Introduction

Natural Resource Management and Invasive Species: Pathways for Spreading a Problem

The invasion of zebra mussels in the mid-1980s caused a surge of invasive species awareness and prompted federal legislation in the form of the Non-indigenous Aquatic Nuisance Protection and Control Act of 1990. This act was reauthorized and amended to the National Invasive Species Act in 1996. In February 1999, the Presidential Executive Order 13112 created the National Invasive Species Council and the Invasive Species Advisory Committee in response to growing concern over invasive species.

Species such as the Chinese mitten crab, New Zealand mud snail, killer sea weed (*Caulerpa taxifolia*), silver carp, purple loosestrife, and others have national management plans dedicated to their control and management. Many species do not have a national management and control plan but are still a concern. The cost of controlling and managing invasive species is in the billions of dollars and invasive species are considered to be the 2nd leading cause of species extinction and endangerment.

Non-indigenous species have arrived in the United States via shipping and importation pathways. Invasive species move through these human-assisted pathways to new habitats and may impact native plants, animals, and economies. For example, it is widely accepted that zebra mussels, *Dreissena polymorpha*, were introduced to the Great Lakes through international shipping traffic and ballast water discharge. Shippers did not intend to move zebra mussels, just to use ballast water to safely cross the ocean. Once ships enter U.S. ports in the Great Lakes, ballast water is discharged and cargo loaded. Unfortunately, many species can survive transoceanic trips in ballast water by hitchhiking to new waters as non-target species (biological contaminants). Likewise, the horticultural industry has provided pathways by which numerous plants and their hitchhikers/non-targets, have been imported into the United States and now cause major problems in agricultural, rangeland, riparian, and other natural areas. Some of our worst insect invaders, such as the Formosan termite *Coptotermes formosanus shiraki*, arrived in packing and crating materials. These are just a few examples of how species are moved around the planet.

Non-Target Species – any species of organism that is not intentionally moved. For example, if your management activity calls for you to stock largemouth bass, then any other species of fish (or other organism) would be a non-target species. Your intent would be to only move largemouth bass.

On a smaller scale, invasive species can unintentionally be spread to new habitats through natural resource management work. These invasive species can also be termed non-target species as they hitchhike on targets such as waders, boats,

clothing, or anything else that you intend to move from one place to another. Some familiar pathways include the movement of targets such as field or farm equipment, relocation of species to restore their range, or into or out of a refugium. Species monitoring, collections, natural resource surveys, and fish stockings are also potential pathways for moving non-targets.

Target Species – any species of organism that is intentionally moved. For example, if your management activity calls for you to stock largemouth bass, then your target species would be largemouth bass.

Understanding pathways and developing plans to remove non-target species and prevent biological contamination is necessary to prevent the unintended spread of species. Introductions of hitchhiking species of plants, animals, and biologics, such as parasites and disease-causing pathogens, are unintentional, like the zebra mussel spread to North America. However, these introductions should not be considered "accidental." It is our responsibility as resource professionals to strive to do no harm and understanding invasive species pathways and developing plans to remove hitchhiking species are necessary to prevent their unintended spread.

Invasive Risk Assessment and Planning

Invasive Species Risk Assessment and Planning (ISRAP) is a tool that manages the risk of moving non-targets in natural resource management activities. The first step in the risk management process is to conduct a risk assessment of potential pathways. Risk assessment determines the significance of potentially moving species to an area where they may become invasive. Once it is determined that a pathway poses a significant risk, then a plan is implemented to reduce this risk. The plan is created using a modification of the Hazard Analysis and Critical Control Point (HACCP) planning process.

HACCP, as part of campaigns to help prevent the spread of invasive by increasing awareness, has become a recognizable brand. HACCP training workshops, a website, and an international standard have been created. The key to understanding natural resource-modified HACCP is to view non-target species of plants, animals, diseases, pathogens, and parasites as hitchhikers or hazards throughout the planning process. Many plant parts and seeds (non-targets) are moved from place to place attached to socks, sampling equipment, or nets (targets).

The HACCP planning process for natural resource management that has been in use is a five step tool to reduce the risk of spreading invasive species and other non-targets in human related pathways. This tool defines the critical point in a given activity whereby the risk of a hazard (hazard = non-target or invasive species movement) can be reduced to an acceptable level. At this critical control point, the risk of a hazard is reduced by means of a control measure. This control measure is then evaluated to ensure that the control measure is operating as intended.

The ISRAP process takes advantage of this pre-existing HACCP brand and planning process (with a few modifications) and combines them with the risk assessment to create a tool that is focused on preventing the spread of invasive species.

Natural Resource Pathway Management

Planning is nothing new for biologists and managers, but applying ISRAP and/or HACCP alone to natural resource work is a relatively new concept. Without appropriate planning, the management work that takes biologists, technicians, and their equipment to many different habitats could be pathways for species spread. ISRAP identifies high-risk activities and focuses attention on those actions needed to close open pathways. Plans documenting risks, as well as methods used to remove non-target species, give managers the opportunity to weigh risks for species spread against benefits from natural resource actions. For some pathways, the risks outweigh resource benefits until better procedures to remove non-target species are identified. ISRAP planning provides a systematic method to make consistent decisions based on identified risks. ISRAP plans create a reference source documenting best management practices and procedures that can be shared with other offices, agencies, and the private sector to reduce risks of species spread through pathways with similar characteristics.

"Planning Is Everything"

First-time natural resource ISRAP planners tend to pick well-known invasive species as non-target species to remove from pathways. While these species deserve increased attention, biologists recognize that many local species could become invasive if introduced outside their native range. ISRAP planning for natural resource pathways intends to remove all non-targets. Information and reference sources on species that have gained national recognition are included in the References. The examples of non-target species spread used in this manual show how natural resource pathway planning can help prevent similar types of spread.

Before learning the mechanics of ISRAP planning, you must recognize one important point; creating an ISRAP plan is a small part of applying the ISRAP concept for natural resource work. The values of ISRAP planning are many. Using an onion as an example, planners will find new layers of questions, learning that natural resource management has increased in complexity rather than decreased. Sorry! ISRAP planning will not make your life easier, but it will make you a better biologist, and our natural resources will be better protected from invasive species. In order to be successful, this proactive tool requires a commitment from agency heads to managers to field staff.

Chapter 2:
Case Study of Inks Dam National Fish Hatchery

Learning Objectives

- Create a visual image of the location and layout of the Inks Dam NFH facility which is the example used through the 5-step ISRAP process.
- Identify species present at Inks Dam NFH that have the potential to become a non-target.
- Describe the production sequencing of the largemouth bass culture.
- Identify pathways (e.g. water supply) that effect fish production.

Inks Dam National Fish Hatchery (NFH) is a warmwater facility in central Texas raising sportfish for stocking throughout the U.S. Fish & Wildlife Service's (Service) Southwest Region (Region 2). One of the programs at Inks Dam NFH is the production of largemouth bass for stocking in tribal waters in Arizona. The facility pumps raw water from Lake Buchanan to fill their ponds. Lake Buchanan contains a suite of warmwater fish species native to central Texas. Annually largemouth bass broodstock are spawned in ponds from late March to early May. The fry from the spawning adults are separated and reared in ponds where they are provided natural and artificial food. The largemouth bass are grown to 6-8 inches and stocked in September – October. Before the fish are stocked they are seined out of the rearing ponds and placed in holding tanks for 2-5 days before they are loaded into the stocking truck and transported to Arizona.

Prior to the implementation of ISRAP at Inks Dam NFH, sometimes the shipments of largemouth bass contained non-target organisms including fish, invertebrates, and plants that were occasionally spread to receiving waters. This occasionally caused fish management challenges and has possibly led to the establishment of invasive species in Arizona and New Mexico. To deal with this issue Service Fishery Program managers developed an HACCP plan for Inks Dam NFH as well as every other Fishery field station in Region 2. The success of this program to help prevent the spread of invasive species led the Region 2 Regional Director to establish a regional policy that called for every Service field station in Region 2, including all programs, to develop and implement HACCP plans for their activities. Subsequently the Fisheries Program on a national scale developed a policy stating that all Fishery field stations nationwide would develop and implement HACCP plans for their activities.

Remember from Chapter 1 that the ISRAP process takes advantage of this pre-existing HACCP brand and planning process (with a few modifications) and combines them with the risk assessment to create a tool that is focused on preventing the spread of invasive species. Henceforth, we will refer to HACCP plans as ISRAP plans in this manual.

The potential pathways that were identified as sources for non-target species introduction included the water in which the largemouth bass were raised. This is a potential source since water from Lake Buchanan is directly supplied to the hatchery with the possibility of introducing numerous species including Guadalupe bass, several sunfishes, threadfin and gizzard shad, logperch, and several others. Other non-target species could be present in the rearing ponds including bullfrogs, invertebrates, aquatic plants, and potential fish pathogens. Another potential pathway for non-targets was the water that was used to fill the stocking truck. Originally the trucks were filled with water from the lake, but now the trucks are filled with well water.

Inks Dam National Fish Hatchery located 60 miles northwest of Austin, Texas. *Photo Credit - Bob Pitman & Robert Lindsey/USFWS*

The ISRAP plan for stocking of largemouth bass from Inks Dam NFH included the filling of trucks with well water instead of raw lake water. Additionally, hatchery personnel used flow-through holding tanks to remove non-target plants and invertebrates. Large mesh dipnets were used to collect the largemouth bass while allowing the smaller non-target fish species to pass through. Finally hatchery personnel inspected all holding tanks to ensure that the non-targets were removed prior to loading the fish in the stocking truck.

As a check on the efficacy of these control measures to remove non-target species from shipments of largemouth bass to Arizona, Service biologists on the receiving end inspect every shipment of fish prior to the bass being stocked. Since the ISRAP plans have been implemented at Inks Dam NFH it has effectively prevented the shipment of non-target organisms.

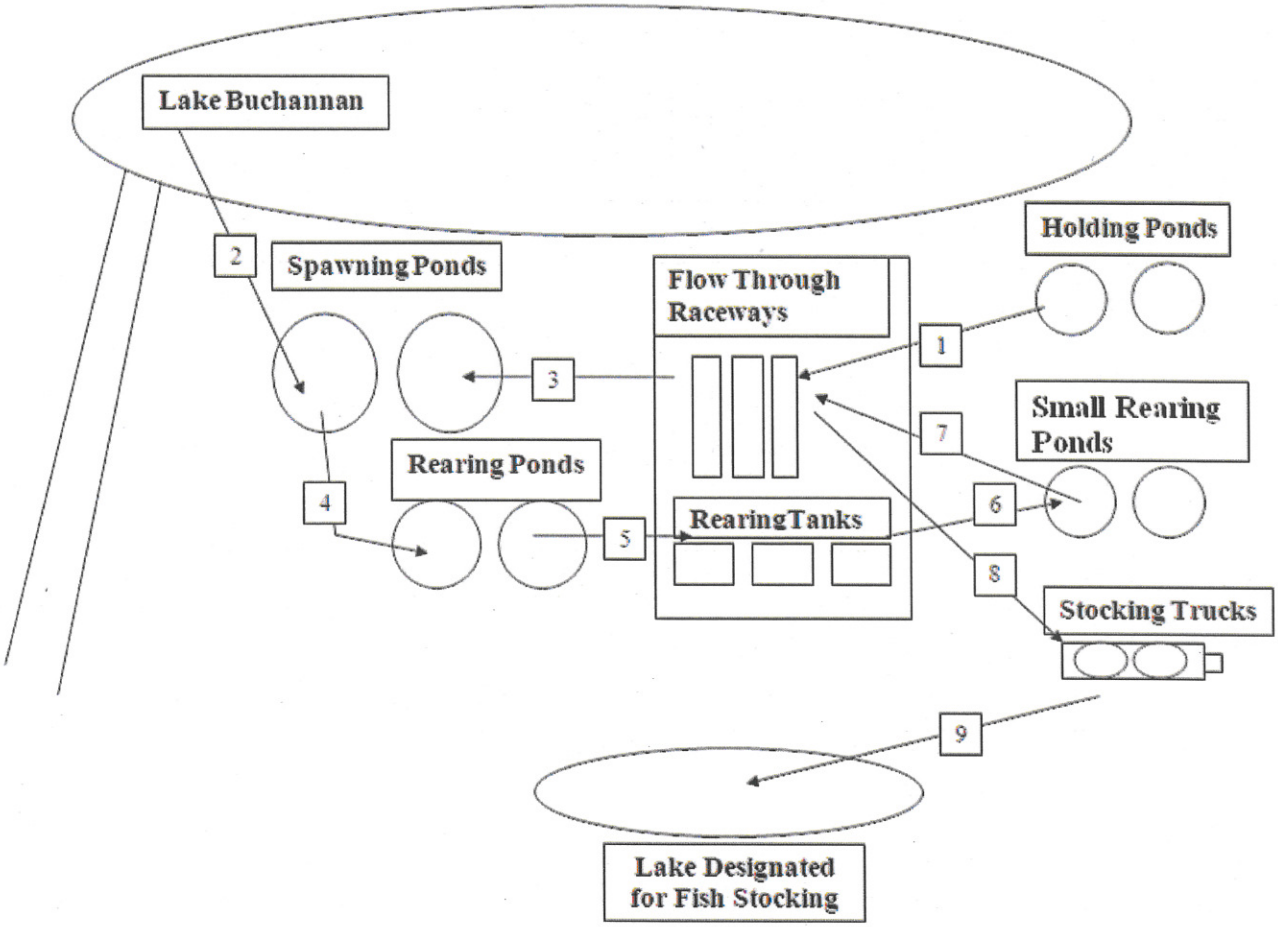


Diagram of the Inks Dam National Fish Hatchery facility and production sequence of largemouth bass culture.

Chapter 3:

Step 1 – Activity Description

Learning Objectives:

- Describe the 5 steps of Invasive Species Risk Assessment Planning.
- Identify the essential components of a well-written Activity Description.
- Explain the necessity of teamwork and team diversity.
- Write an Activity Description encompassing all six Description components.

A successful ISRAP program depends on creating a firm foundation, which includes management commitment, ISRAP training, and assembly of an effective ISRAP team. Attempting to implement an ISRAP program without these components will likely lead to ISRAP planning that will lack a thorough assessment of the potential hazards and commitment to apply ISRAP planning consistently in the field.

Management Commitment - For ISRAP planning to work, it is extremely important to have the support of everyone in the agency, from the Director to the biological technicians in the field. Without it, the plan will not become an agency priority or be effectively implemented.

ISRAP Training - Education and training are important elements in developing and implementing an ISRAP program. Employees who will be responsible for the ISRAP program must be adequately trained in its fundamentals. This course is designed to meet that need.

ISRAP Team Assembly - Assembling a team is an essential step in building an ISRAP program. Although one person might be able to analyze risks and develop a plan successfully, it is essential to build a team. The team approach maximizes encompassing expertise and the ability to brainstorm ideas and identify hazards.

Five Steps to ISRAP Planning

There are five steps to ISRAP adopted from HACCP planning.

1. Describing the activity.
2. Identifying potential non-targets.
3. Diagramming the flow of tasks for the activity.
4. Filling out a non-target analysis worksheet.
5. Completing the non-target risk action plan form.

Each step corresponds to a specific form in the ISRAP process. Forms are included in Appendix B.

ISRAP Step 1 – Activity Description

Management Objective & Contact Information	
Management Objective:	Contact Person:
	Phone:
	Email:

Activity Description i.e. Who; What; Where; When; How; Why

Once an ISRAP team is established, the members first describe the management objective or activity, the method of accomplishing the activity, and the intended purpose and need for the activity.

