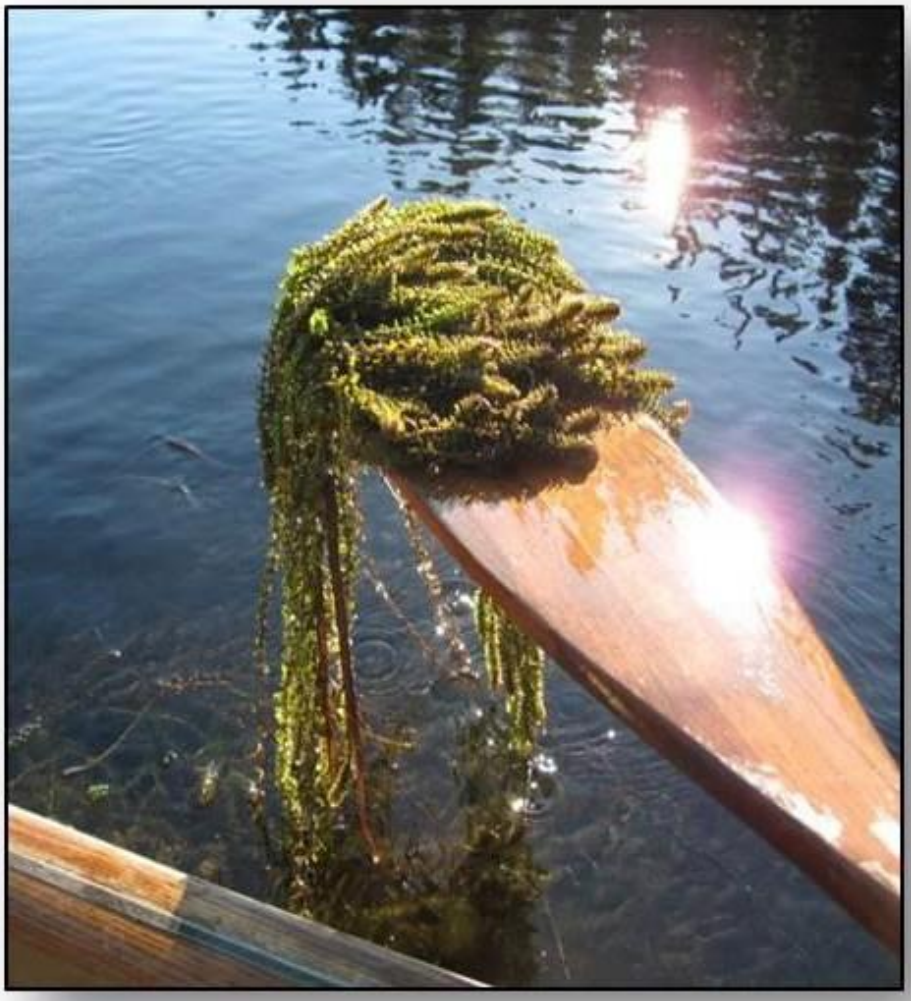
Photograph by US Forest Service



RAPID RESPONSE PLAN FOR *ELODEA* IN ALASKA

UNITED STATES FISH AND WILDLIFE SERVICE
ALASKA REGION, ANCHORAGE, ALASKA,
APRIL 2020

Contents

INTRODUCTION TO *ELODEA* IN ALASKA

Elodea is a genus of submerged aquatic plant species considered nonnative to Alaska (Wurtz et al. 2013), though several species including *Elodea canadensis*, *E. nuttallii*, and an *E. canadensis* x *E. nuttalli* hybrid (all of which hereafter referred to as *Elodea*) can now be found throughout the state. *E. nuttallii* has been found primarily in the Fairbanks area, *E. canadensis* primarily in Anchorage, Cordova, and parts of the Kenai Peninsula, and their hybrid in Nikiski lakes on the Kenai Peninsula (*Elodea* subcommittee of the Kenai Peninsula SWCD 2019). As *E. canadensis*, *E. nutalli*, and their hybrid are all common in the commercial aquarium trade, independent aquarium dumps are hypothesized as the initial mode of introduction of the different species into the state. Floatplanes, boats, and other vectors, as well as natural dispersal, are likely responsible for further spread throughout the state.

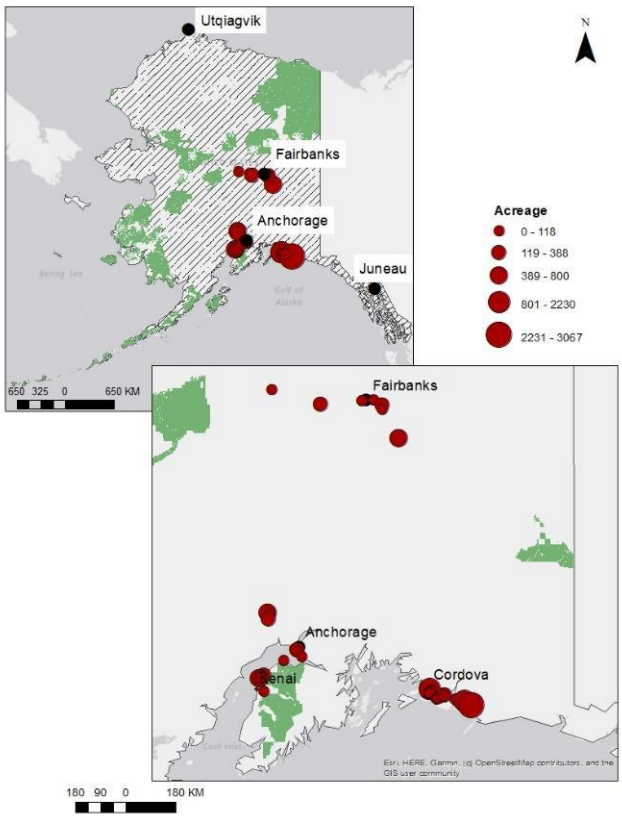


Figure 1. Map of *Elodea* infestations across the state of Alaska (top), with detail (bottom). Green shaded areas are National Wildlife Refuges, hatched areas are state and federal managed lands.

Both *E. nuttallii* and *E. canadensis* are similar in appearance, though *E. nuttallii* has shorter and narrower leaves that are bent and folded along the midrib. *E. nuttallii* is also generally smaller and paler green with more branches than *E. canadensis*. However, characteristics often overlap, making the species difficult to distinguish. Genetic techniques have been developed to distinguish these two species, though for the purpose of most on-the- ground response and treatment efforts genus level identification is sufficient. The life history traits of *E. nuttallii* and *E. canadensis* are similar in that both species are resistant to varying water current rates and have high regeneration (regrowth into viable plants) and colonization ability (establishment in sediment) via fragmentation (*Elodea* subcommittee of the Kenai Peninsula Cooperative Weed Management Area). In experimental tests, both *Elodea* species were shown to withstand strong current and survive long-distance dispersal, increasing invasion capabilities (Barrat-Segretain et al. 2002). Both species prefer depths ≤ 3 m, but will eventually spread to 5—6 m, though there is some evidence that *E. nuttallii* can tolerate deeper environments. Additionally, *E. canadensis* prefers mesotrophic lakes whereas *E. nuttallii* prefers eutrophic lakes and can tolerate higher levels of pollution (oligo-mesoprobic). Both species are salt intolerant but to varying degrees: ≤ 0.25% *for E. canadensis* (Sand-Jensen 2000) and ≤ 1.4% for *E. nuttallii* (Centre for Aquatic Plant Management 2004); for comparative purposes, ocean water is typically 3.5% salt (*excerpted and revised from* The *Elodea* subcommittee of the Kenai Peninsula).

Prior to 2020, the only known locations of *Elodea* in Alaska were in Eyak Lake near

Introduction

Cordova (recorded in 1982), and in the Chena Slough near Fairbanks (recorded in 2009). However, *Elodea* has now been found in ~25 unique water bodies statewide (Figure 1). *Elodea* has continued dispersing downstream from Chena Slough to the Chena River and has also been found in Totchaket Slough and Manley Slough on the Tanana River, as well as Chena Lake, Birch Lake and Bathing Beauty Pond around Fairbanks. It has also been found in water bodies on the Copper River delta, Alexander and Sucker Lakes in the Matanuska- Susitna Valley; and in fall 2019, a new infestation was also identified in Big Lake near Wasilla. In Anchorage, *Elodea* was initially found in Sand Lake in 2011, though it has subsequently been eradicated from Sand Lake as well as Delong, Little Campbell, and Hood Lakes. However, at the time of finalizing this document, small pockets of *Elodea* remain in and around the Anchorage Area (for example, in Little Survivor Creek and Jewell Lake). On the Kenai Peninsula, *Elodea* has been eradicated from Beck, Daniels and Stormy Lakes, and appears to be eradicated from Sports, Seppu and Hilda Lakes (*excerpted and revised from* The *Elodea* subcommittee of the Kenai Peninsula 2019). A new infestation in Sandpiper Lake on the Kenai National Wildlife Refuge was found in the fall of 2019, and efforts are underway to chemically treat the infestation.

Quick response actions have resulted in the successful eradication efforts on the Kenai Peninsula. However, the example of Alexander Lake demonstrates the consequences that come from delaying response actions, especially in dynamic systems with relatively high water turnover. *Elodea* was first detected in Alexander Lake within the Susitna River Basin in 2014. At the time of the initial detection, the *Elodea* infestation was limited to approximately 10 acres of the ~750 acre Alexander Lake, and the Alaska Department of Natural Resources (ADNR) and its partners estimated the initial cost for a three year eradication and effectiveness monitoring program to be ~$90,000. Unfortunately, it took the local partnership two years to secure sufficient funding, the necessary state permits, and to complete the appropriate National Environmental Policy Act (NEPA) process. By the time ADNR and its partners initiated treatment in 2016, the infestation had grown to over 500 acres, a nearly 5,000% increase in affected area, resulting in a significant increase in the cost of treatment. Streamlining the response process is key to preventing similar events from occurring in the future.

Given the growing concern about the spread of *Elodea* in the state of Alaska, in 2014 the ADNR established a quarantine of five aquatic invasive plant species including *E. canadensis* and *E. nutallii*. The quarantine also extends to three species not yet detected in Alaska: Brazilian waterweed (*Egeria densa*), Hydrilla (*Hydrilla verticillata*) and Eurasian watermilfoil (*Myriophyllum spicatum)*. This quarantine prohibits the import, transport, purchase, or distribution of plants or plant parts of these species within the state of Alaska, including the intentional transport of wild plants or plant parts. Further information about the quarantine can be found here: http://plants.alaska.gov/invasives/aquatics.html. Any unknown aquatic plants should be identified by an expert to ensure that invasive plant species are not making it into Alaska unnoticed.

Elodea is the first submersed freshwater invasive plant to establish in Alaska, and can cause substantial economic and environmental harm (Carey et al. 2016 in The *Elodea* subcommittee of the Kenai Peninsula 2019). In areas of North America, Europe, New Zealand, Australia, and Africa where it is invasive, *Elodea* has compromised water quality, grown so abundantly that boat traffic is hindered, reduced dissolved oxygen, and severely impacted native fisheries (Carey et al. 2016 in The *Elodea* subcommittee of the Kenai Peninsula 2019). *Elodea* is particularly insidious, in that it only takes a small plant fragment to infest an entire water body due to its vegetative growth. If it establishes throughout Alaska, *Elodea* is likely to cost $100

million per year in lost revenue to the commercial sockeye (*Oncorhynchus nerka*) fisheries (Schwoerer 2017). Predictive bioclimatic models suggest that *Elodea* will continue to aggressively colonize even further north in Europe (Heikkinen et al. 2008), which may also occur in Alaska, a region particularly impacted by changing climate regimes and increasing human vectors that may spread this species (Luizza et al. 2016). Efforts to eradicate and limit the spread of *Elodea* in Alaska are therefore increasingly warranted and necessary.

This plan will serve as a framework to facilitate quick and effective management response when faced with the threat of newly identified reports of *Elodea* across Alaska. We emphasize that rapid response refers specifically to urgent actions taken to eradicate founding populations while these populations are still isolated (The U.S. Department of Interior 2016). However, in some cases, rapid eradication may not be possible, and rapid response actions may also include urgent actions taken to limit the spread of isolated populations of these invasive species. While these actions are written specifically for *Elodea*, this plan is relevant for rapid response to any invasive submerged aquatic plant species in Alaska.

The goal of this document is to consolidate information and facilitate communication within the United States Fish and Wildlife Service (Service), as well as among Service partners. Some actions outlined in this document are specific to the Service and may not be relevant for other agencies or organizations. However, the specific tasks outlined within each step can be modified to reflect the mandates, authorities, and jurisdictions of other agencies or organizations.

Portions of the above text excerpted and modified from: *Elodea* subcommittee of the Kenai Peninsula Cooperative Weed Management Area. 2019. Integrated Pest Management Plan for Eradication *Elodea* from the Kenai Peninsula.

□ STEP 1: BE PREPARED FOR *ELODEA* RESPONSE

This step outlines actions that entities should take immediately to increase capacity to respond to any new report of *Elodea* in Alaska. This is an integral step for rapid response. While some of these tasks are specific to federal agencies and Service, they can be modified by other agencies to increase preparedness for *Elodea* rapid response in Alaska.

