

INTEGRATED PEST MANAGEMENT PLAN

GLEN CANYON NATIONAL RECREATION AREA AND RAINBOW BRIDGE NATIONAL MONUMENT

National Park Service
Revised September 2018



Approved:	<u>Ulin Skell</u>	<u>9-21-18</u>
	Superintendent	Date
Recommended:	<u>Justin Pilkington</u>	<u>9/14/2018</u>
	Park Integrated Pest Management Coordinator	Date
Concurred:	<u>Michael R. Kim</u>	<u>9-14-18</u>
	Deputy Superintendent	Date
Concurred:	<u>Maschele Zia</u>	<u>9/14/18</u>
	Assistant Superintendent	Date
Concurred:	<u>STR</u>	<u>9-14-18</u>
	Chief of Business and Technology	Date
Concurred:	<u>STR</u>	<u>9-14-18</u>
	Chief Ranger	Date
Concurred:	<u>CHM</u>	<u>9-14-18</u>
	Chief of Facilities	Date
Concurred:	<u>CHM</u>	<u>9/18/18</u>
	Chief of Interpretation	Date
Concurred:	<u>STR</u>	<u>9-14-18</u>
	Administrative Officer	Date
Concurred:	<u>Stacy Aho</u>	<u>9-14-2018</u>
	Safety Officer	Date
Concurred:	<u>Kenneth J. Hyde</u>	<u>9/14/2018</u>
	Chief of Science and Resource Management	Date

Contents

1.0 INTRODUCTION	1
1.1 How to use this document to address pest issues.....	1
2.0 AUTHORITIES, LEGAL REQUIREMENTS, POLICY	1
2.1 Federal Regulations	2
2.2 NPS Guidelines and Policies	2
2.3 Park Purpose	2
2.4 Regulations Covering Pesticide Use	3
3.0 OVERVIEW OF IPM PLAN	4
3.1 Description of the IPM Program	4
3.2 Park IPM Objectives	6
3.3 Roles, Responsibilities, and Inter-divisional Relationships	7
4.0 MAJOR PEST MANAGEMENT ISSUES	11
5.0 IPM METHODS.....	18
5.1 Pest Identification.....	18
5.2 Inspections and Monitoring	18
5.3 Sanitation	22
5.4 Action Thresholds.....	25
5.5 Records	27
6.0 HUMAN HEALTH AND SAFETY CONCERNS	28
6.1 Diseases	28
6.2 Wildlife Safety Concerns.....	28
6.3 Pesticide Safety Concerns.....	28
6.4 Other Safety Concerns	31
7.0 EMPLOYEE TRAINING	31
8.0 FREQUENCY OF PLAN UPDATES.....	31
9.0 STATEMENT BY PARK MANAGEMENT IN SUPPORT OF THE PARK IPM PROGRAM AND SPECIFIC FULL-TIME EQUIVALENT AND BUDGET NEEDS FOR PROACTIVE PARK IPM PROGRAM.....	31
10.0 LITERATURE CITED	33

TABLE

4.1. Glen Canyon NRA Pests by Management Zone and Level of Concern.....	152
--	------------

1.0 INTRODUCTION

This Integrated Pest Management (IPM) plan is intended to be a practical management guide and decision-making tool for all National Park Service (NPS) employees, concessionaires, contractors, permittees, licensees, and visitors of the Glen Canyon National Recreational Area (GLCA) and the Rainbow Bridge National Monument (RABR). Because RABR is administered by GLCA, this IPM plan covers both of these NPS units. Through IPM and the detailed information provided in this IPM plan, pests can be effectively managed and prevented. This IPM plan should be reviewed and updated frequently for the best possible guidance regarding pest identification and control for GLCA and RABR (the Park). However, before implementing any project that involves pest control in the Park, one must consult with the appropriate departments and personnel of the Park and other agencies to ensure that all policies and regulations are followed. Components addressing Museum IPM issues and actions are incorporated throughout this IPM plan,

1.1 How to use this document to address pest issues

Step 1 – Identify Pest Problem

Pest problems generally identify themselves, but monitoring can provide for early detection, potentially making control much easier.

Step 2 – Identify the pest

Determine what pest is causing the problem. This can sometimes be more difficult than it would seem. Proper identification may require expertise; contact the Park IPM Coordinator for assistance.

Step 3 - Review pest fact sheet

Pest fact sheets are available on SharePoint in IPM Documents section under Science and Resource Management. These fact sheets are updated regularly and will have recommendations to solve many pest problems. Most pest problems in GLCA can be solved with proper sanitation and exclusion. If your pest does not have a fact sheet, contact the Park IPM Coordinator.

Step 4 – Contact the Park IPM Coordinator

Step 3 may solve the pest problem, but if not, or if you simply have questions, contact the Park IPM Coordinator ([Currently Vacant](#)).

Chemical treatments require WASO approval through the Park and Regional IPM Coordinators, but other steps that do not involve chemical treatments can be conducted without assistance from the IPM Coordinator. Pest management actions that do not involve chemicals still require consultation with the appropriate departments to ensure that all policies and regulations are followed. Additionally, some pest treatment steps, such as modifications of historic structures and ground disturbing activities at historic properties and areas with the potential to contain buried historic properties, need to be taken in consultation with Cultural Resources. Many pest control steps will require working with appropriate departments within the park; for example, removal of mammal pests may require Natural Resource Management assistance or disturbance

2.0 AUTHORITIES, LEGAL REQUIREMENTS, POLICY

The following is a summary of the laws, policies, statutes, regulations, and Executive Orders pertaining to the preparation of this IPM plan for the Park.

2.1 Federal Regulations

Endangered Species Act of 1973, as amended

National Environmental Policy Act of 1969; Public Law 91-190; 42 United States Code (USC) 4321-4370(e), as amended

Executive Order No. 13112—Invasive Species

Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended

Lacey Act, as amended

Federal Plant Pest Act

Federal Noxious Weed Act of 1974, as amended

Migratory Bird Treaty Act

Executive Order No. 12898—Environmental Justice

Title 7 (136r-1) Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Executive Order No. 13148—Greening the Government through Leadership in Environmental Management

President Carter’s August 2, 1979, Memorandum requiring Federal Agencies to use IPM technology for pest control and to reduce the use of toxic pesticides

2.2 NPS Guidelines and Policies

Director’s Order No. 30A—Hazardous and Solid Waste Management

Director’s Order No. 77—Natural Resource Guidelines

Director’s Order No. 77-1—Wetland Protection

Director’s Order No. 77-7—Integrated Pest Management

Museum Property Management; Director's Order (DO) #24 4.3.9

NPS Museum Handbook, Chapter 5 – Biological Infestations (Sample Museum IPM Plan)

NPS Museum Handbook, Part I, Museum Collections

NPS Management Policies 2006

2.3 Park Purpose

GLCA was established by Congress on October 27, 1972, “... to provide for public outdoor recreation use and enjoyment of Lake Powell and lands adjacent thereto and to preserve the scenic, scientific, and historic features contributing to public enjoyment of the area....” As a part of the National Park System, GLCA also adheres to the 1916 Organic Act, which authorized the setting aside of land “...to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

The recreation area is an approximately 1.25 million-acre unit of NPS that is located in southeastern Utah and northern Arizona. Its major recreational component is Lake Powell, the

second largest capacity human-made lake in North America. It was formed as a result of the installation of Glen Canyon Dam on the Colorado River. Lake Powell covers 163,000 acres (when full) in Utah, extending 180 miles northeast from the Utah–Arizona border and constituting about 13% of the surface area of GLCA. Three highways and four marinas provide access to the lake.

The remaining 87% of the Park is magnificent Colorado Plateau red rock landscape. The recreation area includes Escalante River, Escalante Canyon, Orange Cliffs, historic Hole-in-the-Rock Road, countless natural arches, bridges, hoodoos, and slot canyons, and the Colorado River upstream of Lake Powell and below the Glen Canyon Dam to historic Lee’s Ferry.

RABR is one of the world’s largest natural bridges. While RABR is a separate NPS unit, it is near GLCA and is administered by GLCA. Several Native American tribes from the region consider RABR sacred, and approximately 300,000 people from around the world visit the site each year.

The IPM plan works within this wide framework of required management actions to ensure that public and official uses of the Park are compatible with the highest standards of resource protection and to provide opportunities for public education in resource conservation ethics (NPS 2005).

2.4 Regulations Covering Pesticide Use

Before any NPS employees, concessionaires, contractors, permittees, licensees, or visitors of GLCA and RABR use any pesticides, they must follow the proper procedures to make certain that all laws and regulations are followed. Licenses, training, and rules that would apply to any project involving pesticide use in the Park are required through the following regulations and authorities.

At the federal level, pesticide regulations fall under the authority of the U.S. Environmental Protection Agency (EPA). Utah and Arizona fall within Regions 8 and 9, respectively, of the EPA regions. For Region 8, call (303) 312-6617; for Region 9, call (415) 947-8704. The EPA’s role regarding pesticides is to oversee the registration, distribution, sale, and use of pesticides.

States also play a role in pesticide regulations. They have the primary authority for compliance, monitoring, and enforcement against use of pesticides with regards to the labeling requirements.

The regulation of pesticide use in Arizona is governed by the Structural Pest Control Commission, also referred to as the Pest Management Division, and is covered in the Arizona Revised Statutes, Chapter 20, Articles 3-3601 through 3-3633; the full text can be found online at: https://opm.azda.gov/Assets/PDFDocuments/Laws&Rules/Laws_Pest_Management_Division.pdf. The Pest Management Division is located at 1688 W Adams, Phoenix, AZ. 85007. The Pest Management Division phone number is (602)542-4373.

Pesticide use in Utah is regulated by the Utah Pesticide Control Act under the authority of the Utah Department of Agriculture and Food (UDAF). These laws are covered in the Utah Code, Statutes, and Constitution, Title 4, Chapter 14; the full text can be found online at: <http://ag.utah.gov/pesticides/39-pesticides/212-pesticide-laws.html>. UDAF is located at 350 North Redwood Road, P.O. Box 146500, Salt Lake City, Utah 84114-6500. The UDAF phone number is (801) 538-7100.