Examples of activities include the following:

- Natural resource management (agricultural and aquatic)
- Raising and/or stocking of fish
- Importing of fish/plants
- Surveys (aquatic and terrestrial)
- Restorations (habitat and native species) and bringing in species and outside construction materials
- Research field work
- Fire control
- Law enforcement
- Navigational aids
- Road construction and maintenance
- Recreation activities
- Biocontrol → intentional introductions
- Pet trade
- Nursery stock: soil → fire ants

The project description should be a narrative description that includes such information as the "who, what, when, where, how, and why" of a particular project. The description should offer a historical working reference to facilitate communication with the immediate staff conducting the activity as well as any other resource management agency personnel that may be involved.

Here is a sample showing how Inks Dam NFH filled out Step 1 of the form.

ISRAP Step 1 – Activity Description

Management Objective & Contact Information	
Management Objective: Rearing and distribution of largemouth bass free of non-targets.	Contact Person: Hatchery Manager
	Phone: Phone: 1-800-LUV-FISH
	Email: fishlover@tex.net

Activity Description i.e. Who; What; Where; When; How; Why
Who: Inks Dam National Fish Hatchery personnel What: Raising 6-8" largemouth bass free of non-targets Where: Double-ponds at Inks Dam NFH in Burnet, TX When: Spawned in April, raised in ponds, & stocked in September-November How: In early March 4-year-old broodstock are harvested by draining the pond and moved to flow-through raceways. In 2-3 weeks, depending on temperatures, fish are sorted by sex and 50 pair are stocked into a spawning pond and allowed to spawn in cages. Most fish will spawn in 3 days. About 17 days after brood fish are stocked fry collection begins. Schools of fry are collected with seines and moved in 20-gallon tubs to filled and fertilized rearing ponds. Fry usually are kept in these rearing ponds for 3 weeks when they are harvested as 1.5 inch fingerlings and moved to holding tanks to be trained on artificial feed. After four weeks of feeding these fish are moved to small rearing ponds where artificial feeding on pellets continues throughout the rest of the rearing cycle. The 6-8 inch fish are usually equipped with oxygen and easy loading/unloading access. The yearling fish are graded, sorted, weighed, and treated, if needed, before they are loaded for distribution in two to three days. Larger fish are easier to separate from non-targets and some species have matured and left the rearing pond. Fish are then distributed to receiving waters in the southwest. Requesting Fish & Wildlife Conservation Offices meet the delivery truck to assist with stocking. Why: Stocking of tribal waters in Arizona

Chapter 4:
Step 2 – Potential Non-Targets

Learning Objectives:

- Identify the different non-target categories (Vertebrates, Invertebrates, Plants, Other Biologics).
- Describe the importance of teamwork by involving others of diverse backgrounds.
- Successfully complete a form for ISRAP Step 2.

Later you will need to perform a non-target risk analysis (when you get to ISRAP Step 4) as part of the development of an ISRAP plan. First, however, managers must gain a working knowledge of potential non-targets in their area. The ISRAP plan is designed to control all *reasonable* non-targets.

It is important to understand the difference between non-target and target. These were defined in the Introduction. For practical purposes you may consider a species a non-target if it may be present in the action area, but is not the species for which an action was initiated. Similarly, you may consider a species (or any object) a target if it is intentionally moved from one place to another.

Targets can include gear, yourself, and/or a species that you intend on move. Non-targets are categorized into four general classes: vertebrates, invertebrates, plants, and other biologics. Species considered non-targets vary from state to state, agency to agency, and biologist to biologist. Consulting with local experts will help to determine which species are considered non-targets. Discussions about non-targets can help focus planning objectives and establish the basic foundation for each ISRAP plan.

Here is a sample showing how Inks Dam NFH filled out Step 2 of the form:

ISRAP Step 2 – Identify Potential Non-Targets

(to be transferred to column 2 of ISRAP Step 4 – Non-Target Analysis Worksheet)

Non-Targets That May Potentially Be Moved/Introduced
Vertebrates: Guadalupe bass (*Micropterus treculi*), logperch (*Percina caprodes*), gizzard shad (*Dorosoma cepedianum*), white bass (*Morone chrysops*), bluegill (*Lepomis macrochirus*), warmouth (*Lepomis gulosus*), green sunfish, common carp, smallmouth buffalo, redbreast sunfish, bullfrogs, tadpoles, gulf coast toad, aquatic snakes
Invertebrates: miscellaneous aquatic insects, Asian clam (*Corbicula spp*), crayfish
Plants: Hydrilla, Eurasian watermilfoil, water star thistle, water hyacinth, brushy pond week, various algae (*Chara, Pithophora, Hydrodicton*)
Other Biologics (pathogens, parasites, etc.): Largemouth bass virus

Chapter 5:
Step 3—Flow Chart

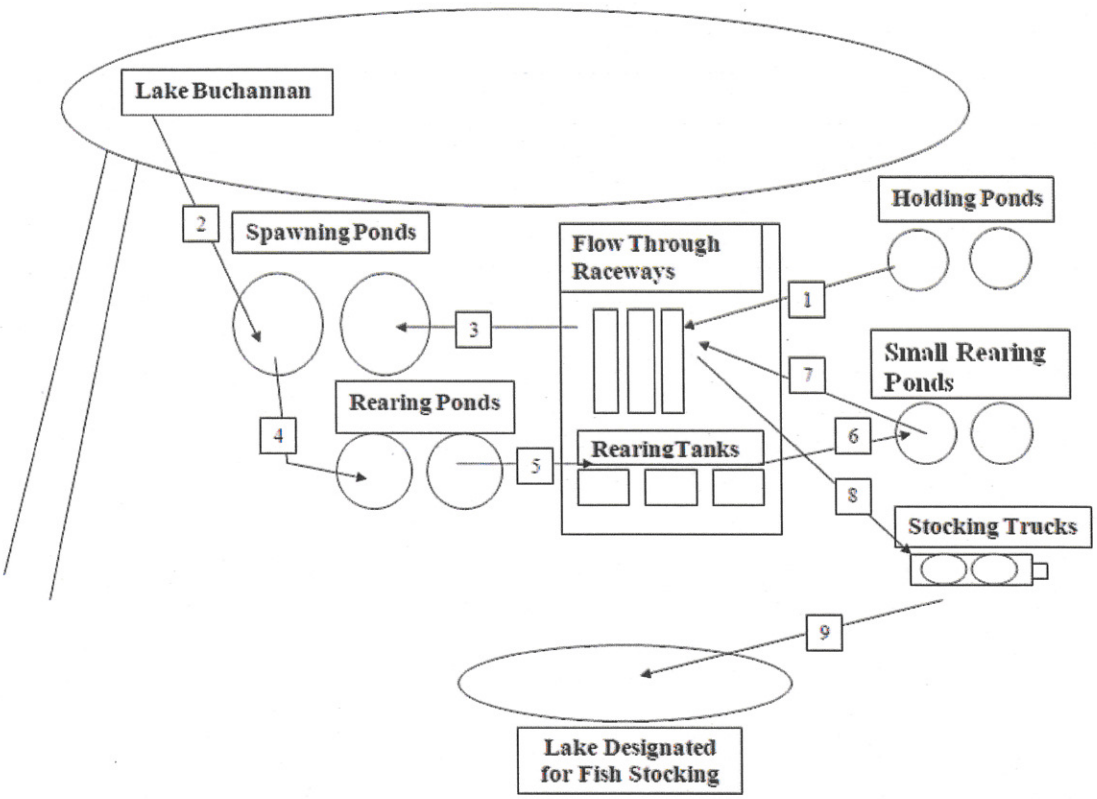
Learning Objectives:

- Discuss relationship between the Activity Description, Potential Non-targets, and the Activity Flow Chart.
- Describe the importance of teamwork by involving others of diverse backgrounds.
- Identify and connect the relationship between the tasks from the Activity Flow Chart and Step 4 of the ISRAP.
- Complete an Activity Flow Chart in small teams.
- Develop team exercise candidate ISRAP projects for Day 2.

A flow chart is a method for showing the tasks required to accomplish the activity. Information is taken from the Activity Description (ISRAP Step 1, Chapter 2) and is an outline of the sequence of actions that should occur. Thus, it is important to include all the tasks within the activity. The flow chart contains a task number, title and description. If a task is missed, a significant non-target may not be addressed.

Any activity covered by an ISRAP plan should include a sequential set of steps necessary to complete the activity. These are what you should list in the Activity Flow Chart. If your covered activity includes steps that occur in parallel (simultaneously by different crews), then your activity is too general for a single ISRAP plan. This is one of the most common mistakes made by those creating HACCP or ISRAP plans for the first time. In this case you should break the activity into two or more sub-activities and then create ISRAP plans for each of these. Of course, each sub-activity must include steps that occur in a sequential fashion. Remember, an ISRAP will not be effective if the steps defined for your activity are too broadly defined. Be specific yet concise.

The ISRAP team should evaluate the entire activity/operation and make any changes required in the flow chart. The evaluation allows each team member to gain an overall picture of how the activity is conducted. The flow chart is an important tool that the ISRAP team will use to complete the remaining steps of the plan. In addition, a diagram of the activity based on the flow chart's tasks is a useful aide in visualizing the activity and completing the risk analysis in Step 4. Here is an example of an activity diagram for Inks Dam. (Activity diagrams are optional.)



Above is an activity diagram to illustrate the sequence of events that occur at Inks Dam NFH during Largemouth Bass rearing activities.

On the next page is an example Activity Flow Chart that shows how Inks Dam NFH's ISRAP team completed this ISRAP step 3.

Invasive Species Risk Assessment Planning

ISRAP Step 3 – Activity Flow Chart

Outline Sequential Tasks of Activity
(to be transferred to column 1 of the ISRAP Step 4 – Non-Target Analysis Worksheet)

Task 1	Title: Harvest and Sort Brood
	Description: Harvest brood fish from holding ponds & transfer to raceways. Hold fish for 2-3 weeks in raceways. Sort, grade, sex brood stock (50 pair) for spawning.

⇓

Task 2	Title: Filling Spawning Ponds
	Description: Fill spawning ponds with Lake Buchanan water through gravity feed water line.

⇓

Task 3	Title: Brood Transfer
	Description: Transfer broodstock (50 pair) to spawning pond.

⇓

Task 4	Title: Harvest Fry
	Harvest fry 17 days after brood fish are stocked out to spawn and move to rearing pond for 3 week phase I rearing.

⇓

Task 5	Title: Harvest Phase I Fingerlings
	Description: Harvest phase I fingerlings (1.5 inches) and move to confined rearing tanks with flow-through water and begin 4 weeks of feeding artificial diet.

⇓

Task 6	Title: Harvest Pre-Phase II Fingerlings
	Description: Harvest pre-phase II fish and move to small rearing ponds. Continue feeding until harvest in November as phase II (6-8 inch fish).

⇓

Task 7	Title: Harvest Phase II Fingerlings
	Description: Harvest phase II LMB and move to flow-through raceway and complete grading, sorting, counting, weighing, and examination.

⇓

Task 8	Title: Fill and Load Distribution Truck
	Description: Fill Regional Distribution Unit with well water. Load phase II largemouth and haul to stocking sites.

⇓

Task 9	Title: Stock LMB
	Description: Fishery staff meets distribution unit and net fish directly or send them through the quick discharge tube into lakes or ponds.

What <u>else</u> is in the bucket? – Photo Credit: Pos, Robert H.

Chapter 6:
Step 4 – Non-Target Analysis Worksheet

Step 4 Learning Objectives:

- Demonstrate relationship to first three steps and incorporation of information into Non-Target Analysis Worksheet.
- Explain the strength and diversity of developing teamwork in brainstorming and evaluating the risk of each non-target in Step 2 exercise.
- Evaluate significance and severity of each non-target through the Risk Assessment Matrix.
- Define control measure, control point, and critical control point.
- Given a significant non-target risk, determine if the control measure action is a control point, a critical control point or an optional critical control point for the activity.
- Complete a Non-Target Analysis Worksheet.
- Identify and connect the relationship between the Non-Target Analysis Worksheet and the final step of the ISRAP.

Step 4 is a pivotal point of ISRAP to determine if an activity is a risk to the natural resource, and if so, what corrective actions can be developed to eliminate or reduce non-targets to an acceptable level. The power of HACCP is applied through the first three steps of ISRAP. Step 4 incorporates information from the previous steps, and then utilizes the Risk Assessment Matrix (RAM). The RAM determines risk level of each associated task reported on the Non-Target Analysis Worksheet (NTAW). Each task title described in Step 3 (Activity Flow Chart) is listed in column 1 of the NTAW. Potential non-targets identified in Step 2 (Identifying Potential Non-Targets) are recorded in column 2. By utilizing the RAM, you can identify any potential non-targets that pose a risk for the task (column 3). The RAM provides a resulting RAM score that you should record in column 4 along with an associated justification. After further assessments of potential non-targets are completed by the ISRAP team, you should describe control measures for each task identified as a potential risk in column 5. Next, you must decide whether or not the task is considered a critical control point (CCP) for the overall activity (recorded in column 6). **If any potential non-target hazards have been identified (in step 2) then you must identify at least one task as critical control point within your ISRAP plan.** Later, you will complete Step 5 so that you may complete the activity under controlled conditions.

Below is a Risk Assessment Matrix (RAM) for Aquatic Management Activities. Additional RAMs are available in Appendix A.

RAM for Aquatic Management Activities

Risk Level	Criterion for Aquatic Management Activities
No Risk	**Does Not Exist**
Level 1a: Low Risk	• **Activities In Immediate Drainage W/O Barriers (Continuous, Tributaries Within Drainage)** • Like Habitat, No Differences In Known Species Assemblages • No NTS, AIS, or ORVI In Origin
Level 1b: Low Risk	• **Activities In Immediate Drainage W/ Barriers (Barriers Between Tributaries Within Drainage)** • Like Habitat, No Differences In Known Species Assemblages • No NTS, AIS, or ORVI In Origin
Level 1c: Low Risk	• **Activities In Common Drainage W/ Barriers Or Isolation (Non-Continuous)** • Like Habitat, No Differences In Known Species Assemblages • No NTS, AIS, or ORVI In Origin
Non-Target Analysis Critical Control Point Upper Limit (Significance Line)	
Level 2a: Moderate Risk	• Activities In Common Drainage W/ Barriers Or Isolation (Non-Continuous) • **Known Difference In Habitat And/Or In Species Assemblages From Origin To Destination** • Potential Of NTS In Origin, But Not A Concern • No AIS or ORVI In Origin
Level 2b: Moderate Risk	• Activities Within Watershed • **Potential Of NTS In Origin And A Concern** • No AIS or ORVI In Origin
Level 3a: High Risk	• **Activities Out Of Watershed** • No ORVI or AIS In Origin
Level 3b: High Risk	• **AIS Present In Watershed, But Not Identified In Origin** • No ORVI In Origin
Level 3c: High Risk	• **AIS Present In Source, But Controllable** • No ORVI In Origin
Level 3d: High Risk	• **ORVI Present, But Controllable In Origin**
Severe Risk	• **AIS, or ORVI In Water Body** • **ISRAP Not Effective In Removal Or Control**

NTS – Non Target Species
AIS – Aquatic Invasive Species
ORVI - Optical Recognition Virtually Impossible

Analyzing the Risk of Non-targets

Analyzing potential risk hazards is fundamental in HACCP. For natural resource management, this planning process is still integrated under ISRAP in assessing non-target risks present within the activity environment. ISRAP augments the HACCP process by incorporating the Risk Assessment Matrix (RAM) shown on page 6-2. In the initial execution of HACCP for natural resources activities, it became apparent that physical and biological factors surrounding an outdoor environment made it challenging to fully assess hazards under the traditional HACCP format; since the process was originally developed for manufacturing and other confined work conditions. To establish a plan that effectively prevents the movement of non-targets, it is crucial to fully understand the possible influences and environmental differences surrounding an activity in the field.

