Quinault Indian Reservation

Forest Management Plan

2017

BIA Taholah Office

Quinault Reservation
Forest Management Plan

April 2017 through April 2027

Prepared by:
Quinault Indian Nation
Department of Natural Resources
and
Bureau of Indian Affairs
Taholah Agency

Compiled by:
Cynthia Harbison, QIN Planning Forester

Date Approved: 4/21/17

Fawn Sharp
President, Quinault Indian Nation

Date Approved: 4/21/2017

Gregory K. Masten
Superintendent, Taholah Agency

By Tribal Resolution No: **17-96-96**

Quinault Indian Nation
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QUINAULT BUSINESS COMMITTEE
RESOLUTION NO. 17-96-96

WHEREAS, the Quinault Business Committee is the recognized governing body of the Quinault Indian Nation under the authority of the Quinault Indian Nation's Constitution adopted by the Quinault General Council on March 22nd, 1975; and

WHEREAS, the Quinault Indian Nation desires the resources of the Quinault Indian Reservation to be managed sustainably for the maximum use, benefit and value of its people; and

WHEREAS, the National Indian Forest Resources Management Act (25 U.S.C. Ch. 33) (NIFRMA) requires the Bureau of Indian Affairs to prepare a Forest Management Plan (FMP) for all Indian forest lands based on the principles of sustained yield management and objectives established by the affected tribe, and

WHEREAS, the Forest Management Plan for the Quinault Indian Reservation (FMP) is a management policy that provides direction for implementation of forest management activities on the Quinault Indian Reservation, was prepared with the full and active consultation and participation of the Quinault Indian Nation, and assures compliance with the Bureau of Indian Affairs statutory and regulatory requirements as required by NIFRMA to have an approved Forest Management Plan in place; and

WHEREAS, the Forest Management Plan for the Quinault Indian Reservation is a ten-year planning document providing for sustainable management of reservation forestry resources based on the most current available science, data and information, and which calls for a 38% increase in the Annual Allowable Cut (AAC), and

WHEREAS, the Quinault Indian Nation has assumed all BIA functions dealing with trust and tribal timber sales under the Self-Governance Compact and the Quinault Business Committee does not believe there are adequate resources of staff and funding available to meet this increased AAC; and

WHEREAS, it remains imperative that a current Forest Management Plan is in place to continue forest activities on the reservation for the benefit of the QIN and the trust allotment owners, and

WHEREAS, the QIN is a signatory to the FMP, which includes its owned lands on the reservation under the application of the FMP but recognizes it in effect is an underfunded mandate, now

THEREFORE BE IT RESOLVED, that the Quinault Business Committee hereby supports and approves adoption of the attached ten-year Forest Management Plan for the Quinault Indian Reservation and agrees it applies to all trust and tribal lands within the reservation boundaries and it shall become effective upon approval of the Secretary of the Interior or their authorized representative, and terminate ten years later, and now

THEREFORE BE IT FURTHER RESOLVED, the QIN will work to secure additional funding to fully implement the FMP or will work to identify more efficient methods of implementing the FMP such that the sustainable annual allowable cut can be made with the resources available, but recognizes that the full AAC may not be reached within the time period allowed because of the underfunded mandates included in the FMP and limited QIN resources available for implementation, and now

THEREFORE BE IT FURTHER RESOLVED, that the President of the Quinault Indian Nation, or her designee, is authorized to sign the attached Forest Management Plan on behalf of the Quinault Indian Nation.

Fawn R. Sharp, President
Quinault Indian Nation

CERTIFICATION

AS SECRETARY OF THE QUINAULT BUSINESS COMMITTEE, I HEREBY CERTIFY THAT THE FOREGOING RESOLUTION WAS DULY ENACTED BY THE QUINAULT BUSINESS COMMITTEE ON THE 10TH DAY OF APRIL, 2017 BY A VOTE OF 8 FOR, 0 AGAINST, AND 1 ABSTAINING.

Latosha Underwood, Secretary
Quinault Business Committee

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Quinault Mission Statement

It is the ***mission*** of the Quinault Business Committee to always seek the Creator's wisdom and guidance to enhance quality of life of our Nation's people through:

1. Preserving our *roots*: sovereignty, treaty rights and constitution, cultural* traditions, and natural resources

2. Promoting our *wings*: employment and educational opportunities, prosperity, and physical, spiritual, and emotional well-being

*The totality of socially transmitted behavior patterns, arts, beliefs, institutions, and all other products of human work and thought characteristic of a community or population.

The American Heritage Dictionary, Second College Edition ©1982, 1985, 1991 by Houghton Mifflin Company

Quinault Vision Statement

We are a nation that draws strength from the values of our past and the resources within our community to manifest our shared future.

We are a healthy, thriving and sustainable community that inspires hope and self-reliance in our people, Our youth share the responsibilities of leadership and are prepared to take care of their future.

We recognize the contribution of each citizen, honor authentic engagement and open communication, and have deep reverence for the Quinault Spirit that shines through our people, our ways, and our beautiful lands.

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Table of Contents

Acronyms

AAC	Annual Allowable Cut
APHIS	Animal and Plant Health Inspection Service
BIA	Bureau of Indian Affairs
Bt	*Bacillus thurgenesis*
CAA	Clean Air Act
CEA	Conservation Easement Area
CFI	Continuous Forest Inventory
CFR	Code of Federal Regulations
CT	Commercial Thin
DBH	Diameter at Breast Height
DIB	Diameter Inside Bark
DNR	Department of Natural Resources
EA	Environmental Assessment
ELZ	Equipment Limitation Zone
EP	Environmental Protection
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FARR	Federal Air Rules for Reservations
FFMS	Fire and Fuels Management Specialist
FLAD	Forest Landscape Analysis and Design
FMD	Forest Management Deduction
FMO	Fire Management Officer
FMPA	Fire Management Preparedness Analysis
FMZ	Fire Management Zone
FPR	Forest Practices Regulation
FPS	Forest Projection System
HEMTIC	Hemlock Tree Improvement Cooperative
HPA	Hydraulic Project Application
IAM	Indian Affairs Manuel
IC	Incident Commander
ID	Interdisciplinary
IFLAA	Indian Forest Land Assistance Account
ISS	Invasive Species Specialist
LTSY	Long-term Sustained Yield
MBF	thousand-board feet
MMBF	million-board feet
NAAQS	National Ambient Air Quality Standards
NBA	North Boundary Area
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NFMAS	National Fire Management Analysis System
NPDES	National Pollution Discharge Elimination System
NWRO	Northwest Regional Office
NWTIC	Northwest Tree Improvement Cooperative
OHWM	Ordinary High Water Mark
OIC	Officer in Charge
ONF	Olympic National Forest
PCT	Precommercial Thin
PMO	Pest Management Officer
QDFi	Quinault Department of Fisheries
QDNR	Quinault Division of Natural Resources
QIN	Quinault Indian Nation
QIR	Quinault Indian Reservation
QLTE	Quinault Land and Timber Enterprise
QQCWMA	Queets Quinault Cooperative Weed Management Area
RMZ	Riparian Management Zone
RTOC	Rayonier Timber Operating Company
SNC	Swiss Needle Cast
THPO	Tribal Historic Preservation Officer
TPA	Trees per Acre
TSI	Timber Stand Improvement
USFS	United States Forest Service
USFS-WSC	United States Forest Service - Westside Service Center
USFWS	United States Fish and Wildlife Service
USNPS	United States National Park Service
WFPA	Western Forest Protection Association
WFSA	Wildland Fire Situation Analysis
WMZ	Wetland Management Zone
WSDA	Washington State Department of Agriculture
WWP	Western White Pine

Chapter 1. General Overview

This chapter includes the introduction, summary, goals and objectives, pertinent laws and regulations, basic silvicultural prescriptions, staffing requirements necessary to implement the plan in a timely manner, and a general monitoring and evaluation plan.