NPS policy specifies that pest management actions affecting NPS lands, waters, facilities, and properties are to be conducted based on the use of sound Integrated Pest Management (IPM) approaches. Mechanical, cultural, educational, chemical pesticides, biological control agents, and

other methods, are some of the tools reviewed when preparing an IPM strategy. NPS policy requires that pesticides, biological control agents and GMOs, must be reviewed and approved prior to use.

Proposed and actual use of pesticides is tracked in the NPS' Pesticide Use Proposal System (PUPS) database. Submission of pesticide use proposals, pesticide use logs, biological control agents, and genetically modified organisms (GMOs), are submitted by the Park IPM Coordinator to the Regional IPM Coordinator on an annual basis for review (approved or denied). The PUPS Database maintains a legal record of these actions, as required by the Federal Insecticide, Fungicide, and Rodenticide Act, Federal Records Act, and state regulations. Data from NPS PUPS are provided to the National Archives Records Administration on a tri-annual basis as required by 44 U.S.C. and 36 CFR. PUPS can be found at: <https://irma.nps.gov/pups/>. This data also provides a Servicewide legal record of pesticide use for the NPS.

The NPS does not have a pre-approved list of these tools and each proposal must be re-evaluated each calendar year and submitted annually through PUPS by the Park IPM Coordinator.

3.0 OVERVIEW OF IPM PLAN

The concept of IPM was incorporated into the NPS through a Presidential Directive on August 9, 1979. NPS policy has installed IPM practices in the management of all resources on NPS lands, including concessions and leased properties. NPS conducts an IPM program to reduce risks to the public, Park resources, and the environment from pests through pest-related management strategies. IPM is a decision-making process that coordinates all available knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage through cost-effective means that pose the least possible risk to people, resources, and the environment.

NPS, and each Park unit, will use an IPM approach to address pest issues. Proposed pest management activities must be conducted according to the IPM process prescribed in Director's Order No. 77-7—Integrated Pest Management. Pest issues will be reviewed on a case-by-case basis. Controversial issues, or those that have the potential to negatively impact the environment, must be addressed through established planning procedures and be included in an approved Park management or IPM plan. IPM procedures will be used to determine when to implement pest management actions and which combination of strategies will be most effective for each pest situation.

Under the NPS IPM program, all pesticide use on lands managed or regulated by the NPS, whether that use was authorized or unauthorized, must be reported annually (NPS 2006).

3.1 Description of the IPM Program

An IPM program coordinates all available biological, environmental, and modern pest management technology in an attempt to prevent unacceptable levels of pest damage with the most economical means available and the smallest possible amount of pesticide hazards to people and the environment. This approach relies on cost-effective and site-specific pest controls, decision-making processes, and risk-reduction systems. Unlike any given single method of pest control, the IPM approach is more effective than traditional methods because it combines tactics like sanitation, monitoring, exclusion, habitat modification, and (only when necessary) judicious use of specific herbicides or pesticides.

In order to implement a successful IPM program, careful planning, coordination, and organization of management techniques must be attained. Understanding the strengths and weaknesses of each method will be crucial to the development of a management tactic that will be used as an integrated approach to the pest problem at hand. This IPM program will combine all available tools and methods in order to achieve the best possible management of unwanted pests in the Park. These tools and methods include the following control types: biological, physical and mechanical, cultural (prevention), and chemical (pesticide application). Each method has strengths and weaknesses that should be examined with respect to the best management strategy for the pest issue.

The park's museum collections are housed in various locations and structures in the park; a storage facility at headquarters, a historic structure and at other sites in the Lees Ferry/Lonely Dell Historic District, and on exhibit in the two visitor centers. The structures are composed of different material and have different modifications that exclude pests. All areas housing museum collections are regularly inspected and monitored for evidence of pests, areas of potential pest access and attraction, moisture problems, and identification of susceptible objects. The park is working on a *Housekeeping Plan for Museum Collections* and *Collections Management Policy* (CMP) that will further document IPM activities.

The basic guidelines for the GLCA/RABR IPM program have been described in an eleven-step process wherein protocols and written records are developed to help prevent pest damage and protect park resources. The elements of the eleven-step process are:

1. Describe your site management objectives and establish short and long term priorities.
2. Build consensus with stakeholders, occupants, decision makers and technical experts (ongoing).
3. Document decisions and maintain records.
4. Know your resource (site description and ecology).
5. Know your pest. Identify the potential pest species; understand their biology and conditions conducive to supporting them (air, water, food, shelter, temperature, and light).
6. Monitor pests, pathways, and human and environmental factors, including population levels and phenological data.
7. Establish "injury thresholds," the point at which no additional damage or pest presence can be tolerated. This is the action threshold at which a pest management action will be implemented through an approved IPM strategy.
8. Review available tools and best management practices. Develop a management strategy specific to your site and identified pest(s). Tools that can be considered include: 1) no action, 2) physical, 3) mechanical, 4) cultural, 5) biological, and 6) chemical management. Because there is a wide-range of options under each of these "tools" depending on the species, size of infestation, habitat and/or pest type, and a host of other considerations, this document will not go into detail on any of these tools. Specific fact sheets and monitoring/control plans should be developed for each species or management area that requires either a rapid response or long-term control action.
9. Define responsibilities and implement the lowest risk, most effective strategy, in accordance with applicable laws, regulations, and policies.

10. Evaluate results; determine if objectives have been achieved; modify strategy if necessary.

11. Education and provide outreach. Continue the learning cycle. Return to Step 1.

3.2 Park IPM Objectives

The objectives of this IPM plan derive from the following guiding principles:

- The safety of staff and partners working and living in AND park visitors recreating and visiting park facilities is paramount
- Understand that some approaches to a pest problem will involve short-term solutions, while other approaches will focus on long-term solutions.
- Assess all control options for the identified pest and understand the strengths and weaknesses of each option in order to determine the most effective method for each pest issue.
- Establish partnerships and define roles for all stakeholders, including NPS employees, concessionaires, contractors, permittees, licensees, and visitors, throughout the IPM process.
- Obtain all necessary approvals and abide by all applicable laws and regulations when implementing a strategy.
- Formulate education and outreach programs for all stakeholders, including NPS employees, concessionaires, contractors, permittees, licensees, and visitors.

This IPM Plan includes the following objectives:

- To provide for the health and safety of park employees, park visitors, concessioners, permittees and other park users and the protection of natural and cultural resources and park infrastructure from the harmful effects of pests.
- Define the roles and responsibilities of persons involved in the pest management program and provide sufficient information to enhance program success.
- Identify pest problems, action thresholds, measures to prevent the spread of pest problems, and responsive management actions to address pest problems.
- To minimize/mitigate any non-target impacts and to address problems where native wildlife may become pests BEFORE the only resolutions are removal of individual animals.
- Provide rational, safe, effective IPM alternative methods for pest management within NPS procedural policy guidelines, which describe management actions necessary to modify habitats to reduce or limit the buildup of excessive high pest populations.
- Establish the necessity of periodic site inspections and monitoring to document when responsive management actions are necessary.
- Emphasize the needs for evaluating the post-treatment results of habitat modifications or pesticide treatments through periodic pest population monitoring and the need of written documentation for any management actions taken, data collected, and results obtained.
- Minimize the reliance on pesticides and establish that pesticides will only be used if absolutely necessary and as approved by the IMR IPM Coordinator. If it is determined that a pesticide is a necessary and justified component of the IPM strategy, the most effective and lowest risk product will be incorporated into the IPM strategy and used when the specific pests is at the most vulnerable stage, and used at times posing the least possible hazards to persons, resources, or environment.

3.3 Roles, Responsibilities, and Inter-divisional Relationships

It is essential for all Park operations to support staff and visitor health and safety, as well as to preserve and protect Park resources. The IPM program has similar responsibilities and should closely involve all Park personnel. Many persons in the Park, ranging from managers to residents, engage in pest management activities at some point. To make the IPM program most effective, the entire Park staff (and several non-NPS persons) should participate as members of the pest problem-solving team. Various roles and responsibilities for the GLCA/RABR IPM program are described below.

Superintendent

The Superintendent has the overall responsibility for Park functions, including the parkwide and museum IPM program. The Superintendent may delegate the IPM program implementation to the IPM Coordinator and other Park divisions. The Superintendent may also make reasonable attempts to provide adequate staffing and funding to implement and sustain the IPM program and provide for monitoring, exclusion, and pest management needs.

The Superintendent must: understand the principles and practices of IPM and see how the broad scope of IPM tactics relates to Park resources and activities; designate and train a Park museum technician to oversee historic artifacts and their preservation; inform employees, through memos, of the need for vigilance and the need to practice IPM functions; annually review the IPM plan with the IPM Coordinator for necessary changes or additions; provide proper and necessary training for the IPM Coordinator and other staff; and ensure that all pesticide applications are done by certified pesticide applicators who meet both state and federal requirements.

Park IPM Coordinator

The responsibilities of the Park IPM Coordinator are described in Director's Order No. 77—Natural Resource Guidelines. The GLCA IPM Coordinator serves as the focal point for all activities that directly (or indirectly) involve pest management, including maintenance, resource management, interpretation, planning and design, and other Park responsibilities.

The IPM Coordinator must: compile IPM-related information and educate Park staff and residents regarding IPM techniques, methods, and pesticide and pest safety; submit all PUPS use requests and compile and submit year-end use reports; perform the IPM activities in this plan, assist staff with solving pest problems, review pest monitoring reports, and train employees with pest management duties; prepare monitoring forms, conduct inspections, and document needed repairs and structural deficiencies for action by maintenance staff; annually review, in conjunction with the Superintendent and other Program Managers, the IPM plan for necessary changes or additions; ensure that personnel who apply restricted-use pesticides work under direct supervision of a certified applicator; ensure that all reports, requests, and pesticide-use logs are accurate, complete, and submitted in a timely manner; ensure proper storage of pesticides in locked pesticide cabinets with proper pesticide labels and Safety Data Sheets (SDSs) on all approved pesticides; inform the Superintendent about all pest management issues and pesticide use; ensure semiannual (early spring and late summer) inspections of Park buildings for evidence of pest activity. The IPM Coordinator directs pest monitoring actions and establishes action thresholds, which if exceeded initiate further pest management actions. The IPM Coordinator coordinates all park IPM activities with cluster, regional, and national NPS IPM authorities as appropriate.

