
In case of inadequate ventilation wear respiratory protection.
Keep away from flames and hot surfaces. - No smoking.
Wear respiratory protection.

Response •
IF ON SKIN: Wash with plenty of soap and water.
Specific treatment, see supplemental first aid information.
If skin irritation occurs: Get medical advice/attention.
Take off contaminated clothing and wash before reuse.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
Do NOT induce vomiting.
If eye irritation persists: Get medical advice/attention.
In case of fire: Use appropriate media Water fog, foam, dry chemical or carbon dioxide (CO2). for extinction.
Immediately call a POISON CENTER or doctor/physician.
IF exposed or concerned: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a poison control center or doctor if you feel unwell.

Storage/Disposal •
Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.
Store in a well-ventilated place. Keep cool.
Store locked up.
Keep container tightly closed.

Other hazards

OSHA HCS 2012 •
This product is extremely toxic to fish. Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Section 3 - Composition/Information on Ingredients

Substances

- Material does not meet the criteria of a substance.

Mixtures

Composition		
Chemical Name	**Identifiers**	**%**
Rotenone	CAS:83-79-4	5%
Cubé Resins other than Rotenone	NDA	5%
2-Pyrrolidinone, 1-methyl-	CAS:872-50-4	10%
Diethylene glycol monoethyl ether	CAS:111-90-0	56.7%
Other ingredients	NDA	Balance

Section 4: First-Aid Measures

Description of first aid measures

Inhalation

- IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CONTROL center or doctor.

Skin

- IF ON SKIN: Wash with plenty of soap and water. If irritation or rash occurs, get medical advice/attention. Take off contaminated clothing and wash before reuse.

Eye

- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Ingestion

- IF SWALLOWED: Immediately call a poison control center or doctor. Aspiration hazard - if swallowed, do NOT induce vomiting.

Most important symptoms and effects, both acute and delayed

- Harmful if swallowed, fatal if inhaled, causes dizziness or drowsiness if inhaled at non-lethal doses, causes serious eye irritation, causes skin irritation, may damage fertility or the unborn child. Refer to Section 11 - Toxicological Information.

Indication of any immediate medical attention and special treatment needed

Notes to Physician

- Treat symptomatically and supportively.

Section 5: Fire-Fighting Measures

Extinguishing media

Suitable Extinguishing Media

- Use water spray, alcohol-resistant foam, carbon dioxide, or dry chemical.

Unsuitable Extinguishing Media

- Avoid heavy hose streams.

Firefighting Procedures

- As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
  Do not allow fire fighting water to escape into waterways or sewers.
  LARGE FIRES: Dike fire control water for later disposal; do not scatter the material.
  LARGE FIRES: Move containers from fire area if you can do it without risk.

Stay upwind.
Ventilate closed spaces before entering.
Do not breathe gas/fumes/vapor/spray.
Keep unauthorized personnel away.

Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards
- Combustible liquid.
Containers may explode when heated.

Hazardous Combustion Products
- Carbon monoxide and carbon dioxide.

Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA).

Section 6 - Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Personal Precautions
- Do not walk through spilled material. Ventilate enclosed areas. Wear appropriate personal protective equipment, avoid direct contact. Avoid breathing fumes. Keep all sources of ignition away.

Emergency Procedures
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Ventilate closed spaces before entering. Avoid release into the environment. Keep out of low areas. Keep unauthorized personnel away. Stay upwind. Take precautionary measures against static discharge. Turn off electric power to area.

Environmental precautions

- LARGE SPILLS: Prevent entry into waterways, sewers, basements or confined areas.

Methods and material for containment and cleaning up

Containment/Clean-up Measures
- Absorb spills with an inert material, clay granules or other inert absorbent material and put in container for disposal.
LARGE SPILLS: Dike far ahead of spill for later disposal.
Stop leak if you can do it without risk.
SMALL SPILLS: Take up with sand or other non-combustible absorbent material and place into containers for later disposal.
Wear appropriate personal protective equipment, avoid direct contact.

Section 7 - Handling and Storage

Precautions for safe handling

Handling
- Keep away from fire - No Smoking. Avoid breathing fumes. Use only in well ventilated areas. Wear appropriate personal protective equipment, avoid direct contact. Avoid contact with skin or eyes.

Conditions for safe storage, including any incompatibilities

Storage
- Store locked up. Store in a cool/low-temperature, well-ventilated dry place away from heat and ignition sources. Keep from freezing. Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F Do not store at temperatures below 4.4°C/40°F. Keep container tightly closed. Store only in original container.

Incompatible Materials or Ignition Sources
- Heat, sparks, open flame. Strong acids, oxidizing agents and toxic materials.

Other Information

- See product label for additional information.

Section 8 - Exposure Controls/Personal Protection

Control parameters

Exposure Limits/Guidelines • No data available.

Exposure Limits/Guidelines				
	Result	ACGIH	NIOSH	OSHA
Rotenone (83-79-4)	TWAs	5 mg/m3 TWA (commercial)	5 mg/m3 TWA	5 mg/m3 TWA

Exposure Limits Supplemental
ACGIH
•Rotenone (83-79-4): **TLV Basis - Critical Effects:** (CNS impairment; eye and upper respiratory tract irritation)

Exposure controls

Engineering Measures/Controls • Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values.

Personal Protective Equipment

Pictograms •

Respiratory • Wear a dust/mist (or particulate) respirator.

Eye/Face • Wear chemical splash safety goggles.

Hands • Impervious gloves. Some materials that are chemical resistant to this product are Barrier Laminate, Nitrile Rubber, Neoprene Rubber or Viton.

Skin/Body • Coveralls, over long-sleeved shirt and long pants will be needed. Mixers, loaders, and others exposed to the concentrate, through cleaning equipment or spills must wear a chemical-resistant apron.

Environmental Exposure Controls • Refer to Section 13 - Disposal Considerations.

Other Information

- See product label for specific use PPE instructions.

Section 9 - Physical and Chemical Properties

Information on Physical and Chemical Properties

Material Description			
Physical Form	Liquid	Appearance/Description	Orange viscous liquid.
Color	Orange	Odor	Solvent
Odor Threshold	No data available		
General Properties			

Boiling Point	No data available	Melting Point/Freezing Point	No data available
Decomposition Temperature	No data available	pH	4.5 (1% aqueous solution)
Specific Gravity/Relative Density	= 1.09 Water=1	Density	No data available
Water Solubility	No data available	Viscosity	No data available
Critical Temperature	No data available		
Volatility			
Vapor Pressure	No data available	Vapor Density	No data available
Evaporation Rate	No data available		
Flammability			
Flash Point	192 °F(88.8889 °C)	UEL	No data available
LEL	No data available	Autoignition	No data available
Flammability (solid, gas)	No data available		
Environmental			
Octanol/Water Partition coefficient	No data available		

Section 10: Stability and Reactivity

Reactivity

- Non-reactive under normal handling and storage conditions.

Chemical stability

- Stable under normal temperatures and pressures.

Possibility of hazardous reactions

- Hazardous polymerization will not occur.

Conditions to avoid

- Excessive heat >110°F. Heat, sparks, open flame, other ignition sources, and oxidizing conditions. Keep away from fire. Do not allow product to freeze.

Incompatible materials

- Strong oxidizing agents and strong acids.

Hazardous decomposition products

- Thermal decomposition may produce oxides of carbon.