1.1 Introduction

The Forest Management Plan for the Quinault Indian Reservation (QIR) provides the direction and technical specifications by which forest management activities will be performed. It addresses management policy and provides direction for its implementation. The policy stated within this plan is implemented on individually-owned trust and tribally-owned land on the QIR by the Quinault Division of Natural Resources (QDNR) Forestry Department and the Bureau of Indian Affairs (BIA) Taholah Agency.

Although this plan addresses issues surrounding resources other than timber (for example, fish and wildlife habitat), it is not intended to make the QDNR Forestry Department and the BIA-Taholah Agency responsible for all resources, but rather to ensure that the issues and policies for all forest resources are addressed in a formal planning document.

Brief History of the Planning Process

The first FMP for the QIR was implemented in 2003 and was to expire in October of 2013, but was extended to April 2017. The Quinault Indian Nation (QIN) and the BIA initiated the forest management planning process for this plan in 2009. Because the plan is considered a federal action, it is required to go through the National Environmental Policy Act (NEPA) process. To address this requirement, an Environmental Assessment (EA) was initiated for the purpose of developing management alternatives, assessing them for significant impacts to the human environment and to assist decision makers in selecting an alternative. The first step of the process was to implement a public outreach process. Public issues and concerns were also solicited by the QIN and BIA at public meetings held at Taholah, Queets and Aberdeen in March 2013. From this process, the EA was developed with four management alternatives.

(i) Public Outreach—Defining Issues and Developing Alternatives. The first step in the process was to determine the issues of concern from affected and interested parties. The QIN Planning Forester solicited and documented feedback from QDNR staff regarding the previous FMP. A questionnaire was developed and mailed out to tribal members and landowners as well. The responses were summarized and reviewed, the results of which, along with input from the QDNR interdisciplinary (ID) team , were used to define critical issues and develop four potential management alternatives.

(ii) Public Meetings. To determine whether the proposed alternatives met the needs of the affected parties, several public meetings were held to present the alternatives and procure comments. Parties in attendance were tribal members, landowners, the Allottees' Association, and the QIN Business Committee.

(iii) Environmental Consequences. After it was established that the alternatives addressed the issues of concern, QDNR performed an analysis of the environmental consequences of each alternative.

(iv) Alternative Selection. The alternatives were analyzed and presented to the QIN Business Committee (BC) in April 2013, for their feedback and direction. The BC requested that some modifications be made to Alternative 3. The modifications were made, which resulted in a new Alternative 3.1. The EA was finalized on 5/13/13, and presented to the BC on 5/13/13 for final selection of a preferred alternative. After further review from the Superintendent and the BC, Alternative 3.0 was chosen by resolution on 1/25/16.

Preferred Alternative: Alternative 3.0 – Modified No-Action

Reservation Setting

(i) Location. The QIR is located on the southwest side of the Olympic Peninsula of Washington (**see Map 1.1** in Appendix D) and forms a triangle from the Queets village in the north, Lake Quinault on the east, and the town of Moclips in the south. The Pacific Ocean makes up the western boundary. Adjacent lands to the reservation are managed by Washington State Department of Natural Resources, the Olympic National Forest, and the Olympic National Park as well as some private residential and commercial lands.

(ii)Topography. Aside from the North Boundary Area (NBA), the Quinault Indian Reservation is low elevation and relatively flat. The NBA, located in the northeast portion of the reservation, gradually ascends to higher elevation, reaching 2,769 feet at its highest. Several major rivers cross the QIR including the Queets, the Raft, and the mainstem Quinault River.

(iii) Climate. The QIR lies within a temperate rainforest and receives between 80 inches of precipitation along the coast and 150 inches in the NBA. It is generally cloudy and cool throughout the year. July, August, and September are generally the driest months. The wettest months are November, December, and January. Temperature averages range from 41.5 ^{o}F in the winter to 59.6 ^{o}F in the summer.

(iv) Forest Area. The QIR encompasses approximately 207,000 acres. Approximately 23,000 acres are privately owned fee patent properties and about 22,000 acres are non-forested lands including Lake Quinault, major rivers, ocean beaches, sand bars, major gravel pits, urban areas, and drivable roads. Total acres of forestland under QIN and BIA timber management is about 162,000 acres, including individual Indian owned trust and tribally owned lands. **Map 1.1** (Appendix C) illustrates the QIR ownership pattern—pink indicates fee land; green indicates tribal or individually owned trust lands; and beige units indicate Trust allotments.

1.2 Summary of Forest Management Plan

The Forest Management Plan is the guiding document for forest practices on the QIR. The format is based on the Indian Affairs Manual (IAM) 53, Supplement 2, Section 3 and 25 Code of Federal Regulations (CFR) Part 163.

This is a 10-year plan that will officially commence in October of 2016 and remain in effect through October of 2026. Within a year of the final approval of this plan, an implementation and

monitoring policy will be developed to assess the effectiveness of the management guidelines delineated in Chapter 3: Timber Management Standards.

Information gleaned through monitoring will also be used in a formal plan review process commencing at the end of the initial 5 years of the planning period. If the desired effects are not reached, or if a change in goals and/or philosophies occurs, forest practices will be adjusted accordingly and a modification to the plan will be implemented prior to the expiration of the 10-year period. If forest practices are successful and no change in goals or philosophies occurs, the plan will be extended for subsequent 10-year periods with the only modification being the inclusion of an updated harvest unit map (Appendix C: **Map 3.1**).

The plan consists of 11 chapters:

Chapter 1: General Overview.

(i) Introduction. This section includes a discussion of the process used to develop the forest management plan and a description of how this document was informed by other documents.

(ii) Forest Management Goals and Objectives. This section includes three specific goals and associated objectives to support the long-term overarching goal of ecologically sustainable management of natural resources.

(iii) Laws and Regulations. This section lists the federal and tribal laws and regulations that apply to the management of the natural resources within the QIR.