Park Museum Technician

The Park museum technician is responsible for the care of the collections, monitoring for pests in all spaces containing collections, and implementing the museum IPM plan.

Chief of Maintenance

The Division of Maintenance staff has a very important role in Park pest management. The Maintenance staff provides all the repairs and installs any exclusionary measures to buildings to ensure there are no entryways from which pests can access the inside spaces. Total exclusion of pests from entry into structures is the first line of defense in this IPM plan. This includes maintaining screens on windows and chimneys, tight door sweeps, closing cracks and crevices, repairing leaks, and generally keeping structures in good repair. It is also important to report observations of pests or their activity to the IPM Coordinator for action, because Maintenance staff may work in areas that are not frequented by the IPM Coordinator or other pest management personnel. Maintenance staff will be trained to be alert to conditions conducive to pest presence, signs of pests and pest damage, and to report findings.

Maintenance staff assistance is also critical in identifying invasive weed outbreaks along road shoulders, any NPS maintained roads, launch pads, and parking areas, and at project sites. In

developed areas where it is critical to maintain vegetation-free areas (i.e. around electrical facilities, as fire breaks, etc.) it is important that they work closely with the IPM Coordinator to identify the tools that best facilitate this.

Maintenance staff are also instrumental in ensuring that good sanitation procedures (the second line of defense in this IPM plan) are carried out to eliminate food, water, shelter, and human refuse collection conditions that encourage pests; and punctually schedule repairs to structures, utilities, or vegetation that supports pest infestations.

Housing Officer

The Housing Officer assists housing residents in resolving pest problems by ensuring they understand IPM principles and regulations, investigating pest problems, coordinating with the IPM Coordinator, suggesting pest solutions, and coordinating facility improvements with the Chief of Maintenance on park housing to achieve pest solutions.

Park Rangers and Other Roving Employees

Park Rangers and other employees whose duties cause them to travel frequently within the Park must continually watch for food (in the form of open containers, coolers, and trash or garbage), water, and harborage available to pests and promptly correct the situation or report such conditions to the IPM Coordinator. Such employees must be alert to conditions conducive to pest presence, signs of pests, and pest damage. Park Rangers must constantly remind visitors not to feed or water animals and to properly store foods at campsites and place food refuse only in covered garbage receptacles.

Chief of Science and Resource Management

The Division of Resources Management will prepare Resource Management Project statements that cover significant IPM plans or operations, particularly outside of Development Zones. They are also responsible for planning multi-year invasive weed control programs and in addressing invasives during site restoration, post wildfire, large in-park project, and partner project planning, including during NEPA compliance reviews and planning. Where appropriate, proposals should be prepared that seek to obtain support funding from the Natural Resource Protection Program and other sources.

The Resources Management Division will conduct appropriate planning and take approved measures to protect museum collections, herbariums, and natural resource collections from pests. Through training and on-the-job research they will continue to provide resource expertise when needed to inform IPM decisions.

Park Safety Officer

The Park Safety Officer plays an influential role in Park pest management. During all safety inspections, the Park Safety Officer must watch for and report to the IPM Coordinator any evidence of pests, destructive or hazardous conditions caused by pests, and inappropriate pesticide storage. Health and safety hazards concerning pest infestations must be noted in safety inspection reports.

The Park Safety Officer must coordinate with the IPM Coordinator and staff to ensure that employees are provided with the latest health and safety information on pests and pesticides. During safety inspections or monitoring of Park resources, the Park Safety Officer will encourage employees to follow safety and health requirements. Finally, the Park Safety Officer must monitor

applications of Restricted-Use or state-limited-use pesticide compounds for safe application methods.

Chief of Interpretation

The Division of Interpretation must inspect for, monitor, and correct (if possible) any conditions of inadequate sanitation or availability of pest harborage in the Visitor Center, display, and other interpretive areas. The Division of Interpretation must ensure that stored boxes, papers, equipment, and other materials are placed on shelving or pallets off the floor to allow for cleaning, inspection, and pest management measures. Employees in the Division of Interpretation must constantly remind visitors not to feed the animals and to place food scraps and garbage in covered receptacles.

Chief of Business and Technology

The Chief of Business and Technology must ensure that concessions and other non-Federal operations are regularly inspected and monitored for pests and must report to the IPM Coordinator poor sanitation conditions, irregular cleaning schedules, poor garbage practices, availability of pest harborage, and use of non-approved pesticides. They are also the primary park contact for requests by concessioners to use pest control treatments to help exclude insects from residences, hotels, offices, storage buildings, and boats. The Business and Technology Division must ensure that non-Federal operators comply with recommendations from Public Health Officers and the Park IPM Coordinator and that all chemical treatments proposed be cleared and reported through the PUPS reporting system.

Other Employees

All persons (Contracting Officer, Warehouse Manager, Supervisors, Foremen, private contractors, concessionaires, cooperative associations, etc., as appropriate) who may be involved in purchasing, storing, and using pesticides in the Park must ensure that proper IPM procedures and NPS pesticide-approval policies are followed.

Items purchased with NPS funds to be used as insect repellents (both skin and clothing applied) must be pre-approved through the PUPS reporting system and quantities used reported to the IPM coordinator at years-end. These can be critical safeguards for employee safety from mosquito, tick, and other insect borne diseases, but still need to be approved, tracked, and reported.

Park Residents

Park residents (including non-NPS residents) must ensure that their quarters and the areas surrounding their quarters are kept clean and do not attract or harbor pests. Residents must promptly report pest infestations, structural deficiencies, and other maintenance needs that could lead to pests gaining access to living quarters to the IPM Coordinator and Division of Maintenance. Residents are not allowed to use pesticides (insecticides, rodenticides, herbicides, etc.) that have not been specifically **pre-approved**, except pesticides used under the following conditions do not require pre-approval:

- cleansers and disinfectants used in restrooms and restaurants;
- personal insect repellents and insecticides that employees or park visitors personally obtain and use to meet personal needs; and
- insect repellents and insecticides applied to personally owned pets (NPS 2006).

Park Concession Operations

Park concession operations are located in several Development Zones parkwide. They include hotel facilities, restaurants, retail and business offices. dormitory style housing with food preparation and dining areas. individual housing units including trailers, and maintenance and storage facilities. Because of concerns for public health, safety, and visitor satisfaction, the concession partners should work closely with the Park IPM Coordinator and Business Office staff to ensure that monitoring, inspection, exclusion, and treatment for IPM issues is occurring. Every effort should be made to exclude pests and remove food/moisture/harboring items before seeking **pre-approval** from the NPS for exterior, attic, and crawl space pest control treatments. Should a pest control issue require a treatment for an ongoing public health, safety, or visitor satisfaction issue, then a formal request should be made at least 30 days prior to the proposed treatment in order for the NPS to have the treatment reviewed and the proposed chemical approved through the Pesticide Use Proposal System. All pesticide use must be documented at the time of treatment and an annual report provided to the Park IPM Coordinator by January 15th of the following year.

4.0 MAJOR PEST MANAGEMENT ISSUES

Major pest issues at GLCA/RABR relate to the need for preserving cultural and natural resources to the maximum extent possible while also providing for the health, safety, and comfort of visitors, partners, and staff. In general, new exotic species will not be introduced into the Park. In rare situations, an exotic species may be introduced or maintained to meet specific, identified management needs when all feasible and prudent measures to minimize the risk of harm have been taken, and it is:

- a closely related race, subspecies, or hybrid of an extirpated native species; or
- an improved variety of a native species in situations in which the natural variety cannot survive current, human-altered environmental conditions; or
- a means of controlling another, already established exotic species; or
- a necessity to meet the desired condition of a historic resource, but only where it is prevented from being invasive by such means as cultivating (for plants) or tethering, herding, or pasturing (for animals). In such cases, the exotic species used must be known to be historically significant, to have existed in the Park during the Park's period of historical significance, or to have been commonly used in the local area at that time; or
- an agricultural crop that is being used to maintain the character of a cultural landscape; or
- a necessity to provide for intensive visitor use in developed areas, and the following conditions exist:
 - the available native species will not meet Park management objectives; and
 - the exotic species is being managed so it will not spread or become a pest on Park or adjacent lands.
- the exotic species is a sterile, non-invasive plant that is being used temporarily for erosion control; or
- the introduction is directed by law or expressed legislative intent.

Domestic livestock, such as cattle, sheep, llamas, horses, and mules, are exotic species that are maintained in some parks: for commercial herding, pasturing, grazing, or trailing purposes; for recreational use; or for administrative use, to maintain the historical scene or support Park operations. Occasionally, some of these animals may escape and become feral, including horses, burros, and unbranded cattle. Attention to these animals will be on a case-by-case basis. GLCA will manage recreational and administrative uses of livestock and commercial grazing of livestock to prevent those uses from unacceptably impacting Park resources. GLCA is unique in that the enabling legislation authorizes domestic livestock grazing, and directs that it be administered by the Bureau of Land Management (see NPS 1999 Grazing Management Plan). Currently, nearly 700,000 acres of park lands are managed in grazing allotments administered by the BLM.