Section 11 - Toxicological Information

Information on toxicological effects

Components		
Rotenone (5%)	83-79-4	**Acute Toxicity:** Ingestion/Oral-Rat, adult female LD50 • 39.5 mg/kg; Ingestion/Oral-Rat, adult male LD50 • 102 mg/kg; Inhalation-Rat LC50 • 0.0212 mg/L 4 Hour(s); Skin-Rabbit LD50 • >5000 mg/kg; **Irritation:** Eye-Rabbit • Essentially non-irritating; Skin-Rabbit • Essentially non-irritating

GHS Properties	Classification
Acute toxicity	**OSHA HCS 2012** • Acute Toxicity - Dermal - Classification criteria not met; Acute Toxicity - Inhalation 2; Acute Toxicity - Oral 4
Skin corrosion/Irritation	**OSHA HCS 2012** • Skin Irritation 2

Serious eye damage/Irritation	OSHA HCS 2012 • Eye Irritation 2A
Skin sensitization	OSHA HCS 2012 • Classification criteria not met
Respiratory sensitization	OSHA HCS 2012 • Classification criteria not met
Aspiration Hazard	OSHA HCS 2012 • Classification criteria not met
Carcinogenicity	OSHA HCS 2012 • Classification criteria not met
Germ Cell Mutagenicity	OSHA HCS 2012 • Classification criteria not met - Not classified - data lacking
Toxicity for Reproduction	OSHA HCS 2012 • Toxic to Reproduction 1B
STOT-SE	OSHA HCS 2012 • Specific Target Organ Toxicity Single Exposure 3: Narcotic Effects
STOT-RE	OSHA HCS 2012 • Classification criteria not met

Potential Health Effects

Inhalation

Acute (Immediate)
- Fatal if inhaled. May affect the central nervous system. Symptoms may include dizziness or drowsiness. May cause respiratory irritation.

Chronic (Delayed)
- No data available

Skin

Acute (Immediate)
- Causes skin irritation.

Chronic (Delayed)
- No data available

Eye

Acute (Immediate)
- Causes serious eye irritation.

Chronic (Delayed)
- No data available

Ingestion

Acute (Immediate)
- Harmful if swallowed.

Chronic (Delayed)
- No data available

Mutagenic Effects
- Rotenone is not mutagenic.

Carcinogenic Effects
- No component in this product present at 0.1% or greater is listed by IARC, OSHA or NTP.

Reproductive Effects
- Rotenone has been tested and does not cause birth defects. Rotenone does not have adverse effects on reproduction. 2-Pyrrolidinone, 1-methyl- caused adverse effects on sexual function and fertility and/or development based on animal experiments.

Section 12 - Ecological Information

Toxicity

Components		
Rotenone (5%)	83-79-4	**Aquatic Toxicity-Fish:** 96 Hour(s) LC50 *Rainbow Trout* 0.00194 mg/L [Acute] NOEC *Rainbow Trout* 0.00101 mg/L [Chronic] **Aquatic Toxicity-Crustacea:** NOEC *Daphnia magna* 0.00125 mg/L [Chronic] 96 Hour(s) EC50 *Daphnia magna* 0.0037 mg/L [Acute]

Persistence and degradability

- Rotenone is not persistent in the environment and its low vapor pressure (6.9x10-10 torr) and Henry's Law constant (1.1x10-13 atm-m3 mol-1) limit its volatility. If released

to water, rotenone generally degrades quickly through abiotic (hydrolytic and photolytic) mechanisms.

Bioaccumulative potential

- Rotenone has a relatively low potential for bioconcentrating in aquatic organisms.

Mobility in Soil

- Rotenone is mobile to moderately mobile in soil and sediment with a half-life of a few days to several weeks or longer depending on water temperature.

Other adverse effects

Potential Environmental Effects

- Extremely toxic to fish and aquatic invertebrates.

Section 13 - Disposal Considerations

Waste treatment methods

Product waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations. Never place unused product down any indoor or outdoor drain.

Packaging waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations. See product label for disposal instructions. Nonrefillable container.

Section 14 - Transport Information

	UN number	UN proper shipping name	Transport hazard class(es)	Packing group	Environmental hazards
DOT	NA1993	Bulk packaging only: Combustible liquid, n.o.s. (Diethylene glycol monoethyl ether)	Comb. Liq.	III	Marine Pollutant
IMO/IMDG	UN 3082	Environmentally hazardous substance, liquid, n.o.s. (Rotenone)	9	III	Marine Pollutant
IATA/ICAO	UN 3082	Environmentally hazardous substance, liquid, n.o.s. (Rotenone)	9	III	Acute Aquatic Toxicity

Special precautions for user - None specified.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code - No data available

Other information

IMO/IMDG - No data available

IATA/ICAO - No data available

Section 15 - Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazard Classifications • Acute, SARA Title III Section 313, Chronic

FIFRA – Pesticide Labeling

This chemical is a pesticide product registered by the United States Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS), and for workplace labels of non-pesticide chemicals. The hazard information required on the pesticide label is reproduced below. The pesticide label also includes other important information, including directions for use.

WARNING

Precautionary Statements • KEEP OUT OF THE REACH OF CHILDREN.

Hazards to Humans and Domestic Animals • May be fatal if inhaled. Do not breathe the vapors-or spray mists. May be fatal if swallowed. Causes moderate eye irritation. Harmful if absorbed through skin. Do not get in eyes or on skin or clothing.

First Aid • Have product container or label with you when obtaining treatment advice. If inhaled • Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice. If swallowed • Call a poison control center or doctor immediately for treatment advice. • Do not give any liquid to the person. • Do not induce vomiting unless told to do so by the poison control center or doctor. • Do not give anything by mouth to an unconscious person. If in eyes • Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice. If on skin or clothing • Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor at for treatment advice.

Environmental Hazards • This product is extremely toxic to fish and other aquatic organisms. Fish kills are expected atrecommended rates. Consult your State Fish and Game Agency and other agencies beforeapplying this product to public waters to determine if a permit is needed for such an application.Do not contaminate water outside of the treatment area by cleaning of equipment or disposal ofequipment wash waters. Do not contaminate water outside of the treatment area, food or feed bystorage or disposal. Do not discharge effluent containing this pesticide into sewage systemswithout notifying the sewage treatment plant authority (PTOW).

Physical or Chemical Hazards • FLAMMABLE Keep away from heat and open flame.

Inventory		
Component	**CAS**	**TSCA**
Diethylene glycol monoethyl ether	111-90-0	Yes
2-Pyrrolidinone, 1-methyl-	872-50-4	Yes
Rotenone	83-79-4	No

United States

Environment

U.S. - CERCLA/SARA - Section 313 - Emission Reporting

• Diethylene glycol monoethyl ether	111-90-0	Not Listed

• 2-Pyrrolidinone, 1-methyl-	872-50-4	1.0 % de minimis concentration
• Rotenone	83-79-4	Not Listed
U.S. - EPA - Designated Generic Categories - Certain Glycol Ethers		
• Diethylene glycol monoethyl ether	111-90-0	
• 2-Pyrrolidinone, 1-methyl-	872-50-4	Not Listed
• Rotenone	83-79-4	Not Listed

Section 16 - Other Information

Revision Date
- 20/June/2016

Last Revision Date
- 20/June/2016

Preparation Date
- 20/June/2016

Disclaimer/Statement of Liability
- The information and statements herein are believed to be reliable but are not to be construed as a warranty or representation for which we assume legal responsibility. Users should undertake sufficient verification and testing to determine the suitability for their own particular purpose of any information or products referred to herein. NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE IS MADE.