Step 1 Strategic Tasks

1) Familiarize oneself with Federal laws and regulations regarding authorities of the Service to respond to and manage invasive species (Tool 1.1).
2) Review the Integrated Pest Management (IPM) approach and existing *Elodea* IPM plans, to understand the suite of options available for *Elodea* eradication and control in Alaska.
    a) Integrated pest management is a sustainable approach to managing pests that utilizes a variety of tools to minimize health, environmental, and economic risks.
    b) See further information about Integrated Pest Management here.
3) Designate individuals to receive Hazard Analysis and Critical Control Point (HACCP) training. Each National Wildlife Refuge (Refuge) and Fish and Wildlife Conservation Office (FWCO) should identify at least one individual to receive HACCP training. All offices should develop a HACCP plan for *Elodea* Rapid Response, even those with no known infestations.
    a) HACCP planning is a management tool that provides a structured method to identify risks and focus procedures used in natural resource pathway activities. Understanding pathways and developing plans to reduce the abundance of non-target species and prevent biological contamination is necessary to avoid unintended spread of species.
    b) Further information regarding HACCP planning is provided in Tool 1.2, and guidance to reduce risk of spread of *Elodea* can be found in Tool 1.3.
4) Designate individuals to receive Certified Pesticide Applicator Training from the Alaska Department of Environmental Conservation (ADEC). See Tool 1.2 for detail.
    a) If herbicides are found to be the preferred option for *Elodea* response, this certification is required to apply pesticides of any kind in the state of Alaska. Refuges and FWCO's should designate at least one individual to obtain ADEC pesticide applicator certification.
    b) This certification is good for one to three years depending on test scores, and applicators must be re-certified upon expiration.
5) Develop standing contracts with pesticide supply companies to facilitate the purchase of durable goods at times when funds are available, which can then be banked for future use.
    a) Also, refer to existing Memoranda of Understanding or Cooperative Agreements to collaborate with other agencies to purchase supplies with end of year funds.
    b) Contact the Service Regional Office (Tool 1.4) for region-wide opportunities to work within.
6) Pursue collaborations with local dive shops/SCUBA training programs, as these organizations may be able to provide volunteer divers to assist with survey efforts.
7) Through floatplane and boat vectors, even remote Wilderness areas are susceptible to *Elodea* infestation. For Refuges with federally designated Wilderness, a Minimum Requirements Analysis (MRA) must be completed prior to taking management action in

Wilderness. Refuges with Wilderness should complete a wilderness review in advance to decide on acceptable response actions for Wilderness. This will facilitate rapid completion of the MRA in the event *Elodea* is detected in Wilderness. Additional detail regarding invasive species control in Wilderness is provided in Tool 5.3 and Appendix B.

Step 1 Roles and Responsibilities

- Funding from the Regional Office may be available to support Pesticide Applicator and HACCP trainings for Service staff. Contact the Alaska Region's Regional Invasive Species Program Coordinator or the Sub-Regional Strike Team Coordinators for information (Tool 1.4).

Step 1 Tools

Tool 1.1. Regulations Relating to Invasive Species

A compilation of resources regarding regulations of invasive species can be found here

A summary of the Injurious Provisions of the Lacey Act can be found here

Tool 1.2. Training Information Links

HACCP Training Information and a Link to HACCP Template

ADEC Certified Pesticide Applicator Training Information

Tool 1.3. Guidelines for Preventing AIS Spread

Guidelines for Preventing the Spread of Aquatic Invasive Species, US Fish and Wildlife Service, Region 7, Anchorage Alaska.

Tool 1.4. Service Contacts

Role	Name	Contact Info
Regional Invasive Species Coordinator	Aaron Martin	aaron_e_martin@fws.gov Cell: (907) 378-0568 Office: (907) 786-3510
Sub-Regional EDRR Project Manager (interior/northern Alaska)	Lisa Dlugolecki	lisa_dlugolecki@fws.gov Cell: (907) 251-5959 Office: (907) 455-1840
Sub-Regional EDRR Project Manager (southcentral/southwestern Alaska)	Ben Wishnek	benyamin_wishnek@fws.gov Cell: (907) 251- 0692

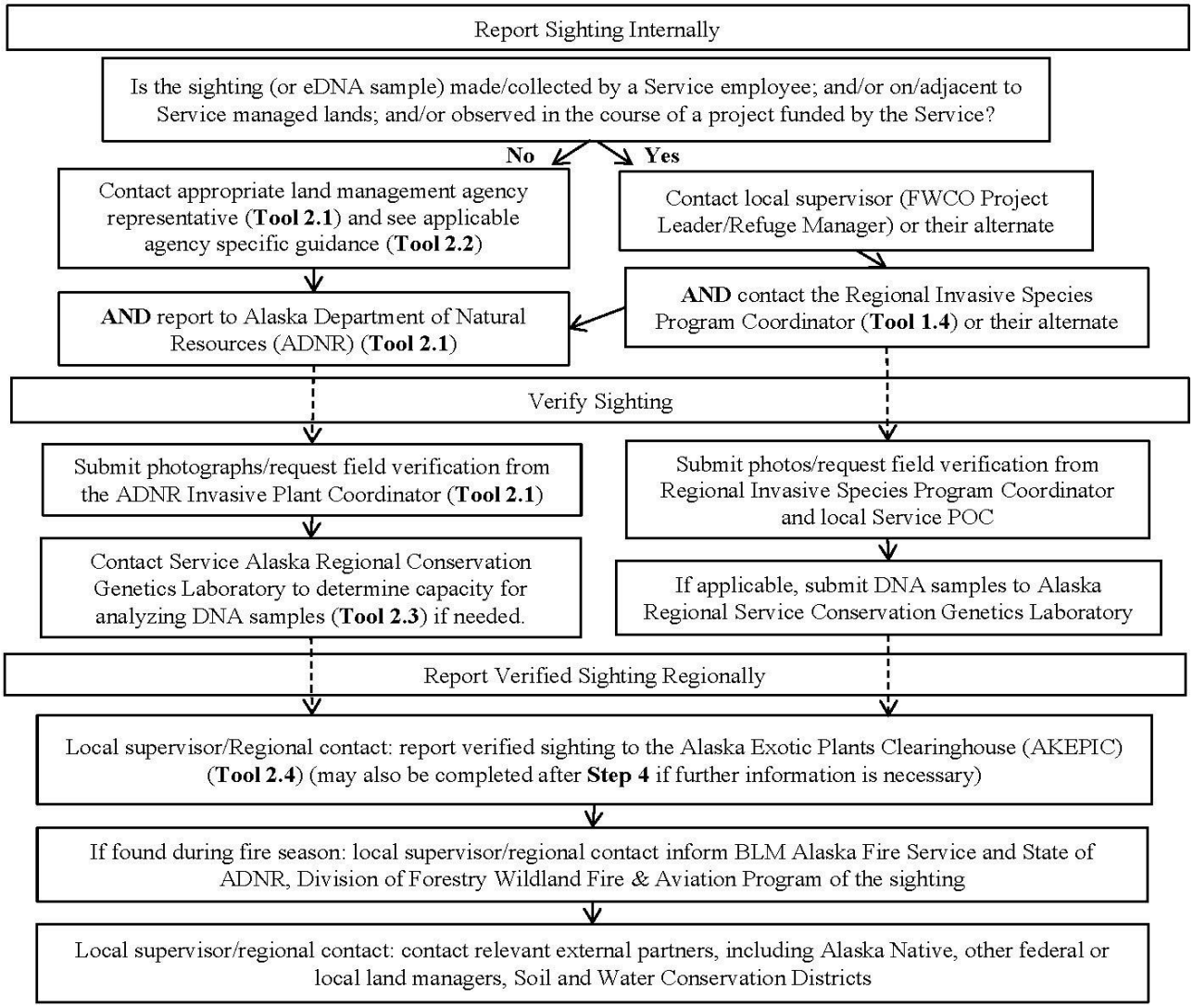
□ STEP 2: REPORT AND VERIFY SIGHTING

This step outlines the process to report a sighting of suspected *Elodea* and verify the species identity. Take these actions as soon as the suspected *Elodea* is observed. This step provides guidance for sightings made by Service and non-Service employees on and off Service lands.

Step 2 Strategic Tasks

1) Report sighting locally.
2) Verify sighting.
    a. A positive eDNA sample can only be used to direct targeted detection efforts. A sighting will only be fully verified if there is a visual confirmation of detection.
    b. If photographs are inadequate to verify the species, on the ground verification at the site by a person familiar with *Elodea* field identification will be necessary.
3) Report verified sighting regionally (submit to database).

Figure 2.1. Flow chart of strategic tasks associated with Step 2.



Step 2: Report and Verify

Step 2 Tools

Tool 2.1. Non-Service Contact Information

Agency	Role	Region	Name	Contact Info
Alaska Department of Natural Resources	Invasive Plant and Agricultural Pest Coordinator	All of AK	Daniel Coleman	daniel.coleman@alask.gov (907) 754-8721
Alaska Department of Fish and Game	Invasive Species Program Coordinator	All of AK	Tammy Davis	tammy.davis@alaska.gov (907) 465-6183
Homer Soil and Water Conservation District	Natural Resource Specialist	Southern Region Kenai Peninsula	Katherine Schake	katherine@homerswcd.org (907) 235-8177 ex. 5
Fairbanks Soil and Water Conservation District	Invasive Plant Specialist	Interior AK	Aditi Shenoy	aditi.shenoy@gmail.com (907) 479-1213 ex. 104
Tyonek Tribal Conservation District	TTCD Conservation Director	Game Mgmt Unit 16B	Nicole Swenson	nswenson@tyonek.com (907) 646-3110
National Parks Service	Invasive plants coordinator	All of AK	Chris Overbaugh	chris_overbaugh@nps.gov (907) 644- 3452
Bureau of Land Management, Alaska State Office	Fisheries and Riparian Program Lead	All of AK	Matt Varner	mvarner@blm.gov (907) 271-3933
US Forest Service	Ecologist	Prince William Sound Zone	Kate Mohatt	kate.mohatt@usda.gov (907) 754-2348
Bureau of Indian Affairs	Natural Resource Manager	All of AK	Keith Kahklen	keith.kahklen@bia.gov (907) 586-7618

Tool 2.2. Non-Service Invasive Species Management Policies

BLM – Alaska Invasive Species Management Plan 2010

National Park Service Alaska Region Invasive Plant Management Plan, 2009

Step 2: Report and Verify

Tool 2.3. Tools for Verification

See this flyer for basic information regarding *Elodea* identification

For eDNA/DNA samples contact:
U.S. Fish and Wildlife Service Conservation Genetics Laboratory
1011 E. Tudor Road Anchorage, Alaska 99503; (907) 786-3858
This protocol for collecting eDNA samples from streams has become a standard for collecting and shipping aquatic based eDNA samples. Contact the Service Conservation Genetics Laboratory for more information.

Tool 2.4. Alaska Exotic Plant Information Clearinghouse Data Entry Form

Download the Alaska Exotic Plant Information Clearinghouse (AKEPIC) Data Entry Form here
Submit completed form to: uaa.aknp@alaska.edu

□ STEP 3: FORM INCIDENT RESPONSE TEAM

Due to the risk posed by *Elodea*, any verified sighting will initiate the rapid response process. Upon verification, a designated Incident Response Team will be assembled to determine the appropriate course of action and enact the response. This step provides guidance for assembling this team. Due to overlapping jurisdictions and limited capacity for any one agency to address invasive species efforts statewide, a successful response will benefit from including multiple partners.

Step 3 Strategic Tasks

1) Identify key partners to form the incident response team.
    a) Whenever possible, the response team should be made up of local partners such as Refuge or FWCO biologists, tribal/Alaska Native partners, state partners and individuals from Soil and Water Conservation Districts/Cooperative Weed Management Areas (CWMAs) as they have the connections and local knowledge that will best enable a rapid response (see Roles and Responsibilities for detail). CWMAs have the ability to coordinate regional partnerships working on local invasive species issues, house certified pesticide applicators, may have resources to contribute, have established relationships with local landowners, and are familiar with site-specific obstacles to rapid response.
    b) The team should also include private land owners as consulting members to help foster support from affected stakeholders and to serve as liaisons with adjacent landowners.
    c) Ensure that the response team includes individuals with relevant trainings.
2) Assign leadership, define roles and responsibilities.
    a) Guidance for the minimum leadership roles that should be identified are listed in Tool 3.1.
    b) Other partners may be involved but may not have defined roles or additional roles can be identified to reflect specific circumstances.

Step 3 Roles and Responsibilities

- ADNR needs to be the lead agency for application for the General Permit (see Tool 6.4) to ADEC.
- Service staff at the Alaska Regional Office can help identify and/or contact additional partners that could be involved.
- Depending on specifics of the infestation, private landowners and other parties (Alaska Native organizations, other federal and state agencies) may or may not be directly involved in the response process. However, if the infestation or associated response actions could have impacts on lands managed by these agencies/individuals, they should always be included in regular communication at a minimum.
- Refuge or FWCO staff may still want to engage in a response off of a Refuge if the incident threatens Refuge lands or Refuge resources.