The RAM assists in defining the risk parameters surrounding the activity described under the management objective. Three versions of the matrix are available (Appendix A) distinguished by three general categories of natural resource management activities: **Aquatic Stocking/Transplant** for hatchery activities and aquatic transplants, **Aquatic Management Activities** for aquatic field projects, and **Land Management Activities** to assist in evaluating terrestrial activities. These risk categories are separated into five classes: No Risk, Low Risk, Moderate Risk, High Risk and Severe Risk. Each class is color coded to illustrate the progressive risk level and increasing severity.

It is imperative to stress that any activity will have some element of risk regardless of all the best procedures applied. A risk-free environment is an ideal situation that just does not exist as stated under the "No Risk" class. With ISRAP we should focus on reasonable risks. That is, we should focus on risks that have a reasonable likelihood of occurring. An ISRAP team must decide what is reasonable and what is not given practical, real-world conditions. If there are no risks that could reasonably occur, then you may have a situation that could fall under the "No Risk" class. This situation definitely does not preclude the necessity of an ISRAP plan. It is important to complete a plan to document how you came to this decision. Additionally, circumstances may change in the future. An ISRAP plan would make re-evaluating the activity under the new circumstances much easier to accomplish. Please take this a careful reminder that a certain level of acceptable risk is always a reality to expect and respect. However, accepting this understanding should not deter an activity from being planned or implemented. It is safe to proceed—for now. If no risks were determined, the activity should be revaluated further at regular intervals or as circumstances change.

The RAM separates progressive risk levels based on differing risk attributes in significance from low to high, which also increase in potential severity. Increases in levels of severity are based on significant non-target hazards. These range from native non-target species to invasive non-target species and other biologics (i.e. pathogens, microscopic life stages, etc.). Organisms and other hazards that are not easily identified in the field are defined as "ORVI," which is an acronym for "optical recognition virtually impossible." The highest severity class is "Severe Risk" where any potential non-target species cannot be effectively removed by any measure. Usually, when there is a severe risk, the field activity under the proposed management objective must be stopped,

unless the benefits of this activity outweigh the potential impacts of introducing non-targets.

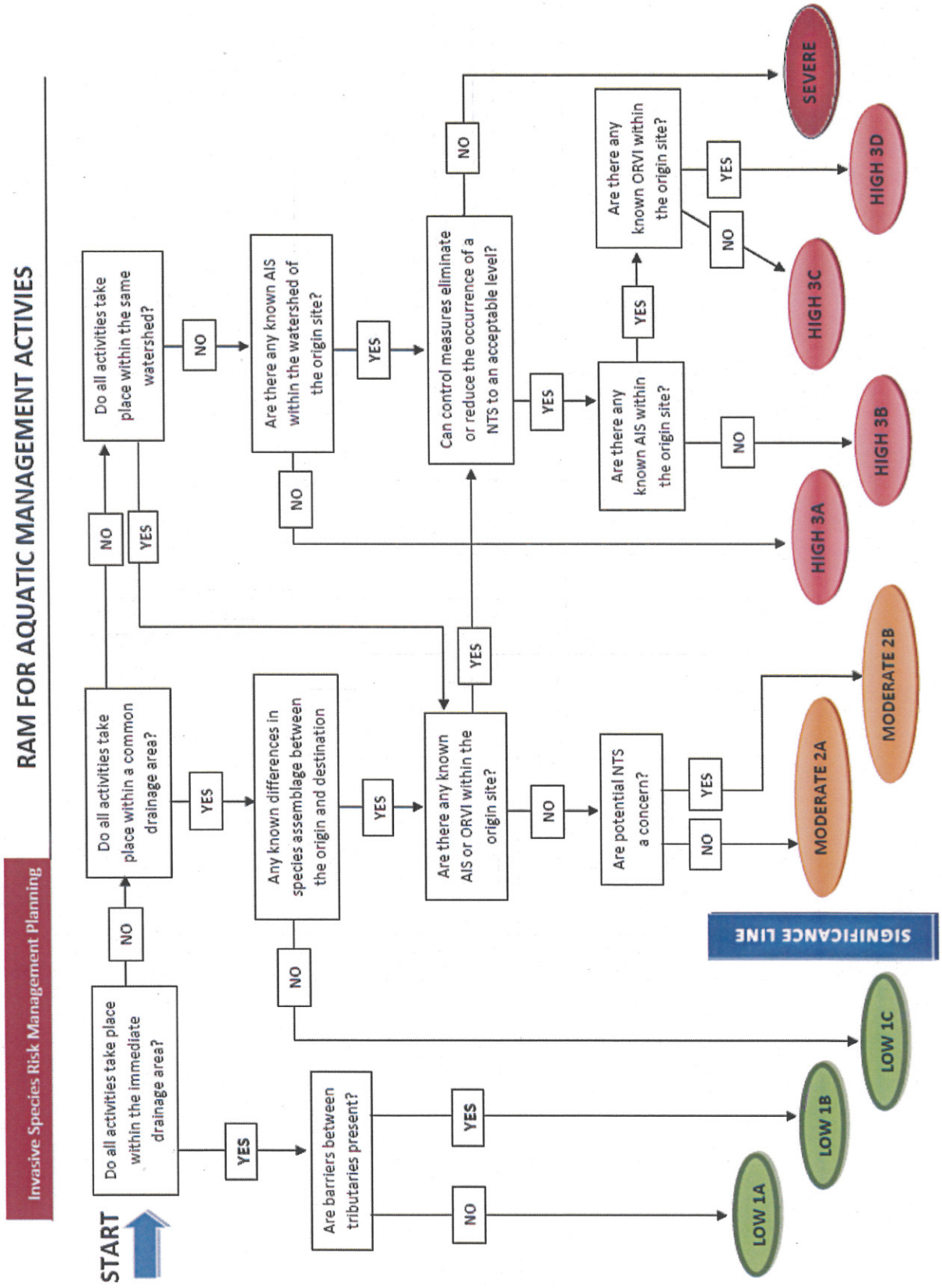
Each risk class is differentiated by a "significant criterion" (bolded and underlined) not present in the previous risk class. For example under the Aquatic Management Activities category, Level 2a Moderate Risk class sets the criterion "**Known Difference in Habitat And/Or in Species Assemblages from Origin To Destination**." This criterion is an acknowledged higher risk compared to the Level 1c Low Risk class where "Like Habitat, No Differences in Known Species Assemblages" is defined. Obviously the risk of moving a non-target species that is not present in the destination is higher risk than Level 1c Low Risk where there are like species assemblages between the origin and destination.

The matrix determines the significance and severity of potential non-target hazards by initially assessing each task under the management objective. The RAM is also useful to grade the overall activity defined at Step 1 to understand the variables present and associated risk level. However, it is very important to continue and assess each task as well to fully evaluate any possible non-target risk.

To implement the RAM start at Level 1a Low Risk, answering each criterion (under the "Criterion for Aquatic Management Activities" column) with a "Yes" or "No." Once a significant criterion is answered "Yes", then that class is considered the lowest risk level for a corrective action to address possible non-target hazards. Continue with the matrix. A higher level of risk may exist. **The RAM score should reflect the highest level of risk for an activity.** Some may find it easier to identify the highest level of risk using a flow diagram. For each RAM, a corresponding flow diagram has been constructed. On the following page is the diagram for Aquatic Management Activities. Additional flow diagrams are available in Appendix A.

A dividing line between Low and Moderate Risk, defined as the "Non-Target Analysis Critical Control Point Upper Limit" or significance line sets the acceptable level of risk within the matrix. If any significant criterion cannot be answered "Yes" below this significance line (greater than Level 1c, Low Risk), then either the task poses low risk for spread of a non-target or appropriate corrective actions are already in place to remove the probable threat. If a risk is significant and below the significance line on the RAM (Level 2a or above), then control measures (sometimes referred to as preventive measures) are required to reduce the non-target hazard to an acceptable risk level. Control measures are actions that can be used to control and remove identified non-targets.

Control Measures - Actions that can be used to control and remove identified non-targets. For example, hand sorting fish to select only a target species is a control measure, because targets are separated from non-targets.


Invasive Species Risk Management Planning
RAM FOR AQUATIC MANAGEMENT ACTIVIES
START
Do all activities take place within the immediate drainage area?
YES
NO
Are barriers between tributaries present?
YES
NO
LOW 1A
LOW 1B
Do all activities take place within a common drainage area?
YES
NO
Any known differences in species assemblage between the origin and destination
YES
NO
Are there any known AIS or ORVI within the origin site?
YES
NO
Are potential NTS a concern?
YES
NO
MODERATE 2A
MODERATE 2B
LOW 1C
Do all activities take place within the same watershed?
NO
YES
Are there any known AIS within the watershed of the origin site?
YES
NO
HIGH 3A
Can control measures eliminate or reduce the occurrence of a NTS to an acceptable level?
YES
NO
SEVERE
Are there any known AIS within the origin site?
YES
NO
HIGH 3B
Are there any known ORVI within the origin site?
YES
NO
HIGH 3C
HIGH 3D
SIGNIFICANCE LINE

In the Inks Dam example below the ISRAP team determined that potential non-targets were not significant (not reasonably likely to occur) during Task #1 - Harvest and Sort Brood (see column 2 of the NTAW). They denoted the RAM score as a Level 1b – Low Risk (column 4). For justification it is stated (column 4 of the NTAW) that adult fish are sorted and individually handled. Standard operating procedures removed any possibility of a non-target transfer and the task did not require implementation of any additional control measures.

In the same example, Task #2, Filling Spawning Ponds (see page 6-7), is an example of a task requiring a control measure. The ISRAP team determined that vertebrates posed a risk at Level 2b – Moderate Risk, since fish can easily be introduced into the pond, resulting in a "Yes" answer to the significant criterion, **Potential of NTS in Origin And A Concern**.

Filtering "sock" on pond water supply line - Photo Credit: Bob Pitman & Robert Lindsey/USFWS

Because the risk within this task falls below the significance line, control measures are needed to remove the threat of a non-target. The team determined that the risk could be reduced to a Level 1 class by adding a filter sock to the pond inflow.

If corrective measures cannot be applied to reduce risk above the significance line, then the ISRAP team should further evaluate the management objective, the overall activity, and individual tasks to determine if the non-target threat can be reduced to an acceptable level. This can be accomplished by adjusting the activity to remove the issue or expand the team for more expertise to determine if further corrective actions can be incorporated. After further assessment, if the overall activity or any task still cannot be adjusted to reduce risk to an acceptable level, then it must be determined if the activity is worth the risk involved, considering the potential impacts that could manifest should an unwanted introduction occur. In general, it is recommended that such an activity should not be performed under the prescribed management objective until control measures can be implemented to a degree that reduces risk to an acceptable level. Notable exceptions might include activities performed for national security or during emergency operations.

ISRAP Step 4 – Non-Target Analysis Worksheet

1 Tasks (from ISRAP Step 3 - Activity Flow Chart)	2 Potential non-targets identified in ISRAP Step 2	3 Are any potential non-targets significant? Yes or No	4 Justify Risk Assessment (e.g. RAM Score)	5 If you have decided that this is a Control Point, what Control Measures can be applied to stop the spread of non-targets?	6 Is this task a critical control point? Yes or No
Task # 1: Harvest and Sort Brood	Vertebrates: Other Fish Species	No	Level 1b – Low Risk Fish are large and easily separated		No
	Invertebrates: Miscellaneous aquatic insects	No	Level 1b – Low Risk Adult fish are handpicked and moved		No
	Plants: Hydrilla, water star thistle	No	Level 1b – Low Risk Adult fish are handpicked and moved		No
	Other Biologics: None	No	Level 1b – Low Risk		No
Task # 2: Fill Spawning Pond with Inks Lake water	Vertebrates: Other Fish Species	Yes	Level 2b – Moderate Risk Fish easily travel with water into ponds	Filters need to be utilized	No
	Invertebrates: Miscellaneous aquatic insects	Yes	Level 2b – Moderate Risk Insects easily travel with water into ponds	Filters need to be utilized	No
	Plants: Hydrilla, water star thistle	Yes	Level 2b – Moderate Risk Plants easily travel with water into ponds	Filters need to be utilized	No
	Other Biologics: None	No	Level 1b – Low Risk		No

ISRAP Step 4 – Non-Target Analysis Worksheet (continued)

1 Tasks (from ISRAP Step 3 - Activity Flow Chart)	2 Potential non-targets identified in ISRAP Step 2	3 Are any potential non-targets significant? Yes or No	4 Justify Risk Assessment (e.g. RAM Score)	5 If you have decided that this is a Control Point, what Control Measures can be applied to stop the spread of non-targets?	6 Is this task a critical control point? Yes or No
Task # 3: Brood Transfer	Vertebrates: Other Fish Species	No	Level 1b – Low Risk Large broodstock easily separated from non-targets		No
	Invertebrates: Miscellaneous aquatic insects	No	Level 1b – Low Risk Large mesh nets will not collect insects		No
	Plants: Hydrilla, water star thistle	No	Level 1b – Low Risk Plants will be flushed out by water flow		No
	Other Biologics: None	No	Level 1b – Low Risk		No
Task # 4: Harvest Fry	Vertebrates: Other Fish Species	No	Level 2a – Moderate Risk Other species could be in the pond and collected in seine	Visually examine tubs and remove non-targets by hand	No
	Invertebrates: Miscellaneous aquatic insects	No	Level 2a – Moderate Risk Other species could be in the pond and collected in seine	Visually examine tubs and remove non-targets by hand	No
	Plants: Hydrilla, water star thistle	No	Level 2a – Moderate Risk Other species could be in the pond and collected in seine	Visually examine tubs and remove non-targets by hand	No
	Other Biologics: None	No	Level 1b – Low Risk		No

Developing Effective Control Measures

Developing effective control measures relies on assembling an ISRAP team with the expertise to understand the overall conditions and potential non-target hazards present during the proposed activity. The RAM guides the team under general parameters to initially define the possible significance and severity within an activity. **It is an important responsibility of the ISRAP team to expand and enlist all available knowledge in Step 4 to further evaluate these risks and develop appropriate control measures that reduce non-target risks to an acceptable level.**

Keep in mind that there may be differences of opinion, even among experts, as to the significance and severity of any non-target and the hazard it imposes. Although the RAM sets the initial level of risk by the significant criterion, the ISRAP team must weigh all opinions of each risk to determine an effective control measure. It is important to include brainstorming if there are differing views or if certain conditions surrounding the activity are not clear. Brainstorming should result in a workable list of potential non-target risks at each task and what control measures can be implemented.

Identifying too many non-targets can be a problem because it can dilute your ability to focus efforts and control the truly significant risks. Accordingly, it is essential that only significant non-target species be identified and controlled with the ISRAP plan. The dilemma is deciding what is significant. As a guideline, a non-target must be controlled if 1) it is reasonably likely to occur beyond an acceptable level, *and* 2) if not properly controlled, the task is likely to result in an unacceptable risk of introducing non-targets that may harm the resource.