Appendix 6. CFT Legumine™ Fish Toxicant Specimen Label

CFT Legumine

Fish Toxicant

SHAKE WELL BEFORE USING

RESTRICTED USE PESTICIDE

Due to acute inhalation, acute oral and aquatic toxicity. For retail sale to, and use only by, Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

THE APPLICATOR IS RESPONSIBLE FOR CONFORMING TO THE LABEL. IMPORTANT GUIDANCE ON THE SAFE AND EFFECTIVE USE OF THIS PRODUCT IS PROVIDED IN THE *ROTENONE SOP MANUAL*, AVAILABLE FROM THE REGISTRANT OR THE AMERICAN FISHERIES SOCIETY AT *www.fisheries.org/units/rotenone*

FOR CONTROL OF: Fish in Lakes, Ponds, Reservoirs and Streams

SPECIMEN LABEL

ACTIVE INGREDIENTS:

Rotenone	5% w/w
Cube Resins other than rotenone	5%
OTHER INGREDIENTS*:	90%
TOTAL:	100%

*Contains Petroleum Distillates

KEEP OUT OF REACH OF CHILDREN

WARNING

See Additional First Aid, Precautionary Statements and Directions for Use including Storage and Disposal Instructions

EPA Reg.No. 89459-48

EPA Est. No. Ⓐ 44616-MO-1 Ⓑ 44616-MO-2

PRECAUTIONARY STATEMENTS – HAZARDS TO HUMANS AND DOMESTIC ANIMALS – WARNING

May be fatal if inhaled. Do not breath the vapors or spray mists. May be fatal if swallowed. Causes moderate eye irritation. Harmful if absorbed through skin. Do not get in eyes or on skin or clothing.

FIRST AID

Have product container or label with you when obtaining treatment advice.

If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice.
If swallowed	• Call a poison control center or doctor immediately for treatment advice. • Do not give any liquid to the person. • Do not induce vomiting unless told to do so by the poison control center or doctor. • Do not give anything by mouth to an unconscious person.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may contact 1-800-248-7763 for emergency medical treatment information. You may also contact the National Pesticide Telecommunication Network at 1-800-858-7378 for information including health concerns, medical emergencies or pesticide incidents.

NOTE TO PHYSICIAN: Contains petroleum distillate. Vomiting may cause aspiration pneumonia. Symptoms of exposure include numbness, lethargy and incoordination. Decontamination, symptomatic and supportive treatment is recommended.

Personal Protective Equipment (PPE)
Some materials that are chemical resistant to this product are Barrier Laminate, Nitrile Rubber, Neoprene Rubber or Viton. If you want more options, follow the instructions for Category E on EPA chemical-resistance category selection chart.

All mixers, loaders, applicators, and other handlers (except pilots) must wear at a minimum, the following PPE: (1) coveralls, over long-sleeved shirt and long pants; (2) chemical-resistant gloves; (3) chemical-resistant footwear plus socks; (4) protective eyewear; and (5) a dust/mist respirator.

In addition, mixers, loaders, and others exposed to the concentrate, through cleaning equipment or spills must wear a chemical-resistant apron.

Exception: waterproof waders may be worn in place of coveralls, chemical-resistant apron and chemical-resistant footwear.
See Engineering Controls for additional requirements and exceptions.

User Safety Requirements
Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate; do not reuse them. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

Engineering Controls for Mixing/Loading/Applying Liquid Formulations Packaged in Containers > 5 Gallons
Mixers/loaders/applicators must either:
(1) Use a closed system that meets the requirements listed in Worker Protection Standard (WPS) for dermal protection of agricultural pesticides [40 CFR 170.240(d)(4)], or
(2) Use the Semi-Closed Probe Mixing/Loading/Applicator System described below.

Remove plug from bung of drum containing this product only when drum is sitting on the ground or on a secure level platform, with the drum pointed up. Do not pour this product from its drum.
Transfer product from the drum of the mixing tank by use of a suction hose connected to one end of the suction pump on the mixing tank and connected at the other end to a probe/dip tube. Remove the plug from the bung of the drum and insert the probe/drip tube into the bung of the drum until the foam ring/gasket fits snugly around the bung opening to minimize leakage of liquid rotenone. The probe/dip tube should be specifically sized to insure a snug fit into the bung which incorporates an anti-drip flange to remove excess liquid rotenone when the probe/dip tube is removed. In addition, the foam ring/gasket on the probe/dip tube insures a snug fit to minimize leakage of liquid rotenone. Do not handle the probe/dip tube in a manner that allows dripping or splattering of the product onto yourself or any other person. Do not touch the portion of the probe/dip tube that has been in contact with this product until the probe has been triple rinsed with water. See Rotenone SOP Manual (SOP 8) for further information on the operation of the Semi-Closed Probe system.

If the entire product is removed from the drum, then triple rinse the probe while it remains inside of the drum if possible. If not, remove the aspirator probe and triple rinse it and all parts of the aspirator in site water. If an unrinsed probe must be removed from the drum, triple rinse it and all parts of the aspirator in treated site water. The anti-drip flange must be designed to remove excess rotenone product from the probe as it is extracted from the drum. Take the following steps if the probe must be disconnected from the suction hose before both the probe and the hose have been triple rinsed: (1) equip the probe end of the hose with a shutoff valve; (2) install a dry-brake coupling between the valve and the probe, and then close the shut off valve before disconnecting the probe. See Rotenone SOP Manual (SOP 8) for further information on unrinsed probes.

Mixers/loaders/applicators using all systems must wear PPE as required in the PPE section of this labeling for mixers/loaders. All systems must be capable of removing the pesticide from the shipping container and transferring it into mixing tanks and/or application equipment. At any disconnect point, the system must be equipped with a dry disconnect or dry-couple shutoff device to minimize drips.

Transferring (Mixing/Loading) Liquid Formulations
Mixers and loaders must transfer product from original to mixing tank or secondary container using a measuring device, inside a plastic-lined bermed area or other secondary confinement area capable of recovering spilled product. Wash plastic liner or other secondary confinement area and dispose of into treated site water. Do not handle this product in a manner that drips or splatters the product onto yourself or any other person. See Rotenone SOP Manual (SOP 10) for further guidance.

Product Containers ≤ 5 Gallons – Transfer product from original container into measuring device, within secondary confinement area, by pouring or using pump or pipette-type device. See Rotenone SOP Manual (SOP 10) for further guidance.

Product Containers > 5 Gallons – Do not pour rotenone concentrate from containers > 5 gallons. Transfer product from original container into measuring device, within secondary confinement area, using hand or electric drum pump. See Rotenone SOP Manual (SOP 10) for further guidance.

Engineering Controls for Applying Liquid Formulations
Applications using a boom or other mechanized equipment must release this product below the water surface. Applications made with aircraft, backpack sprayer, drip can, or handheld or hand-directed nozzle may release this product above the water surface.

Engineering Controls for Aerial Applications
Open cockpits are prohibited. Pilots must use a cockpit that has a nonporous barrier that totally surrounds the cockpit occupants and prevents contact with pesticides outside the enclosed area. Pilots in enclosed cockpits may wear a long-sleeved shirt, long pants, shoes, and socks instead of the PPE required for applicators in the PPE section of this labeling.

Engineering Controls for Boat Applications
When boat pilots or others on the application boat are located within an enclosed area that has a nonporous barrier that totally surrounds the occupants and prevents contact with pesticides outside the enclosed area; they: (1) may wear long-sleeved shirt, long pants, shoes, and socks, instead of the PPE required for applicators in the PPE section of this labeling; (2) must be provided and have immediately available in the use of an emergency when they must exit the enclosed area while the application is taking place, the PPE required for applicators of the PPE section of this labeling; (3) must take off any PPE that is worn while outside the enclosed area before reentering the enclosed area; and (4) store all used PPE in a chemical-resistant container, such as a plastic bag, to prevent contamination of the enclosed area.

User Safety Recommendations

Certified Applicators applying or supervising any aspect of the application of this product should attend a training program for the Rotenone SOP Manual. The American Fisheries Society offers this training: go to www.fisheries.org/units/rotenone for current schedule of training.