Step 3: Form Response Team

Step 3 Tools

Tool 3.1. Definitions and Duties for Key Leadership Roles

1) Response Plan Implementation Coordinator

Should be pre-designated to provide the leadership needed to avoid confusion in directing implementation of eradication actions. Will monitor the status of the rapid response, determine the need for seeking additional involvement, and will direct the roles of other participating agencies. In charge of directing the situation assessment (Step 4) and the implementation of the response plan (Step 6).

Name: **Agency:** **Contact Information:**

For verified reports on Service lands, this position may be filled by:

Refuge Biologist or Manager/FWCO Biologist or Project Leader

For verified reports not on Service lands, this position may be filled by:

The ADNR Invasive Plant and Agricultural Pest Coordinator or
Natural Resource Specialist from appropriate federal/state/SWCD/Alaska Native group

2) Central Communication Coordinator

Should contact and inform all of the primary points of contact for local, state, federal agencies and Alaska Native organizations affected. Communication with the broader public and the media should go through the Public Communication Coordinator unless the response team decides otherwise.

Name: **Agency:** **Contact Information:**

For verified reports on Service lands, this position may be filled by:

Service Regional Invasive Species Program Coordinator/EDRR Project Manager or
Refuge Manager /FWCO Project Leader

For verified reports not on Service lands, this position may be filled by:

The ADNR Invasive Plant and Agricultural Pest Coordinator or
Invasive Species Coordinator/Natural Resource Specialist from appropriate federal/state/SWCD/Alaska Native group (see Tool 2.1)

3) Public Communication Coordinator

Should deliver timely and consistent messages to the public and to the media. They should coordinate among agencies, as it is essential to use consistent messages when dealing with the public. Contradictory or conflicting messages weaken public confidence in response actions and decision making.

Name: **Agency:** **Contact Information:**

This position may be filled by:

Service External Affairs or respective program outreach staff from the agency leading the response

□ STEP 4: TAKE RISK REDUCTION ACTIONS AND COMPLETE FIELD SURVEYS AND SITUATION ASSESSMENT

The assembled team should now work together to implement immediate actions that will reduce the risk of spread while the situation is further assessed. This step provides resources to inform risk reduction actions, and also provides a framework to inform the actions outlined in Steps 5 - 7.

Step 4 Strategic Tasks

1) Take risk reduction actions such as:
    a) Place signage to alert the public about the infestation and to educate about Clean, Drain, Dry practices.
    b) Pursue temporary closures of access points to infested water bodies.
    c) Coordinate with Alaska Department of Fish & Game (ADF&G) to temporarily reduce sport fishing and hunting opportunities in the localized area.
    d) Pursue voluntary agreements from floatplane and watercraft operators to not use lakes during and/or prior to treatment.
    e) Interview floatplane and watercraft users to identify other areas of potential spread.
    f) Place fragment barrier at water body outlets to capture and monitor *Elodea* fragments moving downstream.
        i) Barrier mesh should be of small enough size to capture small fragments and checked as regularly as conditions allow.
        ii) Depending on circumstances, this action could require additional regulatory permitting (see Step 6).
2) Complete the field survey to determine the extent of infestation and understand the non-target species that could be impacted (Tool 4.1) at the water body where Elodea was found, and also adjacent water bodies. Use best management practices .
3) Collate information from the field survey and other sources to complete the situation assessment. The situation assessment provides a general outline of all known information about the infestation, and will facilitate the communication and decision making actions in Steps 5-7.
4) Identify additional partners for response.
5) Communicate with the public if appropriate to circumstances (see additional details in Roles and Responsibilities).
6) Report sighting to AKEPIC if not completed in Step 2.

Step 4 Roles and Responsibilities

Within-response team communication

- The Response Plan Coordinator will lead the field survey and situation assessment and report back to the Central Communication Coordinator (CCC). The CCC will facilitate disseminating information to the other members of the team.
- During or following the field survey process, once the full extent of the infestation is understood, additional agencies may need to be included for the Response Plan Implementation.

Step 4: Risk Reduction, Field Survey, Situation Assessment

Communication with the public

- Once the infestation is understood, the Public Communication Coordinator should consider working with the agencies' External Affairs Program to develop a press release and/or hold a public meeting outlining the information that is known.
- At this step, a full response plan need not be developed, but the public should be aware that actions are being considered. Providing information to the public as soon as possible can increase buy-in and limit challenges further down the line.
- However, under some conditions, alerting the public too soon could hinder response efforts. The response team will make the decision of when to alert the public.

Step 4 Tools

Tool 4.1. Field Survey

Detailed protocols for conducting the on-the-ground field surveys for *Elodea* have been developed:

Alaska Invasive Species Survey Protocol: A rapid screening method for Alaska's lakes and slow rivers, 2012.

This document is currently not available online. Contact the Service Regional Invasive Species Coordinator for a copy of this document.

A more rigorous *Elodea* screening protocol is currently being developed by the Alaska Center for Conservation Science. Once this protocol has been completed, the link will be provided.

Tool 4.2. Situation Assessment

The following situation assessment provides a general outline which can be used to condense information from field surveys to facilitate communication among partners during Steps 5-7. This is minimal amount of data needed to inform an effective response plan:

1. **Obtain a detailed bathymetric map of the infested water body.**
   ADF&G maintains bathymetric maps for select lakes.
   The Service does not have a database of bathymetry data. The Kenai Peninsula is the only region where systematic bathymetry has been done. On Refuge lands, contact the Refuge Supervisory Biologist to determine if any bathymetric data has been collected in association with prior specific projects.
   If no bathymetric data exists, contact the ADNR and/or the Service Water Resources Division to determine capacity to acquire the information.

2. **Identify size and depth of infested water body.**
   Wetland Mapper: https://www.fws.gov/wetlands/data/mapper.html Google Earth: https://www.google.com/earth/versions/

3. **Assess connectivity of waterway, hydrology, and survey downstream/upstream waterways**
   Note sources of inputs, the waterway's drainage area, any receiving streams or rivers, and the prominent wind direction. Determine how frequently the water

body fills with new water (i.e., the turnover rate).

4. **Identify the geographic extent and abundance of the *Elodea* at the known location.** The level of detail necessary to inform actions may vary depending on specifics of the wetland. If a wetland is large and partial lake treatment could be a consideration, several site visits over time may be needed to fully understand the extent of an infestation. If the lake is very small and full water body treatment options are likely to be pursued, a less extensive estimate of the infestation may suffice to make management decisions.

5. **Systematically sample water chemistry, aquatic vegetation, macroinvertebrates and fish to determine the non-target species present that may be impacted by treatments.**

6. **Interview landowners and watercraft/floatplane pilots using the infested system to determine movements prior to the detection to identify other potential infestations.**

7. **Determine the extent of public access.** Note the presences of launch sites, floatplane use, and other points of public access, and any other obvious pathways for potential spread. Determining where float planes typically land and dock can also help to identify locations of infestations.

8. **Determine whether there is a need for law enforcement action or if any additional form of investigation is needed.**

9. **Determine additional location specific risk factors or impacts that should be considered in this location** (drinking water wells, surface drinking water intakes, species listed under the Endangered Species Act, subsistence use, presence of other invasive species, is the infestation in federally designated Wilderness)?

□ STEP 5: EVALUATE RESPONSE OPTIONS

In this section we outline a number of treatment options available to pursue eradication of *Elodea*, and emphasize that an adaptive Integrated Pest Management approach is the preferred strategy for response. The Service's primary goal of any rapid response effort should be eradication. However, if funding does not allow for immediate eradication efforts to be pursued, rapid response actions should still be taken to limit spread (see Step 4 Risk Reduction), until such time that funds can be acquired to pursue eradication

Step 5 Strategic Tasks

a. Identify the *Elodea* response options relevant to the given circumstance.
b. Select among response options to control/eradicate an infestation (Tool 5.1 and Tool 5.2).
c. Consider any special circumstances of the infestation. For example, if an infestation is located in federally designated Wilderness, additional steps are required (Tool 5.3).
d. Continue to re-affirm roles and responsibilities. Identify who is in charge of each component of the response (e.g., environmental analyses, state and/or federal Pesticide Use Permit/Proposal applications, logistics, etc.). Further detail about permitting is found in Tool 6.2.

Step 5 Roles and Responsibilities

- The selection of the response option(s) should be led by the Response Plan Implementation Coordinator, but will be made together with the response team. The Central Communication Coordinator will communicate the final decision among members of the team and partners.
- If the Service Regional Invasive Species Program Coordinator (or their alternate) is not actively involved in the response efforts, it is the duty of the Central Communication Coordinator to update them of progress and keep them regularly informed of resources needed.

Step 5 Tools

Tool 5.1. Elodea Response Options

In this document, we emphasize that rapid response refers specifically to urgent actions taken to address a new record of *Elodea* while an infestation is still isolated. The ultimate goal of rapid response is to enact actions on short time scales to eradicate such infestations. However, we recognize that in some instances eradication responses may be slowed due to extenuating circumstances. In such cases, rapid response may include urgent actions taken to limit the spread of isolated populations until eradication actions can be undertaken. In addition to the Risk Reduction actions established during Step 4, the following options can be used to address infestations.

PHYSICAL TREATMENT OPTIONS

Bottom barriers

Bottom barrier treatments are performed by covering the target aquatic vegetation with a light barrier to block sunlight and deprive plants of energy. Ideally, bottom barriers should be

heavier than water but porous enough to allow gas bubbles produced by bottom sediments and decomposing plant material to pass through the barrier without "ballooning" the material off the bottom. According to literature from Nebraska (Barrow 2010), bottom barriers may kill aquatic plants in one to two months.

Positive Features of Bottom Barriers

Effective at killing plants. If it is possible to install the barriers without any cutting or pulling of existing vegetation, this method could be implemented with minimal fragmentation. Can be a good option for vegetation control in high use arears like boat launches.

Negative Features of Bottom Barriers

Not reasonable for use over large areas due to deployment time and cost. Difficult to install and maintain in flowing systems. Gas production that results from decaying organic matter under the barrier may affect the long term functionality and stability of the method (Gunnison and Barko 1992). Limited permeability of a bottom barrier has been shown to create anoxic conditions and increased ammonium concentrations beneath the barrier. This can result in the elimination of native aquatic macroinvertebrate communities (Eakin and Barko 1995). This method is not species-specific and could impact many non-target plants.

Drawdown

Lowering the water level in a water body to expose target vegetation is known as drawdown. Drawdown during the winter exposes the sediment to both freezing and loss of water. Freezing temperatures can kill aquatic plants that have no overwintering structures such as viable seeds, tubers, or winter buds. Lowering the water levels in the summer can expose the sediments to desiccation and high temperatures. These conditions can also kill some aquatic plants. Drawdown would require the relocation of native aquatic organisms to reduce individual mortalities.

This management technique may only be a viable response for a small set of water bodies for which water-control structures are in place. For smaller water bodies, it may also be possible to pump water out to reduce water levels. In this case, water would need to be pumped into high and dry fields to prevent accidental spreading of *Elodea* fragments caught in the pumping system. Lastly, temporary dams could be placed to divert water way from seasonal slough systems. Drawdown options may be effective in systems within limited groundwater influence, as groundwater inflow could replace pumped/diverted water rapidly.

Positive Features of Drawdown

This is an effective way to kill aquatic plants. Drawdown may be very cost effective on water bodies with existing water control structures. Complete draining is not necessary in deep water bodies as suitable rooted aquatic plant habitat is limited to shallower areas.

Negative Features of Drawdown

Existing water management structures are necessary to avoid costs and logistical issues associated with pumping. This method is not species-specific and could impact many non- target organisms. Target plants may recolonize areas subjected to drawdowns if too little time was allotted to the treatment or if wet areas remained in the treatment area.

Hand Pulling

Hand-pulling aquatic invasive plants involves removing entire plants, including roots, from the area of concern and disposing of them in an area away from the shoreline. In shallow water, no specialized equipment or training is required to perform this technique. In deeper

water, hand pulling is best accomplished by divers with SCUBA equipment and mesh bags for the collection of plant parts.

Positive Features of Hand Pulling

Hand pulling is a relatively low impact method. May be suitable for volunteer work crews if infestation is in shallow water and close to towns or villages.

Negative Features of Hand Pulling

Hand pulling is time and labor intensive so it would only be feasible in areas with small patches of *Elodea* or other target plant species. Another major disadvantage of hand pulling is that it could produce an abundance of plant fragments. The treatment area would have to be carefully contained with some sort of fragment barrier and monitored during and after treatment. Collection bags could release fragments unintentionally. The pulled plant material would need to be disposed of in a way that prevents additional infestations.

Diver-Operated Suction

Diver-operated suction, or suction dredging, is a method whereby SCUBA divers use hoses attached to small dredges to suck plant material and some sediment from the bottom of a water body. The purpose of suction dredging is to remove all parts of the plant including the roots. The plant material is collected and disposed of while water is returned to water body.