Determining Critical Control Points

For every significant non-target identified during the risk assessment of a task, there must be an associated control measure to address the non-target hazard. This point during a task is known as a control point. In the Inks Dams example, the control point during Task #2, Filling Spawning Ponds, is an added measure of installing the filter sock on the supply line. This procedure resulted in preventing the possibility of introducing any non-targets. The control measure addressed the significant criterion (**Potential of NTS in Origin And A Concern**) and reduced the risk to an acceptable level. Although adding the sock reduced the non-target risk, this control point is not critical in controlling non-targets at stocking since there are several opportunities for non-targets to be introduced in subsequent tasks prior to completion of the activity. A more detailed description of how to determine if a control point is critical or not will be presented below.

Control Point - the point during a task at which potential hazards are controlled by a control measure. Control points may be optional or critical.

Control points are categorized as either optional or critical. An optional control point addresses the risk of a hazard during the activity where a control measure is implemented to reduce or eliminate non-targets. However, although the control point may address the non-target risk at a particular task, it is not the control point where it is critical to remove the non-target threat to complete a successful activity free of non-targets. Optional control points may not be the best point to remove a significant non-target hazard, but still may be important to help reducing any non-targets within the activity. The control measure implemented at an optional control point helps in reducing the risk of these species impacting a later task. Therefore, Task #2 in the Inks Dam ISRAP is an example of an optional control point because the filter sock helps to reduce the number of non-target species that will exist during subsequent tasks.

Optional Control Point – control point where control measures can be applied to prevent or reduce the risk of significant non-target hazards. Non-targets are controlled at an optional control point, but this point is not the critical control point to remove or reduce the significant non-target hazard for a successful activity.

Critical Control Point - The best point at which significant hazards can be prevented or reduced to minimum risk. Critical control points are those in which control measures are essential for preventing the spread of non-target hazards.

Critical Control Points (CCPs) are crucial in reducing the non-target risk to an acceptable level to complete a successful activity under the management objective. Points may be identified as CCPs where the risk of non-target hazards can be prevented. In the Inks Dam NFH example, the following may be true:

- Raw surface water containing non-targets should be avoided.
- Non-target hazards can be eliminated by filtering raw-intake water.
- Non-target hazards can be eliminated during harvest by rearing species to a larger size.
- Non-target hazards can be separated from harvested fish for stocking during grading procedures.
- Non-target hazards can be separated manually from larger fish in small quantity shipments.
- Non-target hazards can be eliminated by distributing contaminated shipments to already infested public waters.

It may not be possible to fully eliminate or prevent a non-target hazard. In some cases and with some hazards, minimization may be the only reasonable goal of the ISRAP plan. Although non-target species minimization is acceptable in some instances, it is important that all significant non-target hazards be addressed. Any limitations of the ISRAP plan to control those hazards should also be understood by resource management agencies and their partners. When ISRAP plans cannot satisfactorily control hazards, other approaches to prevent the spread are required.

An ISRAP plan can lose focus if points are unnecessarily identified as CCPs. If control measures are not applied, then that task does not have a control point. This means the

task is neither an optional control point nor a critical control point (CCP). Tasks #1 and #3 are examples of where conditions or standard operating procedures do not require any non-target control measures, therefore these tasks do not have a control point. Only points where control measures are implemented are control points. Moreover, only points at which significant hazards *must* be controlled are considered critical control points. Those new to the HACCP planning process tend to designate many optional control points as CCPs. This may unnecessarily increase effort and reduce efficiency.

Designated CCPs should be limited only to the tasks where control of the significant non-target hazards can best be achieved and is essential for a successful activity. For example, risk of a non-target plant fragment can be controlled by attempting to avoid infested areas of the lake, by trying to pick each fragment off a net before leaving the lake, or by freezing the net for 48 hours before going into uninfested waters. However, trying to avoid infested areas or pick off plant fragments would not be considered CCPs if freezing the net for 48 hours best controlled the hazard, especially if doing so made the first two control measures unnecessary. In this example we have three control points. The first two are optional control points while only the last (freezing the net) is a critical control point.

Differentiating between CCPs and optional control points varies from activity to activity and depends on the uniqueness of the activity. When designating CCPs, you must also consider any applicable state statutes or rules that may dictate the identification of a CCP. For example, it is illegal to transport particular non-target species overland in some states, and CCPs that comply must be developed.

During non-target risk analysis in the previous section, you learned how to determine where non-target enters an activity. Often, the best place to control a non-target is at the point of entry. But this is not always true. The CCP can be several tasks away from the point at which the significant non-target risk is introduced.

A series questions can help you identify CCPs for a process. These questions are discussed below and shown in the CCP decision tree on page 6-13. You will need to perform one iteration through the decision tree for non-target hazard listed for each task rated as a significant risk (Level 2a or higher) during the risk analysis. For example, if you have two types of non-targets and four tasks identified as a significant risk within your activity, then you would need to run through the decision tree a total of eight times (2 x 4 = 8) in order to cover each unique non-target combination for each task and non-target. Properly used, the CCP decision tree can be a helpful tool in identifying CCPs, but it is not a perfect one. Use your best judgment.

Once each control point is assessed, any task identified as having a critical control point needs to be carried on to Step 5, Non-Target Risk Action Plan Form, to develop a plan for addressing the significant non-targets for a successful activity. On occasion there are situations where no critical control points are identified for the entire activity. If this is the case, the ISRAP team needs to further assess each task to ensure that optional control points are adequate to control any significant non-target threats. If all questions can be answered, then the activity can be initiated with the caveat that close monitoring will be employed through each task to be assured that the possible threat of significant non-targets has been thoroughly evaluated and accompanying risks removed.

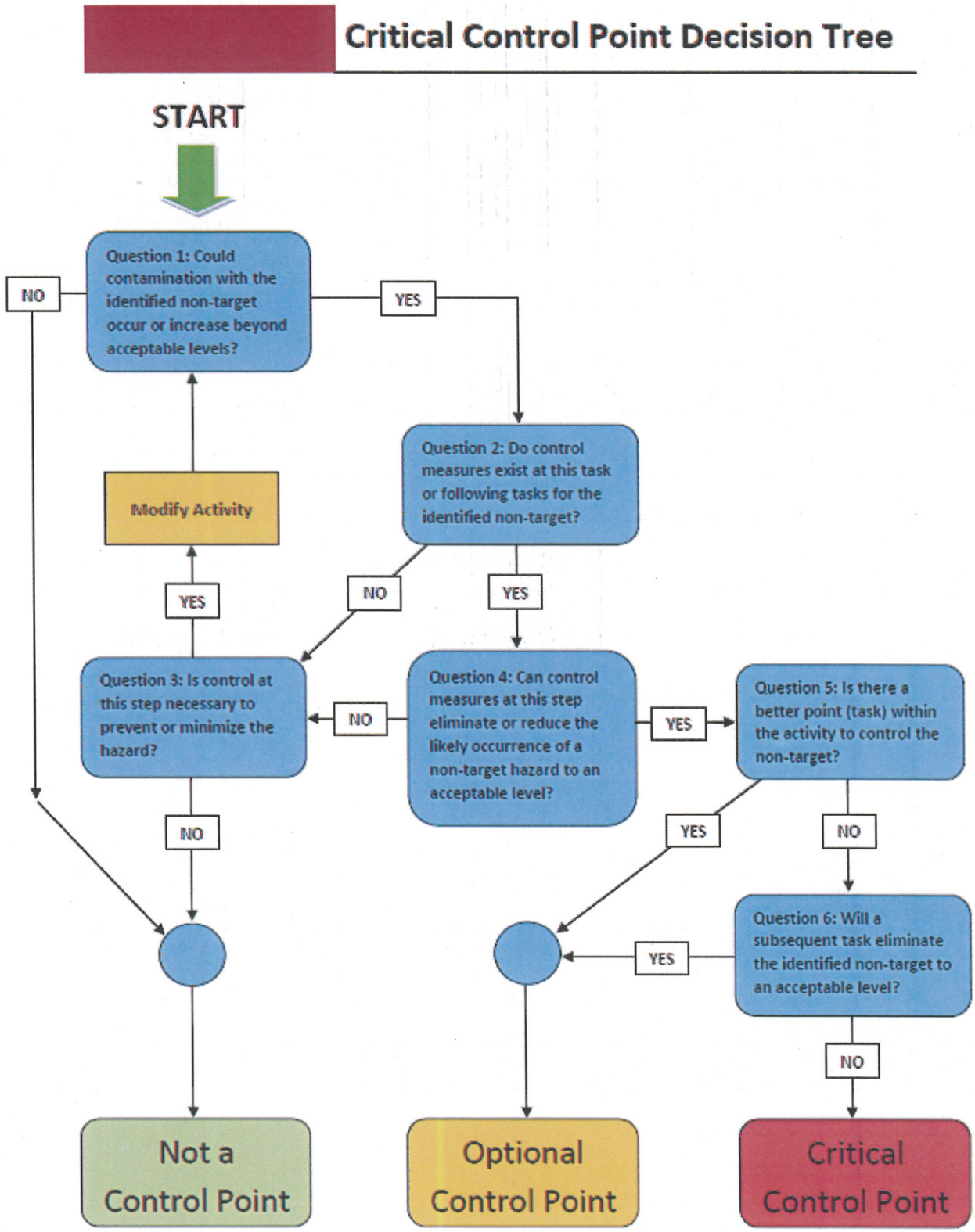
ISRAP Step 4 – Non-Target Analysis Worksheet (continued)

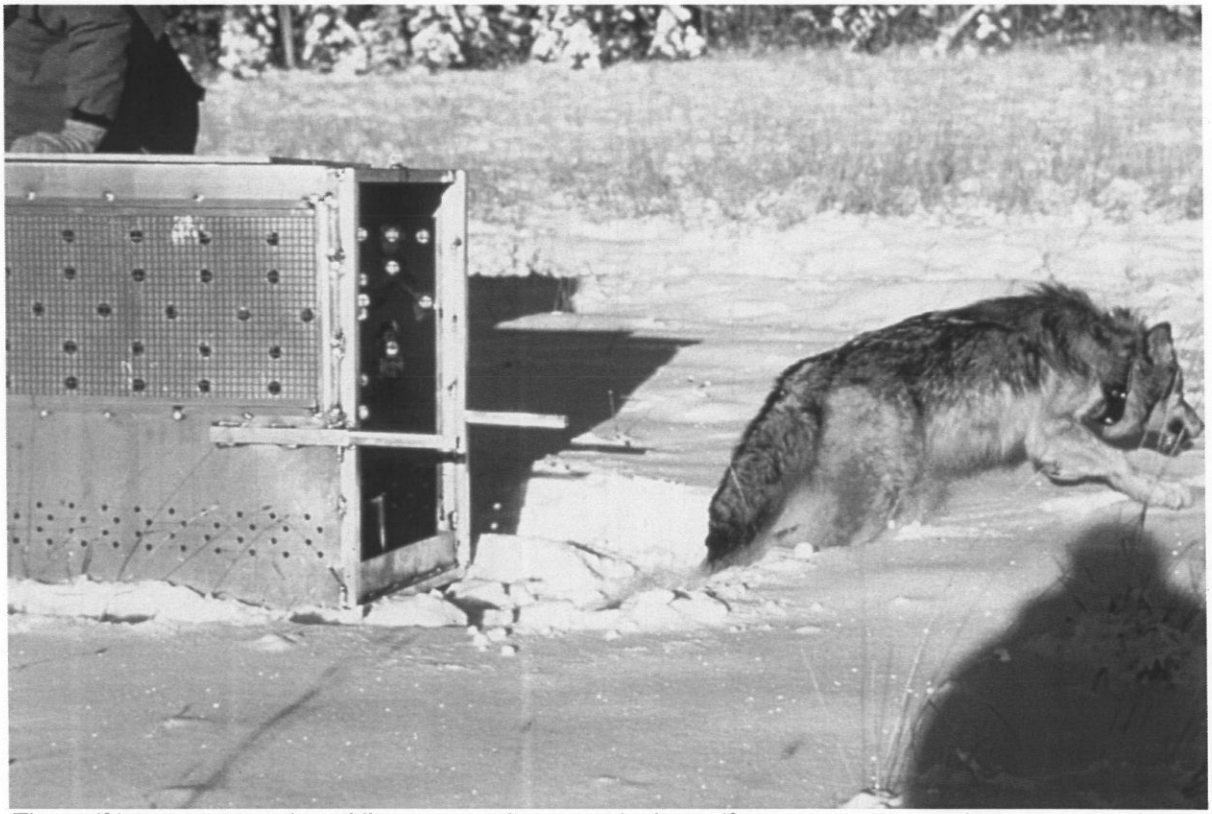
1 Tasks (from ISRAP Step 3 - Activity Flow Chart)	2 Potential non-targets identified in ISRAP Step 2	3 Are any potential non-targets significant? Yes or No	4 Justify Risk Assessment (e.g. RAM Score)	5 If you have decided that this is a Control Point, what Control Measures can be applied to stop the spread of non-targets?	6 Is this task a critical control point? Yes or No
Task # 7: Harvest Phase II Fingerlings	Vertebrates: Other Fish Species	Yes	Level 2a – Moderate Risk Non-targets are potentially present	Fish harvested with large mesh net. Fish are sorted and any NTS are removed.	No
	Invertebrates: Miscellaneous aquatic insects	Yes	Level 2a – Moderate Risk Non-targets are potentially present	Invertebrates are sorted and removed using ≥ ½ inch mesh	No
	Plants: Hydrilla, water star thistle	Yes	Level 2a – Moderate Risk Non-targets are potentially present	Water flow in raceways will remove plants after 24 hours	Yes
	Other Biologics: None	No	Level 1b – Low Risk		No
Task # 8: Fill and Load Distribution Truck	Vertebrates: Other Fish Species	Yes	Level 2a – Moderate Risk Non-targets are potentially present	NTS removed during previous task; truck will with well water free of NTS	No
	Invertebrates: Miscellaneous aquatic insects	Yes	Level 2a – Moderate Risk Non-targets are potentially present	NTS removed during previous task; truck will with well water free of NTS	No
	Plants: Hydrilla, water star thistle	No	Level 1b – Low Risk NTS removed during previous task and truck filled with well water free; No NTS present		No
	Other Biologics: None	No	Level 1b – Low Risk		No

ISRAP Step 4 – Non-Target Analysis Worksheet (continued)

1 Tasks (from ISRAP Step 3 - Activity Flow Chart)	2 Potential non-targets identified in ISRAP Step 2	3 Are any potential non-targets significant? Yes or No	4 Justify Risk Assessment (e.g. RAM Score)	5 If you have decided that this is a Control Point, what Control Measures can be applied to stop the spread of non-targets?	6 Is this task a critical control point? Yes or No
Task # 9: Stock LMB	Vertebrates: Other Fish Species	Yes	Level 2a – Moderate Risk NTS could have passed through control points		Yes
	Invertebrates: Miscellaneous aquatic insects	Yes	Level 2a – Moderate Risk NTS could have passed through control points		Yes
	Plants: Hydrilla, water star thistle	No	Level 1b – Low Risk NTS removed at previous CCP		No
	Other Biologics: None	No	Level 1b – Low Risk		No

Question 1	**Could contamination with the identified non-target occur or increase beyond acceptable levels?** If "yes," ask question 2. If "no," then stop. This task is not a control point, which means that it is also not a CCP.
Question 2	**Do control measures exist at this task or following tasks for the identified non-target?** If "yes," skip question 3 and ask question 4. If "no" because you cannot identify a control measure, ask question 3.
Question 3	**Is control at this step necessary to prevent or minimize the hazard?** If "yes," you have identified a significant non-target hazard that will not be controlled. If you continue, it is likely that you will spread the non-target. The step must be redesigned to include a control measure. Sometimes there is no reasonable control measure available. In such cases, ISRAP does not provide assurance that the activity is free of non-target hazards and you must live with the consequences. If "no," the step is not a CCP for the non-target hazard.
Question 4	**Can control measures at this step eliminate or reduce the likely occurrence of a non-target hazard to an acceptable level?** If "yes" this step is a control point. The next step will determine if it is an Optional or Critical Control Point. If "no," ask question 3…. This may also indicate a SEVERE risk. When there is a severe risk, the field activity must be stopped, unless the benefits of this activity outweigh the potential impacts of introducing non-targets.
Question 5	**Is there a better point (task) within the activity to control the non-target?** If "yes," then you have found an optional control point. You may apply control measures here if resources are available, but this is not a CCP. If "no," then ask question 6.
Question 6	**Will a subsequent task eliminate the identified non-target to an acceptable level?** If "yes," this step is not a CCP for the hazard. Be sure the hazard is controlled by a subsequent processing step. If "no," this step is a CCP. Control measures must be applied at this point (task) in order to prevent the spread of the non-target.