(i) Trespass: This section includes a description of specific types of trespass on the QIR along with specific areas of concern including procedures for reporting trespass and processing complaints.

(iv) Silvicultural Prescriptions. This section contains five basic 'forest area types' have been identified on the QIR utilizing the Forest Landscape Analysis and Design (FLAD), each requiring specific silvicultural prescriptions: matrix, riparian management zones, potential avulsion and/or erosion zones, wetlands, and unstable slopes. Brief description of each forest area type and the associated management guidelines are provided.

(v) Organization and Funding. This section describes staffing and funding requirements necessary to implement the plan are described for each component of the forestry program.

(vi) Monitoring and Adaptive Management. This section describes the monitoring activities that will occur to evaluate compliance and effectiveness of the FMP, as well as outlines the dispute resolution process for adaptive management.

Chapter 2: Forest Inventory Report.

This chapter details the inventory and inventory procedures for the QIR, including a description of the forest and the inventory system, a summary of inventory results, the calculation and discussion of the annual allowable cut, and recommendations for improving the inventory.

Chapter 3: Timber Harvest Standards.

(i) Harvest Policy. This section outlines the tribal and federal laws and regulations guiding forestland management activities on the QIR.

(ii) Timber Management. This section defines the criteria for harvest unit selection on tribal and individual trust lands. It includes a description of pre-sale layout procedures, defines the ID Team and their roles, and describes mapping standards. The section then explains general timber management guidelines, guidelines for timber harvest in riparian management zones and wetlands and/or prairies. Finally, the section identifies criteria for choosing a logging system and outlines post-harvest guidelines.

Chapter 4: Roads and Mineral Pit Management

(i) Roads Management. This section deals with the construction and maintenance of forest roads. It defines road types, presents a brief history of the road system, describes the current conditions of forest roads, outlines the goals and objectives of the road system, and defines closures.

(ii) Minerals Management. This section includes information on mineral pit management, development, and reclamation.

(iii) Forest Health. This section contains a list of QIR specific pests along with a discussion of how each will be controlled.

(iv) Forest Development. This section includes fuels management, tree improvement and pest management strategies, regeneration and stand improvement programs, and a discussion on pesticide use.

Chapter 6: Forest Invasive Species.

This chapter briefly discusses forest invasive species on the QIR, and outlines the general strategy for the prevention and treatment of invasive plants.

Chapter 7: Air and Water Quality

(i) Air Quality. This section briefly discuses air quality on the QIR and laws and regulations regarding air quality.

(ii) Water Quality. This section includes a discussion of current water quality conditions, protections needed for surface and groundwater, and monitoring projects.

(iii) Climate Change. This section acknowledges climate change and describes some of the potential impacts of climate change on natural resources on the QIR.

Chapter 8: Fish and Wildlife Habitat

(i) Fish. This section outlines the effects of historic forest practices on fish habitat, and includes a discussion of current fish and associated habitat conditions.

(ii) Wildlife. This section includes a discussion of current wildlife and associated habitat conditions, protections needed for the Endangered Species Act (ESA) and big game species, and management of big game to reduce damage to timber resources.

Chapter 9: Cultural Resources.

This section defines cultural resources on the reservation, regulation, the current condition of cultural resources, and management directions.

Chapter 10: Fire Management.
This section includes strategies for managing both wildfire and prescribed fire including fuels management.

Chapter 11: Economic Benefit Assessment.
This chapter summarizes the monetary benefits derived from forest resources. This includes revenues from forest management, individual Indian and non-Indian benefits, as well as regional economic impacts and future projects.

Illustration by Scott Kryskalla

1.3 Forest Management Goals and Objectives

The lands within the QIR have been the homeland of the Quinault people for thousands of years and are an integral and inseparable part of the Quinault history, culture, tradition, and identity. The QIN and BIA recognize that they must provide for the future by maintaining a proper balance between use and conservation of the QIR's natural resources. With proper vision, the QIR can be managed in an ecologically sustainable way that protects heritage of the land and sustains in perpetuity the way of life of the Quinault people and other trust landowners.

Goal: Sustain the harvest of forest products on the Quinault Indian Reservation to provide economic return to the landowner, provide for employment opportunities, and to support regional economic infrastructure.

(i) Manage the commercial forest resources on the Quinault Indian Reservation on a sustained yield basis.
(ii) Maintain qualified professional, scientific, technical, and support personnel to implement sustained yield management of forest resources.
(iii) Provide opportunity for resource extraction and processing of forest products on a regional scale.

Goal: Implement holistic forest management practices to conserve or improve habitat for fish and wildlife.

(i) Follow the management prescriptions described in the riparian management zones section of this document to:
    a. Restore normative floodplain and riparian processes to increase habitat complexity for fish and wildlife.
    b. Maintain water quality.
(ii) Follow the management prescriptions described in the general timber harvest guidelines section of this document.

Goal: Enhance cultural values by providing access to and conservation of traditionally-used forest resources and lands.

(i) Create a plan for the retention of large red and yellow cedar trees across the landscape to be used for canoes.
(ii) Develop a management plan for traditionally used plants as part of the Wetland Management Plan.
(iii) Manage riparian forest corridors to improve habitat for fish and wildlife in order to sustain fishing and hunting.
(iv) Preserve and protect traditional, cultural, and archaeological areas and ensure tribal access.

1.4 Laws and Regulations

The FMP is a requirement under federal law as part of the trust responsibility belonging to the Secretary of the Interior. The National Indian Forest Resources Management Act of 1990 mandates that all management activities on Indian trust forest lands be consistent with an approved Forest Management Plan (53 IAMN 2-H). In 25 CFR 163.11(a), it states 'An appropriate forest management plan shall be prepared and revised as needed for all Indian forest lands.' In addition to the FMP, there are also tribal natural resource laws and regulation that have been adopted under QIN's authority as a sovereign nation, which must also be complied with. They include the following:

Quinault Tribal Code of Laws Title 61, Natural Resource Management (revised October 23, 1995) – Title 61 is the overriding document for forest resource management on the QIR.

QIN Forest Practices Regulations (FPRs) (adopted October 22, 1979) - QDNR was given authority to establish these regulations under Title 54, Chapter 10, of the Quinault Forest Practice Act. Their purpose is to administer and enforce management guidelines to ensure the commercial forest lands of the reservation would be managed consistent with sound policies of natural resource protection.

Enforcement

(i) Appointed legal representatives of the QIN are authorized under Title 61 to pursue civil enforcement remedies on behalf of the Nation and other interested parties. These legal representatives include the QIN Resource Protection Officers and representatives of the Environmental Protection Department (EP) of the Quinault Division of Natural Resources.

(ii) Forest practice activities are monitored before, during, and after operations to prevent violations to Title 61 and the QIN's Forest Practice Regulations. Civil penalties include payment of fines and/or monetary damages, and seizure/forfeiture of equipment.