Positive Features of Diver-Operated Suction

This method is species specific and could minimize impacts to non-target aquatic plants. Suction dredges are popular in some areas of Alaska, due to their use in mining, and may be readily available.

Negative Features of Diver-Operated Suction

This method was found to be extremely labor-intensive. The efficacy of suction dredging was evaluated in the Chena Slough in 2012 and 2013. The rate of removal, based on a 0.59 acre trial with an eight person crew, was estimated to be approximately 400 hours for 1 acre of *Elodea*. While suction dredging may be a good tool for removing small patches of *Elodea*, it is unlikely to be an effective means of complete eradication in large infestations. Transportation and disposal of collected plant material may be problematic. The collected plant material would need to be disposed of in a way that prevents additional infestations. Like other mechanical control techniques, this method would produce an abundance of plant fragments. Another issue associated with this method is that suction dredging would mobilize any toxins present in sediment. An evaluation of sediments in the project area may be required prior to treatment.

CHEMICAL TREATMENT OPTIONS

Fluridone

Mention of specific products or companies does not constitute endorsement. **In all cases, use of a pesticide must follow the current EPA label. To use in a manner that does not follow the label is a violation of federal law.**

At the time of completing this response plan, Fluridone is the only known herbicide available to successfully kill all parts of an *Elodea* plant (Dr. Lars. Anderson, UC-Davis, pers. comm). Fluridone is a selective systemic aquatic herbicide which inhibits the formation of carotene, a plant pigment, causing the rapid degradation of chlorophyll by sunlight, which then prevents the formation of carbohydrates necessary to sustain the plant. Adequate concentrations must be maintained in the treated area for 45-90 days after the initial application, which is determined through periodic water monitoring. Complete eradication with fluridone products generally require treatment of 45—90 days per growing season for two or more growing seasons,

requiring one or more applications during the growing season. The ideal time for the first treatment is shortly after ice out (late May, early June) when plant biomass is low, turbidity is low, water volume is low, and the plant is actively growing, but before a thermocline is established in the lake (typically mid- to late-June) that can inhibit a uniform distribution of fluridone in the water column (Kenai IPM, 2019).

However, fluridone can be applied at any time that *Elodea* is photosynthesizing, which appears to be year-round. Pedlow et al. (2006) effectively treated watermilfoil in a Michigan lake with a whole-lake treatment of low-dosage fluridone, first applied in October and subsequently boosted in November, with herbicide residuals maintained through the winter. Despite relatively low uptake by plants during this time, this disadvantage may be offset by low water volume, minimal mixing (no wind due to ice cover), and reduced concerns about potential impacts to anadromous fish and human health.

Fluridone is a tan to off-white odorless crystalline solid, chemically formulated as 1-methyl-3-phenyl-5-[3-(trifluromethyl)phenyl]-4(1*H*)-pyridinone, and applied as either a pellet or liquid (Bartels et al. 1978, McCowen et al. 1979). Fluridone may be applied to an entire water body or on smaller infestations within a water body. In the former case, fluridone is generally applied as a liquid by boat through the surface or an underwater drip station, depending on the size and flow of the treatment area. For partial water body treatments, fluridone is typically applied as time-release pellets. A targeted, partial-lake treatment will result in less herbicide to the lake, reduced treatment costs, and fewer non-target impacts. The herbicide must be applied following all directions on the EPA approved label and will not exceed the maximum annual cumulative concentration (150 ppb). Consultation with individuals from pesticide companies can help to identify the appropriate treatment prescription for a given infestation.

Fluridone effect on Elodea.

Fluridone is a slow-acting systemic herbicide used to control *Elodea*, hydrilla, Eurasian watermilfoil and other underwater plants. Like other systemic herbicides, fluridone is absorbed from water by plant shoots and from the hydrosoil by the roots of aquatic vascular plants (Marquis et al. 1981). The susceptibility of a plant to fluridone is associated with its uptake rate and rate of translocation. Fluridone interferes with the synthesis of RNA, proteins, and carotenoid pigments in plants, and disrupts photosynthesis of targeted plants. In particular, carotene production is inhibited, preventing carbohydrate formulation necessary to sustain the plant. Fluridone symptoms on submersed aquatic plants appear as progressive albescence of young leaves followed by leaf necrosis, initially appearing 3—6 days after application (McCowen et al. 1979), but requiring 45—90 days for optimal lethality. Eventually, aquatic plants gradually sink to the bottom and the amount of open water increases (McCowen et al. 1979). Fluridone does not affect water quality parameters such as pH, dissolved oxygen, color, dissolved solids, hardness, nitrate nitrogen, total phosphates, and turbidity (McCowen et al. 1979).

Although fluridone is considered to be a broad spectrum herbicide, when used at concentrations $\leq$ 150 ppb, it is effective for removing *Elodea*, which is considered highly susceptible to the effects of fluridone at low concentrations (McCorkelle et al. 1992). At higher concentrations, fluridone controls a broad spectrum of annual grass and broadleaf weeds, but not algae (Bartels et al. 1978, Berard et al. 1978, McCowen et al. 1979, Marquis et al. 1981). Fluridone has been field tested on a variety of invasive or non-native aquatic plants including salvinia (*Salvinia* spp.), bladderwort (*Utriculata* spp.), Eurasian watermilfoil (*Myriophyllum*

spicatum), coontail (*Ceratophyllum demersum*), pondweeds (*Potamogeton* spp.), cattail (*Typha* spp.), horsetail (*Equisetum* spp.), duckweed (*Lemna* spp.), fanwort (*Cabomba caroliniana*), vallisneria (*Vallisneria* spp.), water hyacinth (*Eichornia crassipes*), hydrilla (*Hydrilla* spp.) and *Elodea* (*Elodea* spp.)(McCowen et al. 1979). Because fluridone does not work on algae, ponds or water bodies with high algal concentrations should not be treated with this herbicide as the algal coating on *Elodea* can prevent herbicide absorption. Field tests in mixed invasive and native submerged aquatic vegetation showed reduction in invasive populations with native plant cover retention of approximately 70% (Madsen et al. 2002). Treatments of Michigan lakes resulted in drastic reductions in invasive Eurasian watermilfoil, increases in native submerged aquatic vegetation, and increases in size and abundance of native fish populations (Schneider 2000).

Fluridone is removed from treated water by degradation from sunlight (photolysis), adsorption to sediments, and absorption by plants. In partially-treated water bodies, dilution reduces the level of the herbicide more rapidly following application. In field studies, fluridone (various formulations) decreased logarithmically with time after treatment and approached zero detectable presence 64—69 days after treatment (Langeland and Warner 1986), though in Alaska fluridone has been seen to persist for longer durations (D. Coleman, personal communication). In other studies, fluridone levels decreased rapidly to a value below detection limits after 60 days in various parts of the water column, with a half-life ≤ 7—21 days (Kamarianos et al. 1989, Osborne et al. 1989, Muir et al. 1980, McCowen et al. 1979).
Fluridone can persist in hydrosoils (sediments) with a half-life exceeding one year (Muir et al. 1980). Fluridone can persist for months (over the winter) in the water column when applied in autumn due to lower water temperatures and low light levels. This attribute has resulted in fluridone applications in the fall in the Midwest where lakes freeze (WADOE 2000).

Diquat

Growth suppression of *Elodea* infestations in the nearshore littoral zone (<10' depth) may be accomplished with diquat dibromide (diquat), to minimize plant fragmentation and decrease the likelihood of further spread within infested water bodies or *Elodea*-free systems. Diquat is a nonselective, contact algicide, defoliant, desiccant and herbicide that is best applied when turbidity is low, and when native plant biomass is low (e.g., before greenup in spring).

Several companies selling diquat product have registered their product with ADEC. Diquat is formulated as 6,7-dihydrodipyrido (1,2-a: 2',1'-c) pyrazinediium dibromide (Cochran at al. 1994). It is a general use herbicide typically used to control broadleaf and grassy weeds in non-crop and aquatic areas (USEPA 2002). It is an organic solid of colorless or yellow crystals, or dark red-brown in water solution, and is highly soluble in water. In the presence of strong oxidizers, diquat may pose a fire and explosion hazard. Diquat is a quick-acting contact herbicide, causing injury only to the parts of the plant to which it is applied (Hayes and Laws 1990). Diquat is absorbed by plant leaves where it interferes with cell respiration and prevents uptake of oxygen.

The Maximum Contaminant Level (MCL) is 0.02 milligrams per liter (mg/L) or 20 ppb for diquat (USEPA 2002). Diquat residue studies suggest that diquat is not persistent in water, as it binds to suspended particles in the water, taken up by plants, or binds to bottom sediments. The half-life is less than 48 hours in water. Affected plants decompose and release diquat, which is then degraded by microbes, photodegraded by sunlight, or adsorbed to sediment particles. Adsorbed sediment diquat is also degraded by microbial activity, although diquat has been found

in the bottom soil of pools and ponds four years after application. Adsorption rates are highest in loam, sandy clay loam, and sandy loam soils or sediments (Cochran et al. 1994). Granular activated carbon can be used to remove diquat to below MCL.

Diquat treatment alone has not been used for complete *Elodea* eradication, as contact herbicides only affect the portion of a plant that physically comes into contact with the chemical. They do not move through a plant's vascular tissues the way systemic herbicides do. As such, they are not effective in killing a plant's root system (*Elodea* subcommittee of the Kenai Peninsula Cooperative Weed Management Area, 2019). However, diquat herbicides are less expensive than fluridone herbicides. Thus, diquat has been used in Alaska to control *Elodea* infestations and reduce potential for spread via fragments while funding is secured to pursue further eradication efforts.

Fluridone + Diquat Combination

The one-time use of diquat, in combination with multiple applications of fluridone, is an efficient and effective cocktail for minimizing the risk of further spread of *Elodea* within a short period. The application of diquat can manage dispersal risk, and could be considered in any newly infested water body with vectors such as public boat launches, resident floatplanes, and high migratory bird use or high-volume water flow. Recognizing that eradication will not be likely without subsequent fluridone applications.

Negative features of chemical treatments

Minor impacts to native vegetation may be seen as a result of chemical treatment. Since both fluridone and diquat are herbicides they are both expected to negatively impact susceptible native vegetation to some degree. The impacts of chemical treatment must be weighed against the impacts that submersed aquatic invasive species would have if other actions (including no action) were taken.

Floridone is selective but has the potential to impact the following common native vegetation: *Lemna minor,* Ruppia *maritima, Nuphar luteum, Nymphaea spp., Utricularia spp*., *Myriophyllum spp*., *Potamogeton spp*., *Ceratophyllum demersum,* and *Najas spp*. (SePRO 2015, SePRO 2017, SePRO 2019a,b,c). Fluridone treatment may result in removal of these species from a treated water body. Seeding or transplanting native species to treated water bodies may be necessary if monitoring indicates that removal of native species has occurred.

Diquat is non-selective and has the potential to impact all vegetation it contacts. It is most likely to negatively impact the following common native vegetation: *Lemna spp., Typha spp*., *Utricularia spp*., *Myriophyllum spp*., *Potamogeton spp*., *Ceratophyllum demersum,* and *Najas spp*. (Syngenta 2009). Diquat is never applied to an entire water body and does not typically kill rooted vegetation. In the event native species are negatively impacted during treatment it is likely that they will recover or be replaced by native species that were outside the treatment area and not impacted.

Minor impacts to non-target macrophytes were observed after chemical treatments in Beck Lake and Daniels Lake. Lily pads (*Nuphar polyspealum*) exhibited earlier onset of leaf senescence and chlorosis than plants in untreated lakes. However, the abundance of other native macrophytes increased after treatment (Sethi et al. 2017). Field tests in mixed invasive and native submersed aquatic vegetation, conducted in Michigan lakes treated with approximately 5ppb fluridone and spot treated with diquat, showed reduction in invasive populations with native plant cover retention of approximately 70%. Submersed plant species diversity also increased after treatment (Madsen et al. 2002).

Step 5: Evaluate Response Options

Lastly, diaquat has been shown to bind tightly to sediments, especially those containing clay minerals, and persist for long periods of time (Washington Department of Ecology, 2002). Diquat adsorbed to clay minerals will not be biologically available to plants or microorganisms (Weber and Weed 1974). This would prevent diqaut from inhibiting plant growth but also slows its microbial degradation.

The following information was excerpted and revised from:
Beattie, L., Everett, C., Jacobs, L., Million, B., Rich, C., Rogers, J., Spellman, B., and T.L. Wurtz. 2011. Control Options for *Elodea* spp. in the Chena Slough near Fairbanks, Alaska.

And from the Programmatic Environmental Assessment of the United States Fish and Wildlife Service Management Strategy for *Elodea* and other Submersed Aquatic Invasive Plants in the Alaska Region, 2020.

More detail about the impacts that chemical and non-chemical treatments may have on the environment can be found here: Integrated Pest Management Plan for Eradicating *Elodea* from the Kenai Peninsula, prepared by the *Elodea* subcommittee of the Kenai Peninsula Cooperative Weed Management Area, 2019).

Tool 5.2. Response Options Decision Template

This template provides a framework for evaluating response options and determining the most appropriate options for a given scenario.