Critical Control Point Decision Tree
START
Question 1: Could contamination with the identified non-target occur or increase beyond acceptable levels?
NO
YES
Question 2: Do control measures exist at this task or following tasks for the identified non-target?
Modify Activity
YES
NO
YES
Question 3: Is control at this step necessary to prevent or minimize the hazard?
Question 4: Can control measures at this step eliminate or reduce the likely occurrence of a non-target hazard to an acceptable level?
NO
YES
Question 5: Is there a better point (task) within the activity to control the non-target?
NO
YES
YES
NO
Question 6: Will a subsequent task eliminate the identified non-target to an acceptable level?
YES
NO
Not a Control Point
Optional Control Point
Critical Control Point



The wolf is a target species while any parasites on or in the wolf are non-target species
Photo Credit: Parker, LuRay

Chapter 7:
Step 5 – Non-Target Risk Action Plan (NTRAP)

Learning Objectives:

- Explain how information from Steps 1-4 applies to completing the Non-Target Risk Action Plan (NTRAP).
- Define the prescribed limit, range, or criterion for Control Measures.
- Describe the process for monitoring Control Measures.
- Describe how to evaluate Control Measures.
- Establish corrective actions if needed.
- Describe the use of supporting documents.
- Complete a Step 5 NTRAP Form utilizing a more diverse team.

In order to complete the final form in your ISRAP plan, you will need information completed in the previous step (the Non-Target Analysis Worksheet, ISRAP step 4). Find the tasks that you have identified as Critical Control Points (CCPs) in column 6 of the Non-Target Analysis Worksheet. An effective ISRAP plan must have at least one CCP if there is any reasonable chance of moving non-target hazards. You will complete a separate form for each CCP identified from your Non-Target Analysis Worksheet. Thus, if you found two CCPs, your Non-Target Risk Action Plan will consist of two forms.

Establish Controls

Controls must be established for each CCP identified in the non-target analysis. A control represents the procedures that are used to ensure that an activity is free of non-targets. Each CCP must have one or more controls for each significant non-target hazard. When a process deviates from the control limits, corrective action must be taken to ensure that non-targets have not slipped through the control point. Examples of control limits might be a minimum flow rate and time during which fish are held in the holding tank to ensure that aquatic nuisance plant fragments are trapped in the outlet filters. In this case, adhering to a minimum flow rate and time controls the aquatic plant hazard. Another example of a control limit might be a minimum dosage (e.g. 400 ppm) of a control chemical (e.g. KCl) used to kill any exiting non-targets.

In many cases, the appropriate control may not be readily apparent or available. Tests may need to be conducted or information gathered from sources such as scientific publications, regulatory guidelines, experts, or experimental studies. If the information

needed to define controls is unavailable, a conservative value should be selected. The rationale and reference material used to establish controls and their limits should become part of the support documentation for the ISRAP.

Control Limit - A specific criterion that must be met for each control measure associated with a critical control point. Often a variety of options exist for controlling a particular hazard. Selection of the best control option and the best control limit is often driven by practicality and experience.

Control - (a) (verb) To manage the conditions of an operation to maintain compliance with established criteria. (b) (noun) The state in which correct procedures are being followed and criteria are being met.

Establish Operating Limits

If monitoring shows a trend toward lack of control at a CCP, managers should take action before the control limit is exceeded. The point at which managers take such an action is called the operating limit. Operating limits should not be confused with control limits. Operating limits are established at a level that would be reached before the control limit was violated. For example, if a minimum flow rate of 30 cubic feet per second (cfs) is required, operating limits may be set to control flow between 32 and 40 cfs. In this example, if monitoring shows that flow is slowing below 32 cfs, then adjustments are necessary to ensure that flow is increased before the control limit (30 cfs) is breached.

The activity should be adjusted when the operating limit is breached to avoid violating critical limits. Biologists and technicians should make these adjustments to avoid loss of control and the need to take corrective action. Spotting a trend toward loss of control early and acting on it can reduce the risk of spreading non-target species with minimal stress on target species subjected to ISRAP procedures used to separate non-targets. If a control limit is ever exceeded, then Corrective Actions are necessary. These will be discussed in later sections.

Operating Limit - Criteria that are more stringent than critical limits and that are used to reduce the risk of non-target contamination. For example, if a certain chemical concentration is required to control a non-target hazard, the operating limit is generally set above the minimum concentration needed to ensure effective treatment.

Operating limits may be selected for various reasons:

- For quality (e.g., separating fish by species and size).
- To avoid exceeding a control limit (e.g., a flow rate in holding tanks could be higher than the control limit to ensure that any aquatic plant fragments are trapped in the outlet filter or a disinfectant solution could be stronger than needed to ensure control).

Management Objective

Review the first form (ISRAP step 1, Activity Description) and copy the management objective into the first box of the Non-Target Risk Action Plan (ISRAP step 5, Non-Target Risk Action Plan). This information is included to remind those using the form of the overall reason for the management activity.

Critical Control Point Task

Review your Non-Target Analysis Worksheet (ISRAP step 4) and find the first CCP (see column 6 for the first task identified as a CCP). Copy the title of the task that corresponds to this CCP into the appropriate box on the Non-Target Risk Action Plan. Also, add the task number in the adjacent box.

Significant Non-Targets

Review your Non-Target Analysis Worksheet (ISRAP step 4) and find the non-target hazards that you identified as significant (See step 4 column 3). Each significant hazard must be copied into the appropriate box on the Non-Target Risk Action Plan.

Control Measures

Establishing controls is often difficult because research is limited for many natural resource pathways. The same is true for prevention. Therefore, it is important for resource management agencies, university researchers, and the private sector to work together to identify procedures known to be effective so that we can separate non-targets from shipments, collections, surveying, sampling, monitoring, and the equipment used for our work.

Once acceptable controls are identified, they must be monitored by a planned sequence of observations or measurements to assess whether each CCP is under control.

For each significant hazard, you should have identified a control measure and listed it on your Non-Target Analysis Worksheet (step 4). Copy the control measures corresponding to each significant hazard into the appropriate box on the Non-Target Risk Action Plan.

Prescribed Range, Limit, or Criterion for Control Measure

Whatever your control measure, there should be some specific level of application necessary to ensure control. For example, if you plan to kill microbes with chlorine bleach, you must specify the minimum concentration and duration necessary for this control measure to be effective. Your Prescribed Range, Limit, or Criterion for this hypothetical control measure might be "a minimum of a 5% chlorine bleach solution administered for a minimum of 10 minutes."

Every control measure must have some specified range, limit or criterion. Without such, there is no way to ensure effectiveness of the control measure. Be specific and keep in mind that you may need supporting documentation to justify your control limits. List your control limits, range, or other criteria in appropriate box on the Non-Target Risk Action Plan.

Control Measure Monitoring

Monitoring is the process that the manager relies upon to maintain control at a CCP. Accurate monitoring indicates when there is a loss of control at a CCP. When controls are not adequate, corrective actions are needed. Reviewing the monitoring records can determine the extent of the problem and the corrective action. Monitoring also provides that activities from the ISRAP plan were followed.

Who monitors the control measures and their appropriate limits (or range or other criteria) to ensure that they are implemented appropriately? Assignment of the responsibility for monitoring is an important consideration when developing an ISRAP plan. The individual assigned to CCP monitoring could be the manager, biologist, or technician. Including all personnel in ISRAP planning builds a broad base of understanding and commitment to the program. All unusual occurrences and deviations from controls should be reported immediately to make sure that adjustments and corrective actions are timely. All records and documents associated with CCP monitoring must be signed or initialed by the person doing the monitoring.

How are the control measures monitored? *Where does the monitoring occur*? Monitoring must be designed to provide rapid (real-time) results. There is no time for lengthy analytical testing because control limit failures must be detected quickly and appropriate corrective actions instituted before transfers, distributions, and releases occur.

Physical and chemical measurements are preferred monitoring methods because testing can be done rapidly. Physical measurements (e.g., time, temperature, and direct observation) can often be related to hazard control. Example physical measurements include the following:

- *Time and temperature* - This combination of measurements is often used to monitor the effectiveness of procedures used to destroy or control hazard contamination of collection gear, nets, and other natural resource survey equipment and materials. An example would be the drying or freezing of

equipment for a specific time to kill a contaminant.

- *Water flow rate* - Since plant fragments, eggs, and many invertebrates cannot swim against the current, holding fish in flowing water to separate them from hitchhikers is one way to control the hazard. Measuring flow rate and the time it takes for one complete water exchange is an example of physical measurements that may need to be monitored.
- *Visual examination* - Observations for the presence of hazard contamination of equipment - such as firefighting equipment, agricultural implements, sample nets, species collection gear, and boats and trailers - is one way to monitor for non-target hazards.

How often are the control measures checked to ensure that they are administered appropriately? Monitoring can be continuous or intermittent. Where possible, monitor continuously. Continuous monitoring is possible for many types of physical and chemical parameters. A monitoring instrument that produces a continuous record does not control the hazard on its own, it needs to be observed periodically and action taken when needed. This too is a component of monitoring. The length of time between checks directly affects the amount of corrective action when a critical limit deviation is found. The frequency of intermittent monitoring should be determined from historical knowledge of the activity and pathway.

Answer the monitoring questions in the appropriate box on the Non-Target Risk Action Plan.

Evaluate Control Measures

Every time a control measure (for a task identified as a CCP) is performed, one must ask "did the action fall outside a prescribed range, limit, or criterion?" That is, "was the control measure applied appropriately?" For example, if at least a 5% chlorine bleach solution was called for, but a 3% bleach solution was used instead, then the control action fell outside the prescribed range (because 3% is not at least 5%). Mark the "yes" box on the Non-Target Risk Action Plan if the control action fell outside the prescribed range, otherwise check the "no" box.

Now, "did the control measure fail?" Sometimes a control measure with a prescribed range, limit, or other criteria is not always effective. A failed control measure means that a non-target hazard was not controlled. If this happens then you may spread the non-target hazard. If you notice that a control measure failed, then check the box marked "yes." Otherwise, check the box marked "no." Obviously, if you had to check the "yes" box then the control measure (or its prescribed range) must be adjusted so that it will be an effective control. You will need to do this before resuming your task. In the meantime, a failed control measure also requires that you perform a corrective action.

Corrective Action

A corrective action is only necessary if a control measure failed. When control measures are not implemented correctly at a CCP, predetermined, documented corrective actions should be instituted immediately.

Corrective actions are implemented when monitoring results indicate a deviation from prescribed control limits. Effective corrective actions depend heavily on an adequate monitoring program. The primary objective is to establish an ISRAP plan that permits rapid identification of deviations from a control limit. The sooner the deviation is identified, the more easily corrective actions can be taken and the greater the potential for minimizing the risk of spread. An individual who has a thorough understanding of the activity, pathway, and ISRAP plan and who has the authority to make decisions needs to be assigned the responsibility of making corrective actions.

If monitoring reveals that control limits are not met, then there must be a corrective action that has been written into the plan that identifies procedures to follow to ensure that the hazard has been controlled. Corrective actions are the backup plan. List here what you plan to do next if you applied a control measure only to find that it didn't work. **Continuing on should not be an option unless something else is done to control the non-target hazard**.

Corrective actions must bring the CCP back under control. A corrective action should take care of the immediate (short-term) problem as well as provide long-term solutions. The objective is to implement a short-term fix so that control can be re-established as soon as possible without further deviations. An unanticipated or recurring control limit failure necessitates a re-evaluation of the ISRAP plan and the corresponding control measure.

A permanent solution to eliminating or minimizing the initial cause or causes for the deviation should be implemented if necessary. Specific instructions for corrective actions must be available to all workers in the operation and should be part of the documented ISRAP plan.

Corrective actions are often written in an "if/then" format; the "if" part of the corrective action describes the condition, and the "then" part describes the action taken.

Predetermined corrective actions are written into the ISRAP plan. When control limits are exceeded and a corrective action occurs, a separate corrective action report is helpful as supporting documentation and should contain a description of the activity/pathway, a description of the deviation, corrective action taken, name of the individual responsible for taking the corrective action, and results of any evaluations.

ISRAP Step 5 – Non-Target Risk Action Plan Form (NTRAP)

(any "Yes" from column 6 of ISRAP Step 4 – Non-Target Analysis Worksheet) One Page for Each Critical Control Point. Use this Form for	
Management Objective from Step #1:	Rearing and distribution of largemouth bass free of non-targets.
Critical Control Point: Task # 7 "Yes" from Step 4, column 6	**Title:** Harvest Phase II Fingerlings
Significant **Non-Target**(s): (Step 4, column 3)	Plants
Control Measures (Step 4, column 5):	Water flow in raceways will remove plants after
Prescribed range, limit, limitation or criterion for **Control Measure**:	24 hours>30 GPM for 20 hours & remove plant fragments from screen.
Control Measure Monitoring: WHO?	Minimum of 2 Hatchery Staff
HOW?	Flow meter
WHERE?	LMB holding tank
HOW OFTEN?	1st and 24th hour for flow

Evaluate **Control Measure** (Answer Yes or No to the following questions):

Yes	No	
☐	☐	Did the action fall outside a prescribed range, limit, or criterion?
☐	☐	Did the **Control Measure** fail?

Corrective Actions, if any "yes" above:	Continue >30 GPM flow-through for 20 more hours

Supporting Documents (if any):
Management Plan, Checklist, Decontamination Techniques, SOPs, Scientific Journal Article, etc.
Control Measure checklist

Development Team Members:	June "Short-Timer" McIlwain Steve "No-Tree" Sharon Jonathan "The Diagrammer" Thompson Dave "The Wizard" Britton Stewart Jacks

Date Developed:	**11-18-09**	**Date(s) Reviewed:**	?

Supporting Documentation

The purpose of supporting documentation is for validation, to provide objective evidence that all essential elements of the plan have a scientific basis and represent a valid approach to controlling the pathway hazards. There are several approaches to validating the ISRAP plan, among them incorporation of fundamental scientific principles, use of scientific data, reliance on expert opinion, or conducting of specific observations or tests.

Validation can be performed by the ISRAP team or by an individual qualified by training or experience. Validation activities may be similar in scope and time commitment to the original plan development. Actual components of the plan should be validated before relying on the ISRAP plan or and when factors warrant. These factors could include: changes in the pathway; using new or different techniques; new scientific information about potential hazards or their control; or new infestations of invasive species. Validation involves a scientific and technical review of the rationale behind each part of the ISRAP plan from hazard analysis through each CCP verification strategy.

Supporting documents include information and data used to develop the plan. This includes the written Non-Target Analysis Worksheet and records of any information used in performing the risk assessment, hazard analysis and establishing the controls.