(iii) Under Section 1.C of the Self Governance Agreement, Commissioned Tribal Police have assumed the responsibility of patrol, detection, and investigation of civil trespass issues on trust lands within the QIR.

(iv) Per timber sale contract and paid permit specifications, the Officer in Charge will administer the contract in such a way that actions are in compliance with pertinent laws and regulations. All contract violations will be handled per contract specifications.

Trespass

This section is a reference plan for the enforcement of trespass laws within the QIR. It is not a comprehensive description of how those laws are to be enforced but rather is intended to serve as a model for the future development of enforcement activities.

Enforcement of Trespass Law Goals

(i) To ensure that harvesting methods are in accordance with tribal regulations and applicable Federal laws, statutes, and regulations.
(ii) To protect the natural resources from unlawful cutting, damage, and/or removal.
(iii) To promptly address damaging or threatening situations.

Scope and Intent
The protection of the QIR's natural resources from unlawful activities and/or activities that are outside the scope of permits is of high priority. Violations of regulatory guidelines must be addressed in a timely and professional manner. The loss of resources can be held to a minimum through actions such as:

(i) Aggressive enforcement patrols of the interior lands via foot, vehicle, watercraft, and aircraft,
(ii) Training forestry personnel in the methods of stewardship through a forest warden training program,
(iii) Posting all entries and boundaries with warnings of the consequences for violating Tribal and Federal regulations,
(iv) Quick, 24-hour response to areas of suspicious activity,
(v) Ongoing monitoring during times of harvesting,
(vi) Education of cedar salvage operators in forest use practices & regulations, and
(vii) Control of major access points onto the QIR.

Authority/Jurisdiction
Under 25 CFR 163.29, both the BIA and QIN are jointly responsible to coordinate the prosecution of trespass actions. Designated enforcement officers are authorized through 25 CFR Part 163 to investigate reported trespass violations; the BIA is currently responsible for prosecuting trespass cases.

Commissioned tribal police and resource protection officers have jurisdiction over "all persons acting within the boundaries of the Quinault Indian Nation" (Title 61 1979).

Types of Trespass
Trespass means the removal of forest products from, or damaging forest products on, Indian forest land, except when authorized by law and applicable federal or tribal regulations. Trespass can include any damage to forest resources on Indian forest land resulting from activities under contracts or permits or from fire. [25 C.F.R. 163.1] There four types of trespass monitored for on the QIR: timber trespass, specialized forest products and resources trespass, criminal trespass onto reservation lands, and fire trespass.

(i) **Timber.** Timber trespass (the unauthorized removal of forest products from, or damaging forest products on, Indian forest land, including any damage to forest resources on Indian forest land resulting from activities under contracts or permits or from fire) has been viewed as a significant type of trespass in terms of both monetary and resource value.

(ii) **Specialized Forest Products and Resources.** The illegal harvesting of specialized forest products is becoming one of the most common forms of trespass. The locations where these products can be found need to be identified and documented. This information would assist enforcement personnel and those administrating permits and could also be used in a continuous special forest products inventory.

(iii) **Criminal Trespass onto Reservation Lands.** The QIN maintains the authority to restrict certain reservation lands from non-Indian people. Any person who shall enter or remain upon any lands or pick up, with intent to keep, materials from lands, including beaches or waters, as to which notice against trespass is given by actual communication to such person, or by posting in a manner reasonably likely to come to the attention of intruders, or

by fencing or other enclosure manifestly designed to exclude intruders, shall be guilty of an offense.

(iv) **Fire.** The Resource Protection Officers who are not wildfire investigators work closely with the Washington State fire investigators during initial wildfire investigations. When a wildfire occurs on trust lands, reports are submitted to Resource Protection for review and to ensure the accuracy of damages after which the billing and collection is directed to the Bureau of Indian Affairs—Taholah Agency. If the case warrants review by the Federal Solicitor, Resource Protection in conjunction with the BIA-Taholah Agency office submits its report for solicitor's review. Unless specifically requested by the State of Washington to the contrary, Resource Protection Officers allow the State Investigator to take the initial lead investigator responsibilities. If requested to take the lead, investigative procedures are implemented to ensure proper evidentiary processing and handling as outlined in 53 IAM and in Rules of Evidence & Crime Scene Processing (Washington State Criminal Justice Training Commission). If the wildfire originated from fee lands and the State Investigator refers criminal charges to the local County Prosecutor's Officer, the Resource Protection Officers may ask that restitution be sought through the County Courts if approved by the BIA-Taholah Agency.

Other Forestland Protection Concerns

The resource protection staff also deals with the following forest protection concerns:

(i) Wildlife. Wildlife trafficking is growing at an alarming rate worldwide and threatens an increasing variety of terrestrial, freshwater, and marine species. A high demand exists for some of the species that occur within the QIR including, but not limited to bald eagles, black bear gall bladders, and elk and deer velvet antlers.

(ii) Logging and salvage operations. Natural resource permit violations, boundary violations, debris and dumping of petroleum products, road access issues, hauling issues, and timber trespass.

(iii) Recreation. Recreational uses such as hiking, fishing, hunting, and rock collecting can be damaging to the resources. All recreational activities within the QIR are prohibited by non-Quinault peoples, except as authorized by the Business Committee.

(iv) Residential. Septic dumping, household garbage (discarded appliances), etc.

(v) Special areas along rivers. Fishing grounds, boat launches

Specific Areas of Concern

Certain forest products sometimes yield a value to warrant specific concern and protection. The Resource Protection Office has been directed to emphasize the protection of the following culturally sensitive areas. Other areas may be identified during the planning period.

The Canoe Stand. Located in the North Boundary Area, this stand of old growth western red cedar is one of the last cedar stands suitable for the manufacture of traditional canoes. This stand has been subjected to theft several times within the last several years, occurring at all hours of the day/night, and may be associated with the after effects of Pacific Ocean storms that produce high winds, heavy rains, and blowdown of ancient cedar trees. Patrol efforts are heightened during these times to protect any trees that may have blown down. Other efforts to discourage trespass in the Canoe Stand include the installation of gates, roadblocks, and monitoring and alarm equipment at various access points to the stand.

Beargrass Areas. The QIR is a high target area for beargrass theft because of its low elevation. Off reservation, the large majority of premium beargrass areas are found in elevations above 3,000 feet. Most harvesters in these areas have access to legal permits, either through

the Forest Service or the State. In the winter, however, when harvesting in the higher elevations is difficult to impossible because of large accumulations of snow, harvesters attempt to come onto the QIR. Enforcement efforts are increased in known beargrass areas during the winter months. As in the Canoe Stand, efforts are made to discourage trespass in beargrass areas by installing gate.

Culturally Modified Areas. The majority of culturally modified areas is on or around the major water courses and would only be evident by old scarring or healed wounds on standing and/or downed timber. The tree species that gives the greatest testimony to historical human disturbance is the western red cedar. Protecting any and all culturally modified areas should be a focal point of harvest management with emphasis on pre-harvest cruising for culturally modified trees.