1. Examine all feasible response options:

Based on the information gathered in the site specific assessment, list all feasible response actions:

Examples of potential actions to consider include, but are not limited to: chemical controls, containment, mechanical controls, outreach to user groups/targeted signage

2. Decision making: comparing options

Take the response options that were determined to be feasible and complete the following table for each option.

Criteria	Response Option 1	Response Option 2	Response Option 3
What resources would be needed to implement this strategy?	☐ Personnel ☐ Boats ☐ SCUBA ☐ Barriers ☐ Pesticides and applicators ☐ Transportation ☐ Funding	☐ Personnel ☐ Boats ☐ SCUBA ☐ Barriers ☐ Pesticides and applicators ☐ Transportation ☐ Funding	☐ Personnel ☐ Boats ☐ SCUBA ☐ Barriers ☐ Pesticides and applicators ☐ Transportation ☐ Funding
List any other resources that may be needed to address this infestation			
Of the needed resources, which are readily available?			
What is the cost estimate for this response option?			
Do any regulations or permitting restrictions apply to this action?			

Step 5: Evaluate Response Options

How feasible is it to meet your response objectives using this response option?			
What precedents exist for using this eradication/control methodology?			

Potential sources of funding:

Internal

- ☐ Fisheries and Aquatic Conservation Program's Aquatic Invasive Species Allocation
- ☐ National Wildlife Refuge System's Invasive Species Base Allocation
- ☐ National Fish Habitat Partnership Allocations
- ☐ Tribal Wildlife Grant for projects occurring on federally recognized tribal lands
- ☐ Wildlife and Sportfish Restoration Allocation

External

- ☐ Other US Department of Interior, Department of Agriculture, State of Alaska agencies
- ☐ Alaska Sustainable Salmon Fund
- ☐ National Fish and Wildlife Fund
- ☐ Borough Assemblies, local governments, corporate donations

Tool 5.3. Special Considerations for Federally Designated Wilderness

The Wilderness Act of 1964 established the National Wilderness Preservation System (Wilderness), which today has grown to more than 104 million acres, approximately half of which (~57 million acres) are located in Alaska. The Service manages 21 designated Wilderness areas totaling approximately 18.6 million acres on 10 Refuge units in Alaska.

Table 5.3. Wilderness areas managed by the Service in the Alaska Region.

WILDERNESS AREA	SIZE (ACRES)	REFUGE UNIT
Aleutian Islands (1980)	1,300,000.00	Alaska Maritime
Bering Sea (1970)	81,340.00	Alaska Maritime
Bogoslof (1970)	175.00	Alaska Maritime
Chamisso (1975)	455.00	Alaska Maritime
Forrester Island (1970)	2,832.00	Alaska Maritime
Hazy Islands (1970)	32.00	Alaska Maritime
Semidi (1980)	250,000.00	Alaska Maritime
Simeonof (1976)	25,855.00	Alaska Maritime
St. Lazaria (1970)	65.00	Alaska Maritime
Tuxedni (1970)	5,566.00	Alaska Maritime
Unimak (1980)	910,000.00	Alaska Maritime
Mollie Beattie (1980)	8,000,000.00	Arctic NWR
Becharof (1980)	400,000.00	Becharof NWR
Innoko (1980)	1,240,000.00	Innoko NWR
Izembek (1980)	307,981.76	Izembek NWR
Kenai (1980)	1,354,247.00	Kenai NWR
Koyukuk (1980)	400,000.00	Koyukuk NWR
Selawik (1980)	240,000.00	Selawik NWR
Togiak (1980)	2,270,799.00	Togiak NWR
Andreafsky (1980)	1,300,000.00	Yukon Delta NWR
Nunivak (1980)	600,000.00	Yukon Delta NWR

Step 5: Evaluate Response Options

The Service has developed guidelines for addressing invasive species in Wilderness areas. **Section 2.19** of the guidelines states the following:

"May the Service control invasive species, pests, and diseases in Wilderness?
The Service will follow an IPM approach to prevent, control, or eradicate invasive species, pests, and diseases subject to the criteria in section 2.16 (also see the Refuge program's biological integrity policy at 601 FW 3.16 for detail about managing non-native species to maintain and restore biological integrity, diversity, and environmental health). The Service will determine appropriate IPM procedures through a Minimum Requirements Analysis (MRA) and document them in the Refuge's Wilderness Stewardship Plan (WSP). If the approved IPM plan determines that chemical or biological treatments are necessary, we will only use agents that have the least impact on nontarget species and on the wilderness environment in compliance with current Service policy. We may make an exception to introducing species (see section 2.17) for Service-approved, nonnative biological control agents."

- Pre-planning efforts outlined in Step 1 should have already been undertaken to facilitate the development of the MRA. In Alaska, all actions taken in Wilderness require an MRA. A short-form MRA has been developed for use only in Alaska. Contact the Service Alaska Wilderness Coordinator for this form: **Roger Kaye, roger_kaye@fws.gov**. Instructions from completing the short form MRA are available in Appendix B.
- If the short-form MRA is not appropriate, particularly if managers are considering a use prohibited by Section 4(c) of the Wilderness Act of 1964, use the Arthur Carhart National Wilderness Training Center's Minimum Requirements Decision Guide (Carhart standard form).
    - The Minimum Requirements Decision Guide can facilitate the completion of the MRA. This guide can help to identify if actions are warranted in Wilderness. Things to consider include whether or not options outside of Wilderness can be taken to address a situation, and if actions are necessary by meeting the following criteria:
        1) Is action necessary to satisfy valid existing rights or a special provision in Wilderness legislation?
        2) Is action necessary to meet the requirements of other federal laws?
        3) Is action necessary to preserve one or more of the qualities of wilderness character: Untrammeled, Undeveloped, Natural, Solitude or Primitive and Unconfined Recreation, or Other Features of Value that reflect the character of this area?

An example Minimum Requirements Analysis case study for non-native invasive plants can be found here, with additional detail. This Alaska Supplement provides assistance in adapting the use of the Minimum Requirements Decision Guide to Alaska's Wilderness units with respect to the Wilderness Act of 1964 and the Alaska National Interest Lands Conservation Act.

□ STEP 6: DEVELOP AND IMPLEMENT INCIDENT RESPONSE FRAMEWORK

This step provides the framework to develop an incident response plan, which is a systematic process to direct and enact response actions while ensuring all involved entities work together and all regulatory permitting needs are met. Several agencies and organizations will likely be involved in implementing the incident response plan, and should work together to develop this plan.

Step 6 Strategic Tasks

1) Define a clear management goal.
    a. The goal of rapid response efforts should be eradication of newly identified infestations. In some cases this may not be feasible and alternative goals may be pursued. All members of the response team should be in agreement with the management goal for the rapid response plan.
    b. In the event that multiple infestations are present, the Invasive Plant Inventory and Early Detection Prioritization Tool can facilitate prioritization of actions.
2) Draw from existing management plans and eradication projects to inform further actions.
    a. Past *Elodea* eradication projects have been successful across the state, and have used an integrated pest management approach.
    b. Drawing from established *Elodea* eradication plans to direct response actions will increase efficiency (see Tool 6.1 for examples).
3) Review existing environmental documents and acquire regulatory permits (see Tool 6.2 – 6.5). Moving quickly through this step is integral to rapid response.
    a. Identify a qualified individual to oversee all permitting.
    b. If pesticides will be used on Service managed lands, or if the Service provides funding or personnel for pesticide application, a Service Pesticide Use Proposal must be completed. An Endangered Species Act (ESA) Section 7 Consultation may be required.
    c. Ensure that all actions are compliant with the National Environmental Policy Act. In 2020, a Programmatic Environmental Analysis (EA) for Service activities was developed. This EA analyzes the impacts of certain *Elodea* response options in Alaska. Carefully consider if the Programmatic EA applies to the current scenario, and document the decision to undertake actions under the Programmatic EA or conduct additional analyses if applicable.
    d. Most chemical treatment actions will fall under the 2019 General *Elodea* Permit. ADNR must be the lead agency for pesticide applications that utilize a General Permit.
4) Define the timeline for the response.
    a. Taking into account the required permits, time of year, and logistics of the site, identify the ideal timing for enacting response actions.
    b. All partners and the broader public should be made aware of this timeline.
5) Use the framework provided in Tool 6.6 to develop a response plan. This will include identifying the best qualified individuals to complete the on-the-ground response, as well as identifying/ confirming available resources, among other considerations.

Step 6: Implement Incident Response

Step 6 Roles and Responsibilities

- If the Programmatic EA does not cover the planned response, the NEPA process should be completed by the managing office (Refuge or FWCO). Relevant documents should be submitted to the Regional Invasive Species Program Coordinator and the Regional IPM Coordinator for review.
- The Regional IPM coordinator can also provide insight into the Service's Pesticide Use Proposal process if needed.

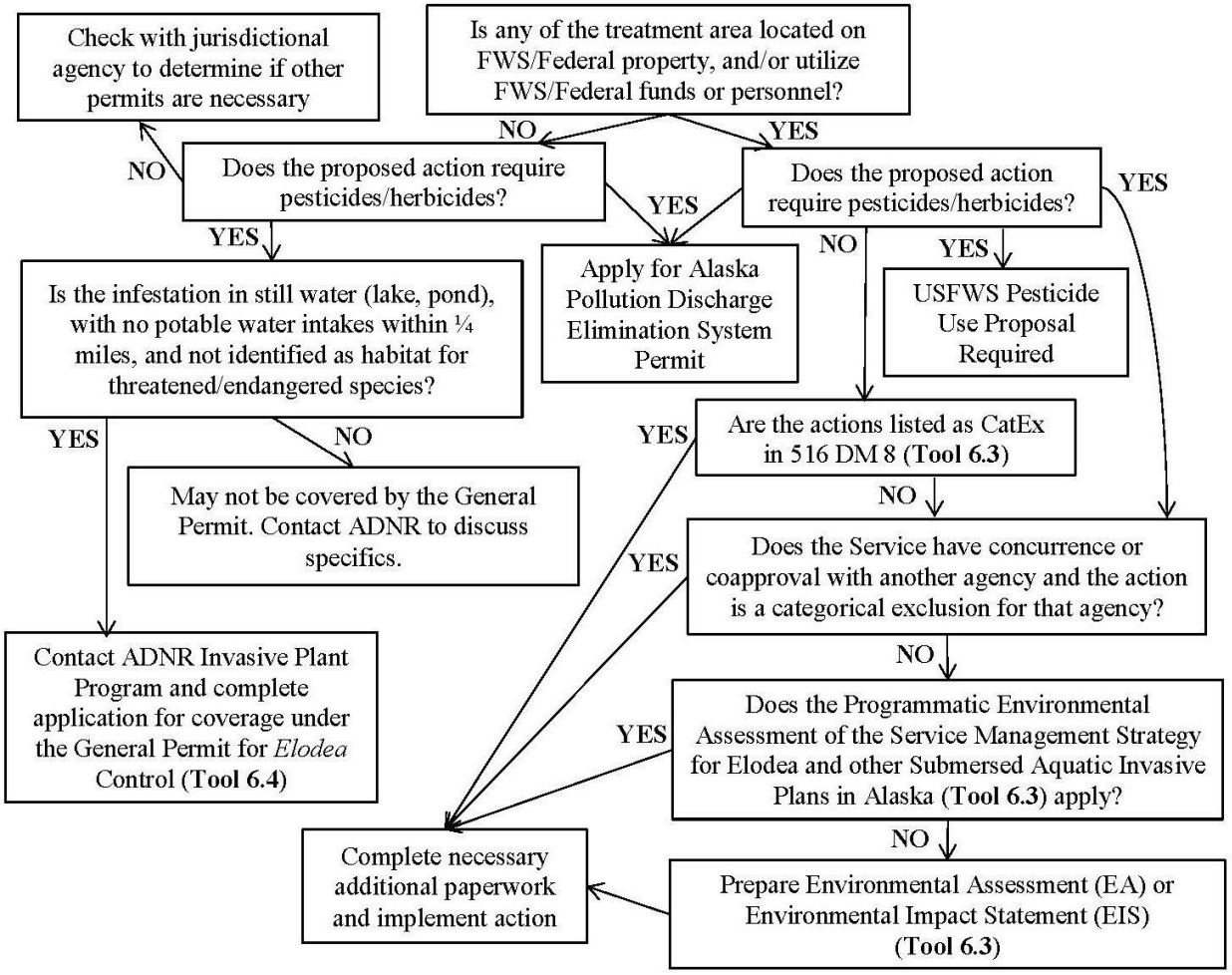
Step 6 Tools

Tool 6.1. Integrated Pest Management Plans for Eradicating *Elodea* in Alaska

Elodea Subcommittee of the Kenai Peninsula Cooperative Weed Management Area. Integrated Pest Management Plan for Eradication *Elodea* from the Kenai Peninsula, 2019.

Fairbanks *Elodea* Steering Committee. Integrated Pest Management Plan for for Eradicating *Elodea* from Interior Alaska, 2017 (draft)

Tool 6.2. Regulatory Permitting Flowchart



Tool 6.3. National Environmental Policy Act (NEPA)

Careful analysis should be done to determine if the Programmatic Environmental Analysis (EA) applies to the given scenario. The final Programmatic EA and Finding of No Significant Impact (FONSI) can be found on the Service Alaska Region Invasive Species website.