Supporting documents may also include information about the current geographic range of non-targets that may get into the pathway and sufficient data used to establish the adequacy of any barriers to this contamination. In addition to data, support documents may also include correspondence with consultants or other experts.

Supporting documents should also include a list of the ISRAP team, each member's responsibilities. A section at the bottom of the Non-Target Risk Action Plan is provided for this information.

ISRAP Step 5 – Non-Target Risk Assessment Plan Form (NTRAP)

(any "Yes" from column 6 of ISRAP Step 4 – Non-Target Analysis Worksheet) One Page for Each Critical Control Point	
Management Objective from Step #1:	Rearing and distribution of largemouth bass free of non-targets.
Critical Control Point: Task # 9 "Yes" from Step 4, column 6	**Title:** Stock LMB
Significant **Non-Target**(s): (Step 4, column 3)	Vertebrates, Invertebrates
Control Measure (Step 4, column 5):	Hand sorting each fish
Prescribed range, limit, or criterion for **Control Measure**:	No more than 50 fish at any time across the sorting board
Control Measure Monitoring: WHO?	Minimum of 2 staff members
HOW?	With net & visually examine for NTS
WHERE?	Stocking site
HOW OFTEN?	1 time prior to stocking

Evaluate **Control Measure** (Answer Yes or No to the following questions):

Yes	No	
☐	☐	Did the action fall outside a prescribed range, limit, or criterion?
☐	☐	Did the **Control Measure** fail?

Corrective Actions, if any "yes" above:	Re-sort group

Supporting Documents (if any):
Management Plan, Checklist, Decontamination Techniques, SOPs, Scientific Journal Article, etc.
Stocking slip
Fish count verification sheet

Multiple Critical Control Points

If you identified more than one CCP on your Non-Target Analysis Worksheet, then you will need to complete an additional Non-Target Risk Action Plan form for each additional CCP that you identified. That is, you need a separate action plan for each CCP. Once you have completed an action plan for each CCP, your ISRAP plan is finished. However, do not just file it away and forget it. Please use the Non-Target Risk Action Plan every time your covered activity is performed and re-evaluate your ISRAP plan frequently, especially if anything covered in you activity changes.

Water Chestnut (*Trapa natans)* is an invasive aquatic plant that moves in and dominates an area, forming dense surface mats that can severely limit recreation and habitat.

– *Photo Credit:* Mystic River Watershed Association

Chapter 8:
Implementing ISRAP

Learning Objectives:

- Explain how Supporting Documents can augment ISRAP plans by providing validity and clarity.
- Explain how periodic review of ISRAP plans is essential.
- Describe how sharing plans can help others as well as your own ISRAP team.
- Remind how stewardship of the environment is paramount to natural resource management activities.

Supporting Documentation and Periodic Review

A common problem that faces the ISRAP process is implementation. Many plans are constructed and then become dust collectors on a shelf. This is not the intent for an ISRAP plan. Plans by themselves are only pieces of paper (or an electronic equivalent). The planning process is what is important and should not cease once an ISRAP plan is completed. Circumstances change. Procedures change. Materials and personnel change. We live in a dynamic world where we need to periodically re-evaluate our actions to ensure that our precautions are still valid.

Supporting documents and periodic review are essential to the implementation of the ISRAP process on the ground level. As described in Chapter 7, supporting documents can be checklists for verifying that work has been completed, equipment manuals, standard operating procedures, decontamination literature or any other documents that are relevant to the activity. Peer-reviewed scientific journal articles that provide evidence for the effectiveness of a particular control measure could be important to document the validity of your established procedures. With time, new information becomes available. Such information could substantially impact how your activity meets your management objectives and could impact the effectiveness of your control measures. Conducting a periodic review of the plan ensures that plan components stay fresh. During the course of a year many projects may have employee turnover, change standard operating procedures, and/or add activities. Meanwhile, additional invasive species continually enter new habitats. A periodic review on at least an annual basis will ensure that new pathways for spreading invasive species are recognized and controlled.

It is important to consider ISRAP planning as a living document for review with ever changing environmental conditions and the possibility of new non-target species influencing our field activities. Considering these challenges, we recommend that you

and your partners make a reasonable effort to review standard operating procedures and ISRAP documents on a consistent. This is especially important as many people in natural resource management agencies will retire in unprecedented numbers over the next five years. Do not rely on corporate memory that may retire with them. Preserve best management practices within a fully documented ISRAP plan.

Sharing Plans

Sharing plans is at http://www.haccp-nrm.org is a way to share your ISRAP process information. The website can be used to provide examples to other professionals that are working to prevent the spread of invasive species in their activities. Also share your ISRAPs with partners and public entities. The more you expose those that might be affected by non-target movement and potential invasive species introductions, the better the opportunity to reduce the risk through effective communications and constructive planning together. By putting your ISRAP plan online, you also provide a way for others to provide valuable feedback. Interested parties or others who perform similar management activities may have ideas or suggestions that did not initially come to your ISRAP team. The on-line database of ISRAP plans is available to connect others around the globe and further our common goal of conserving our valuable natural resources.

A Word on Conservation Ethics

First, do no harm. As stewards of natural resources it is our responsibility to do our part to protect and preserve nature. Part of this responsibility is to not unknowingly spread invasive species in our professional and personal lives. None of us wants to inadvertently destroy the resource that we work so hard to conserve. A good steward will take in the larger picture and evaluate the consequences of his or her own actions (or inactions).

We must all work together to continue to educate everyone about invasive species and potential irreversible damage that one simple uninformed miscue can invoke. Of course, it should not be necessary to remind us all that spreading invasive species is prohibited in most jurisdictions. Federal and state laws are in place to enforce this prohibition. Natural resource managers are not generally exempt from these regulations. Activities that move species, whether intentionally or unintentionally, should be considered in only in the most specific circumstances where reasonable precautions are taken and such movement is warranted and done only to enhance the environment following all applicable rules, regulations, and laws. ISRAP planning is a valuable tool that can be used to document how these criteria are met.

ISRAP Glossary

Alien - an organism that is outside of its native range; a organism that is foreign to its current geographic location. See non-indigenous.

Aquarium Release - a type of intentional introduction whereby a captive or aquatic pet animal, aquarium plant, or contaminated water is released into open waters by an aquarium hobbyist.

Aquatic Nuisance Species (ANS) - a non-indigenous species that threatens the diversity or abundance of native species; the ecological stability of infested waters; or commercial, agricultural, aquacultural, or recreational activities dependent on such waters.

Bait Bucket Introduction - the introduction, release or escape of fish (usually small minnows) or invertebrates, originally used or intended to be used as bait, into open waters as a result of fishing activities.

Contaminant Introduction - see stock contaminant.

Control - (a) [verb] to manage the conditions of an activity or a non-target to maintain compliance with established criteria (e.g. to control a non-target means to prevent its spread). (b) [noun] the state in which correct procedures are followed and criteria are met.

Control Limit - a specific criterion that must be met for each control measure associated with a critical control point. For example, if the application of a bleach solution was used as a control measure to prevent the spread of a non-target species, the control limit might be the minimum concentration of that solution (e.g. ≥5% bleach solution). In this example, a 3% bleach solution would fail to meet the control limit.

Control Measures - actions that can be used to control a potential hazard (sometimes referred to as a preventive measure). Control measures are the first, and sometimes only, line of defense against the spread of non-targets. If control measures fail, corrective actions should be implemented.

Control Point - any step or task at which potential hazards can be controlled. Control points may be critical control points or optional control points. Only critical control points are essential for preventing risk, however, if resources allow, optional control points may also be employed to further minimize risk well below acceptable levels.

Corrective Action - a procedure that must be followed if a control measure fails at a critical control point. A corrective action is backup procedure used as a second line of defense that may be necessary to prevent the spread of a non-target if the first-line defense (a control measure) fails to control a non-target.

Critical Control Point (CCP) - the best point, step, or procedure at which significant hazards (not-targets) can be controlled, prevented, or reduced to acceptable levels in order to minimum the risk of spread.

Deviation – when a control measure fails to achieve a critical limit or falls outside of an established acceptable range.

Endemic - a species or any other taxonomic group that is native and exclusive to a limited geographic area (such as a lake, drainage system, biogeographic region, or country). An endemic species is native to a limited geographic area and nowhere else. The term 'endemic' is sometimes incorrectly used as synonym for 'indigenous.'

Escape - a type of unintentional introduction whereby a non-target species escapes into open water from captive conditions such as an aquaculture facility, research facility, hatchery, ornamental fish farm, or zoological park.

Established - an introduced organism with one or more reproducing, sustainable populations.

Exotic - something that is found outside of its native range; something that is foreign (see non-indigenous).

HACCP - Hazard Analysis and Critical Control Points – a system or plan for controlling hazards (non-target species) in order to minimize risk and/or detrimental impact while meeting a management objective.

Hazard - a non-target species that is reasonably likely to be transported through natural resource work and become established, creating negative impacts to native species and/or their habitats.

Indigenous - occurring or found naturally in a particular area or ecosystem (e.g. species that are indigenous to North America are those that historically occurred in North America prior to the arrival of the first European settlers). In contrast to endemic species, indigenous species may be found naturally in more than one particular geographic area. An indigenous species is a member of its native, natural community.

Intentional Stocking or Relocation - a purposeful introduction of a native or non-native species for specific natural resource management purposes.

Introduce - the intentional or unintentional process of releasing, or allowing to be released a non-target species into an ecosystem, region, or specific geographical location where it is not native

Introduced Species - a species moved by humans (or by human actions), either intentionally or unintentionally, to an ecosystem, region, or specific geographical location where it is not native.

ISRAP - Invasive Species Risk Assessment and Planning – a strategic method for controlling non-target species pathways through the use of HACCP and simple risk assessment.

Locally Established - an introduced species with one or more naturally reproducing populations but with a very restricted distribution and no evidence of natural range expansion (in general, limited to a relatively confined area, such as a small lake).

Monitor - conduct planned observations or measurements to assess whether a critical control point is under control and produce an accurate record for future use in verification.

Native - a species that occurs naturally within a specific geographical range (e.g. species native to North America existed there before the arrival of European settlers). See indigenous.

Naturalized - a well established species, not originally native to a particular geographic area, but has become integrated with native species into the otherwise natural food web.

Non-Indigenous - a species that exists in a geographic area that is outside its historic or native geographic range. In this manual, the term 'non-indigenous' includes both foreign (i.e., exotic) and transplanted species, and is often used synonymously with 'alien,' 'non-native' and 'introduced.'

Non-Native - see non-indigenous

Non-Target Species (NTS) - any species of organism that may be present in the action area, but is not the species for which an action was initiated; synonymous with 'hazard' in the industry's application of HACCP planning.

Open Water - in this manual, includes all lakes, rivers, streams, and springs; also includes any water body, such as a reservoir, pond, canal, and

drainage ditch, considered to be outside the boundaries or control of captive conditions (e.g. aquaculture facility, research facility, hatchery, ornamental fish farm, or zoological park). An open water may have either a permanent, temporary, or intermittent water connection (e.g. via flooding) with other aquatic systems.

Operating Limits - prescribed limits for control measures used to reduce the risk of contamination by non-target species. Operating limits are usually more stringent than critical limits. For example, if a certain chemical concentration, say 5 ppm, is required to control (i.e., kill) organisms of a non-target species, then a manager might set the operating limit above this minimum concentration needed to ensure effective treatment. This manager, for example, would, perhaps, set the operating limits to 8 to 10 ppm.

Pathway - an activity or process through which a species may be transferred to a new location where it could become introduced.

Pathway Management - the act of assessing a pathway, identifying control points, and incorporating control measures or corrective actions to reduce or eliminate non-target species.

Pests - species that are considered to be undesirable. Species considered to be pests may or may not threaten the diversity or abundance of native species; the ecological stability of infested waters; or commercial, agricultural, aquacultural, or recreational activities dependent on such waters. Native species can be pests.

Reintroduction - the intentional release by humans of a species into a drainage, or portion of a drainage, in which it was indigenous in historic times but where it subsequently became locally extinct.

Restocking - the deliberate release by humans of a species into an area where it already occurs, usually with the intention of augmenting the existing population.

Reported - refers to an introduced species that has been recorded (i.e., collected, stocked, or observed) from open waters but is not as yet known to be established.

Risk - (a) [verb] expose to a chance of loss or damage; (b) [noun] an estimate of the likely occurrence of a hazard or non-target species; (c) [noun] a quantitative measure of the likelihood of an undesirable event occurring times the impact of the event occurring. In this manual the term 'risk' is most often used as defined in (a) or (b) because the impact of the event

occurring, as described as a risk component in (c), is usually considered to be a complete (100%) failure of the management objective.

Severity - the level of detrimental impact of an introduced non-target species (if not properly controlled).

Stock Contaminant - a non-target organism unintentionally stocked with, or instead of, the target organism (e.g., green sunfish are a stock contaminant if they are mistakenly mixed with or misidentified as bluegill, the target organism, during bluegill stocking).

Target - anything intentionally moved from one to place to another. A target may be an organism, a piece of equipment, or even a person. Examples of natural resource activities where the term 'target' could be applied include stocking a particular fish species for recreation or restoration, collection of a particular species for captive breeding or relocation, movement from location to location by a biologist while collecting habitat data, and moving equipment from area to area or region to region.

Taxon - group of organisms of any taxonomic rank or sub-rank (e.g. domain, kingdom, phylum, subphylum, class, subclass, order, suborder, genus, species, subspecies). Plural is taxa.

Translocate – to move something from one place to another.

Transplant - a species moved by humans, either deliberately or accidentally, from an area where it is native, to another area outside its native distribution but within the same national geographic range (e.g. rainbow trout in Virginia).

Unsuccessful introduction - an introduced species that has failed to establish a self-sustaining or reproducing population.

Validation - the element of verification focused on collecting and evaluating scientific and technical information to determine whether the HACCP plan, when properly implemented, effectively controls identified pathway hazards.

Vector - a biological pathway for a disease or parasite (i.e., an organism that transmits pathogens to various hosts).

Verification - the use of methods, procedures, or tests, in addition to those used in monitoring, that determine whether the HACCP system is in compliance with the HACCP plan and/or whether the plan needs modification.

Kudzu (*Pueraria lobata*) was intentionally introduced to control soil erosion. The plant now occupies 7 million acres and is often referred to as "the plant that ate the South." Growing an average of 12 inches per day, Kudzu literally swallows forests, preventing other plants and trees from getting proper

The intensive filtering activity of invasive Zebra mussels (*Dreissena polymorpha*) can drastically alter aquatic ecosystems by increasing water clarity and decreasing the food available to native species. (Photo credit: NOAA)

Once introduced, aquatic invasive plants can spread quickly. Once established they reduce light and oxygen to native wildlife (Photo credit: Maine Bureau of Land and Water Quality).

The highly invasive nature of purple loosestrife (*Lythrum salicaria*) allows it to form dense stands that replace native plants that provide a quality source of nutrition for wildlife (Photo credit: National Park Service).

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Walters, C., Adaptive Management of Renewable Resources, 1986, republished by The Blackburn Press, Caldwell, NJ, 2001.

World Health Organization (WHO), "HACCP: Introducing the Hazard Analysis Critical Control Point System," Document WHO/FSF/FOS, 1997.