The following areas might yield evidence of historic and/or cultural modification:

- Natural prairies (O'Took, Moses, Baker, Chow Chow, and Moclips)
- All river and major creek junctions
- Old Indian trails
- Fishing weirs
- Any area of standing old growth
- Old settlement sites and logging camps
- Cemeteries

Reporting
The law enforcement agency to which a trespass is reported depends on the status of the land on which the trespass occurs:

Trust Land. The QIN is responsible for investigating violations on trust land.

Fee Land. The county sheriff is responsible for the investigation of violations on fee land even though the QIN retains the jurisdiction to administer civil regulatory issues within the interior of the QIR.

Fractionated Interest. If there is fractionated interest (a mixture of trust and fee owners in a single allotment) the violation is investigated as if it were completely in trust status by the QIN.

Tribally Owned Fee Land. If a violation occurs on tribally owned fee land, the investigation is normally handled as if the land were in trust status. In these situations,

Table 2.3: Agencies that coordinate with QIN Resource Protection Office

BIA	Taholah Agency Olympic Peninsula Agency Northwest Regional Office
Local Tribal Authorities	
State of Washington	DNR Washington State Patrol Department of Fish and Wildlife Department of Ecology
County Sheriff's Office	Grays Harbor County Jefferson County
Other federal agencies	US FS US NPS Immigrations and Naturalization Services Federal Bureau of Investigations United States Marshals National Archives and Records Administration US EPA
Sharing Groups	Pacific Northwest Timberlands Security Informational Sharing Group Southwest Washington Timberland Officers Sharing Group

however, the QIN can pursue civil remedies in both tribal and state court, or request the county to pursue criminal remedies in state court.

In most cases, land ownership status is not determined until after the initial contact in the field has been made. If, at this time, the ownership status is determined to be fee, the investigating officer would complete an “Informational Report” and forward it to the appropriate law enforcement agency.

Because of the complex nature of land ownership and jurisdictional considerations, the procedure for processing complaints is dynamic and can be complicated. Tribal, Federal, and Washington State laws may apply and, in some cases, are concurrent.

The enforcement officers in the Resource Protection Office work with numerous agencies and organizations to coordinate, assimilate, and disseminate information that is gleaned from field sources within and without the QIR. **Table 2.3** outlines some of these agencies and organizations.

1.5 Silvicultural Prescriptions

Forest lands of the QIR can be categorized into four basic forest types: matrix, riparian management zones, potential avulsion and/or erosion zones, wetlands, and unstable slopes.

Matrix. The matrix is the most continuous and interconnected pattern in the landscape, comprising most of the lowland portion of the reservation. It is within the matrix that other forest types reside.

Silvicultural prescriptions for this portion of the reservation include:

- Replanting at 400 to 680 trees per acre depending on site-specific characteristics following harvest.
- Evaluating the stand for pre-commercial thinning following a ten to fifteen year stand exam.
- Considering commercial thinning stands depending on site and stand conditions.
- Applying fertilizer ten to fifteen years prior to final harvest.
- Clear-cutting stands at final harvest with a targeted rotation age of 40 years.

Riparian Management Zones. Streams on the QIR are classified as either type D, type H, or type O waters. All waters have a ‘riparian management zone (RMZ)’ which is measured from the ordinary high water mark of the stream to the edge of an allotted amount depending on the stream type. Harvest activities permitted within these zones differ depending upon the type of water.

Wetlands. Generally, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. For the purposes of this plan, the wetlands have been divided into two categories: forested and non-forested. Non-forested wetlands have a ‘wetland management zone’ (WMZ) which is measured from the edge of the delineated wetland to an allotted amount, depending on the wetland acreage.

Unstable Slopes. Unstable slopes will be managed to minimize acceleration of the naturally occurring rate of landslides secondary to forest practices. Protection measures will be made to safeguard slope stability of the following types of unstable slopes:

(i) Inner gorges, convergent headwalls, and bedrock hollows steeper than 35 degrees (70%),
(ii) Toes of deep-seated landslides with slopes steeper than 33 degrees (65%),
(iii) Groundwater recharge areas for glacial deep-seated landslides,
(iv) Outer edge of a meander bend along a valley wall or high terrace of an unconfined meandering stream, or
(v) Areas that have the potential to threaten public safety, deliver sediment to a public resource, or threaten capital improvement.

1.6 Organization and Funding

Implementation of the 2017 forest management plan requires additional QDNR staff and those additions will not be confined to the Department of Forestry or the Taholah Agency.

The following is a discussion of potential staffing requirements for each department to implement this plan in a timely manner. During the life of this plan, there may be departmental reorganization which would change the staffing needs of the various departments as efficiency is increased or greater needs are identified. The staffing requirements should be reviewed on an annual basis to ensure that the current organization and staffing levels are adequate.

Total impact on staff time can't be known until the plan is fully implemented; the information presented in this section and the associated appendices are strictly an estimate. The increased Annual Allowable Cut (AAC) calls for additional staff for QIN Forestry, Trust Forestry in the Taholah Agency, Environmental Protection (EP), and Resource Enforcement Departments. A higher AAC will probably result in a greater number of timber sales that need to be reviewed by the Interdisciplinary team, and additional staff would be required to adequately review and provide technical input into forest practices applications. The total estimated cost across the four departments is $1,058,095.

If it is found that additional staffing is required but staffing needs cannot be met, it may not be possible to achieve the level of harvest that the resource will allow. Furthermore, adverse ecological impacts could occur if staff does not have adequate time to lay out and thoroughly review timber sales.

1. Taholah Agency.

Additional people will be necessary in the Taholah Agency to implement this plan. Five additional staff will be required at the BIA Taholah Agency, in addition to retaining the current staff, to implement this plan to sustain a 32.8 million board foot (MMBF) AAC on trust allotments and to increase the western red cedar salvage sales and permits.

One additional pre-sale forester is required to accomplish the increased AAC, and two pre-sale technicians will be required to assist the pre-sales foresters in timber sale lay out due to the increased workload from the higher AAC. One additional accounting technician will be required to assist in land owner research and disburse additional timber sale proceeds generated as a result of the increased AAC. Finally, one cedar salvage technician will be required to increase

the number of western red cedar salvage sales and permits by 25 to better accommodate individual requests.

Box 1.1 is an estimation of the additional funding that will be required to adequately staff the BIA –Taholah Agency in order to effectively implement the FMP. If an unexpected funding or manpower shortfall is incurred, it is likely that the annual allowable cut will not be met, and that payments to beneficial trust landowners may not be processed in a timely manner.