Users should remove clothing/PPE if pesticide gets inside. Then wash thoroughly and put on clean clothing. Users should remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This product is extremely toxic to fish and other aquatic organisms. Fish kills are expected at recommended rates. Consult your State Fish and Game Agency and other agencies before applying this product to public waters to determine if a permit is needed for such an application. Do not contaminate water outside of the treatment area by cleaning of equipment or disposal of equipment washwaters. Do not contaminate water outside of the treatment area, food or feed by storage or disposal. Do not discharge effluent containing this pesticide into sewage systems without notifying the sewage treatment plant authority (PTOW).

PHYSICAL AND CHEMICAL HAZARDS

Flammable. Keep away from heat and open flame.

DIRECTIONS FOR USE

RESTRICTED USE PESTICIDE

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING, INCLUDING BOTH THE CONTAINER LABEL AND THE ROTENONE STANDARD OPERATION PROCEDURES MANUAL (SOP) available from the registrant or the American Fisheries Society at www.fisheries.org/units/rotenone. THIS PRODUCT MUST BE ACCOMPANIED BY AN EPA-APPROVED ROTENONE SOP MANUAL. READ THE CONTAINER LABEL AND ROTENONE SOP MANUAL PRIOR TO USE. THE APPLICATOR IS RESPONSIBLE FOR FOLLOWING THE DIRECTIONS FOR USE CONTAINED WITHIN BOTH THE CONTAINER LABEL AND THE SOP MANUAL.

This product is registered for use by or under permit from, and after consultation with State and Federal Fish and Wildlife and/or Natural Resource Agencies.

GENERAL INFORMATION

This product is a specially formulated product containing rotenone to be used in fisheries management for the eradication of fish from lakes, ponds, reservoirs, rivers and streams. Properly dispose of unused product. Do not use dead fish for food or feed. Do not use water treated with rotenone to irrigate crops or release within ½ mile upstream of an irrigation water intake in a standing body of water such as a lake, pond, or reservoir.

General Application Precautions and Restrictions: The Certified Applicator supervising the treatment must remain on site for the duration of the application. Do not allow recreational access (e.g., wading, swimming, boating, and fishing) within the treatment area while rotenone is being applied (see Placarding of Treatment Areas). In streams/rivers/lakes/reservoirs/ponds, do not apply this product in a way that will result in active rotenone concentrations > 200 parts per billion/0.2 ppm (> 4.0 ppm 5% rotenone formulation). Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application (see Placarding Treatment Areas and Re-entering of Treatment Area). This product must not be applied to estuarine or marine environments. Where practical, users should collect and bury dead fish.

Applications using a boom or other mechanized equipment must release this product below the water surface. Applications made with aircraft, backpack sprayer, drip can, or hand-held or hand-directed nozzle may release this product above the water surface.

Mixers/loaders of liquid rotenone product containers of 5 gallons or less should not handle more than 25 gallons of undiluted product per day.

Re-entering the Treatment Area: For applications that result in concentrations greater than 0.09 ppm active rotenone (when applying at a rate of > 1.8 ppm of 5% rotenone formulation), handlers reentering treated water, must wear, at a minimum, the following PPE: (1) coveralls over long-sleeved shirt and long pants; (2) chemical-resistant gloves; (3) chemical-resistant footwear plus socks; and (4) Chemical-resistant apron. Duration of PPE requirements for handlers re-entering treated water exactly corresponds to duration of placarding requirements (e.g., PPE requirements end when placards are removed; see Placarding of Treatment Areas section of this labeling). Exception: waterproof waders may be worn in place of coveralls, chemical-resistant apron and chemical-resistant footwear.

Placarding of Treatment Areas: The Certified Applicator in charge of the application (or someone under his/her supervision) must placard all access areas to the treatment area. Detailed instructions for placarding are presented in the Rotenone SOP Manual. Placards must be placed every 250 feet along the shoreline of the treated area OR, at public access points (e.g., trailheads, roads and trails). Placards must contain the following information: (1) DANGER/PELIGRO; (2) DO NOT ENTER WATER/NO ENTRE AGUA; Pesticide Application; (3) CTF Legumine Fish Toxicant; (4) the purpose of the application; (5) the start date and time of application; (6) end date and time of application; (7) "Recreational access (e.g., wading, swimming, boating, fishing, etc.) within the treatment area is prohibited while rotenone is being applied"; (8) "Do not swim or wade in treated water while placard is displayed"; (9) "Do not consume dead fish from treated water"; and (10) the name, address, and telephone number of the responsible agency or entity performing the application.

Signs must remain legible during the entire posting period. For lotic (flowing water) and lentic (standing water) applications of ≤ 0.09 ppm active rotenone (≤ 1.8 ppm 5% formulation), signs can be removed once application is complete. For lotic applications > 0.09 ppm active rotenone (> 1.8 ppm 5% rotenone formulation), signs can be removed 72 hours after application is complete. For lentic applications > 0.09 ppm active rotenone (> 1.8 ppm 5% rotenone formulation), signs can be removed following 24-hour bioassay demonstrating survival of bioassay sentinel fish or 14 days, whichever is less.

Monitoring and Notification Requirements for Water Aquaculture: For treated water bodies used for aquaculture, the Certified Applicator or designee under his/her direct supervision must prohibit the restocking of fish unless monitoring samples confirm rotenone concentrations are below the level of detection for 3 consecutive samples taken no less than 4 hours apart. Detailed guidance for monitoring levels of rotenone in water is presented in the Rotenone SOP Manual (SOP 16).

Drinking Water: For applications > 40 ppb or 0.04 ppm active rotenone (> 0.8 ppm 5 % rotenone formulation) in waters with drinking water intakes or hydrologic connections to wells, 7 to 14 days prior to

application, the Certified Applicator or designee under his/her direct supervision must provide notification to the party responsible for the public water supply or individual private water users against the consumption of treated water until: (1) active rotenone < 0.04 ppm as determined by analytical chemistry, or (2) fish of the *Salmonidae* or *Centrichidae* families can survive for 24 hours, or (3) dilution with untreated water yields a calculation that active rotenone is < 0.04 ppm, or (4) distance or travel time from the application sites demonstrates that active rotenone is < 0.04 ppm. See Rotenone SOP Manual (SOP 16) for guidance on notification and bioassay and chemical analysis techniques and dilution, distance, and travel time criteria.

Specifications to Control Spray Drift

RELEASE HEIGHT: Spray must be released at the lowest height consistent with pest control and flight safety.

BOOM LENGTH: The boom length must not exceed 75% of the wing span or 90% of the rotor blade diameter. Orient nozzles backward with minimal downward angle into slip stream.

SWATH ADJUSTMENT: When applications are made with cross wind, the swath will be displaced downwind. The applicator must compensate for this displacement at the downwind edge of the application area by adjusting the path of the aircraft upwind. Leave at least one swath unsprayed at the downwind edge of the treated area.

DROPLET SIZE: Use low drift nozzles designed to produce larger spray droplets with fewer driftable fines. Apply as a medium or coarser spray (ASAE standard 572).

WIND SPEED: Do not apply when wind speeds are >12 miles per hour.

DETERMINING TREATMENT RATE

Use this product only at locations, rates, and times authorized and approved by appropriate State and Federal Fish and Wildlife and/or Natural Resource Agencies. The actual treatment rate and rotenone concentration needed to control fish varies widely, depending on the type of water environmental factors including pH, temperature, depth, turbidity, and the target species. The tables below are a general guide for the proper rates and concentrations for complete kills of target species. The Certified Applicator must conduct bioassays using site water (or water of similar quality) and target species (or surrogate species of similar sensitivity) to refine the treatment rate with the maximum limit allowed. Detailed guidance bioassays and designing treatment for complete kills of target species are presented in the Rotenone SOP Manual (SOP 5). Rates must be within the range specified on the label.

FOR USE IN PONDS, LAKES, AND RESERVOIRS

The tables in this booklet are a general guide for the proper rates and concentrations. This product disperses readily, laterally and vertically. For complete coverage, it is best to apply this material to water bodies that are not thermally-stratified. However, this material will eventually penetrate below the thermocline in thermally-stratified bodies of water.