Web Resources

AIS-HACCP – Minnesota Sea Grant
http://www.seagrant.umn.edu/ais/haccp

Early Detection & Distribution Mapping System - Center for Invasive Species and Ecosystem Health
www.eddmaps.org

Global Invasive Species Database - IUCN
www.issg.org/database/welcome

HACCP for Natural Resource Management – USFWS/UT Arlington
www.haccp-nrm.org

HACCP for Natural Resource Management in Spanish - Conabio
www.conabio.gob.mx/invasoras/index.php/Análisis_de_riesgo

Non-indigenous Aquatic Species Database - USGS
http://nas.er.usgs.gov

Executive Order 13112

Federal Register: Feb 8, 1999 (Volume 64, Number 25)

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

Section 1. Definitions.

(a) "Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) "Ecosystem" means the complex of a community of organisms and its environment.

(d) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.

(e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "Native species" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) "Stakeholders" means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) "United States" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

Section 2. Federal Agency Duties.
(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and

(3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive

Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

Section 3. Invasive Species Council.
(a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council. (b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

Section 4. Duties of the Invasive Species Council.
The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in

section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species;

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(g) prepare and issue a national Invasive Species Management Plan as set forth in section 5 of this order.

Section 5. Invasive Species Management Plan.
(a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk that introductions will occur. Such recommended measures

shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to the Office of Management and Budget on whether the order should be revised.

Section 6. Judicial Review and Administration.
(a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs.

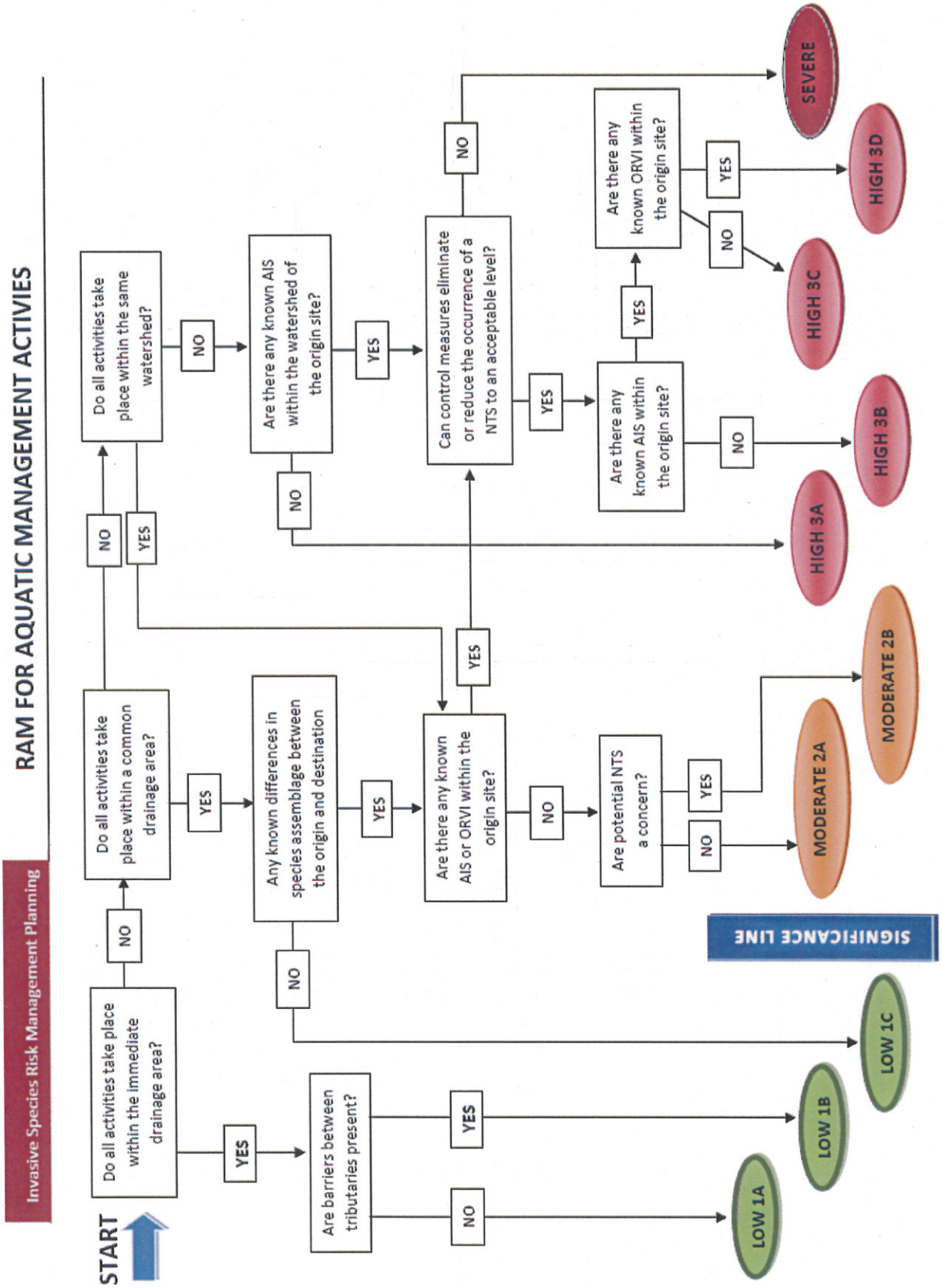
(d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.

WILLIAM J. CLINTON
THE WHITE HOUSE,
February 3, 1999.

RAM for Aquatic Management Activities

Risk Level	Aquatic Management Activities
No Risk	**Does Not Exist**
Level 1a Low Risk	• **Activities In Immediate Drainage W/O Barriers (Continuous, Tributaries Within Drainage)** • Like Habitat, No Differences In Known Species Assemblages • No NTS, AIS, or ORVI In Origin
Level 1b Low Risk	• **Activities In Immediate Drainage W/ Barriers (Barriers Between Tributaries Within Drainage)** • Like Habitat, No Differences In Known Species Assemblages • No NTS, AIS, or ORVI In Origin
Level 1c Low Risk	• **Activities In Common Drainage W/ Barriers Or Isolation (Non-Continuous)** • Like Habitat, No Differences In Known Species Assemblages • No NTS, AIS, or ORVI In Origin
Non-Target Analysis Critical Control Point Upper Limit (Significance Line)	
Level 2a: Moderate Risk	• Activities In Common Drainage W/ Barriers Or Isolation (Non-Continuous) • **Known Difference In Habitat And/Or In Species Assemblages From Origin To Destination** • Potential Of NTS In Origin, But Not A Concern • No AIS or ORVI In Origin
Level 2b: Moderate Risk	• Activities Within Watershed • **Potential Of NTS In Origin And A Concern** • No AIS or ORVI In Origin
Level 3a: High Risk	• **Activities Out Of Watershed** • No ORVI or AIS In Origin
Level 3b: High Risk	• **AIS Present In Watershed, But Not Identified In Origin** • No ORVI In Origin
Level 3c: High Risk	• **AIS Present In Source, But Controllable** • No ORVI In Origin
Level 3d: High Risk	• **ORVI Present, But Controllable In Origin**
Severe Risk	• **AIS, or ORVI In Water Body** • **ISRAP Not Effective In Removal Or Control**

NTS – Non Target Species
AIS – Aquatic Invasive Species
ORVI - Optical Recognition Virtually Impossible


Invasive Species Risk Management Planning
RAM FOR AQUATIC MANAGEMENT ACTIVIES
START
Do all activities take place within the immediate drainage area?
YES
NO
Are barriers between tributaries present?
YES
NO
LOW 1A
LOW 1B
Do all activities take place within a common drainage area?
YES
NO
Any known differences in species assemblage between the origin and destination
YES
NO
Do all activities take place within the same watershed?
NO
YES
Are there any known AIS within the watershed of the origin site?
YES
NO
HIGH 3A
Are there any known AIS or ORVI within the origin site?
YES
NO
Can control measures eliminate or reduce the occurrence of a NTS to an acceptable level?
YES
NO
SEVERE
Are there any known AIS within the origin site?
YES
NO
HIGH 3B
Are there any known ORVI within the origin site?
YES
NO
HIGH 3D
HIGH 3C
Are potential NTS a concern?
YES
NO
MODERATE 2B
MODERATE 2A
LOW 1C
SIGNIFICANCE LINE

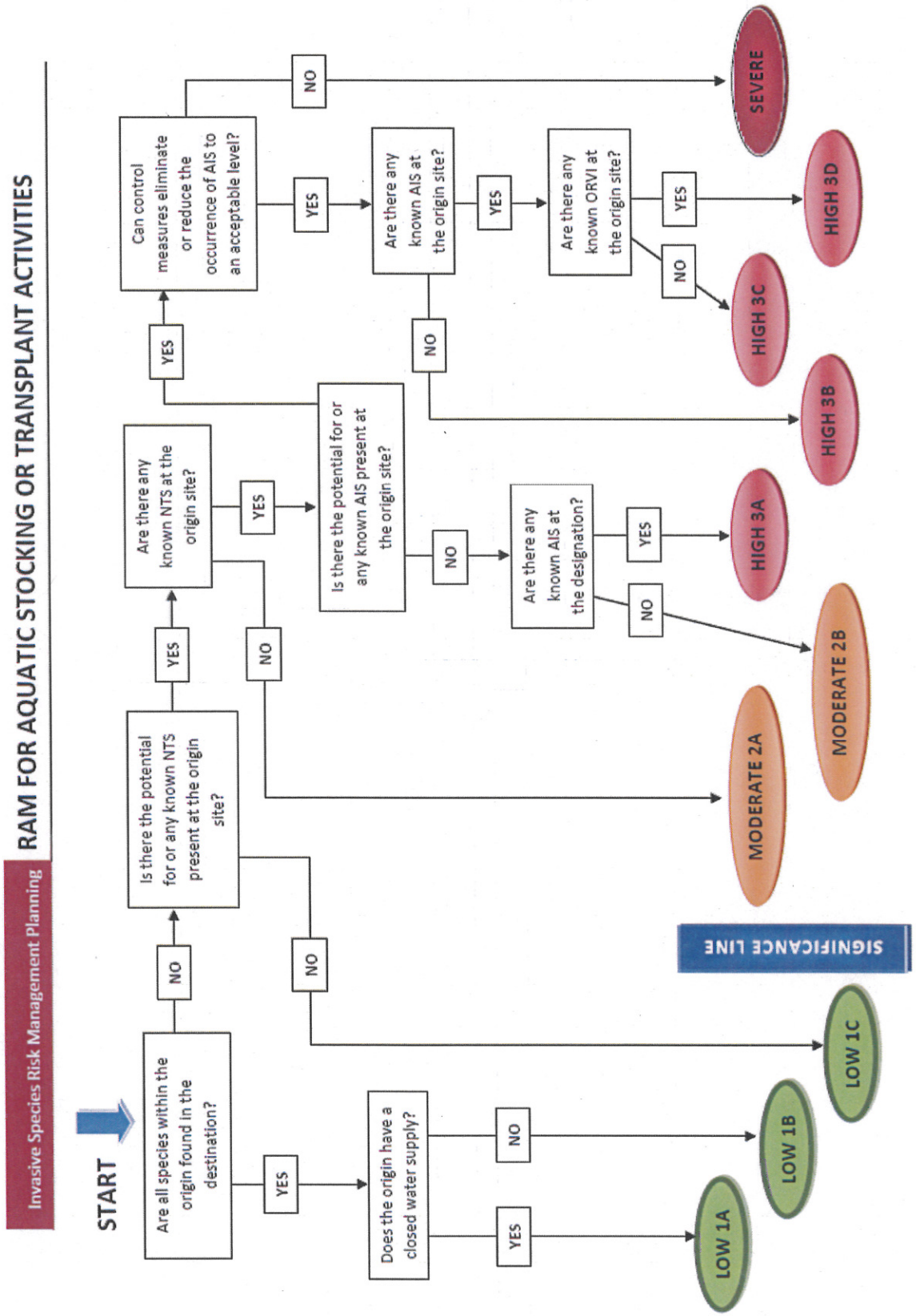
RAM for Aquatic Stocking or Transplant Activities

Risk Level	Aquatic Stocking/Transplant
No Risk	**Does Not Exist**
Level 1a Low Risk	• **Closed Water Supply** • Multiple Species Present, All Found In Destination • No NTS, AIS, or ORVI In Origin
Level 1b Low Risk	• **Open Water Supply** • Multiple Species Present, All Found In Destination • No NTS, AIS, or ORVI In Origin
Level 1c Low Risk	• **Multiple Species Present, Not All Present In Destination** • No NTS, AIS, or ORVI In Origin
Non-Target Analysis Critical Control Point Upper Limit (Significance Line)	
Level 2a Moderate Risk	• Multiple Species Present, Not all Present in Designation • **Potential NTS in Origin** • No AIS or ORVI in Origin
Level 2b Moderate Risk	• **NTS Present in Origin** • No AIS or ORVI in Origin
Level 3a High Risk	• **AIS in Destination, but Not in Origin** • No ORVI in Origin
Level 3b High Risk	• **Potential AIS in Origin, but Controllable** • No ORVI in Origin
Level 3c High Risk	• **AIS Present In Origin, but Controllable** • No ORVI In Origin
Level 3d High Risk	• **ORVI Present, But Controllable In Origin**
Severe Risk	• **AIS or ORVI within Origin** • **ISRAP Not Effective In Removal Or Control**

NTS – Non Target Species

AIS – Aquatic Invasive Species

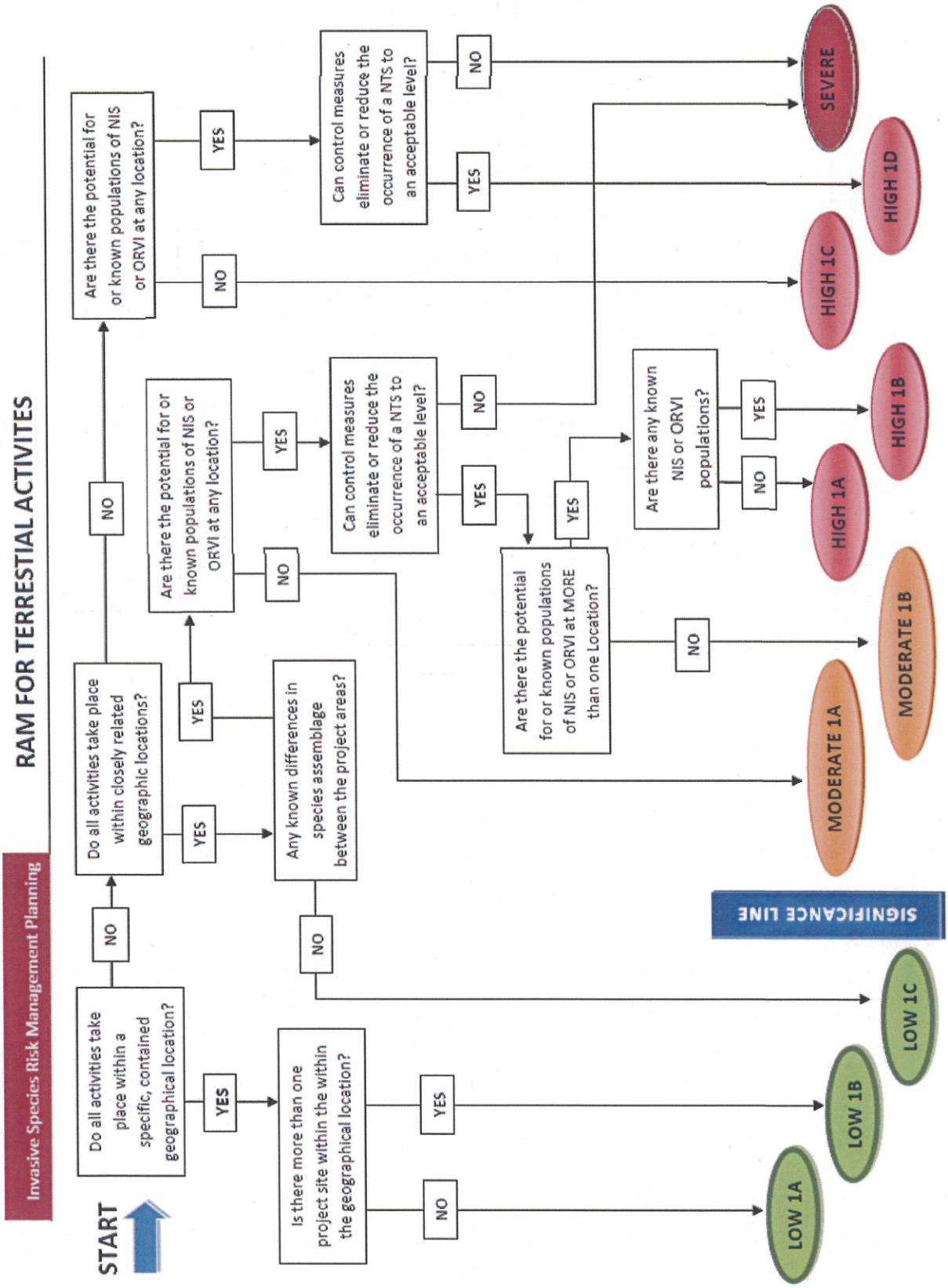
ORVI - Optical Recognition Virtually Impossible