All decisions should be documented. If the Programmatic EA does not apply to the given scenario, alternative NEPA analyses will need to be completed. See Appendix A for further detail regarding the NEPA process.

Tool 6.4. State and Federal Pesticide Use Permits and Proposals

Oftentimes the proposed action for treating *Elodea* infestations is the use of pesticides (herbicides). In this case, permits must be obtained from the appropriate state and federal agencies. Also note, that any individuals physically carrying out the application of pesticides must have undergone the ADEC Certified Pesticide Applicator Training and have the aquatic herbicide endorsement in Tool 1.2.

Service Pesticide Use Proposals

If pesticides are used on Service property, purchased with Service funds, or completed by Service personnel, a Service employee must complete a Pesticide Use Proposal (PUP). Completion of this PUP can be done by the appropriate personnel through the online portal system. A Service PUP may require an Endangered Species Act (ESA) consultation if it could impact a threatened or endangered species. See this link for additional information and instructions for completing the Service Pesticide Use Proposal. For additional information or assistance with the PUP system, contact the Service Regional Integrated Pest Management Coordinator:

Role	Name	Contact Information
Regional Integrated Pest Management Coordinator	Angela Matz	angela_matz@fws.gov (907) 786-3483

State of Alaska Pesticide Use Permits

The following are the conditions under which a Pesticide Use Permit ADEC are required: if pesticides are going to be applied by aircraft, to water, or are being carried out by a state, borough or city agency. Note, additional federal regulations would apply if aerial chemical treatments are pursued, but are not included in this document.

For *Elodea* infestations located in non-moving waters (lakes and ponds) with minimal or no outflow or turnover, no potable water intakes within ¼ of a mile, and at sites that do not provide habitat for threatened or endangered species, the General Permit to Apply Pesticides for the Control of *Elodea* (19-GP-*ELODEA*) is applicable. In other cases (such as in moving waters), this permit may also apply but additional information and forms may be required. Contact ADNR for further detail. This permit applies only to ten approved products, including liquid and pelleted formulations of fluridone, and liquid formulations of Diquat dibromide. The project must go through the ADNR Invasive Plant Program. Contact the ADNR Invasive Plant and Agricultural Pest Coordinator:

Step 6: Implement Incident Response

Role	Name	Contact Information
Invasive Plant and Agricultural Pest Coordinator	Daniel Coleman	daniel.coleman@alask.gov (907) 754-8721

Further detail regarding products covered under the General *Elodea* Permit, and other detail, can be found here. Additionally, if pesticides will be applied to water, an Alaska Discharge Elimination Permit is required from ADEC. Applications can be found here. If additional help is needed contact ADEC:

Role	Name	Contact Information
Pesticide Program Manager	Karin Hendrickson	Karin.hendrickson@alask.gov (907) 376-1856

Tool 6.5. Endangered Species Act Section 7 Consultation

The Endangered Species Act (ESA) directs all Federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the ESA. Section 7 of the ESA, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species.

Informal Consultation

Under Section 7, Federal agencies (including the Service) must consult with the Service when any action the agency carries out, funds, or authorizes (such as through a permit) *may affect* a listed endangered or threatened species. This process usually begins as informal consultation. A Federal agency, in the early stages of project planning, approaches the Service and requests informal consultation. Discussions between the two agencies may include what types of listed species may occur in the proposed action area, and what effect the proposed action may have on those species.

If the Federal agency, after discussions with the Service, determines that the proposed action is not likely to affect any listed species in the project area, and if the Service concurs, the informal consultation is complete and the proposed project moves ahead. If it appears that the agency's action may affect a listed species, that agency may then prepare a biological assessment to assist in its determination of the project's effect on a species.

Formal Consultation and the Biological Opinion

When a Federal agency determines, through a biological assessment or other review, that its action is *likely to adversely affect* a listed species, the agency submits to the Service a request for formal consultation. During formal consultation, the Service and the agency share information about the proposed project and the species likely to be affected. Formal consultation may last up to 90 days, after which the Service will prepare a biological opinion on whether the proposed activity will *jeopardize* the continued existence of a listed species. The Service has 45 days after completion of formal consultation to write the opinion.

In making a determination on whether an action will result in jeopardy, the Service begins by looking at the current status of the species, or "baseline." Added to the baseline are the

various effects – direct, indirect, interrelated, and interdependent – of the proposed Federal action. The Service also examines the cumulative effects of other non-Federal actions that may occur in the action area, including state, Alaska Native, local, or private activities that are reasonably certain to occur in the project area.
Further information about the ESA Section 7 consultation can be found at this link. Information from: https://www.fws.gov/endangered/laws-policies/section-7.html and https://www.fws.gov/midwest/endangered/section7/s7process/7a2process.html

Contact the Service Endangered Species Coordinator for the Alaska Region for additional help or direction regarding Section 7 consultation as needed.

Role	Name	Contact Information
Regional Endangered Species Program Coordinator	Drew Crane	drew_crane@fws.gov (907) 786-3323

Tool 6.6. Incident Response Plan Framework

List the goals and objectives for the response to this infestation. Objectives should be specific, achievable, measurable, relevant and flexible.

The primary objective of rapid response actions should be eradication whenever possible. However, eradication may not be feasible. In such cases, alternative objectives could include immediate actions taken to:

- Prevent further spread
- Contain *Elodea* in known areas of infestation
- Protect human safety

Note, however, that ongoing management for chronic infestations is not a rapid response action, and should not be the goal listed above.

Infestation location

Waterbody name:
Nearest town/city:
GPS Coordinates of wetland:

Extent of infestation

What is the approximate size of the impacted area?
Is the water body connected to any other body of water by in/out flows, canals, etc.?
Is the water body used for recreational activities? List activities (ex: fishing, float planes, etc.)
Are there impediments to accessing the site?

Current Actions

Are there any response actions currently taking place at the infestation site? (Ex: treatment for other invasive species, containment, control activities).

Step 6: Implement Incident Response

Planned actions

What response action was chosen for this infestation? What resources are needed for the response?
What resources are readily available?
For resources not readily available, how can they be obtained?
What actions are needed to limit non-target impacts?

Permitting and regulations (select those that apply)

☐ ADEC PUP required, General Permit Applies? Y/N
☐ Service PUP required
☐ CatEx
☐ Programmatic EA
☐ Section 7 Consultation
☐ Minimum Requirements Analysis (for infestations in Wilderness)
☐ Other

Personnel

Who will be the responsible lead(s) in charge of overseeing the entire response action (should be Response Plan Implementation Coordinator established in Step 3)?

	Name	**Agency**	**Contact Info.**	**Role**
1)				
2)				

Who will be responsible for acquiring the needed resources?

	Name	**Agency**	**Contact Info.**	**Role**
1)				
2)				

Who will be responsible for overseeing outreach and communication to shareholders, partners and the public (should be Public Communication Coordinator established in Step 3)?

	Name	**Agency**	**Contact Info.**	**Role**
1)				
2)				

If necessary, who will be responsible for obtaining permits?

	Name	**Agency**	**Contact Info.**	**Role**
1)				
2)				

List other individuals directly involved in the response and their roles:

	Name	**Agency**	**Contact Info.**	**Role**
1)				
2)				

Step 6: Implement Incident Response

Funding

What is the estimated level of funding needed to implement this rapid response?
What funding sources can be used to support this response effort?

Timeline

When will permits be applied for?
When are permits anticipated to be obtained? Goal date for implementing action(s)?

□ STEP 7: EFFECTIVENESS MONITORING

After the response actions have been taken, continued monitoring of the affected and surrounding areas will be necessary to determine efficacy of the response and observe any non-target effects. This step directs these actions.

Step 7 Strategic Tasks

1) Assign leadership to direct long-term monitoring efforts.
    a. The Response Plan Implementation Coordinator may or may not be the individual in charge of long-term monitoring efforts.
    b. The incident response team should identify individual(s) to direct ongoing monitoring and control. Turning over leadership of these efforts to new individuals should occur as applicable.
2) Establish a long-term monitoring plan for areas that have undergone response actions.
    a. This information may be outlined in a larger Integrated Pest Management Plan if one is developed or already exists for the affected area. This plan should include monitoring of efficacy, as well as estimates of non-target effects of treatment (example provided in Tool 7.1).
    b. Monitoring efforts should include focus on areas that have undergone response actions, but may also include monitoring or early detection efforts in surrounding areas to verify if the infestation has spread to adjacent locations.
3) Develop a communication plan for long-term monitoring efforts.
    a. The Western Regional Panel has established guidelines for categorizing if eradication efforts are successful. These guidelines were developed for invasive mussels, but are relevant to other AIS. According to these guidelines, a water body must have no re-infestation for 5 successive years for an eradication effort to be deemed successful. The Alaska Invasive Species Partnership (AKISP) is currently in discussions to determine the criteria for labeling water bodies, and may choose to adopt the criteria put forth by the Western Regional Panel, or a modified set of criteria.
    b. No water body designations will be made without consensus from local, state and federal partners.

Step 7 Roles and Responsibilities

- The leadership in charge of long term monitoring efforts should also establish a plan for continued communication with partners and the Service Regional Office, as appropriate.
- Ongoing communication to keep the public apprised of ongoing efforts and outcomes will likely be necessary. A public communication coordinator may continue to be assigned to this task.

Step 7 Tools

Tool 7.1. Example Integrated Management Plan

Prior *Elodea* Integrated Management Plans can serve as a foundation on which to develop similar ongoing effectiveness monitoring and control plans. For example, this IPM Plan from Fairbanks may serve as a basis from which similar plans can be developed.

REFERENCES

Barrat-Segretain, M., A. Elger, P. Sagnes and S. Puijalon. 2002. Comparison of three life-history traits of invasive *Elodea canadensis* Michx. and *Elodea nuttallii* (Planch.) H. St. John. Aquatic Botany 74:299-313.

Bartels, P. and C. Watson. 1978. Inhibition of carotenoid synthesis by fluridone and norflurazon. Weed Science. 26(2):198-203.

Beattie, L., Everett, C., Jacobs, L., Million, B., Rich, C., Rogers, J., Spellman, B., and T.L. Wurtz. 2011. Control Options for *Elodea* spp. in the Chena Slough near Fairbanks, Alaska.

Berard, D., D. Rainey and C. Lin. 1978. Absorption, translocation, and metabolism of fluridone in selected crop species. Weed Science. 26(3):252-254.

Bimber, K. L., R. W. Boenig and M. L. Sharma. 1976. Respiratory stress in yellow perch induced by subtoxic concentrations of diquat. Ohio Journal of Science 76(2):87-90.

Bureau of Land Management U.S. Department of the Interior Alaska State Office. 2010. BLM-Alaska Invasive Species Management.

Bowmer, K. H., S. W. L. Jacobs and G. R. and Sainty. 1995. Identification, biology and management of *Elodea*canadensis, Hydrocharitaceae. Journal of Aquatic Plant Management 33:13-19.

Carim, K. J., T. Padgett-Stewart, T. M. Wilcox, M.K. Young, K.S. McKelvey, and M.K. Schwartz. (2015) Protocol for collecting eDNA samples from streams. U.S.D.A. Forest Service, National Genomics Center for Wildlife and Fish Conservation. V2.3 (July 2015).

Catlin, P. M. and W. Wojtas. 1985. The waterweeds (*Elodea* and Egeria, Hydrocharitaceae) in Canada. Canadian Journal of Botany 64:1525-1541.

Centre for Aquatic Plant Management (CAPM). 2004. Information Sheet 25: *Elodea* nuttallii, Nuttall's Pondweed. http://www.nercwallingford.ac.uk/research/capm/pdf%20files/25%20*Elodea*%20nuttallii.pdf. Access Date: 04/25/2013.

Cochran, R. C. (principal) et al. 1994. Diquat dibromide risk characterization document. Medical Toxicology and Worker Health and Safety Branches, Department of Pesticide Regulation, California Environmental Protection Agency.

Cook, C. D. K. and K. Urmi-Konig. 1985. A revision of the genus *Elodea* (Hydrocharitaceae). Aquatic Botany 21:111-156.

Eakin, H. L., and J. W. Barko. 1995. Evaluation of the effect of benthic barrier placement on sediment physical and chemical conditions. Technical Report A-95-2. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Elodea subcommittee of the Kenai Peninsula Cooperative Weed Management Area. 2019. Integrated Pest Management Plan for Eradication *Elodea* from the Kenai Peninsula.

Fairbanks *Elodea* Steering Committee. 2017. Integrated Pest Management Plan for Eradication *Elodea* from Water Bodies in Interior Alaska.

Gosselin, R. E., et al. 1984. Clinical toxicology of commercial products. Fifth edition. Baltimore, MD: Williams and Wilkins.

Gunnison, D., and J. W. Barko. 1992. Factors influencing gas evolution beneath a benthic barrier. Journal of Aquatic Plant Management 30: 23-28.