Box 1.1: Staffing Requirements
Taholah Agency

1 Pre-Sale Forester (P4 G8)	$ 60,604
1 Accounting Technician (T5 G5)	$ 47,255
2 Pre-sales Technicians (T5, G5)	$ 94,510
1 Cedar Salvage Technician (T5 G5)	$ 47,255
1 Vehicle	$ 5,000
Travel and training	$8,000
Equipment and Supplies	$10,000
Total:	**$ 272,624**

2. QIN Forestry

Additional QIN Forestry staff will be required to implement this plan. An additional six permanent and six seasonal staff will be needed, in addition to retaining current staff, to sustain 14.2 MBF AAC on QIN tribal lands, in addition to supporting forest development and fire activities on tribal trust and individual trust allotments.

One additional pre-sale forester is required to accomplish the increased AAC, and one harvest technician is required to assist the pre-sales foresters in timber sale lay out to help efficiency and increased volume expected to result on an annual basis. A new position – technical support administrative supervisor will be needed to supervise and direct forestry administrative and accounting staff.

Under the higher AAC for both BIA Trust Forestry and QIN Forestry, the forest development section is expecting a higher work load during this 10-year planning period and looking into the future. One stand improvement technician, a position that is currently unfunded, must be funded by QIN in order to layout and administer pre-commercial thinning.. Because of increased harvest activity, the department is also anticipating greater pile burning and fire suppression on a seasonal basis, and will greatly benefit from two additional season fire crew members.

The tribal crew foreman and tribal crew are currently unfunded by the Tribe, but are funded out of the Forest Management Deduction (FMD) account; these positions must be funded by the QIN as part of the self-governance forestry program. The FMD budget not only draws indirect for wages, but also should be used to fund forest development projects and activities, not wages. Using the funds for wages is a drain on effective forest development, and a potential detriment to Trust and QIN forest resources.

There is also need for a lead inventory technician. This position would supervise and lead the inventory technicians in order to continue our stand layer inventory system and support forest management planning.

A road technician will be needed under the roads manager to assist with planning and administering road building, road reconstruction, culvert installations, and road maintenance. The position is necessary to allow the roads manager to concentrate on the more critical issues including the creation of the QIR Road Maintenance Plan, which is a requirement of the FMP that has not been accomplished due to insufficient staffing.

Box 1.2 is an estimation of the additional funding that will be required to adequately staff the QIN Forestry Department in order to effectively implement the FMP. If an unexpected funding or manpower shortfall is incurred, it is likely that the annual allowable cut will not be met, forest development activities will become back-logged, and that the Roads Management Plan will not be completed.

Box 1.2: Staffing Requirements
QIN Forestry

1 Pre-Sale Forester (P4 G8)	$60,604
1 Harvest Technician (T5 G5)	$47,255
1 Roads Technicians (T4, G4)	$44,416
1 Stand Improvement Technician (T4 G4)	$44,416
1 Technical Support Administrative Supervisor (P4, G8)	$60,604
4 seasonal Tribal Crew	$53,892
1 Lead Inventory Technician (T6 G6)	$50,994
2 Seasonal Fire Crew Members	$23,109
2 Vehicles	$10,000
Travel and training	$5,000
Equipment and Supplies	$10,000

Total: $410,290

3. Environment Protection

While the FMP does not drastically change environmental protection to fish, wildlife, and other non-timber resources, increased permitting, monitoring and reporting will have a direct effect on staffing levels in the EP Department. To implement the riparian regulations and leave tree requirements of the FMP, the EP Department is anticipating a greater staff time to review timber sales, both pre-harvest and post-harvest. QDNR has recognized the value and need for credible, scientific information as a basis for making management decisions. The management of QIR has become increasingly complex with multiple priorities to manage. Long term ecological monitoring provides information needed to understand and identify change in the ecosystem with changing forest management practices. In order to achieve these long term ecological monitoring projects the Environmental Protection Department requires additional staffing levels to meet these increasing demands.

In order to comply with the National Historic Preservation Act (NHPA), it would be more efficient for the tribe to have a tribal historic preservation officer (THPO). This would allow cultural reviews to remain within the Division, and would allow a more thorough and specific review of forest practices applications than going through the state historic preservation officer. NHPA compliance is a requirement of NEPA and must be addressed in each FONSI. The THPO would be an active member of the ID Team and help train foresters and field staff.

The wildlife technician will be expected to implement the management of wildlife and habitat under the new FMP. This includes field reviews for all timber harvest proposals, road building, cedar salvage and other forest management activities from the standpoint of protecting wildlife. The position will be vital in monitoring long term effects of the FMP changes on wildlife populations and habitat.

Box 1.3: Staffing Requirements
QIN Environmental Protection

1 THPO (P4 G8/9)	$60,604
1 Wildlife Technician (T4 G4)	$ 44,416
1 Fish Biology Technician (T4 G4)	$ 44,416
1 Administration Technician (T5 G5)	$ 47,255
3 Vehicles	$15,000
Travel and training	$5,000
Equipment and Supplies	$7,500

Total: $224,191

The fish biology technician will monitor hydraulic project approvals to protect fish habitat under the new FMP regulations. This includes checking reviews for all timber harvest proposals, road building, stream crossings, bridge installments and cedar salvage projects on the QIR. This position will be vital in monitoring the

long term effects of the FMP changes on fish habitat during the 10 year FMP. Monitoring will take place with riparian management zone measurements and steam temperature monitoring.

An additional position in the EP Department is needed to handle the administrative burden on staff. An administrative technician will help with budgeting, microix, ordering, training and travel requests, among other administrative and program support duties.

The following is an estimation of the additional funding that will be required to adequately staff the EP Department in order to effectively implement the FMP. If an unexpected funding or manpower shortfall is incurred, it is unlikely that effective monitoring of non-timber resources will occur and required reporting to relevant entities (US Fish and Wildlife Service (USFWS), EPA, etc.) will not occur in a timely manner.

4. Resource Enforcement

Because of the increased activity across the reservation, two additional forest resource enforcement staff will be needed to adequately patrol the reservation. The increased AAC and also anticipated increase in cedar salvage, timber theft, forest product theft, trespass, and environmental damages caused by all the theft activities. The increased activity on the reservation may increase the likelihood of violations and require increased monitoring, investigation, reporting and patrolling.

Box 1.4: Staffing Requirements
QIN Environmental Protection

2 Forest Resource Enforcement Officers (T5 G5)	$ 94,510
2 Vehicles	$10,000
Travel and training	$2,500
Equipment and Supplies	$5,000
Total:	**$12,010**

1.7 Monitoring and Adaptive Management

A monitoring and adaptive management plan is an integral part of the Forest Management Plan. The monitoring plan provides the basis for:

- Annual reporting of compliance with goals, objectives, and standards
- Identifying the need for change
- Suggesting adaptive management strategies
- Capturing institutional knowledge about the QIR forest and how it can be successfully managed to meet multiple objectives

Types of Monitoring

Compliance monitoring

Certain monitoring activities are designed to determine whether management activities comply with this FMP. This monitoring is conducted at two scales.

1. Forest Level activity monitoring summarizes forest management activities on an annual basis:
    a. Harvest volume

b. Forest development activities
c. Management costs – including staffing, grants, FMD and Indian Forest Land Assistance Account (IFLAA) accounts
d. Revenues
e. Important changes to forest conditions (fire, new insect or disease infestations, etc.)