Computation of Water Body Volume: To determine volume of any given body of water, make a series of transects across the body of water taking depths at regular intervals. Add the depths and divide by the number of measurements made to determine the average depth. Multiply this average depth by total surface area in order to determine the volume to be treated. Volume is expressed as acre-feet (AF) or cubic meters (m^3). Surface area can be determined by Global Positioning System (GPS) instrumentation and topographic maps. See Rotenone SOP Manual for further guidance.

Amount of CFT Legumine Fish Toxicant Needed for Specific Uses: To determine the approximate number of gallons (or liters) needed, find your "Type of Use" in the first column of the tables below and then divide the corresponding numbers in the fourth column, "AF (or m^3) per Gallon (or Liter) Liquid" into the number of AF or m^3 in your body of water. For example, a normal use of 0.05 ppm active rotenone will require 33 gallons of 5% active rotenone liquid for 100 AF.

Table – Recommended rotenone treatment concentrations and number of acre-feet (AF) standing water covered by one gallon (5% A.I.) product. Adjust amount of product according to the actual rotenone content on Ingredient Statement on label.

Type of Use	Parts per Million (ppm)		AF Per Gallon Liquid
	Product (5% A.I.)	Active Rotenone	
Normal	0.5 – 1.0	0.025 – 0.05	6.0 to 3.0
Tolerant Species	1.0 – 3.0	0.05 – 0.15	3.0 to 1.0
Tolerant Species in Organic Ponds	2.0 – 4.0	0.10 – 0.20	1.5 to 0.75

Table – Recommended rotenone treatment concentrations and number of cubic meters (m^3) standing water covered by one liter of (5% A.I.) product. Adjust amount of product according to the actual rotenone content on Ingredient Statement on label.

Type of Use	Parts per Million (ppm)		m^3 per Liter Liquid
	Product (5% A.I.)	Active Rotenone	
Normal	0.5 – 1.0	0.025 – 0.05	2000 to 1000
Tolerant Species	1.0 – 3.0	0.05 – 0.15	1000 to 333
Tolerant Species in Organic Ponds	2.0 – 4.0	0.10 – 0.20	500 to 250

Recommended Pre-Mixing and Method of Application: Pre-mix with water at a rate of 10% of product to site water. Uniformly apply over water surface or through underwater lines. Divide water body into manageable sections, delineated by marker buoys or flags or GPS coordinates, and treat within 48 hours to avoid deactivation. See Rotenone SOP Manual (SOP 8) for additional guidance.

Deactivation: Water treated with this product will deactivate (neutralize) under natural conditions within one week to one month depending upon temperatures, alkalinity, etc. Rapid deactivation can be accomplished by adding potassium permanganate to the water at the same rate as CFT Legumine Fish Toxicant in parts per million, plus enough additional to meet the organic demand of the untreated water. See Rotenone SOP Manual (SOP 6 and 7) for guidance.

Restocking after Treatment: Typically, wait 2 to 4 weeks after treatment prior to restocking. Place a sample of fish to be stocked in wire cages in the coolest part of the treated waters. If the fish are not killed within 24 hours, the water may be restocked.

USE IN STREAMS AND RIVERS

In order to treat a stream you must: (1) Select the concentration of active rotenone; (2) Compute the flow rate of the stream; (3) Select an exposure time; (4) Select dilution of product and calculation of application rate; (5) Estimate the amount of product needed; and (6) Follow the method of application. For practicality, flows > 25 ft^3/s (> 0.708 m^3/s) should have undiluted product applied, and flows < 25 ft^3/s (< 0.708 m^3/s) should have diluted product applied. For streams associated with a treatment of a standing body of water, to prevent movement of fish from the pond, lake, or reservoir, the stream treatment should begin before and continue throughout treatment of the pond, lake or reservoir until mixing has occurred.

Concentration of Active Rotenone

Select the concentration of active rotenone based on the type of use from those listed on the tables on the next page. Example: If you select "normal use", you could select a concentration of 0.025–0.05 parts per million.

Table – Recommended rotenone treatment concentrations and number of cubic feet per second (ft^3 /s) flowing water treated for 4- and 8-hour periods with one gallon of (5% A.I.) product. Adjust amount of product according to the actual rotenone content on Ingredient Statement on label.

Type of Use	Parts per Million (ppm)		ft^3/s per Gallon (4-hr)	ft^3/s per Gallon (8-hr)
	Product (5% A.I.)	Active Rotenone		
Normal	0.5 – 1.0	0.025 – 0.05	18.4 to 9.2	9.2 to 4.6
Tolerant Species	1.0 – 3.0	0.05 – 0.15	9.2 to 3.1	4.6 to 1.6
Tolerant Species in Organic Waters	2.0 – 4.0	0.10 – 0.20	4.6 to 2.3	2.3 to 1.2

Table – Recommended rotenone treatment concentrations and number of cubic meters per second (m^3/ s) flowing water treated for 4- and 8-hour periods with one liter of (5% A.I.) product. Adjust amount of product according to the actual rotenone content on Ingredient Statement on Label.

Type of Use	Parts per Million (ppm)		m^3/s per Liter (4-hr)	m^3/s per Liter (8-hr)
	Product (5% A.I.)	Active Rotenone		
Normal	0.5 – 1.0	0.025 – 0.05	0.138 to 0.069	0.069 to 0.034
Tolerant Species	1.0 – 3.0	0.05 – 0.15	0.069 to 0.024	0.034 to 0.013
Tolerant Species in Organic Waters	2.0 – 4.0	0.10 – 0.20	0.034 to 0.018	0.018 to 0.008

Measurement of Flow Rate for Stream

Select a cross section of the stream where the banks and bottom are relatively smooth and free of obstacles and the flow appears laminar. Best discharge measurements are achieved with an electronic flow meter and use of the United States Geological Survey *Weighted Area Method*. Alternatively, divide the stream surface width into 3 equal sections and determine the water depth and surface velocity at the center of each section. Determine the velocity by dropping a float and measure the time required to move 10 feet or more. Take at least three readings at each point. To calculate the flow rate from the information obtained above, use the following formula:

$$F = \frac{Ws \times D \times L \times C}{T}$$

Where F = flow rate (ft^3/s or m^3/s), Ws = surface width (ft or m), D = mean depth (ft or m), L = mean distance traveled by float (ft or m), C = Constant (0.8 for rough bottoms and 0.9 for smooth bottoms), T = mean time (s) for float to travel distance.

Exposure Time and Spacing

Apply rotenone as a drip for 4 to 8 hours to the flowing portion of the stream. Multiple application sites are used along the length of the treated stream, spaced approximately ½ to 2 miles apart depending on the water flow travel time between sites. Multiple sites are used because rotenone is diluted and detoxified with distance. Application sites are spaced at no more than 2 hours or at no less than 1-hour travel time intervals. This assures that the treated stream remains lethal to fish for a minimum of 2 hours. A non-toxic dye such as Rhodamine-WT or fluorescein can be used to determine travel times. Cages containing live fish placed immediately upstream of the downstream application sites can be used as sentinels to assure that lethal conditions exist between sites.

Amount of Product and Calculation of Application Rate of Undiluted Product:

$$X = F1\ (1.699\ B) \text{ or } X = F2\ (59.99\ B)$$

X = ml per minute of undiluted CFT Legumine Fish Toxicant applied to the stream, F1 = the flow rate (ft^3/s) and F2 the flow rate (m^3/s) (see Measurement of Flow Rate for Stream on this labeling), B = parts per million desired concentration of CFT Legumine Fish Toxicant. Total amount of product needed:

$$Y = X(60)H$$

Y = total ml of undiluted CFT Legumine Fish Toxicant required for treatment, X = ml per minute of undiluted product, and H = duration (hours) of treatment.