Hamelink, J., D. Buckler, F. Mayer, D. Palawski and H. Sanders. 1986. Toxicity of fluridone to aquatic invertebrates and fish. Environmental Toxicology and Chemistry. 5:87-94.

References

Hayes, W.J. and E.R. Laws (ed.). 1990. Handbook of Pesticide Toxicology, Vol. 3, Classes of Pesticides. Academic Press, Inc., NY.

Heikkinen, R. K., N. Leikola, S. Fronzek, R. Lampinen, and H. Toivonen. 2009. Predicting distribution patterns and recent northward range shift of an invasive aquatic plant: *Elodea* canadensis in Europe. BioRisk 2:1-32.

Kamarianos, A., J. Altiparmakis, X. Karamanlis, D. Kufidis, T. Kousouris, G. Fotis, and S. Kilikidis. 1989. Experimental evaluation of fluridone effectiveness on fish productive aquatic ecosystems. Journal of Aquatic Plant Management 27:24-26.

Kenaga, D. 1992. The impact of the herbicide Sonar on the aquatic plant community in 21 Michigan lakes. Michigan DNR publication.

Langeland, K. and J. Warner. 1986. Persistence of diquat, endothall, and fluridone in ponds. Journal of Aquatic Plant Management. 24:43-46.

Luizza, M.E., P.H. Evangelista, C.S. Jarnevich, A. West and H. Stewart. 2016. Integrating subsistence practice and species distribution modeling: assessing invasive *Elodea*'s potential impact on Native Alaskan subsistence of Chinook salmon and whitefish. Environmental Management 58: 144-163.

Madsen, J. D., K. D. Getsinger, R. M. Stewart and C. S. Owens. 2002. Whole lake fluridone treatments for selective control of Eurasian watermilfoil: II. Impacts on submersed plant communities. Lake and Reservoir Management 18(3):191-200.

Maine Department of Environmental Protection. 2006. Rapid Response Plan for Invasive Aquatic Plants, Fish, and other Fauna.

ManaPennack, 1989. Freshwater Invertebrates of the United States, John Willey and Sons and Company, New York.

Marquis, L., R. Comes and C. Yang. 1981. Absorption and translocation of fluridone and glyphosate in submersed vascular plants. Weed Science. 29(2):229-236.

McCowen, M., C. Young, S. West, S. Parka and W. Arnold. 1979. Fluridone, a new herbicide for aquatic plant management. Journal of Aquatic Plant Management 17:27-30.

McCorkelle, G., G.R. Sainty and K.H. Bowmer. 1992a. Evaluation of Sonar (Fluridone) for aquatic plant management in Australia. Final report for Dow Elanco Australia Ltd, Consultancy Report No 92/2. CSIRO Division of Water Resources, Griffith NSW. 58pp.

Mid-Atlantic Panel on Aquatic Invasive Species. 2009. Rapid Response Planning for Aquatic Invasive Species: A Maryland Example.

Muir, D., N. Grift, A. Blouw and W. Lockhart. 1980. Persistence of fluridone in small ponds. Journal of Environmental Quality 9(1):151-156.

Muir, D., N. Grift, B. Townsend, D. Metner, and W. Lockhart. 1982. Comparison of the uptake and bioconcentration of fluridone and terbutryn by rainbow trout and *Chrironomus tentans* in sediment and water systems. Archives of Environmental Contamination and Toxicology 11:595-602.

Nicholson, S. A. and R. J. Clerman. 1974. Toxicity of diquat to the custracean amphipod *Hyalella* from Chautauqua Lake. Environmental Letters 7(4):215-227.

New York State Department of Environmental Conservation Division of Lands and Forest, Invasive Species Coordination Section. 2016. Rapid Response for Invasive Species: Framework for Response.

Osborne, J., S. West, R. Cooper, and D. Schmitz. 1989. Fluridone and N-methylformamide residue determinations in ponds. Journal of Aquatic Plant Management 27:74-78.

References

Pedlow, C. L., E. D. Dibble, and K. D. Getsinger. 2006. Littoral habitat heterogeneity and shifts in plant composition relative to a fall whole-lake fluridone application in Perch Lake, Michigan. J. Aquat. Plant

Pennsylvania Invasive Species Council 2014. Rapid Response Plan and Procedures for Responding to Aquatic Invasive Species in Pennsylvania.

Sand-Jensen, K. 2000. An introduced vascular plant - the Canadian waterweed (*Elodea* canadensis). Pp. 96-100 in: Weidema, I. (ed.). Introduced species in the Nordic countries. Norden (The Nordic Council), Copenhagen, Denmark.

Sax, N. I. 1984. Dangerous properties of industrial materials. Sixth edition. NY: VanNostrand Reinhold Company.

Schneider, J. C. 2000. Evaluation of the effects of the herbicide Sonar on sport fish populations in Michigan lakes. Michigan Department of Natural Resources, Fisheries Technical Report No. 2000-2. 35 pp.

Shwoerer, T. 2017. Invasive *Elodea* threatens remote ecosystem services in Alaska: A spatially-explicit bioeconomic risk analysis. PhD Thesis, University of Alaska Fairbanks. https://pqdtopen.proquest.com/doc/1895115602.html?FMT=ABS.

Schwoerer, T., and J.M. Morton. 2018. Human dimensions of aquatic invasive species in Alaska: Lessons learned while integrating economics, management and biology to incentivize early detection and rapid response. Chapter 1 in Alaska: Economic, Environmental, and Social Issues, T. Lewis (ed.), Nova Science Publishers, Inc., NY. ISBN: 978-1-53613-437-7.

Sethi, S. A., Carey, M. P., Morton, J.M., Guerron-Orejuela, E., Decino, R., Willette, M., Boersma, J., Jablonski, J., and Anderson, C. 2017. Rapid response for invasive waterweeds at the arctic invasion front: Assessment of collateral impacts from herbicide treatments. Biological Conservation, 212: 300-319. https://doi.org/10.1016/j.biocon.2017.06.015

SePRO Corporation (SePRO). 2015. Sonar® A.S. (EPA Reg. No. 67690-4). Product Label. 11550 North Meridian Street Suite 600 Carmel, IN 46032.

SePRO Corporation (SePRO). 2017. Sonar® Genesis (EPA Reg. No. 67690-54). Product Label. 11550 North Meridian Street Suite 600 Carmel, IN 46032.

SePRO Corporation (SePRO). 2019a. SonarOne (EPA Reg. No. 67690-45). Product Label. 11550 North Meridian Street Suite 600 Carmel, IN 46032.

SePRO Corporation (SePRO). 2019b. Sonar® Q (EPA Reg. No. 67690-3). Product Label. 11550 North Meridian Street Suite 600 Carmel, IN 46032.

SePRO Corporation (SePRO). 2019c. Sonar® X PR (EPA Reg. No. 67690-12). Product Label. 11550 North Meridian Street Suite 600 Carmel, IN 46032.

Syngenta Crop Protection Inc. (Syngenta). 2009. REWARD® Landscape and Aquatic Herbicide (EPA Reg. No. 100-1091). Product Label. Post Office Box 18300, Greensboro, NC 27419.

Thiebaut, G. and F. Di Nino. 2009. Morphological variations of natural populations of an aquatic macrophyte *Elodea* nuttallii in their native and in their introduced ranges. Aquatic Invasions 4(2):311-320.

U.S. Army Corps of Engineers (USACE). 1997. Chena river watershed study – reconnaissance report. Department of the Army, U.S. Army Corps of Engineers, Anchorage, Alaska. Available from

http://www.tvwatershed.org/content/images/stories/reports_and_pubs/Chena%20River%

References

20Watershed%20Study.pdf (accessed 12 March 2011).

The U.S. Department of the Interior. 2016. Safeguarding America's lands and waters from invasive species: A national framework for early detection and rapid response, Washington D.C., 55p.

U. S. Environmental Protection Agency (USEPA). 1986. Pesticide Fact Sheet: Fluridone. No. 81, 5 pp.

U. S. Environmental Protection Agency (USEPA). 2002. Tolerance Reassessment Progress and Risk Management Decision (TRED) for Diquat Dibromide. http://www.epa.gov/oppsrrd1/reregistration/REDs/factsheets/diquat_tred_fs.htm.

The U.S. Fish and Wildlife Service. 2018. National Environmental Policy Act, Draft Reference Handbook.

Van Patten, D. 2005. Soil survey of western Kenai Peninsula Area, Alaska. National Cooperative Soil Survey. Available at: http://soildatamart.nrcs.usda.gov/Manuscripts/AK652/0/WesternKenai_manu.pdf.

Washington State Department of Ecology. 2002. Supplemental environment impact statement assessments of aquatic herbicides: DRAFT volume 6 – copper. Washington State Department of Ecology, Olympia, Washington. Available from http://www.ecy.wa.gov/programs/wq/pesticides/seis/copperrisk.pdf

Weber, J.B. and Weed, S.B. (2015). Effects of Soil on the Biological Activity of Pesticides. In Pesticides in Soil and Water, W.D. Guenzi (Ed.). doi:10.2136/1974.pesticides.c10

Wilson, D. C. and C. E. Bond. 1969. The effects of the herbicides diquat and dichlobenil (Casoron) on pond invertebrates. Part I. Acute toxicity. Transactions of the American Fisheries Society 98(3):438-443.

Wurtz, T. L., N. Lisuzzo, A. Batten and A. Larsen. 2013. Request for analysis of native status of *Elodea* in Alaska. Internal letter dated April 8th. USDA Forest Service, Alaska Region State and Private Forestry, Forest Health Protection, Fairbanks, AK.

Portions of this document were excerpted and modified from:

Maine Department of Environmental Protection. 2006. Rapid Response Plan for Invasive Aquatic Plants, Fish, and other Fauna.

Mid-Atlantic Panel on Aquatic Invasive Species. 2009. Rapid Response Planning for Aquatic Invasive Species: A Maryland Example.

New York State Department of Environmental Conservation Division of Lands and Forest, Invasive Species Coordination Section. 2016. Rapid Response for Invasive Species: Framework for Response.

Pennsylvania Invasive Species Council 2014. Rapid Response Plan and Procedures for Responding to Aquatic Invasive Species in Pennsylvania.

The U.S. Department of the Interior. 2016. Safeguarding America's lands and waters from invasive species: A national framework for early detection and rapid response, Washington D.C., 55p

APPENDICES

Appendix A. Detail Regarding the National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) applies when a Federal action would result in an effect on the environment or to human health, even when the effect would be beneficial, or when a Federal agency responds to an outside request for a permit or license. Prior to completing the following tool, review existing environmental documents. Currently, a Programmatic EA is being developed for actions taken to eradicate *Elodea* in Alaska. This EA will likely cover any proposed actions taken on Service lands or projects utilizing federal funds, though an EA supplement will be required to detail the specifics of the treatment area.

The level of environmental analysis required to comply with the NEPA will differ depending on the action proposed and the anticipated impacts. There are three different levels of NEPA documentation. These include:

- **Categorical Exclusion (CatEx)**. If the proposed action is covered by one of the listed categorical exclusions and no extraordinary circumstances apply, no further analysis under the NEPA is required. The Department and the Service have established a list of categorical exclusions that may cover the proposed action. The Department publishes the list of actions that are categorically excluded in 43 CFR 46.205 and 46.210. The Service's CatEx list is in 516 DM 8. It is not necessary to document that an action qualifies as a CatEx before implementing the action, but in certain circumstances it may be prudent to do so.
  DOI Categorical Exclusions can be found here.
  - **NOTE**: For an action where there may be some question about whether it qualifies as a CatEx, we recommend that you create a record that shows how the action qualifies as a CatEx—called an Environmental Action Statement (EAS). An EAS format can be found in: 550 FW 3
  - **NOTE**: If pesticide/herbicide treatment is the proposed action, then CatEX will not apply, and an EA or EIS will need to be pursued.
- **Environmental Assessment (EA).** If the proposed action is not covered by a CatEx, and the impacts of the proposed action are not likely to be controversial or to have a significant effect on the environment, than you should prepare an EA. If during preparation of the EA you find no significant impacts or impacts can be mitigated below a level of significance through mitigation commitments, then the NEPA review process ends with preparation of a Finding of No Significant Impact (FONSI), and you can implement the action. However, if analyses in an EA indicate that there will be significant or controversial impacts, then you must prepare an Environmental Impact Statement (EIS). If significant or controversial impacts from the proposed action are anticipated, doing an EIS from the beginning (and skipping the EA) may save time and resources.
- **Environmental Impact Statement (EIS).** If the action will have a significant impact on the environment or will be controversial, an EIS is required. Once you complete the EIS, you must develop and issue a Record of Decision that describes the alternative selected for implementation.

Additional detail regarding the NEPA (specific to Refuges) can be found here

The Service Draft NEPA Reference Handbook can be found here

NEPA guidance for working in cooperation with other agencies

Appendix A

In the Departmental Manual for the Service: 516 DM 8, Section 8.5 (C) (8) states [A Categorical Exclusion applies for]:

"*Actions where the Service has concurrence or coapproval with another agency and the action is a categorical exclusion for that agency. This would normally involve one Federal action or connected actions where the Service is a cooperating agency."*

Contact the Council for Environmental Quality or other NEPA professional for additional questions.