The objective of the annual forest level monitoring is to determine if on-the-ground management is within the range of key assumptions of the FMP regarding growth, revenues, and AAC etc.

2. Sale level activity monitoring is a pre-, active- and post-sale effort to determine whether the applicable standards and BMP's were followed on a sale by sale basis.
   a. Pre-Sale activity monitoring would include reviewing: RMZ widths, culvert locations, excluded zones flagging (due to unstable slopes, unmerchantable timber etc.), and other standards as determined by the ID Team.
   b. Active-Sale activity monitoring would include: proper placement of roads and culverts, use of slash mats, seasonal restrictions, slash pile construction, etc.
   c. Post-sale activity monitoring would include a review of: soil rutting, culverts and roads, slash piles, road closures, grading, mitigation work, green tree retention, snag retention, etc.

   A comprehensive check-list of protocols for pre-, post-, and during-activities will be developed by the ID Team.

Effectiveness Monitoring

Some monitoring activities are designed to evaluate key assumptions used in the planning process. Others may determine whether standards in the FMP effectively create the desired conditions. Effectiveness monitoring is designed to answer the following questions:

1. Do the management activities create the desired conditions? Can the management activities be improved to be either more effective and or less costly? Should other management activities be considered?
2. Are the FMP standards effective in protecting key resources/values? Can they be applied as written? Are other standards needed?

Monitoring Procedures

Annual forest-wide compliance reporting

The QIN and BIA Forest Managers will prepare an annual report summarizing the forest-wide compliance monitoring. The report will show sub-totals by ownership, where appropriate.

The report will include:

1. Volume harvested compared to the annual averages projected in the FMP. Running totals will compare actual harvest during the period to the totals for the period.
2. Forest development activities (including precommercial thinning (PCT), reforestation, inventory, etc.)
3. Road construction, reconstruction, maintenance, etc…
4. Revenues from harvest
5. Cedar salvage volumes

6. A narrative summarizing any important changes to forest conditions including, but not limited to, fire, new insect, disease, or invasive species problems
7. Summary of sale level monitoring conducted during the year (pre-
8. Recommendations for changes to the FMP or its planned implementation.

Active Sale compliance monitoring
An onsite review of forest practices with the Sale Administrator (Officer in Charge) will be completed by pertinent members of the ID team with the operator present prior to equipment being taken offsite to ensure that forest practices were conducted following the contract and Title 61 Notice of Decision. At a minimum, the following will be reviewed:

1) Road and gravel pit obligations
2) Hydraulic concerns
3) Site preparation and forest regeneration concerns
4) Assessment of riparian management zones and leave tree requirements

Post-sale compliance/effectiveness monitoring
A representative sample of timber sale areas will be visited within the first two years after harvest, and again at five and ten years after completion of the sale. The post-sale monitoring will provide in-depth review of the sale. The review will be more qualitative than quantitative, focusing primarily on evaluating whether the management activities and standards had the intended effect. Compliance Monitoring Protocols will be developed and approved within one year of approval of this FMP.

Members of the ID Team will conduct the post-sale review. The results of the review will be well documented, with an eye toward passing on-the-ground knowledge from one generation to the next. The report will address at least the following questions:

1. Were the sale objectives met?
2. Were the standards followed? Did they have the intended effect?
3. Is the sale area turning out as expected?
4. What worked? What didn't work? What should be done differently next time?

Long-term Effectiveness monitoring of key sustainability assumptions
Certain planning assumptions are required to determine that the FMP will provide sustainable outputs and conditions over time. More quantitative monitoring will help determine whether adjustments are needed for future planning efforts. Key sustainability assumptions include:

1. Reproduction:
    a. Five to ten years after a harvest, harvested stands should be surveyed for reproduction success. If a pattern of inadequate reproduction is observed in the sale area, the timber management regimes should be re-evaluated.

2. Snag recruitment and snag persistence
    a. The forest management strategy is designed to leave enough large green trees after harvest to fulfill the snag requirements specified by the plan. On some stands, it may take several decades, however, before the trees are large enough to meet the desired snag size.
    b. For planning purposes, it was assumed that if there are enough large green trees available after harvest, there will eventually be enough snags. Periodically, a snag

survey should identify whether there are enough snags and whether they are persisting in the landscape long enough to meet the needs of snag-dependent species. The snag survey will occur on a sample of units from tribal and trust ownerships.

3. Growth
    a. The harvest levels projected in this plan are sustainable, assuming that actual growth is close to the growth projected by the growth and yield model. Periodic re-measurement of the CFI plots will provide information about overall growth rates that can be compared to the growth projected model.

If monitoring shows that the key sustainability assumptions are not valid, then further action is required. Such action may include:

1. Revising standards or management activities;
2. Reconsideration of planning strategies
3. Recalculation of harvest levels.

Such changes may require clarification, amendment, or revision of this FMP. **Table 1.1** suggests a format for capturing the results of key assumption monitoring.

Table 1.1 Proposed monitoring metrics for testing key assumptions in the Forest Management Plan

Effects to be Monitored	Monitoring methods	Frequency	Expected Range	Trigger/Action
Snags and LWDs	**Survey**	**During post-harvest field review**	**90% prescribed snags and logs are present**	**10% of acres have less than 90% of prescribed snags and down logs present**
Growth	**CFI Plots**	**10-15 years**	**Growth projected in the model**	**Deviations likely to affect timber yields by more than 15%**
Reproduction	**Stand examinations**	**2 year, 5 year (free-to-grow)**	**Stocking levels (determined by FPRs)**	**Fail to reach stocking levels (determined by FPRs)**

Chapter 2. Forest Inventory Analysis Report

This chapter includes discussions of the existing forest, previous and current inventories, and the land and area analysis strategy. It also includes an analysis of the inventory results as well as a discussion of the allowable cut. The chapter concludes with recommendations for improving the inventory system.

2.1 Introduction and Purpose

This Forest Inventory Analyses Report (FIAR) provides forest inventory information for decision makers at the QIN and the BIA. The current stand based inventory system will be discussed, forest attributes analyzed, and the future of the forest inventory will be examined. Additionally, an allowable cut value has been generated.

The QIN's stand based inventory was developed in 1999 and has been in continuous use since that time. During the years 2000 through 2003 an emphasis on stand exams was conducted with the help of appropriated funds. These stand exams focused on well-established stands. Since 2004, stand exams have been conducted using in-house staff and have focused mostly on Silvicultural needs, such as plantation and pre-commercially thinning work. As a result, few stands in the soon to be merchantable stage were examined between 2004 and 2011. As the need for better information on stands that will be harvested in the next 15 years has become more of a pressing need, ways to streamline the plantation exams were developed and more time has been spent collecting data on soon-to-be merchantable and merchantable stands. The addition of an efficient third field technician has also helped greatly in increasing the amount of stand exams completed in older stands. These additional exams in the past two years has allowed for a better calculation of the Annual Allowable Cut (AAC) for use in this FMP.