Amount of Product in Drip Can and Flow Rate of Diluted Product:

$$Y = B(102\ F1)H \text{ or } Y = B(3,\ 602\ F2)H$$

Y = ml of undiluted product in the reservoir, B = parts per million desired concentration of CFT Legumine Fish Toxicant, F1 = the flow rate (ft^3/s) and F2= flow rate (m^3/s) (see Measurement of Flow Rate for Stream in this labeling), and H = duration (hours) of treatment.

Discharge of the diluted product:

$$X = Z/60/H$$

X = ml per minute of diluted CFT Legumine Fish Toxicant applied to the stream from drip can, Z = volume (ml) of drip can, and H = duration (hours) of treatment.

Method of Application

The unique nature of every application site could require minor adjustments to the method and rate of application. Should these unique conditions require major deviation from the use directions, a Special Local Need 24(c) registration should be obtained from the state. Before application, authorization must be obtained from state or federal Fish and Wildlife and/or Natural Resource agencies. Since local environmental conditions will vary, consult with the state Fish and Wildlife and/or Natural Resource agency to ensure the method and rate of application are appropriate for that site.

Contact the local water department to determine if any water intakes are within one mile downstream of the section of stream, river, or canal to be treated. If so, coordinate the application with the water department to make sure the intakes are closed during treatment and detoxification.

CFT Legumine Fish Toxicant can drain directly into the center of the stream. Flow should be checked at least hourly. Backwater, stagnant, and spring areas of streams should be sprayed by hand with a 1 to 2 % v/v solution of 5% rotenone product to assure complete coverage. Streams should be treated for 4 to 8 hours in order to clear the treated section of stream of fish. See Rotenone SOP Manual for detailed guidance on application equipment, methods, and strategies.

DEACTIVATION

Flow in a stream and outflow from a treated lake beyond the treatment area must be deactivated with potassium permanganate to minimize exposure beyond the treatment area unless unnecessary. (See Rotenone SOP Manual [SOP 6] for the definition of treatment area, examples when deactivation with potassium permanganate is unnecessary and detailed guidance for deactivating with potassium permanganate [SOP 7].)

Within 1 to 2 hours travel time from the furthest downstream rotenone application site, the rotenone can be deactivated with a potassium permanganate solution or granules at a resultant stream concentration of 2 to 4 parts per million, depending on rotenone concentration and organic demand of the water. A 2.5% (10 pounds potassium

permanganate to 50 gallons of water) permanganate solution is dripped in at a continuous rate using the equation:

X = Y(70 F1) or X = Y(2, 472 F2)

X = ml of 2.5% permanganate solution per minute, Y = ppm of desired permanganate concentration, F1= stream flow (ft^3/s) or F2 = stream flow (m^3/s) or, granular potassium permanganate is applied at a continuous rate using the equations:

Z = Y(1.7 F1) or Z = Y(60.02 F2)

Z = grams of granular potassium permanganate per minute, Y= ppm of desired permanganate concentration, F1 = stream flow (ft^3/s) or F2 = stream flow (m^3/s).

Flow of permanganate should be checked at least hourly. Live fish in cages placed immediately above the permanganate application site will show signs of stress signaling the need for beginning deactivation. Deactivation can be terminated when replenished fish survive and show no signs of stress for at least four hours.

Deactivation of rotenone by permanganate requires between 15 to 30 minutes contact time (travel time). Cages containing live fish can be placed at these downstream intervals to judge the effectiveness of deactivation. At water temperatures less than 50°F, deactivation may be retarded, requiring a longer contact time.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Store only in original containers, in a dry place inaccessible to children and pets. This product will not solidify nor show any separation at temperatures down to 40°F and is stable for a minimum of one year when stored in sealed drums at 70°F.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your state pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional office for guidance.

CONTAINER HANDLING: Nonrefillable container. Do not reuse or refill this container. Clean container promptly after emptying.

{For Containers equal to or less than 5 Gallons:} Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Offer for recycling, if available or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

{For Containers greater than 5 Gallons:} Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY STATEMENT

Our recommendations for the use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice. To the extent consistent with applicable law, the buyer must assume all responsibility, including injury or damage, resulting from its misuse as such, or in combination with other materials.

Circled letter in front of the EPA Est No. corresponds to the first letter in lot number on bottom of container.
Central Garden & Pet Company, 1501 East Woodfield Road, 200W, Schaumburg, Illinois 60173
NOTE: This specimen label is for informational purposes only. All uses may not be approved in all states. See product labeling for use directions.

VEC 15-036

December, 2015
Schaumburg, IL

Appendix 7. Memo on groundwater risk for the Anderson and Kings lakes area.

MATANUSKA-SUSITNA BOROUGH
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e-mail: pre-design&engineering@matsugov.us

Parker Bradley
Invasive Species Research Biologist
Alaska Department of Fish and Game, Sport Fish
1800 Glenn Hwy.
Palmer, AK 99645

February 28, 2020

Re: ANDERSON AND KING LAKES DRINKING WATER WELL RESEARCH

Background

At the request of the State of Alaska, Department of Fish & Game, the Matanuska-Susitna Borough (MSB) Capital Projects Department staff conducted a desktop examination of the location and documentation of private drinking water wells around Anderson Lake and Kings Lake near Wasilla, Alaska. Historically, the two lakes were hydraulically connected through surface water by a culvert. Now, there is only hydraulic connection through groundwater. The results of this research are for the use of the State in planning a treatment of Kings and Anderson Lake with a chemical toxic to fish, in attempt to restore the lakes native fish population.

Method

The research consisted of searching the State's Drinking Water Well Tracking System (WELTS) database for any well logs within approximately 500 feet of the lakes and was conducted in January 2020.

The WELTS has a limited number of well driller's logs available, and only 18 well logs were found out of the approximately 100 residences in this area. Kings Lake has fewer residences around it and only one of the well log found on the WELTS website for the Kings Lake area. Additional well logs may be available in hard copy at the Wasilla office of the DEC, if further investigation is warranted.

We reviewed the 18 well logs available to us for the depths of the well casing, static water elevation, drawdown and overall hole depth. Table 1 provides a summary of the data collected. Please, note that some well logs did not have all of these parameters recorded and some data is more than 30 years

old. The lake surface elevations and the ground elevations adjacent to each well was determined from aerial topography collected for the MSB in 2011. These elevations were then used to compare the well casing and static water depth relative to the lake elevations, to determine potential for hydrologic connection between surface water and private wells nearby. Soils information was also reviewed to determine if there were any confining clay or dense silt layers between the lake water and the well water.

Results of Investigation

Anderson Lake: After reviewing the data, it appears that 10 of the 18 wells evaluated could potentially be hydrologically connected to lake water due to the shallow depth of the wells. These wells are primarily located on lake front property, and have wells less than 50 feet deep, with static water levels reflecting the lake elevations. Refer to Map #1 for location of wells reviewed near Anderson Lake. It does not appear that a confining layer of soils separates the wells from surface water suggesting there is a hydrologic connection between them.

Kings Lake: The only well available for on-line review showed penetration through a confining layer of soil to a depth over 100 feet, suggesting it is not hydrologically connected to surface waters (See Map #2). There are several residences on the north shoreline that did not have available well log data.

Soils in the area are generally classified as Knik silt loam by the National Resource Conservation Service Soil Survey. Soils in the classification typically exhibit a shallow layer of organics (0-2 inches depth from surface) overlaying two feet of silty loam (2-26 inches deep). Below this level is a extremely gravelly course sand to a depth of 5 feet (26-60 inches deep). The deep layer of gravelly sand is confirmed in several of the well logs, though some indicate intermittent layers of dense silty sand (hardpan), clay and even some large boulders and bedrock. The gravelly sand layer contains the static water level in the shallow wells, and this type of soil is typically well-draining with a soil permeability ranging from 0.57 to 1.42 inches/hour (USDA 2005).