The GLCA is currently divided into four management zones, each of which has unique pest management concerns (NPS 1979). These zones include the:

- Natural Zone (620,490 acres)—characterized by maintenance of isolation and natural process while allowing grazing activities; most of this area has been identified as being eligible for inclusion in the National Wilderness System, as outlined by the Wilderness Act of 1974.
- Recreation and Resource Utilization Zone (606,595 acres)—characterized by maintenance of natural processes while allowing to the extent possible both mining and grazing. Lake Powell at full pool is included in this zone; recommended wilderness descends into the lake basin as water levels drop. Eight remote, floating, pump-out facilities exist on the lake.
- Cultural Zone (estimated 8,000 acres)—characterized by the themes of preserving, interpreting, and restoring historical and archeological resources; this zone includes the Lee's Ferry Historic District.
- Development Zone (19,270 acres)—characterized by the provision of visitor services and the practice of facilities maintenance. All NPS facilities, housing areas, and park-based marinas are included in this zone. An extensive array of concession facilities, housing areas, and park-based marinas are also included in this zone. This zone is also the primary take-out zone for boats, jet skis, and large slipped and moored boats which require special care now that Lake Powell is infested with quagga mussels and is conducting an aggressive containment program for these aquatic pests. This zone also includes areas with generators, solar arrays, parking areas, and fenced safety zones that have been graveled and must be kept weed-free for both safety and fire protection reasons.

GLCA has major developed areas, which contain facilities for the public and the Park. These areas include the following.

- Lee's Ferry is on the Colorado River below Glen Canyon Dam. This area includes a launch ramp for boats going upriver and float trips heading downriver, as well as a floating courtesy dock. It also includes a small housing area, an administration building, a restroom building, a water intake and water treatment plant, a maintenance area, and a campground. A number of trails that join an extensive BLM trail system also occur here. An GLCA/GRCA Expanded Nonnative Aquatic Species Management Plan/EA is scheduled to be finalized in late 2018 and will address the full suite of nonnative aquatic pests that could or currently infest the Glen Canyon Reach of the Colorado River upstream of the mouth of the Paria River.
- Wahweap Marina spans the Utah–Arizona border and includes both floating facilities and shore-based facilities. Wahweap Marina facilities include a full resort with a hotel, dining

rooms, a pool, a parking lot, a gas station, several restaurants, a small store, and access to a swimming beach on Lake Powell. The resort is next to the main boat-launch ramp. South of the ramp are the NPS maintenance buildings and Park housing area, gas docks, government docks, breakwaters, and houseboat slips. North of the resort are the fire station, District Ranger's Station, campgrounds, amphitheater, picnic area, fish-cleaning station, Stateline launch ramp, boat rental area, concessionaires' maintenance area, and day use areas with permanent restrooms. On the hill overlooking the lake is the concessionaire housing area, which has a cafeteria and a large boat storage area. Houseboat rentals are available and are another potential "facility" that could harbor pests and lead to human health, safety, and visitor satisfaction concerns.

- Dangling Rope Marina is located 45 miles uplake from Wahweap and is accessible only by boat. At lake level, a large, floating dock holds Maintenance buildings, a gas station, a District Ranger's office, and a small store. Employee housing is on the hilltop.
- Bullfrog Basin Marina and Halls Crossing Marina are located across the Colorado River from one another, approximately 100 miles uplake. Facilities at these two locations are very similar to those at the Wahweap Marina Area. Houseboat rentals are available and are another potential "facility" that could harbor pests and lead to human health, safety, and visitor satisfaction concerns.
- Hite Marina is located upstream at the Colorado River inflow. Currently, NPS facilities consist of a housing area, gas station, store, and a District Ranger's Office.
- Antelope Point Marina is located near Page, Arizona, and consists of a resort that has a large staging area, parking lots, office buildings, ramps, houseboat slips, a restaurant, store, and fuel docks. It is currently undergoing phased expansion. The public launch ramp area consists of the ramp, parking area, and permanent restrooms. Houseboat rentals are available and are another potential "facility" that could harbor pests and lead to human health, safety, and visitor satisfaction concerns.
- Rainbow Bridge National Monument (RABR) is located near Dangling rope Marina on Lake Powell. Rainbow Bridge is one of the world's largest known natural bridges and was designated as a National Monument in 1910. There is no Development management zone in RABR; however, a boat dock with floating restrooms and a long walkway leads to a trail for people to visit and view both sides of Rainbow Bridge from Lake Powell. A viewing area is maintained with benches and a shade structure. The trail connects to historic trails on the Navajo Nation allowing access over-land around and to Navajo Mountain.

Pest issues include aquatic flora and fauna, typical house pests (lice, bedbugs, ants, cockroaches, beetles, snakes, rats, mice, and bees), landscape weeds, invasive floral species, and occasionally, exotic or native birds and mammals. Principal exotic plant species of concern to the NPS include Russian olive, Russian knapweed, Ravenna grass, perennial peppergrass, camelthorn, Siberian elm, and tamarisk (NPS 2006).

The following table draws on incidents, known locations, reports, and other available information to outline the currently known plant and faunal pests of GLCA. Additionally, each pest has been given a priority level in the following categories: Priority A—needs immediate action; Priority B—needs monitoring and control; and Priority C—needs monitoring, but needs control only if an issue is identified or in order to prevent establishment. Fact sheets for many of these pests are available from the Park or on Federal/State websites on the internet. Species specific IPM tools and control options are also available from these sources.

Table 4.1. GLCA Pests by Management Zone and Level of Concern

Common Name	Scientific Name	GLCA Management Zone	Level of Concern	Additional Comments
FAUNAL PESTS - INVERTEBRATES				
Ants	Family Formicidae	Development Zone	Priority C	Concessioner and NPS occupied building concern
Asian clam	<i>Corbicula fluminea</i>	Recreation and Resource Utilization Zone	Priority C	
Bedbugs	Family Cimicidae	Development Zone	Priority C	Concessioner and NPS occupied building concern
Black widow	<i>Latrodectus mactans</i>	Development Zone	Priority C	Concessioner and NPS occupied building concern
Brown recluse	<i>Loxosceles reclusa</i>	Development Zone	Priority C	Concessioner and NPS occupied building concern
Centipedes	Class Chilopoda	Development Zone	Priority C	Concessioner and NPS occupied building concern
Crickets and grasshoppers	Order Orthoptera	Development Zone	Priority C	Concessioner and NPS occupied building concern
Dermeid beetles	Family Dermestidae	Development Zone	Priority B	Museum Concern
Elm leaf beetles	<i>Xanthogaleruca luteola</i>	Cultural Zone	Priority B	
Exotic water flea	<i>Daphnia lumholtzi</i>	Recreation and Resource Utilization Zone	Priority C	
Spiny water flea	<i>Bythotrephes longimanus</i>	Recreation and Resource Utilization Zone	Priority C	
Fishhook water flea	<i>Cercopagis pengoi</i>	Recreation and Resource Utilization Zone	Priority C	
Firebrat	<i>Thermobia domestica</i>	Development Zone	Priority C	
Fleas, common	Family Pulicidae	Development Zone	Priority C	Concessioner and NPS occupied building concern
Flies	Order Diptera	Development Zone	Priority C	Concessioner and NPS occupied building concern
Flies, Biting (Horse & deer) & Gnats	Order Diptera	All	Priority C	1 species of deer fly can transmit Tularemia
Fungi	Kingdom Fungi	Development Zone	Priority C	Concessioner Concern
Gypsy moths	<i>Lymantria dispar</i>	Natural Zone	Priority C	Coordinate with the U.S. Forest Service
Honey bees including Africanized hybrid	<i>Apis mellifera</i>	Development Zone	Priority B	Arizona now considers all honeybees as "Africanized". These "killer" bees are extremely protective of nests and aggressive when stinging
Mosquito	<i>Aedes, Culex</i>	All	Priority C	Malaria, West Nile, Dengue, Chikungunya, Zika diseases
New Zealand mudsnails	<i>Potamopyrgus antipodarum</i>	Recreation and Resource Utilization Zone	Priority B	
Orchard Pests impacting tree health	<i>Woodborers, root fungus, etc</i>	Cultural Zone	Priority B	
Scorpions	Order Scorpionida	Development Zone	Priority B	Concessioner and NPS occupied building concern
Spiders, other	Order Araneida	Development Zone	Priority C	Concessioner and NPS occupied building concern
Swimmer's Itch	<i>Cercarial dermatitis</i>	Recreation and Resource Utilization Zone	Priority B	Parasite with snail and waterbird hosts. Bullfrog area and St. George reservoirs have confirmed cases
Tamarisk Beetles	<i>Diorhabda</i> spp.	Natural and Development Zones	Priority B	
Tent caterpillars	Family Lasiocampidae	Development Zone	Priority C	
Termites, dry-wood	Family Kalotermitidae	Development and Cultural Zones	Priority B	Concessioner and NPS occupied building concern
Termites, subterranean	<i>Reticulitermes</i> spp.	Development and Cultural Zones	Priority C	Concessioner and NPS occupied building concern

Ticks	<i>Various</i>	All Zones	Priority B	Tularemia, Rocky Mountain spotted fever, Lyme disease, etc.
Common Name	Scientific Name	GLCA Management Zone	Level of Concern	Additional Comments
FAUNAL PESTS – INVERTEBRATES CONTINUED				
Wasps & Hornets	Order Hymenoptera	Development Zone	Priority C	Use of Wasp Freeze and other non-insecticidal treatments recommended on nests Concessioner and NPS occupied building concern
Zebra mussels	<i>Dreissena polymorpha</i>	Recreation and Resource Utilization Zone	Priority C	
Quagga mussels	<i>Dreissena bugensis</i>	Recreation and Resource Utilization Zone	Priority A	Quagga mussels present in GLCA
FAUNAL PESTS - VERTEBRATES				
Bats	<i>Various</i>	Development Zone	Priority B	Concern when roost and defecate in occupied buildings, possible source of rabies
Beaver	<i>Castor canadensis</i>	Natural Zone	Priority C	
Birds nesting in or on Facilities	<i>Various</i>	Development Zone	Priority B	Swallows and other birds nesting on/in facilities can result in potential disease transmission and hampered operations. Note that the Migratory Bird Treaty Act protects and has strict requirements/ penalties for how NPS handles these situations
Dove, Eurasian collared	<i>Streptopelia decaocto</i>	Natural and Development Zones	Priority C	
Dove, Rock or domestic pigeon	<i>Columba livia</i>	Natural and Development Zones	Priority C	
Feral Burros or Donkey	<i>Equus asinus</i>	Natural Zone	Priority B	
Feral cattle	<i>Bos taurus</i>	Natural Zone	Priority B	Coordinate with the BLM, owner or leasee if unbranded
Feral horses	<i>Equus caballus</i>	Natural Zone	Priority B	
Gizzard shad, American	<i>Dorosoma cepedianum</i>	Recreation and Resource Utilization Zone	Priority C	
Mammal Pests – Campgrounds & Facilities	<i>Raccoons, ringtails, coyotes</i>	Development Zone	Priority C	Impacts to campers & inhabited buildings, loss of pets, etc. if become habituated. Possible carriers of rabies, & plague fleas
Mammal Pests – Restoration Sites	<i>Deer, rabbits, rodents</i>	All zones	Priority C	Can browse or eat all restoration site plantings, young orchard trees & impact landscaped areas
Mammal Predators	<i>Cougar</i>	All Zones	Priority C	On rare occasions become predatory to humans. Keep from becoming habituated.
Rabbits, Jack & Cottontail	<i>Lepus californicus & Sylvilagus floridanus</i>	All Zones	Priority B	Carriers of tularemia and possibly plague. Take care to avoid fleas and ticks on them
Rodents in Buildings	<i>Native & Non-native</i>	Natural and Development Zones	Priority A	Includes house mouse, Norway rat, and native deer & white-footed mice, & packrats as sources of hantavirus, plague, etc. when in facilities