NEPA guidance in Emergency Situations

§ 46.150 Emergency responses.

This section applies only if the Responsible Official determines that an emergency exists that makes it necessary to take urgently needed actions before preparing an analysis and documentation in accordance with the provisions in subparts D and E of this part.

(a) The Responsible Official may take those actions necessary to control the immediate impacts of the emergency that are urgently needed to mitigate harm to life, property, or important natural, cultural, or historic resources. When taking such actions, the Responsible Official shall take into account the probable environmental consequences of these actions and mitigate foreseeable adverse environmental effects to the extent practical.

(b) The Responsible Official shall document in writing the determination that an emergency exists and describe the responsive action(s) taken at the time the emergency exists. The form of that documentation is within the discretion of the Responsible Official.

(c) If the Responsible Official determines that proposed actions taken in response to an emergency, beyond actions noted in paragraph (a) of this section, are not likely to have significant environmental impacts, the Responsible Official shall document that determination in an environmental assessment and a finding of no significant impact prepared in accordance with this part, unless categorically excluded (see subpart C of this part). If the Responsible Official finds that the nature and scope of the subsequent actions related to the emergency require taking such proposed actions prior to completing an environmental assessment and a finding of no significant impact, the Responsible Official shall consult with the Office of Environmental Policy and Compliance about alternative arrangements for NEPA compliance. The Assistant Secretary, Policy Management and Budget or his/her designee may grant an alternative arrangement. Any alternative arrangement must be documented. Consultation with the Department must be coordinated through the appropriate bureau headquarters.

(d) The Department shall consult with Council on Environmental Quality (CEQ) about alternative arrangements as soon as possible if the Responsible Official determines that proposed actions, taken in response to an emergency, beyond actions noted in paragraph (a) of this section, are likely to have significant environmental impacts. The Responsible Official shall consult with appropriate bureau headquarters and the Department, about alternative arrangements as soon as the Responsible Official determines that the proposed action is likely to have a significant environmental effect. Such alternative arrangements will apply only to the proposed actions necessary to control the immediate impacts of the emergency. Other proposed actions remain subject to NEPA analysis and documentation in accordance with this part.

****Responsible Official** is the bureau employee who is delegated the authority to make and implement a decision on a proposed action and is responsible for ensuring compliance with NEPA.

Additionally, the Executive Office of the President's CEQ, has issued the following information regarding Emergency Actions under NEPA:

In the case of an emergency:

1. Do not delay immediate actions necessary to secure lives and safety of citizens or to protect valuable resources. Consult with CEQ as soon as feasible – Please coordinate any communications with your agency Federal NEPA contacts. (see http://ceq.doe.gov/nepa_contacts/federal.html).
2. Determine if NEPA is triggered, and the appropriate level of NEPA analysis:
   a. Determine if the proposed action is being taken by a Federal agency (e.g., city or state action does not trigger NEPA; Federal decisions to fund city or state action do trigger NEPA) or is statutorily exempt from NEPA (certain FEMA response actions under the Stafford Act are exempt from NEPA, information is available at: http://www.fema.gov/media-librarydata/20130726-1748-25045-1063/stafford_act_nepa_fact_sheet_072409.pdf).
   b. If the Federal agency proposed emergency response activity is not statutorily exempt from NEPA and the agency has a categorical exclusion (CE) that includes that type of activity, then apply the CE, unless there are extraordinary circumstances that indicate using the CE in this particular case is not appropriate. Agency NEPA personnel should be contacted regarding agency-specific definitions of actions that are "categorically excluded."
   c. If the proposed Federal agency emergency response activity is not statutorily exempt from NEPA a categorical exclusion is not available, and the potential impacts of the proposed response activity are not expected to be "significant" environmental impacts, then an Environmental Assessment (EA) is appropriate. Prepare a focused, concise EA as described in Attachment 2. Alternative arrangements as outlined at 40 C.F.R. §1506.11 do not apply because the environmental impacts are not expected to be significant. Agency NEPA personnel should be contacted regarding agency-specific definitions of "significant" actions.
   d. If the proposed emergency response activity is not statutorily exempt from NEPA, is expected to have "significant" environmental impacts, the agency should determine whether it is covered by an existing NEPA analysis. (e.g., implementing pre-existing spill response plans).
   e. If the proposed emergency response activity is not statutorily exempt from NEPA and is expected to have "significant" environmental impacts, and is not already covered by an existing NEPA analysis, then the agency should consult with CEQ to determine whether "alternative arrangements" can take the place of an Environmental Impact Statement. Contact Ted Boling, Associate Director, 202-395-0827, eboling@ceq.eop.gov to develop alternative arrangements under 40 C.F.R.§1506.11.

Factors to address when requesting and crafting "alternative arrangements" include:

- nature, scope, and duration of the emergency;
- actions necessary to control the immediate impacts of the emergency;
- potential adverse effects of the proposed action;
- components of the NEPA process that can be followed and provide value to decision making (e.g., coordination with affected agencies and the public)

Appendix B. FWS Alaska Region Minimum Requirements Analysis Short Form Instructions and Tips

When is it appropriate to use the short form as opposed to the standard Carhart form?

The standard form (see link below for the Carhart form) is appropriate for all projects. It is necessary for consideration of all projects proposing use of any Wilderness Act Section 4c prohibited use. However, it may be most efficient to reserve the Carhart form for more complicated projects (those having many project components, greater impacts, complexity, or controversy). The short form is appropriate for projects that are simple, have fewer impacts, fewer project components, and are less controversial. Examples of appropriate use of the short form include the following: water sampling on lakes with access by floatplane; law enforcement patrols by airplane that do not disturb sensitive resources; routine maintenance of a historic cabin using hand tools with access by motorboat; and archeological survey with small test pits conducted by foot.

If you are having trouble answering any of the questions on the short form, it is a good indication that the standard form is a better fit for that project. It is not appropriate to use the short form on projects that, for example, propose use of a helicopter, large field camps of long duration, lethal sampling, release of chemical tracers, or a survey of visitors within the Wilderness. In these instances the standard form is more appropriate because of the space required to evaluate a broader range of alternatives and impacts, and to do so in a more thorough and complete way.

Usually a project proposal exists independently of the MRA form. If so, attach that description with the MRA.

If a more in-depth MRA is warranted, use the Arthur Carhart National Wilderness Training Center's Minimum Requirements Decision Guide (Carhart standard form), found here: http://www.wilderness.net/MRA

A: Is the project necessary to meet the specific requirements of any law?

Identify any valid existing rights, special provision in the Wilderness Act, or requirement of other law that requires the action. Cite the law and section as applicable. Describe whether the law says that a specific action "shall" be taken or that an action "may" be taken. This is an important distinction, if the law says "may" then the action is discretionary and it needs to be evaluated whether it is actually necessary for the administration of the area as wilderness. In asking if the project is "necessary" to meet the requirements of another law, then it must happen to comply with the law. If we didn't take the action, we would be violating the law.

Apparent conflicts between the Wilderness Act and other legislation may require innovative approaches and not all apparent conflicts are genuine. No law over-rides another law (unless specifically stated in the superseding law). The requirements of all applicable laws must be met.

Federal laws that do not directly address wilderness may influence the need for actions in wilderness. In some instances, the administrator is asked to satisfy the requirements of multiple laws. Likely examples in Alaska include:
Alaska National Interest Lands Conservation Act of 1980 (ANILCA), 16 U.S.C. 3150.
Management of a site listed on the National Register of Historic Places (National Historic Preservation Act).
Alaska Mineral Resource Assessment Program (AMRAP) authorized by section 1010 of ANILCA

B: Does the Does the project propose a Wilderness Act Section 4c prohibited activity, other than use of motorboats, aircraft, and snowmachines for access, as provided for in ANILCA Section 1110?

If so, use the standard MRA form. Note that ANILCA allows these exceptions for access, not, for example, the use of motorboats for fishing, or snowmachines for hi boarding.

C. Can the project be accomplished with only minimal impacts to wilderness character, wilderness resources, and wilderness values? Minimal impacts includes impacts that are no greater than an average recreational trip would have in the same vicinity, time of year, etc.

Describe potential impacts of the action, as proposed, to each quality of wilderness character. These qualities are described below:

- Untrammeled Quality – In wilderness, "the earth and its community of life" are essentially unhindered and free from modern human control or manipulation, "in contrast with those areas where man and his own works dominate the landscape." This quality is important because it helps insure that wilderness is managed with the utmost humility and restraint, respecting the autonomy of nature that allows a place to be wild and free. However, it is unlikely that action is necessary to preserve this quality, unless the decision is to stop taking action. In fact, to preserve this quality it may be necessary to cease actions that manipulate "the earth and its community of life" that are not needed to preserve some other quality of wilderness character.

- Natural Quality – A wilderness area is to be "protected and managed so as to preserve its natural conditions." Wilderness ecological systems are substantially free from the effects of modern civilization. Preserving this quality ensures that indigenous species, patterns and ecological processes are protected and allows us to understand and learn from natural features. To preserve this quality, it may be necessary to take action to correct unnatural conditions even if they were present at the time of designation.

- Undeveloped Quality – Wilderness retains its "primeval character and influence," and is essentially "without permanent improvements" or modern human occupation. Preserving this quality keeps areas free from "expanding settlement and growing mechanization" and "with the imprint of man's work substantially unnoticeable" as required by the Wilderness Act. To preserve this quality, it may be necessary to remove existing structures or installations which are unnecessary for the administration of the area as wilderness or otherwise are not features of the area's wilderness character.

- Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation Quality – The Wilderness Act defines wilderness as having "outstanding opportunities for solitude or a primitive and unconfined type of recreation." This quality is about the opportunity for people to experience wilderness. The opportunities provided by wilderness include the chance to experience primitive recreation, natural sights and sounds, solitude, freedom, risk, the physical and mental challenges of self-discovery and self-reliance, and to use traditional skills free from the constraints of modern culture. Look at each sub-part of this quality (solitude, primitive recreation, unconfined recreation) to determine if there is a need for action. To preserve this quality, it may be necessary to take action to improve solitude, primitive recreation, or unconfined recreation beyond the conditions present at the time of designation.

- Other Features of Value Quality – The Wilderness Act states that areas "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value". Some of these features, such as the presence of threatened and endangered species, are also part of the Natural quality of a wilderness and could be evaluated for effects to that quality unless the specific species or habitat is unique to the wilderness area. Other features, however, such as the presence of important geological formations, cultural resources, historical sites, or paleontological localities, do not fit easily into one of the other four qualities. While many different types of features could be included, the intent is to include those that are significant or integral to the wilderness. Features mentioned in wilderness enabling legislation or legislative history would likely qualify.

Step 2: Determine the minimum activity

A. Where feasible, describe at least two alternative methods to accomplish project objectives.

Describe the relative impacts of all alternatives to the applicable wilderness character qualities.

Dropped alternatives should be briefly mentioned. Valid reasons for deciding that an alternative is unacceptable or not feasible should be limited to: 1) actions that are impossible to accomplish by any means, 2) actions that are possible to accomplish but implementation would cause unacceptably greater negative impacts to wilderness character or, 3) actions that would cause an unacceptable safety risk to workers or the public which cannot be mitigated. Alternatives should not be eliminated from full consideration simply because implementation would take more time or money, or because the skills or equipment needed are not readily available on the local unit.

B. Select a preferred alternative

Briefly describe the benefits or adverse effects to the qualities of wilderness character and other legal requirements:
If any of the qualities of wilderness character are degraded in the selected alternative, you must explain how that degradation is justified by preserving wilderness character as a whole.

If you are selecting an alternative that does not have the least negative impact to wilderness

character, explain why. The most common examples of this are due to safety reasons.

If the least impact to wilderness character is found to be the same in two or more alternatives, you may base your decision on the other criteria (perpetuation of traditional skills, economics, safety). Explain your reasoning.

The rationale should demonstrate that the determination is clearly a result of objective evaluation of the alternatives and not the result of an inappropriate bias or justification of an alternative or method for non-wilderness reasons. If your selection is based at least in part on the safety criterion, be sure to explain the rationale and include or reference supporting analysis or documentation.

Avoid selecting an alternative based primarily on cost and time of implementation. While administrative activities should always be accomplished with economic efficiency, both law and agency policy directs us away from considering the cost as the over-riding factors for administrative use of otherwise prohibited activities. The Wilderness Act provides only the following as legal basis for approving use of any of the Section 4(c) prohibited uses for administrative activities:
"…except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act…"

After you have completed the MRA Worksheet make sure that any mitigation, monitoring, and reporting requirements are summarized on the first signature page.

Approval of the MRA

Like the standard form MRA, decisions made via the short form must be approved according to the provisions of our Wilderness Stewardship Policy, Section 1.20: "Refuge managers may make minimum requirement decisions only if they have attended the Carhart Center's national wilderness stewardship course. If refuge managers have not attended this training, they must send the MRA to their refuge supervisor for approval. If the supervisor lacks the required training, the supervisor must request review and approval from an individual who has had this training and is equal to or higher than the refuge manager in the organizational hierarchy."