Invasive Species Risk Management Planning
RAM FOR AQUATIC STOCKING OR TRANSPLANT ACTIVITIES
START
Are all species within the origin found in the destination?
YES
NO
Does the origin have a closed water supply?
YES
NO
Is there the potential for or any known NTS present at the origin site?
YES
NO
Are there any known NTS at the origin site?
YES
NO
Is there the potential for or any known AIS present at the origin site?
YES
NO
Are there any known AIS at the designation?
YES
NO
Can control measures eliminate or reduce the occurrence of AIS to an acceptable level?
YES
NO
Are there any known AIS at the origin site?
YES
NO
Are there any known ORVI at the origin site?
YES
NO
LOW 1A
LOW 1B
LOW 1C
MODERATE 2A
MODERATE 2B
HIGH 3A
HIGH 3B
HIGH 3C
HIGH 3D
SEVERE
SIGNIFICANCE LINE

RAM for Terrestrial Activities

Risk Level	Criterion for Aquatic Management Activities
No Risk	Does Not Exist
Level 1a Low Risk	• Activities In One Site in Contained Specific Geographic Location • No Know NTS, NIS, or ORVI
Level 1b Low Risk	• Activities in Many Sites within Specific Geographic Location • Like Habitat, No Differences in Known Species Assemblages • No Known NTS, NIS, or ORVI
Level 1c Low Risk	• Activities Among Closely Related Geographic Areas (Many Locations) • Like Habitat, No Differences In Known Species Assemblages • No Known NTS, NIS, or ORVI
Non-Target Analysis Critical Control Point Upper Limit (Significance Line)	
Level 2a Moderate Risk	• Activities Among Closely Related Geographic Areas (Many Locations) • Known Difference In Species Assemblages Between Locations • No Known NIS or ORVI at any location
Level 2b Moderate Risk	• Activities Among Closely Related Geographical Areas (Many Locations) • Potential Of NIS or ORVI at Any Location
Level 3a High Risk	• Activities Among Closely Related Geographic Areas (Many Locations) • Potential of NIS or ORVI at Locations within Multiple Areas
Level 3b High Risk	• Activities Among Closely Related Geographic Areas (Many Locations) • NIS or ORVI at One Location within One Area
Level 3c High Risk	• Activities in Distinctly Separate Geographic Areas • No Known NIS or ORVI at Any Locations
Level 3d High Risk	• Activities in Distinctly Separate Geographic Areas • NIS or ORVI at One Geographic Area
Severe Risk	• ISRAP Not Effective In Removal Or Control

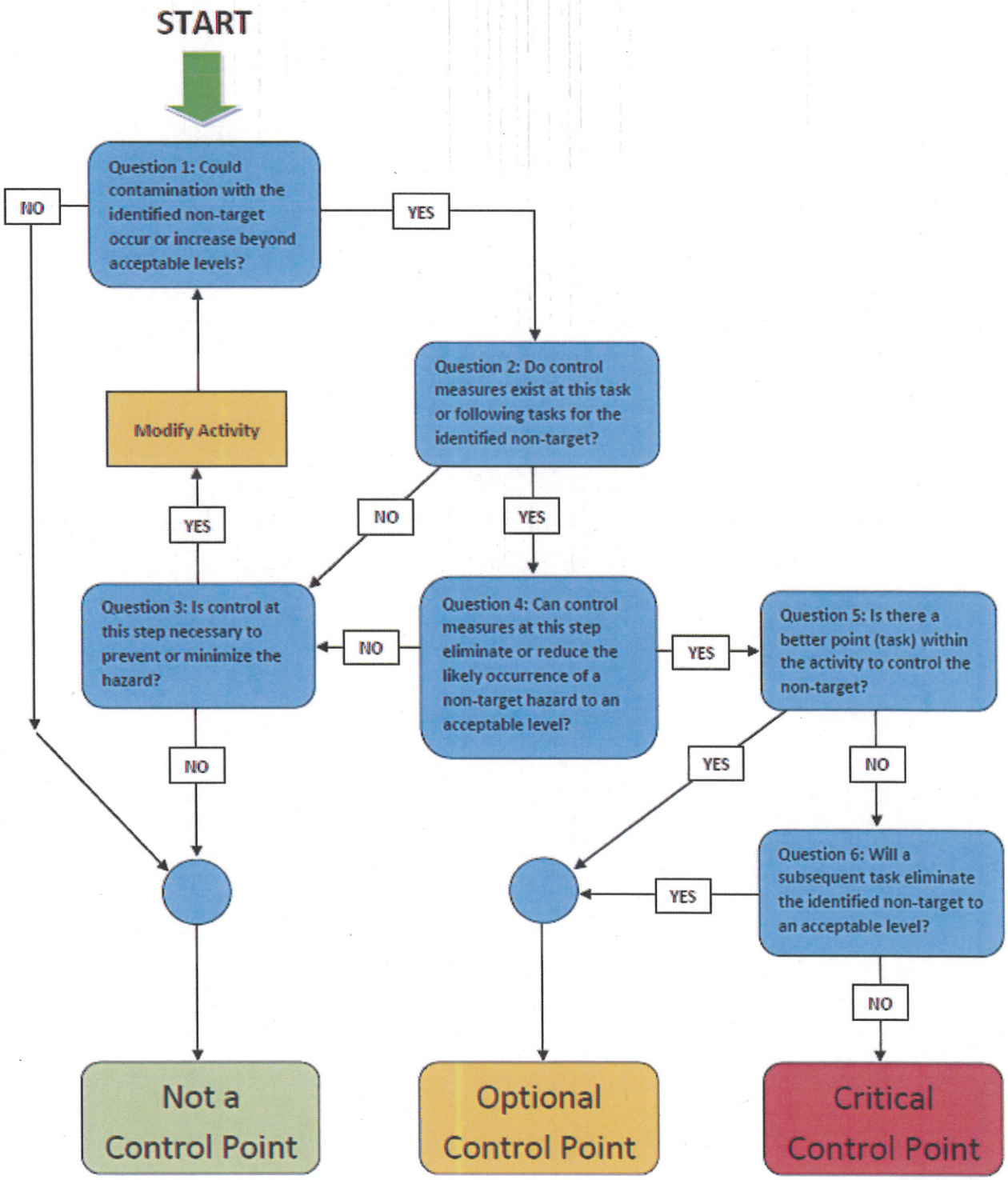
NTS – Non Target Species
NIS – Non- Indigenous Species (may include terrestrial or aquatic species)
ORVI - Optical Recognition Virtually Impossible


Invasive Species Risk Management Planning
RAM FOR TERRESTIAL ACTIVITES
START
Do all activities take place within a specific, contained geographical location?
YES
NO
Is there more than one project site within the within the geographical location?
YES
NO
LOW 1A
LOW 1B
LOW 1C
Do all activities take place within closely related geographic locations?
YES
NO
Any known differences in species assemblage between the project areas?
YES
NO
MODERATE 1A
MODERATE 1B
Are there the potential for or known populations of NIS or ORVI at any location?
YES
NO
Can control measures eliminate or reduce the occurrence of a NTS to an acceptable level?
YES
NO
HIGH 1D
SEVERE
Are there the potential for or known populations of NIS or ORVI at any location?
YES
NO
Can control measures eliminate or reduce the occurrence of a NTS to an acceptable level?
YES
NO
HIGH 1C
SEVERE
Are there the potential for or known populations of NIS or ORVI at MORE than one Location?
YES
NO
Are there any known NIS or ORVI populations?
YES
NO
HIGH 1B
HIGH 1A
SIGNIFICANCE LINE

Questions in Determining a Critical Control Point

Question 1	**Could contamination with the identified non-target occur or increase beyond acceptable levels?** If "yes," ask question 2. If "no," then stop. This task is not a control point, which means that it is also not a CCP.
Question 2	**Do control measures exist at this task or following tasks for the identified non-target?** If "yes," skip question 3 and ask question 4. If "no" because you cannot identify a control measure, ask question 3.
Question 3	**Is control at this step necessary to prevent or minimize the hazard?** If "yes," you have identified a significant non-target hazard that will not be controlled. If you continue, it is likely that you will spread the non-target. The step must be redesigned to include a control measure. Sometimes there is no reasonable control measure available. In such cases, ISRAP does not provide assurance that the activity is free of non-target hazards and you must live with the consequences. If "no," the step is not a CCP for the non-target hazard.
Question 4	**Can control measures at this step eliminate or reduce the likely occurrence of a non-target hazard to an acceptable level?** If "yes" this step is a control point. The next step will determine if it is an Optional or Critical Control Point. If "no," ask question 3…. This may also indicate a SEVERE risk. When there is a severe risk, the field activity must be stopped, unless the benefits of this activity outweigh the potential impacts of introducing non-targets.
Question 5	**Is there a better point (task) within the activity to control the non-target?** If "yes," then you have found an optional control point. You may apply control measures here if resources are available, but this is not a CCP. If "no," then ask question 6.
Question 6	**Will a subsequent task eliminate the identified non-target to an acceptable level?** If "yes," this step is not a CCP for the hazard. Be sure the hazard is controlled by a subsequent processing step. If "no," this step is a CCP. Control measures must be applied at this point (task) in order to prevent the spread of the non-target.

Critical Control Point Decision Tree



ISRAP Step 1 – Activity Description

Management Objective & Contact Information	
Management Objective:	Contact Person:
	Phone:
	Email:

Activity Description i.e. Who; What; Where; When; How; Why

ISRAP Step 2 – Identify Potential Non-Targets

(to be transferred to column 2 of ISRAP Step 4 – Non-Target Analysis Worksheet)

Non-Targets That May Potentially Be Moved/Introduced
Vertebrates:
Invertebrates:
Plants:
Other Biologics (pathogens, parasites, etc.):

ISRAP Step 3 – Activity Flow Chart

Outline Sequential Tasks of Activity
(to be transferred to column 1 of the ISRAP Step 4 – Non-Target Analysis Worksheet)

Task 1	Title:
	Description:

⇓

Task 2	Title:
	Description:

⇓

Task 3	Title:
	Description:

⇓

Task 4	Title:
	Description:

⇓

Task 5	Title:
	Description:

⇓

Task 6	Title:
	Description:

⇓

Task 7	Title:
	Description:

⇓

Task 8	Title:
	Description:

ISRAP Step 4 – Non-Target Analysis Worksheet

1 Tasks (from ISRAP Step 3 - Activity Flow Chart)	2 Potential non-targets identified in ISRAP Step 2	3 Are any potential non-targets significant? Yes or No	4 Justify Risk Assessment (e.g. RAM Score)	5 If you have decided that this is a Control Point, what Control Measures can be applied to stop the spread of non-targets?	6 Is this task a critical control point? Yes or No
Task # Title:	Vertebrates:				
	Invertebrates:				
	Plants:				
	Other Biologics:				
Task # Title:	Vertebrates:				
	Invertebrates:				
	Plants:				
	Other Biologics:				

ISRAP Step 4 – Non-Target Analysis Worksheet (continued)

1 Tasks (from ISRAP Step 3 - Activity Flow Chart)	2 Potential non-targets identified in ISRAP Step 2	3 Are any potential non-targets significant? Yes or No	4 Justify Risk Assessment (e.g. RAM Score)	5 If you have decided that this is a Control Point, what Control Measures can be applied to stop the spread of non-targets?	6 Is this task a critical control point? Yes or No
Task # Title:	Vertebrates:				
	Invertebrates:				
	Plants:				
	Other Biologics:				
Task # Title:	Vertebrates:				
	Invertebrates:				
	Plants:				
	Other Biologics:				

ISRAP Step 4 – Non-Target Analysis Worksheet (continued)

1 Tasks (from ISRAP Step 3 - Activity Flow Chart)	2 Potential non-targets identified in ISRAP Step 2	3 Are any potential non-targets significant? Yes or No	4 Justify Risk Assessment (e.g. RAM Score)	5 If you have decided that this is a Control Point, what Control Measures can be applied to stop the spread of non-targets?	6 Is this task a critical control point? Yes or No
Task # Title:	Vertebrates:				
	Invertebrates:				
	Plants:				
	Other Biologics:				
Task # Title:	Vertebrates:				
	Invertebrates:				
	Plants:				
	Other Biologics:				

ISRAP Step 5 – Non-Target Risk Action Plan Form (NTRAP)

(any "Yes" from column 6 of ISRAP Step 4 – Non-Target Analysis Worksheet)
One Page for Each Critical Control Point. Use this Form for

Management Objective from Step #1:	
Critical Control Point: Task # "Yes" from Step 4, column 6	**Title:**
Significant **Non-Target**(s): (Step 4, column 3)	
Control Measure (Step 4, column 5):	
Prescribed range, limit, or criterion for **Control Measure**:	
Control Measure Monitoring: WHO?	
HOW?	
WHERE?	
HOW OFTEN?	

Evaluate **Control Measure** (Answer Yes or No to the following questions):

Yes	No	
☐	☐	Did the action fall outside a prescribed range, limit, or criterion?
☐	☐	Did the **Control Measure** fail?

Corrective Actions, if any "yes" above:	

Supporting Documents (if any):
Management Plan, Checklist, Decontamination Techniques, SOPs, Scientific Journal Article, etc.

Development Team Members:	

Date Developed:		**Date(s) Reviewed:**	

ISRAP Step 5 – Non-Target Risk Assessment Plan Form (NTRAP)

(any "Yes" from column 6 of ISRAP Step 4 – Non-Target Analysis Worksheet)
One Page for Each Critical Control Point

Management Objective from Step #1:	
Critical Control Point: Task # "Yes" from Step 4, column 6	**Title:**
Significant **Non-Target**(s): (Step 4, column 3)	
Control Measure (Step 4, column 5):	
Prescribed range, limit, or criterion for **Control Measure**:	
Control Measure Monitoring: WHO?	
HOW?	
WHERE?	
HOW OFTEN?	

Evaluate **Control Measure** (Answer Yes or No to the following questions):

Yes	No	
☐	☐	Did the action fall outside a prescribed range, limit, or criterion?
☐	☐	Did the **Control Measure** fail?

Corrective Actions, if any "yes" above:	

Supporting Documents (if any):
Management Plan, Checklist, Decontamination Techniques, SOPs, Scientific Journal Article, etc.