Sparrow, house	<i>Passer domesticus</i>	Natural and Development Zones	Priority C	
Venemous Snakes	<i>Crotalus spp</i>	All Zones	Priority C	7 species in Utah
Common Name	Scientific Name	GLCA Management Zone	Level of Concern	Additional Comments
FAUNAL PESTS – VERTEBRATES CONTINUED				
Waterfowl, domestic	Order Anseriformes	Natural Recreation and Resource Utilization Zone	Priority C	
PLANT PESTS				
Arabian schismus	<i>Schismus arabicus</i>	Natural and Development Zones	Priority A	
Bermudagrass	<i>Cynodon dactylon</i>	Natural and Development Zones	Priority B	
Black Locust	<i>Robinia pseudoacacia</i>	Natural Zone	Priority B	Small, but expanding population in Escalante River area
Broadleaved pepperweed	<i>Lepidium latifolium</i>	Natural and Development Zones	Priority B	
Camelthorn	<i>Alhagi maurorum</i>	Natural and Development Zones	Priority B	
Common Mediterranean grass	<i>Schismus barbatus</i>	Natural and Development Zones	Priority A	
Didymo - Rock Snot	<i>Didymosphenia geminata</i>	Natural Zone	Priority C	Present in Glen Canyon Reach below dam but not currently spreading
Field bindweed	<i>Convolvulus arvensis</i>	Natural and Development Zones	Priority B	
Giant reed	<i>Arundo donax</i>	Natural and Development Zones	Priority A	
Herb sophia	<i>Descurainia sophia</i>	Natural and Development Zones	Priority B	
Orchardgrass	<i>Dactylis glomerata</i>	Natural and Development Zones	Priority B	
Uruguayan pampas grass	<i>Cortaderia selloana</i>	Natural and Development Zones	Priority A	
Puncturevine	<i>Tribulus terrestris</i>	Natural and Development Zones	Priority C	
Ravennagrass	<i>Saccharum ravennae</i>	Natural and Development Zones	Priority A	Highest Priority
Russian knapweed	<i>Acroptilon repens</i>	Natural and Development Zones	Priority B	
Russian olive	<i>Elaeagnus angustifolia</i>	Natural and Development Zones	Priority A	Highest Priority
Russian thistle	<i>Salsola, spp.</i>	All Zones	Priority C	A tumbleweed that has taken advantage of disturbed areas and extensive exposed shorelines due to lower lake levels. Some wildfire concerns
Salt cedar or tamarisk	<i>Tamarix chinensis</i>	Natural and Development Zones	Priority C	
Saltlover	<i>Halogeton glomeratus</i>	Natural and Development Zones	Priority C	
Siberian elm	<i>Ulmus pumila</i>	Natural and Development Zones	Priority B	Maintained in one Cultural Zone
Weeping lovegrass	<i>Eragrostis curvula</i>	Natural and Development Zones	Priority C	
DISEASES				
Avian influenza		All Zones	Priority B	Confirmed nationwide in 2015. Both waterfowl & domestic poultry
Bubonic/Sylvatic plague	<i>Yersinia pestis</i>	All Zones	Priority B	Transmitted by fleas from mammals park-wide
Chronic wasting disease		All Zones	Priority C	Continues to spread in deer and related species
Hantavirus Pulmonary Syndrome		All Zones	Priority B	Transmitted from rodent droppings & nests

Rabies	All Zones	Priority B	Bats, raccoons, and other mammals host this disease and may transmit during human contact
Tularemia	All Zones	Priority B	Numerous outbreaks in western U.S. in 2015
West Nile virus & other mosquito borne diseases	All Zones	Priority C	All 48 continental states have had cases. Mosquito transmitted from bird & mammal hosts
White-Nose Syndrome	All Zones	Priority A	Spreading across U.S. from East coast. High mortality in hibernating bats
Whirling Disease	Natural Zone	Priority B	Present in Colorado River below dam. Can severely impact recreational rainbow trout fishery. Invasive brown trout may harbor and spread.

5.0 IPM METHODS

The following sections outline the methods for an effective IPM program. In the IPM Documents section on SharePoint under Science and Resources are fact sheets for each pest—faunal (animal), floral (plant), and disease, respectively. These fact sheets contain detailed information for each pest, including identification, range, biology, control methods, and references.

5.1 Pest Identification

Accurate identification of suspected pests is an important first step in the IPM program. Park staff should use the pest fact sheets and other useful guidance (e.g., literature and knowledgeable individuals) for proper identification of the pest. The IPM Coordinator can assist and must confirm pest identifications.

5.2 Inspections and Monitoring

Through inspections and pre-treatment monitoring, the primary reasons for most pest infestations can usually be determined. Any pest management measures taken in the Park will first begin with an inspection to identify the sources, kinds, and extent of infestations and will then follow up with monitoring programs to detail any changes in the infestation. Inspections and monitoring will be key to identifying the occurrence, abundance, and trends of pest populations. Inspections and monitoring can also identify conditions that may forecast an increase in the pest population. These activities will: serve as a forewarning of potential future pest problems; document and 'flag' needed repairs; and provide descriptions of deficiencies on area maps. The terms 'Inspection' and 'monitoring' at first glance appear to refer to similar activities; however, these terms actually differ as follows:

- 'Inspection' refers to initially discovering pests or conditions that may support their population; and

- 'Monitoring' refers to watching or measuring, or both, the conditions over time to determine whether pest populations are static, decreasing, or increasing and then making management decisions regarding the significance of those findings.

The need for continual monitoring, especially for rodents, becomes clear when it is understood that pest populations can rapidly increase during even one year and that populations, when large,

require much more effort and time to control. Additional guidelines for inspection and monitoring are found in Director's Order No. 77—Natural Resource Guidelines, Chapter 2, pages 226 and 227 and Appendix III. Inspection and monitoring of pests and pest damage will concentrate on obtaining information on: the existence, extent, and severity of pest infestations; the locations of pest harborage, food, water, and activity areas; the reproductive, life history, and behavioral information for pests; and the safest and most appropriate management strategies, based on site limitations.

Monitoring of invasive and aquatic weed transport routes is also important. These include highways, graveled/dirt roads, parking areas, boat launches, horse & pack animal routes, and in recent years, the extensive lake drawdown areas that are devoid of native vegetation after being submersed at higher lake levels. In a park the size of GLCA/RABR this monitoring can be a daunting task and requires that all who are out working in the park be trained and vigilante of new or expanding infestations.

For museum collection areas specifically, inspections for evidence of museum pest infestations will occur and search for:

- Discovery of flying adult or crawling larval insects
- Moth or beetle pupae
- Pupal tubes or cases
- Insects captured in traps or in ceiling light fixtures
- Chewing or gnawing marks
- Feeding or exit holes
- "Grazed" surfaces
- Presence of feeding debris or fecal pellets/droppings/frass (insect waste, which is usually a soft powdery material) around or below objects
- Presence of frass falling from voids (ceiling tiles, electrical switch plates, etc.)
- Shed/cast skins
- Webbing
- Nest/burrows
- Food caches
- Flyspecks
- Hair falling from fur or pelts
- Missing pile from rugs
- Rodent smudge/grease marks
- Odors or sounds infested or damaged food or food packaging
- Bait consumption

Inspections for pests will occur in the following common harborage sites:

- Areas inside and under drawers, cabinets, and furniture
- Attics and store rooms where rodents or other pests may have made food caches
- Above drop ceilings, and inside elevator shafts and light fixtures
- Fireplaces and chimneys
- Inside electrical equipment and motors (including computers)
- Entry points into the structure and into areas housing collections, such as window sills and door jambs
- Near water sources such as drains and sinks
- Doorways and hallways with outside access
- In stored cardboard or wooden pallets housing collections
- Behind baseboards or wall trim and in inaccessible wall voids which could hold dead animal carcasses. Maintenance staff does this in consultation with a historic architect.

Use these tools for inspections:

- Flashlight
- Magnifying glass
- Nitrile gloves
- Tape measure
- Camera
- Screwdrivers
- Step ladder
- Mirror to view up chimneys
- Sticky labels or marker for numbering traps
- Long wave UV black light (requires protective eyewear)
- Dust mask (NIOSH-approved disposable filtering facepiece respirator with two straps. The park safety officer may require that you wear a respirator for inspections involving mold, bird or bat droppings, or heavy dust. If a respirator is needed, the user must be in a respiratory protection program. For inspections involving rodent infestations, see *COG 2/8: "Hantavirus Disease Health and Safety Update"*).
- Talc (sprinkle on expected rodent pathways, such as against floorboards to detect rodent tracks in rooms not open to the public to indicate mice activity. For use in an historic structure, sprinkle talc onto Mylar®. As talc may be a respiratory hazard, consult with the safety officer before using).