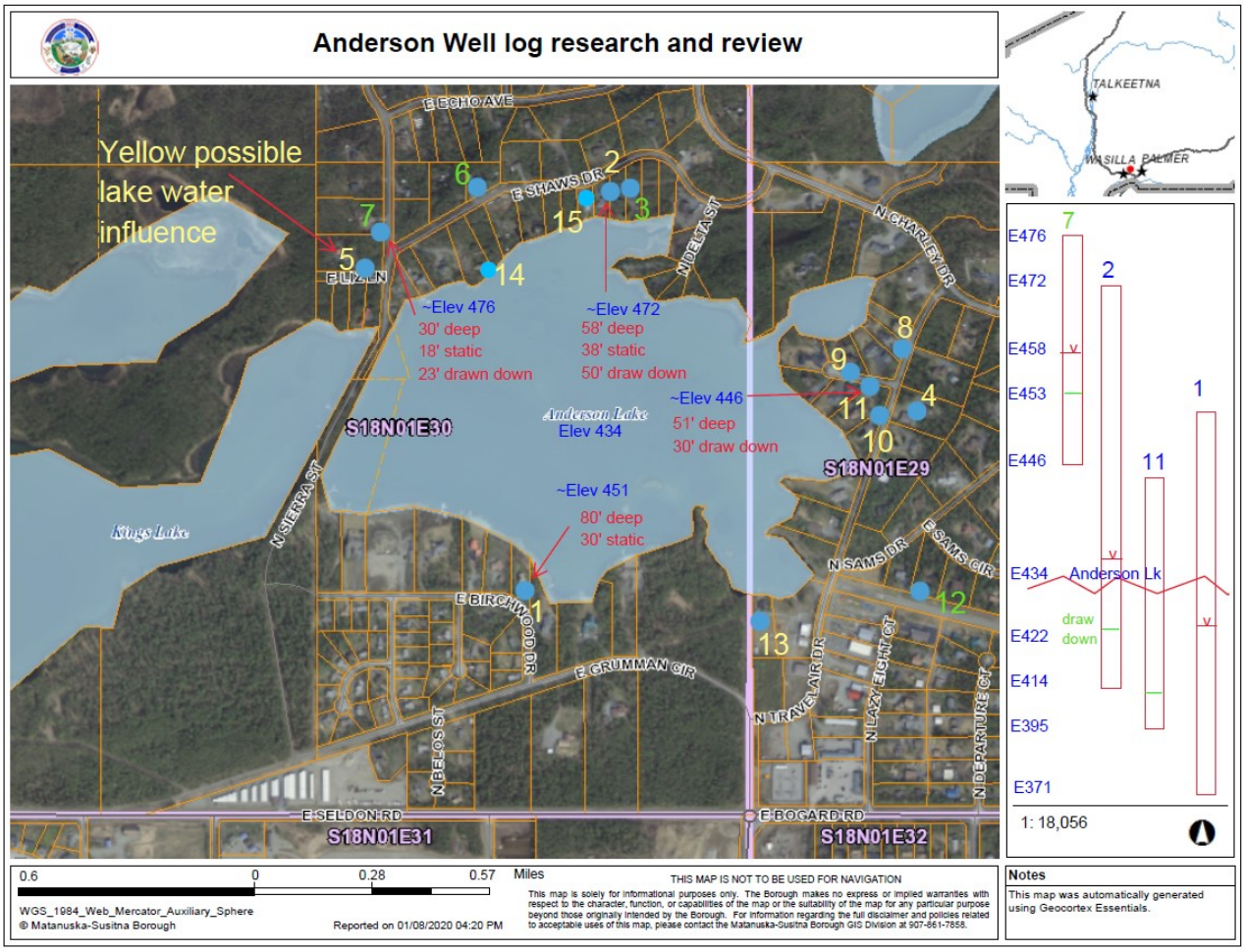
If you have any question or further assistance with this assessment, please, don't hesitate to contact me at (907) 861-7719 or by e-mail at mike.campfield@matsugov.us.

Sincerely,

Michael J. Campfield, P.E.
Environmental Engineer

Anderson and Kings Lakes Well Data

Map #	Log	Property ID	Dist. to Lake	Ground Elevation	Well Depth	To Water	Static	Confining layer	Drawdown	Date Drilled
1	4195	Pinwyck Est. B1 L1	40'	450	80	no data	50	no data	80	-
2	1669	Kings Lake B1 L18	200'	472	58	45	38	no data	no data	4/14/1982
3	19308	Kings Lake B1 L19A	200'	482	121	no data	44	no data	80	5/27/1993
4	11390	Shaw Tri Lakes B2 L12	300'	462	80	60	61	no data	79	6/9/1984
5	4475	Kings Lake B2 L2	400'	460	53	no data	no data	no data	no data	8/14/1975
6	7364	Kings Lake B2 L7	400'	508	145	125	75	no data	125	4/30/1971
7	10972	Kings Lake B2 L3	300'	476	30	24	18		24	7/15/1985
8	40913	Duffs Pond Lot 4	500'	458	65	35	26	40	no data	5/13/2015
9	9325	Duff's Pond Lot 2	200'	444	58	13	17	no data	53	4/23/1985
10	3043	Shaw Tri Lakes B1 L4	250'	452	61	no data	40	30	no data	5/31/1983
11	7362	Shaw Tri Lks B1 L3	300'	445	51	33	30	26	40	4/22/1977
12	29833	Shaw Tri Lakes 3 B4 L2	500'	446	94	80	no data	84	no data	3/30/1984
13	15580	Shaw Tri Lks 1 B1 L9A	100'	442	91	11	no data	76	no data	6/10/1977
14	18072	Kings Lk Est B1 L13A	40'	444	60'	15'	15'			10/11/1986
15	21396	Kings Lake B1 L17A	200'	460	37	33	8	no data	37	3/16/1992
16	3921	Pinwyck Est 1-5	300'	no data	97	no data	no data	no data	no data	6/23/1984
17	27074	Shaw Tri Lks B1 L40	400'	438	101	85	71	no data	no data	9/20/1993
18	9067	Kings Lake Camp. L7	150'	no data	118	16	38		118	4/9/1976