Routine Inspection and Isolation of Incoming Objects

Inspect and isolate all incoming objects, including new and returning loans, for possible pest infestations or microorganisms before they enter the collections storage or exhibit areas.

- Upon receiving the objects, immediately place them in the isolation room for inspection and isolation.
- Locate the isolation room adjacent to the shipping and receiving area. Do not locate it within the collections area. The isolation room must be well sealed and have good lighting. If this is not possible, isolate objects in a well-sealed cabinet outside of the collections area.
- Inspect objects using good lighting and magnifying lenses on a table with a white surface (or over white paper) where any fallen insects, frass, etc. can be readily noticed.
- Examine the underside of furniture and pallets for webbing and insect eggs.
- Inspect wooden objects for exit holes of wood-boring insects.
- Use a UV black light in the dark to detect some kinds of mold on objects. Place objects with evidence of mold in a lidded cardboard box and isolate them.
- Isolate all objects for at least one month before they enter collection areas. Living pests can usually be detected within this period. However, insect eggs can be dormant for years depending on the species. Mold can also lie dormant. The exception is objects made of metal, glass, ceramic, or stone, which need to be inspected but not isolated. Consult the regional curator, conservator, IPM manager or entomologist to determine the appropriate isolation period.
- Re-inspect objects for signs of an infestation throughout the isolation period.
- If pests or evidence of pests are found during inspection, follow the steps listed in "responding to Infestations" in Section H below. Remove pest evidence by vacuuming it off with a HEPA filter. Treat potentially infested objects with a freezer treatment, mechanical cleaning, or other appropriate method.
- Similarly handle non-collection materials such as packing materials and exhibit construction materials but house these separately from collection areas. Immediately discard any packing materials that cannot be verified as pest-free, such as cardboard, in an exterior garbage container.

Museum (and other occupied building) Pest Trapping Program

Physical controls such as traps include insect sticky traps, rodent snap traps, light traps, and pheromone traps.

Inspect traps monthly under normal circumstances, and every one to two weeks when infestations are present or suspected. Inspect rodent snap traps daily. Replace traps every few months. Record the following information for each trap:

- Trap number
- Trap location
- Inspection date
- Pest species
- Number of individuals per species found in the trap
- Life stage of the species, unusual conditions and replacement date for the trap and other useful information
- Photographs of unidentifiable species

Refer to the schematic diagram of the building housing collections and for each numbered trap. Record data about pests found in each trap on a trap monitoring log.

Locate traps in collection and non-collection areas:

- Along perimeter walls
- In corners
- Near doors
- Near windows and other light sources
- Under storage and other furniture
- Near water sources
- Near drains
- Near heat sources
- Inside and outside exhibit and storage cabinets
- Near objects out in the open or that are pest susceptible

When using rodent snap traps, place two traps at each trap station parallel with the wall, or place a single trap with its trigger end against the wall. Locate trap stations every six to ten linear feet along walls and runways used by rodents. Place traps behind objects, under furniture, against walls, or in other locations where rodents find concealment. Bait all rodent snap traps with peanut butter or cotton tied to trap's trigger to catch and control pests.

Note that snap traps are also effective without bait.

Regularly empty all types of traps so they do not attract other pests.

Museum Pest Identification and Injury and Action Thresholds

Identify and document species as specifically as possible (genus, species). Maintain a reference collection of dead pests for identification purposes. Encourage maintenance staff to bring pests to curatorial staff labeled with the date, time, and exact location of catch. Record all finds in the computer database or paper log. See the documentation section above for more information. Create action plans for pests as appropriate.

The action threshold is the point at which pest levels indicate that collections will be damaged if action is not taken.

Periodicity of Inspections and Pre-treatment Monitoring

The IPM Coordinator will ensure inspections of all Park facilities at least twice a year. The first inspection should be made during early spring before pest populations begin to increase, and the second during late fall before dormancy or hibernation periods. Additional 'spot inspections' may take place at other times during the year, as needed, and especially in areas housing museum collections. The IPM Coordinator will approve appropriate inspection and monitoring forms and maps for use in documenting inspections. Continual monitoring of Park facilities coordinated by the IPM Coordinator can provide comparisons of monthly data and information on reproductive and immigration influxes in pest numbers, possible changes in damage caused by pests, information on the relative effectiveness of pest controls, and a guide in planning future controls. Annual trends

in precipitation and other weather data will be recorded as an “early warning” of potential future pest problems, especially plant pests. During monitoring, photo point records may be made of various or selected special problem areas that are most susceptible to pest damage. A comparison of records will provide insight into the cumulative damages. When completed, inspection and monitoring data will be filed by the IPM Coordinator in a permanent IPM file and any needed structural repairs will be documented and referred to the Maintenance Division for prioritization.

Post-treatment Monitoring and Evaluations

An important part of a successful IPM program is post-treatment monitoring. It enables evaluation of the adequacy of treatment, cost-benefit ratios, and guidance for future programs. When treatments are found to be ineffectual, post-treatment monitoring and evaluations will provide ideas for improvements that lessen cost, make treatments easier or faster, or increase the permanency of control. The need to improve treatments may indicate the need to schedule treatments for different times of the season, year, or day or to make treatments at different stages in a pest’s life or activity. All new ideas or alternatives that appear during control activities should be evaluated for possible inclusion in the program during the next update of the IPM plan.

5.3 Sanitation

Proper sanitation is essential to a successful IPM program because it reduces the availability of food, water, and harborage to pests. Although no amount of effort will remove all the potential resources available to pests, good attention to sanitation will aid in limiting a site’s carrying capacity, ultimately reduce pest numbers, and make early detection and control easier.

Interior Sanitation

Because insect pests survive and rapidly reproduce inside structures, good interior sanitation is essential for controls to be effective. Many pests are able to survive for long periods without feeding at all, or they are able to obtain abundant food from commonplace sources as lint, fabric fibers, and mold. All rooms and curatorial storage areas should be inspected to ensure such areas are not attracting or supporting pests. The following measures may be implemented in order to ensure proper interior sanitation:

- Frequently vacuum in and around equipment, furniture, cracks and crevices, and closets and other dark areas. Cleaning removes both food and harborage for the pests and reduces insect survival rates. Remove or clean vacuum bags as soon as vacuuming is finished; do not allow bags that may contain live pests to remain in the building.
- Remove all possible sources of food materials, especially grains and potted plants, from museums and curatorial areas. Do not bring live flowers into the museum or curatorial areas.
- Check for dead insects or rodent carcasses on traps and remove them from the building.
- Establish orderly storage of goods and boxes off the floor on shelves or pallets to allow for cleaning.
- Establish proper refuse and garbage disposal; do not leave garbage in buildings overnight.
- Repair leaking plumbing. Insulate cold-water pipes, which tend to collect condensation. Control sources of sub-floor moisture with increased ventilation.
- If possible, place soda and snack machines outside the building so that water condensation and crumbs will not attract pests into the building and to ensure that pests are not carried

into buildings with supplies. It is best not to keep empty cans or bottles inside buildings; keep the recycling areas outside.

- Clean lint and other organic materials out of stoves, refrigerator coils and other motors, and closets and storage areas.
- Keep all foods in the break rooms and at desks in tightly sealed glass or plastic containers. Immediately clean up food, dirty dishes, and food spills.

Interior Museum Sanitation Measures

Eliminating Pest Food Sources

Work with staff to ensure that all cultural controls relating to eliminating pest food are followed. Ensure that staff is aware of the policies relating to food and drink in structures housing collections.

- Be alert to possible sources of food available to pests throughout the building while performing inspections.
- Regularly inspect wall voids, attics and interiors of suspended ceilings for possible food sources.
- Regularly check attics for dead insects or animal carcasses. Promptly remove and properly dispose of pests and their traces.
- Remove all possible sources of pest food materials, including decorative live plants, live flowers, food, and dirt. Do not allow live or potted plants in structures containing museum collections. Use artificial plants and flowers.
- Do not allow any food into areas housing collections. Designate an area away from collections where staff can eat, such as a break room. Keep all food sealed in containers with lids.
- Properly dispose of trash in sealed containers and remove from building daily, including trash from staff offices and break rooms.

Eliminating Moisture

- Identify and concentrate inspections on sources of dampness that may attract microorganisms, fungus feeding beetles, flies, mites, silverfish, booklice, springtails, and other pests.
- Promptly repair plumbing, sewer, roof, window, and building leaks.
- Insulate cold water pipes to prevent the formation of condensation.
- Correct sub-floor moisture problems by increasing ventilation or by placing moisture barriers beneath buildings, if appropriate, in consultation with the facilities manager and a historic architect.
- Correct poor drainage slopes away from the building in collaboration with maintenance staff.
- Maintain a stable RH and temperature with an allowable seasonal drift in areas housing collections. Keep spaces cool and dry (below 65% RH). See *MH-I*, Museum Collections Environment, Chapter 4 for more information on environmental controls.

Eliminating Harborage

- Work with facilities management and a historic architect where appropriate to find ways to eliminate harborage.
- Remove clutter and debris from areas housing museum collections.
- Move boxes and other items stored on floors to shelving and cabinets and keep them neatly arranged.
- Establish an 18 - 30" wide vegetation-free zone of gravel four inches deep around buildings that house museum collections to create a hostile environment for pests. This may not be appropriate for some historic structures. Work with facilities management to find an alternative solution.

- Keep area next to building foundations free of grass and bushes and trim back tree and shrub limbs that provide shelter and food for insects and other animals or serve as “vegetation ladders.” Work with facilities management to find an appropriate solution for historic structures.
- Promptly remove bird and insect nests from building exteriors.
- Eliminate any animal burrows under buildings that house museum collections.
- Remove piles of wood, stone, building materials, trash, and other material near structures housing collections.
- Work with facilities management to fill low spots in the ground that accumulate water run-off, and eliminate other water-holding sources.
- Keep the areas around garbage dumpsters clean. Regularly remove garbage and immediately clean up spills.

Exterior Sanitation

Rodents and other pests commonly move into structures from outside locations and then return outside again. Good exclusion is aimed at reducing or preventing such movement. Seasonally, outdoor environments can support high numbers of animals by providing harborage and food, which results in population crowding and encourages pests to enter buildings. It is important to practice good sanitation and habitat reduction around buildings and other developments to lessen these population pressures.

- Remove all trash, debris, boxes, logs, stones, rocks, and other sources of pest harborage.
- Store firewood, lumber, and other supplies off the ground and away from buildings to lessen harborage available to pests.
- Remove weeds and accumulations of leaves, grass clippings, and other debris from around buildings and/or other developments. Establish a weed-free zone that is at least 24 inches wide next to buildings to eliminate pest harborage.
- Improve garbage- and trash-handling methods and keep trashcans and surrounding areas clean. Keep tight-fitting, secure lids on all garbage containers.
- Ensure that visitors and campers properly store food and dispose of refuse to minimize mammals becoming habituated to humans and associating human activities as a source of food. This is particularly important in habitats where raccoons, skunks, coyotes, and bears may travel to minimize potentially dangerous human-wildlife interactions where injuries or rabies transmission may occur.
- Improve grade around buildings. Fill or drain low-lying areas, which accumulate water. Repair leaking air conditioners, pipes, and faucets.
- Improve drainage from roofs and downspouts by cleaning gutters and drains frequently.
- Thin or remove dense vegetation around buildings and other developments. Some landscaping vegetation may attract certain insects during spring or fall, when doors are most likely to be left open.
- Do not place bird feeders near buildings. Continually remove bird nests from building eaves or doorways (please note that many native birds are protected by the Migratory Bird Treaty Act and all activities related to them must be cleared by Science and Resource Management staff prior to initiating) to prevent pests’ being attracted to feathers, dead insects, or animal excrement, etc.
- Mount outside lights at least 30 feet from buildings and aim them to shine back onto the building. Use shading and lights that are known to attract fewer insects.

Exclusion of Museum Pests

Exclusion is critical and extremely effective. Pest entryways may be as small as hairline cracks in walls or as large as gaps under a door, holes around pipe traces, uncapped chimneys, open doors, or the complete absence of screens on windows. Entry holes for rodents can be as small as 1/4" in diameter.

Correct exclusion deficiencies by sealing through:

- caulking
- carpentry repairs
- door sweeps
- gaskets
- screens
- filters on air vents and hot air registers

Use sealants such as:

- caulk
- cement
- urethane expandable foam
- copper wool
- copper mesh
- other suitable sealant

5.4 Action Thresholds

Action Thresholds are criteria used to justify the initiation of pest controls. The principal objective of any IPM program is to suppress or manage pest populations to keep their numbers below an Action Threshold, rather than trying to eradicate pests (which is normally impossible or very expensive). Action Thresholds are first established and then refined with information gained through monitoring programs. Criteria used to establish Action Thresholds are based on estimates or observations of:

- pest population numbers
- documented damage to structures or natural resources
- costs for repair or replacement of damage
- data generated by monitoring programs
- knowledge of pest biology (especially reproductive potential)

The action threshold for organisms identified as “museum pests” is the sighting of one larva or adult museum pest, any traces of the pest, or damage to objects that indicate an active infestation.

When action thresholds are exceeded, proceed with control actions. Chapter 5 of the NPS Museum Handbook includes a number of recommended monitoring/inspection and reporting forms that will be utilized in the GLCA/RABR IPM monitoring and action planning process.

Based on inspection and monitoring findings and specific biological attributes of pests, Action Thresholds will be established to determine the need for controlling specific pests. The Action Thresholds will be reviewed and possibly modified to achieve the management objectives.

The need for pest control will be based on established Action Thresholds. The pest control will employ all feasible physical, mechanical, cultural, and biological controls, including exclusion,

sanitation, habitat modification, and direct removal. NPS-approved chemical pesticides will only be used as a last resort when other controls have not achieved acceptable results. There are many control alternatives; however, the success of the controls relies on the integration of the control methods. It is important to try different controls until some form of success is achieved. Pest control methods are most effective when used in combination.

Actions if Museum Pests are Found

Responding to Infestations

Follow the steps noted below to stop an infestation and prevent it from recurring.

- Document what, where and when you see signs of pest activity immediately.
- Isolate the infested object immediately. Wearing gloves, place infested object in a well-sealed plastic bag and double bag. **Never** carry infested objects through the collection without thoroughly isolating them as eggs or larvae can be accidentally dropped and the infestation spread. Move the infested object to an isolation room outside of the collections area.
- Determine the extent of the infestation. Start at the location where the first infested object was found and inspect the collections/areas in ever widening circles. Immediately isolate additional infested objects as they are found and document the findings.
- Identify the pests and pest traces.
- Clean the area surrounding the removed infested object.
- Clean the object.
- Determine object treatment options in consultation with a conservator. Document the treatment.
- After treatment, determine how long to isolate the object before returning to storage or exhibit.
- Determine the source of the infestation. Collaborate with appropriate staff to address the problem.
- Increase inspection and monitoring of the area to confirm that you have eliminated the infestation.

Treatment for an Infested Object

Before treatment, identify the pest to determine that it is a museum pest and will cause damage to museum objects. Contact the park IPM coordinator for assistance.

Cleaning:

- Remove all traces of the pest from the object. Dead pests, larval skins, and nests can attract other pests.
- If an infestation is limited to a single object and has not progressed too far, careful vacuuming with HEPA filters may remove the problem. Before cleaning, ensure the structure of the object can withstand the stress of vacuuming. Use screening material on the HEPA attachment/tube when vacuuming museum objects. Cleaning will probably not remove all eggs, as some can be microscopic. Review the pest's biology and focus efforts on areas where eggs are likely to be deposited. Remove the vacuum bag from the building immediately so it does not become a source of new infestations. After cleaning, determine if further isolation time is needed.
- Determine the life cycle of the pest and monitor the object until you are sure no more insects will hatch. Use this method to clean old or non-active infestations.

Note: When addressing a mouse or rat infestation, do not sweep or vacuum, as this increases the risk of transmission of hantavirus.

Freezer Treatment, also called low temperature treatment:

- Freezing is the method of choice for treating most active infestations of objects.
- However, certain materials can be significantly damaged by freezing. Consult a conservator to determine what materials are appropriate for freezing.
- See COG 3/6: “An Insect Pest Control Procedure: The Freezing Process” for procedures and further information.

Anoxic Treatment:

- Replacing the oxygen with a gas (nitrogen, argon, carbon dioxide) or using an oxygen scavenger/absorber in a closed space can kill insects and their eggs.
- Consult a conservator to determine if the anoxic treatment is appropriate.
- See COG 3/8: “Controlling Insect Pests: Alternatives to Pesticides”, and COG 3/9: “Anoxic Microenvironments: A Treatment for Pest Control” for more information.

Fumigation/Pesticides:

- Consult with the regional curator, the park IPM and a conservator when considering any fumigation or pesticide options.
- All pesticide use must be approved PUPS.
- Conventional chemical fumigation is only appropriate if objects cannot be treated by other means, and is rarely recommended.
- In the event fumigation is needed, work a professional applicator. Do not use space fumigants such as naphthalene, paradichlorobenzene, dichlorvos (Vapona, DDVP, No Pest strips), or thymol.
- Do not use pesticides directly on museum objects. Persistent pesticides may leave residuals on objects and cause damage, and/or be a health risk.
- Document any pesticide use through PUPS.

5.5 Records

All pest management inspection, monitoring, and photo point data and notes on exclusion and sanitation measures will be kept in permanent IPM files that document the timing, techniques, and kinds of pest control actions taken. Periodically, data will be evaluated to determine the relative effectiveness of specific control efforts. These data will then be incorporated into the IPM plan through periodic updates. The IPM Coordinator will complete, submit, and file all requests for pesticide use and annual Pesticide Use Log forms. These will be made available to interested parties. The IPM Coordinator will maintain permanent IPM files that contain the names and addresses of persons having technical expertise to manage specific pests. The IPM Coordinator will also maintain files on the sources of pest management and chemical pesticide supplies, local pest control operators, local and state health departments, and other information that applies to the GLCA/RABR IPM program.

6.0 HUMAN HEALTH AND SAFETY CONCERNS

The following sections outline the concerns and risks to human health and safety with regard to pest issues in the Park.

6.1 Diseases

Pests can come into direct contact with rotting debris, soil, and potential sources of disease organisms because of their feeding and secretive habits, and they may spread diseases to humans. The potential for the spread of disease is the most important reason for effective pest management.

Eight diseases have been identified as potential concerns in the Park. These include chronic wasting disease, rabies, avian influenza, Hantavirus, bubonic plague, and West Nile virus. Disease fact sheets are available on SharePoint in the IPM document section under Resource Management and Science contains detailed information about each of these diseases.

6.2 Wildlife Safety Concerns

Mice often nest in, under, and around electrical and kitchen appliances, where they damage wiring, reduce ventilation around electrical motors, and contaminate foods. Rodents gnaw on electrical wiring and are considered an important initial cause of many structural fires. Serious consequences can develop when rodents damage electrical wiring or fluid hoses in emergency vehicles.

It is not uncommon, especially for children, to be bitten while trying to feed or catch deer, javelina, raccoons, or rodents (ground squirrels and chipmunks). Although rabies is relatively common in the Southwest, rodents seldom carry the disease and rodent bites more likely result in tetanus. Venomous bites by rattlesnakes are also a safety and health concern. Wildlife becoming habituated to humans, in most cases, results in wildlife-human interactions that can lead to injuries, exposure to wildlife related diseases and fleas, or the need to remove and dispose of the individual wildlife. Visitors can also lose pets or have pets exposed to wildlife diseases and fleas. Staff should be vigilant in watching for wildlife that appear to be becoming habituated to humans or human use areas. Visitors and employees are sometimes stung by stinging insects while in the Park. Adequate public warnings will be posted to inform visitors and staff of potential hazards with respect to the wildlife. In areas where larger animals are known to be possible disease carriers, mammals caught in live traps or other kinds of traps and dead animals should be handled with gloves. In disease-endemic areas, it may be advisable to control parasites (fleas, ticks, etc.) before approaching trapped animals. The local health authorities should be consulted for the latest recommendations on parasite control. Snap, Conibear, snare, and foot traps used in above ground locations are not selective and may, if unprotected, kill or injure non-target animals. Whenever possible, traps used to control wildlife will be covered or protected to prevent injury to non-target species. Traps will be checked at least daily to prevent curious people or animals from being bitten or coming into contact with captured animals.