Anderson Well log research and review
Yellow possible lake water influence
E ECHO AVE
E SHAWS DR
N DELTA ST
N CHARLEY DR
E LIZ LN
~Elev 476
30' deep
18' static
23' drawn down
~Elev 472
58' deep
38' static
50' draw down
~Elev 446
51' deep
30' draw down
Anderson Lake
Elev 434
S18N01E30
S18N01E29
~Elev 451
80' deep
30' static
Kings Lake
N SIERRA ST
E BIRCHWOOD DR
E GRUMMAN CIR
N SAMS DR
E SAMS CIR
N TRAVELAIR DR
N LAZY EIGHT CT
N DEPARTURE CT
N BELOS ST
E SELDON RD
E BOGARD RD
S18N01E31
S18N01E32
TALKEETNA
WASILLA PALMER
E476
E472
E458
E453
E446
E434
Anderson Lk
draw down
E422
E414
E395
E371
1: 18,056
0.6
0
0.28
0.57
Miles
WGS_1984_Web_Mercator_Auxiliary_Sphere
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Reported on 01/08/2020 04:20 PM
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Notes
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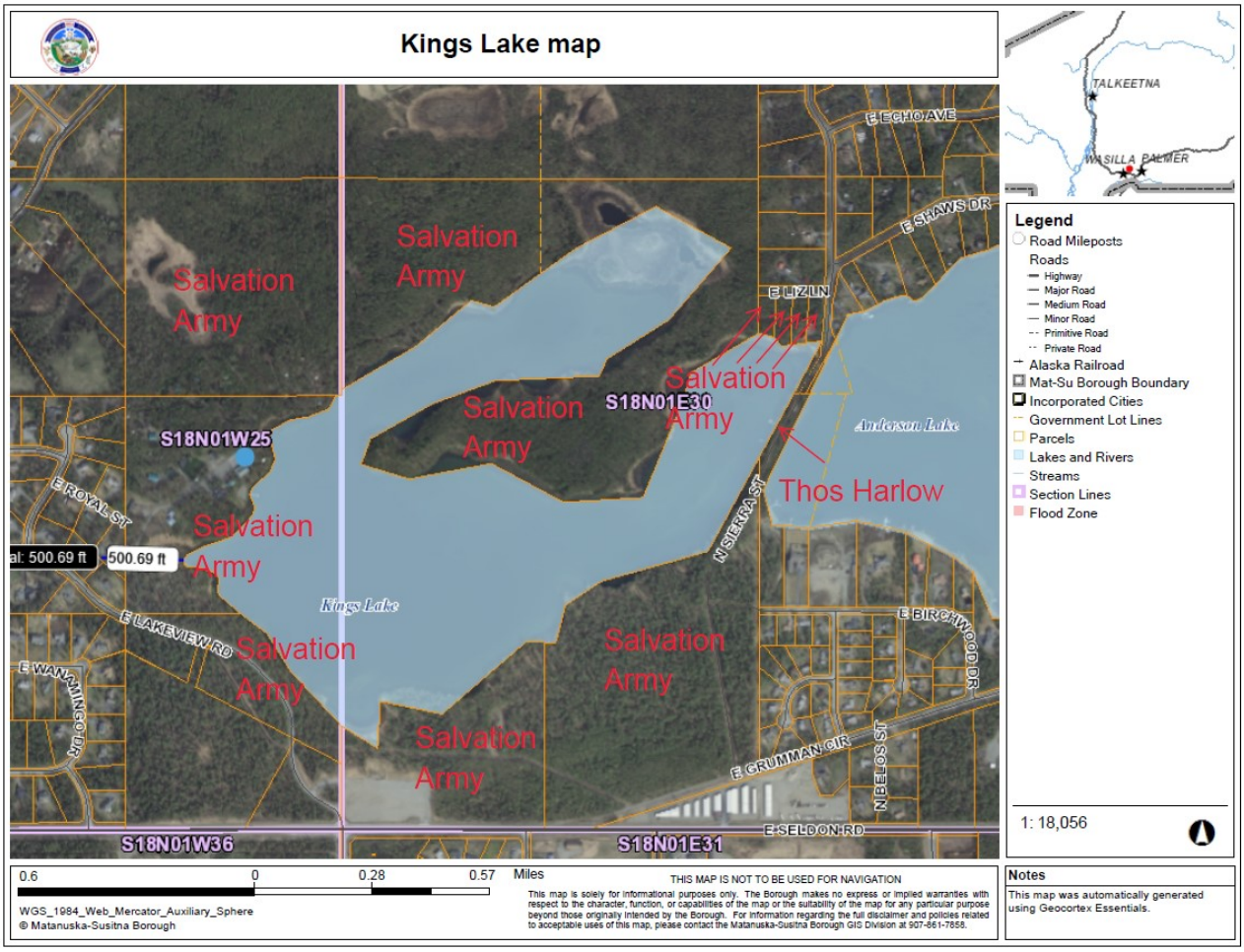
Kings Lake map
TALKEETNA
WASILLA PALMER
E ECHO AVE
E SHAWS DR
E LIZLIN
Salvation Army
Salvation Army
Salvation Army
Salvation Army
S18N01E30
Anderson Lake
S18N01W25
Thos Harlow
E ROYAL ST
N SIERRA ST
500.69 ft
Kings Lake
E LAKEVIEW RD
E BIRCHWOOD DR
E WANAMINGO DR
E GRUMMAN CIR
N BELOS ST
E SELDON RD
S18N01W36
S18N01E31
Legend
Road Mileposts
Roads
Highway
Major Road
Medium Road
Minor Road
Primitive Road
Private Road
Alaska Railroad
Mat-Su Borough Boundary
Incorporated Cities
Government Lot Lines
Parcels
Lakes and Rivers
Streams
Section Lines
Flood Zone
1: 18,056
0.6
0
0.28
0.57
Miles
WGS_1984_Web_Mercator_Auxiliary_Sphere
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Appendix 8. Summary of the Best Management Practices (BMP's) to be utilized for alternative #3.

The following BMP's are practices that reduce contamination of water resources, mitigate non-target impacts and guide the use and handling of chemicals.

Treatment Timing

Timing the rotenone treatment for October (cold water conditions) and shortly before ice-up will accomplish several things. First, cold water will slow the natural degradation of rotenone ensuring the pike population is exposed to the rotenone for the maximum amount of time and reduce the likelihood of failure and subsequent retreatment. This timing will coincide when water recreation is minimal and when waterfowl use has decreased significantly. A fall treatment should avoid killing adult wood frogs as opposed to a warm weather treatment when larval woods frogs are present which are far less tolerant to rotenone exposure.

Gillnetting conducted to verify the success of the rotenone treatments will be done under the ice to prevent the incidental take of birds.

Target Rotenone Concentration

The rotenone product label allows for a range of rotenone concentrations to be used depending on the target fish species and waterbody type. The highest allowable rotenone concentration is 250 ppb for some circumstances. This project will have a target rotenone concentration of <40 ppb. This is a concentration that has been effective at removing northern pike while not exceeding the EPA's Drinking Water level of Concern (DWLOC) for chronic long-term dietary exposure.

Rotenone Deactivation

Rotenone is only required to be chemically deactivated if it leaves the treatment area in excess of 2.0 ppb. This rotenone treatment is not expected to result in discharge of treated water outside of the treatment area due to ephemeral connections. However, a deactivation station will be set up and ready in the event deactivation is needed during a high water event before the rotenone degrades. Otherwise, natural rotenone degradation mechanisms (solar and thermal) will cause the rotenone to fully degrade over time.

Human Safety

Applicators and handlers working with undiluted rotenone are most at risk to chemical exposure. All applicators and handlers will undergo a safety training course provided by the project supervisor who is an ADEC certified pesticide applicator. PPE will always be worn by all applicators and handlers. The majority of the rotenone will be applied with boats equipped with semi-closed pump systems so direct handling of the rotenone rarely needed. Signage will advise against public entry to waters while being treated and to avoid contact with treated water posttreatment until the rotenone is fully deactivated. First aid and spill response supplies will be onsite during the applications and emergency contact information readily available to all workers.

Spill Prevention

All offsite and onsite rotenone storage will utilize a spill containment system capable of containing all product being stored. All overnight rotenone storage will be on ADF&G property and in an enclosed and locked area with appropriate signage posted. Mixing and/or transferring of all rotenone products will be done within a spill container. Spill response equipment and supplies will be close at hand during all rotenone applications. Applicators and handlers will be trained on spill and emergency response plans. All rotenone containers will be securely fastened during transport to avoid movement or tipping.

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U.S. Fish and Wildlife Service, 4401 N. Fairfax Drive, MS 2042, Arlington, VA 22203
Office of Equal Opportunity, U.S. Department of the Interior, 1849 C Street NW MS 5230, Washington DC 20240

The department's ADA Coordinator can be reached via phone at the following numbers:
(VOICE) 907-465-6077, (Statewide Telecommunication Device for the Deaf) 1-800-478-3648,
(Juneau TDD) 907-465-3646, or (FAX) 907-465-6078

For information on alternative formats and questions on this publication, please contact:
ADF&G, Division of Sport Fish, Research and Technical Services, 333 Raspberry Rd,
Anchorage AK 99518 (907) 267-2375.