6.3 Pesticide Safety Concerns

A pesticide, as defined by Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), is any substance or mixture that is used in any manner to destroy, repel, or control the growth of any viral, microbial, plant, or animal pest. Except as noted in the next paragraph, all prospective users of pesticides in the Park must submit pesticide-use requests, which will be reviewed on a case-by-

case basis, taking into account environmental effects, cost, staffing, and other relevant considerations. The decision to incorporate a chemical, biological, or bio-engineered pesticide into a management strategy will be based on a determination by the IPM Coordinator that it is necessary and that all other available options are either not acceptable or not feasible.

Insect repellents and insecticides applied to persons or to livestock must conform to NPS policies and approval procedures. However, the following types of pesticides used under the following conditions do not require approval:

- Cleansers and disinfectants that are used in restrooms and restaurants;
- Personal insect repellents, insecticides, and bear-deterrent sprays that employees or Park visitors personally obtain and use to meet personal needs; or
- Insect repellents and insecticides that are applied to personally owned pets and pack and saddle stock (NPS 2006).

Pesticide Storage, Use, and Disposal

Storage

Pesticides and fertilizers will be stored both before and after use in a safe manner, as instructed on pesticide labels and in posted, non-flammable, temperature-protected, and locked facilities. Pesticides will not be stored with other products. Insecticides and herbicides will be stored in separate facilities, and established pesticide shelf-life guidelines will be followed. SDSs will be kept and be made immediately available for all used or stored chemical pesticides.

Use

Pesticide labels contain directions to protect workers and reduce exposure to non-applicators. It is very important to ALWAYS READ THE LABEL. Failure to follow the label directions violates FIFRA. Existing labels on incoming chemical containers will not be removed or defaced. In addition, under the Occupational Safety and Health Administration's Hazard Communication Standard (29 Code of Federal Regulations [CFR] 1910.1200), workers will be provided with training, protective equipment, and information (SDSs) about the hazardous substances they may handle. Pesticides will not be stored in or transferred to unapproved or unmarked containers. Information will be made available to the public regarding any pesticides used and areas treated. Records will be kept for all pesticides used or stored in the Park.

Disposal

All pesticides, rinsates, and pesticide containers will be disposed of according to the pesticide label directions and regulations established by the EPA (40 CFR 116–117, 165, 170–172) and through the Resource Conservation and Recovery Act (40 CFR 261.30–33).

Safe storage of pesticides in personal residences in the Park is critical for the protection of residents, their children, and domestic animals. Residents will be informed of the recommended guidelines for storing pesticides in the home. Additional general pesticide safety:

- Do not purchase pesticides for use in or around your residence, garden, or yard that have not been approved through the Park IPM Coordinator.
- Keep all pesticides locked up.
- Do not store pesticides in the same cupboards as food, animal feed, seed, or water.
- Do not store pesticides beneath the kitchen sink, where they are in reach of children.
- Store pesticides in dry, cool, well-ventilated places away from sunlight and at temperatures above freezing.
- Mark all entrances to pesticide storage areas with a sign: "Pesticides Stored Here—Keep Out."
- Store and keep all pesticides **only** in original and originally labeled containers.
- Clean up spilled and leaking pesticides immediately.
- Write the date of purchase indelibly on pesticide containers.
- Many pesticides are flammable; take adequate precautions against potential fire hazards.
- Keep all safety data and other information that comes with pesticides.
- Do not mix storage of herbicides and insecticides; keep them in separate storage lockers.

- Keep the Poison Center phone number available: American Association of Poison Control Centers 1-800-222-1222.

6.4 Other Safety Concerns

After applying pesticides in areas subject to visitor use, post warning signs in the treated areas until the pesticides are dry. Employees will take safety precautions in using ladders and tools and will be informed about other specific work and pest hazards related to IPM duties, including:

- Workers on ladders and scaffolds will be warned about the hazards of encountering stinging bee or wasp colonies.
- The public will be kept away from bee and wasp control operations and employees will wear adequate personal protective clothing.
- Employees handling live poisonous snakes will be trained, will only use the proper equipment, and will keep the public back. Poisonous snakes will be transported and released in a safe manner. Also, see the Employee Training section, below.

7.0 EMPLOYEE TRAINING

It is recommended that the Park IPM Coordinator receive 40 hours of initial IPM training. Employees who apply pesticides should be certified as pesticide applicators in his or her state of residence. Training is critical for the safety of NPS employees and the success of the IPM program, and the recommendation is for all personnel who engage in pest management work to avail themselves of as much training as possible. This is especially true for personnel who handle dangerous animals, injured/sick/dead wildlife, or pesticides. Important contacts for training (classroom and correspondence courses, videos, books, etc.) and other IPM information include Park and cluster training officers, professional pest control groups, and various state and Federal agencies.

8.0 FREQUENCY OF PLAN UPDATES

While using this IPM plan, new information may be discovered that should be incorporated into each IPM plan update. All persons using this IPM should keep notes and records of new information gathered while implementing pest projects. The Park IPM plan will be reviewed no less than every five years in order to update the IPM procedures, include new technological advances, note changes in NPS pesticide approval processes, record changes in local technical resources or emergency numbers, add data for new buildings or pest problems, include new information on local disease problems, verify current Federal, state, and local laws and Park and NPS policies, and solicit input from Divisional Chiefs or other sources, as applicable.

9.0 STATEMENT BY PARK MANAGEMENT IN SUPPORT OF THE PARK IPM PROGRAM AND SPECIFIC FULL-TIME EQUIVALENT AND BUDGET NEEDS FOR PROACTIVE PARK IPM PROGRAM

The intent of the GLCA/RABR IPM Plan is to fully support the goals included within the NPS-wide IPM program and to provide for the health and safety of Park staff, visitors, and residents. The Superintendent is responsible for the IPM program and will designate at least one trained Park IPM

Coordinator to direct and implement the GLCA/RABR IPM program, as outlined in Director's Order No. 77—Natural Resource Guidelines.

All pesticides used in the Park shall be in strict accordance with the NPS-wide policy found in Director's Order No. 77—Natural Resource Guidelines. All pesticides used by residents, contractors, concessionaires, special-use permittees, agricultural lessees, and any non-NPS personnel in the Park will conform to NPS policies and guidelines. Prior to purchasing or using pesticides, one must obtain approval, following NPS policies.

Limited 'preventive' pesticide treatments will be made in the Park and only when prior NPS approval is obtained. Approved applications will be considered for pest management for public health and safety reasons in and around inhabited buildings and especially where food is prepared and served or where visitors, staff, and partner employees live and sleep. Unapproved applications could result in environmental contamination, pose serious health hazards to personnel, or cause rapid development of pesticide-resistant pest species. Preventive applications will be considered to be "application of a pesticide in the absence of a target pest" and, as such, a violation of Federal law.

Following use, the pesticide applicator will provide information and the Park IPM Coordinator will document treatments using the NPS Pesticide Use Proposal System (PUPS) database by the end of each calendar year. Personal use of pesticides by employees in residences or by individuals in community gardens must conform to established NPS policies, guidelines, and approval processes. The Park IPM Coordinator will monitor all use of pesticides by residents and will supply them with the most recent IPM information available for managing households, gardens, or nuisance pests by the least toxic methods possible.

Native insects and diseases will be allowed to function unimpeded, except where control is required:

- for reasons of **public health** (as defined by the Centers for Disease Control) or **safety**;
- to prevent the loss of host or host-dependent species from an ecosystem;
- to prevent outbreaks of insects or diseases from spreading to floral or faunal communities or populations outside the Park;
- to conserve U.S. Fish and Wildlife Service listed or proposed endangered species;
- to conserve and protect flora and fauna in developed zones; or
- to preserve, maintain, or restore the historical integrity of cultural resources.

Exotic plant and animal species already present in the Park will be manipulated or eradicated whenever such species threaten the protection or interpretation of resources being preserved in the Park by:

- being detrimental to **public health**;
- disrupting faithful presentations of the historical scene;
- damaging historical and archeological resources;
- threatening perpetuation of natural features, native species, natural ecological communities, or natural ecological processes; or
- significantly hampering management of adjacent Park or non-Park lands.

All decisions to control exotic pest species will consider all possible impacts on Park resources and will consider available alternative control methods and their probabilities for success. Plans to control pests or implement pest control activities for any of the above reasons will follow

prescribed NPS-wide IPM recommendations and guidelines. Great care will be taken to ensure that programs designed to control exotic pests do not ultimately result in significant or unexpected damage to native species, natural ecological communities or processes, or historical objects.

The Superintendent will provide sufficient staffing and funding to carry out a proactive IPM program effectively in the Park and will make budget and staff available to support annual monitoring, exclusion, and pest control needs.

10.0 LITERATURE CITED

National Park Service. 2006. Management Policies. Washington, D.C.: U.S. Government Printing Office.

———. 2006. Scope of Services, Glen Canyon National Recreation Area. Project Management Identification No. 94861. Glen Canyon: National Park Service.

———. 2005. Glen Canyon National Recreation Area and Rainbow Bridge National Monument, Arizona–Utah Wildland Fire Management Plan: Final Environmental Assessment/Assessment of Effect. Glen Canyon: National Park Service.

———. 1979. Glen Canyon National Recreation Area General Management Plan. Glen Canyon: National Park Service.

----- 2014. NPS *Museum Handbook*, Part I Biological Infestations