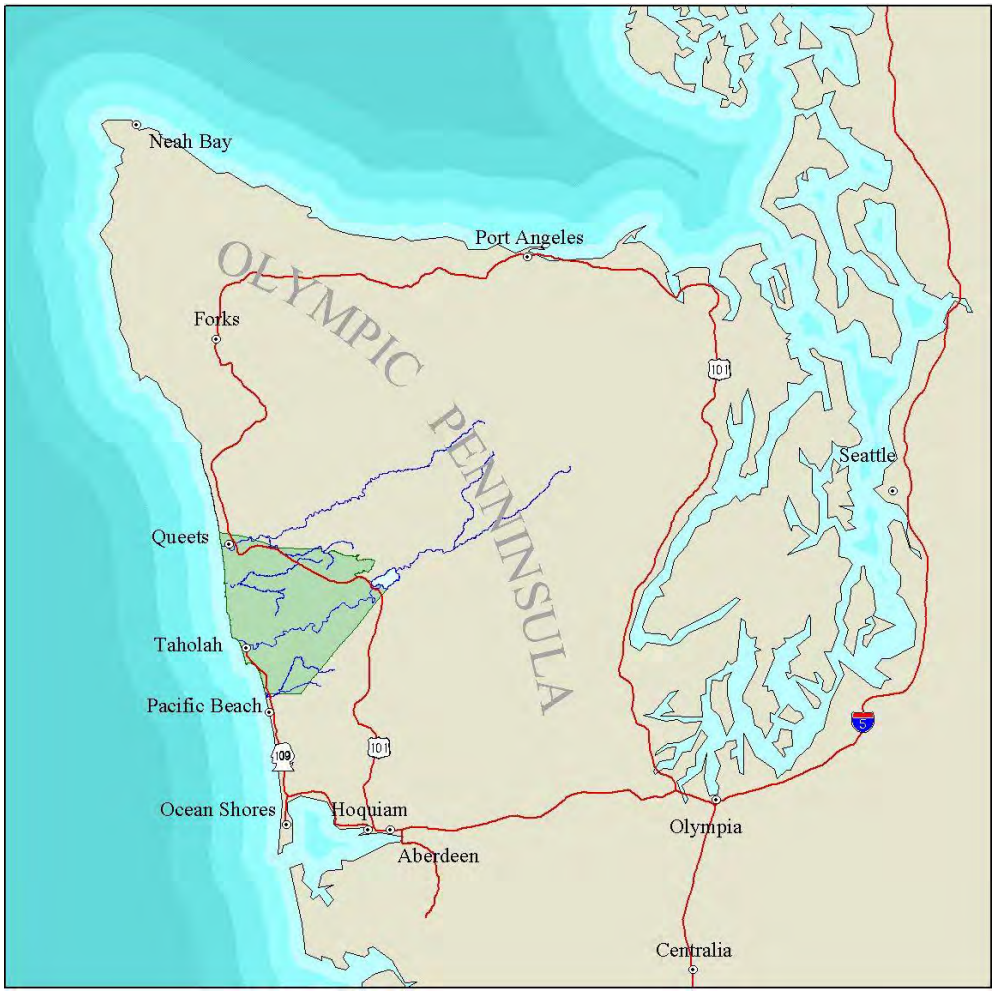
Stand exam data collection will continue in its present form for the foreseeable future. All plantations will be examined to ensure their survival to free-to-grow status, stands that have been precommercially thinned will be examined, and stands approaching merchantability will be examined. Currently, on Commercial Trust Land, 68% of the land base has been examined. The goal is to have current exams completed on 90% of the Commercial Trust land base on the QIR by the end of fiscal year 2023.

2.2 Description of the Forest

Location (**Figure 2.1**)

The QIR is located on the southwest side of the Olympic Peninsula of Washington State and forms a triangle from the Queets Village in the north, Lake Quinault on the eastern boundary, south to the town of Moclips, and is bordered on the west by the Pacific Ocean. The North Boundary Area (NBA) is bordered on the west by state land, and on the north and east by the Olympic National Forest (ONF). Lake Quinault, on the eastern boundary of the QIR, is surrounded by the Olympic National Park (ONP), the ONF, and private residential and commercial land. The southeast section of the QIR is bounded by the ONF and private commercial timberlands.

Figure 2.1 Location of the QIR.



Topography

The QIR borders the Pacific Ocean on the west and the lower ridges of the Olympic Mountains and Lake Quinault on the east. All of the QIR except the northeast portion is low elevation and relatively flat. The northeastern portion gradually ascends to the steep, higher

elevation of 2,769 feet. Several major rivers cross the QIR including the Queets, the Raft, and the main stem of the Quinault River.

Climate

The QIR lies within the temperate rainforest and receives about 80 inches of precipitation along the coast and up to 150 inches of precipitation in the northeast mountainous regions. It is generally cloudy and cool for all months except June, July, August, and September, which are the driest months. The wettest months are November, December, and January. The average summer temperature is 59.6 degrees F and the average winter temperature is 41.5 degrees F.

Forest Area

The QIR encompasses approximately 207,100 acres. Approximately 23,000 acres of forestland are privately owned, fee patent properties and about 22,100 acres are non-forested land including Lake Quinault, major rivers, ocean beaches, sand bars, major gravel pits, urban areas, and roads. This brings the acres of forestland under tribal and BIA timber management to about 162,000 acres (includes all tribal land and individual Indian owned trust land, minus the non-forested acres).

Forest Tree Cover

The dominate tree species found on the QIR are western hemlock and western red cedar, which are located throughout the QIR in significant numbers. Although most of the other tree species can also be located almost anywhere on the QIR, they are generally found in select habitat areas.

Red alder and cottonwood are the dominate hardwood species and are generally found in the river and stream corridors, gravel pits, and alongside roads. Sitka spruce is generally located near the coast and in the river and stream corridors, lodgepole pine is usually found on poorly drained sites, and Pacific silver fir in the higher elevations (above 500 feet). Douglas-fir is found predominately in plantations on fair to good sites. Other commercial species of note include big-leaf maple, Western white pine, and Alaska yellow cedar.

Stand Types

The inventory of the QIR is based on a stand map derived from aerial photo interpretation. Each year the stand map is updated to add new harvest units and other stand changes detected during the year. Data for stands is updated by inputting new data collected during the year, or by growing each stand forward by one year using the stands existing data. Following the year end update, each stand is put into a stand type group for analysis purposes. There are currently 101 groupings of stand types that include ten species types, five size classes, and four stocking density classes.

Forest Pests

Forest pests include insects and diseases that affect the growth, development, and health of native tree species as well as noxious weeds and animals that inflict damage on young plantations.

The insects currently of concern are Sitka spruce tip weevil and pine pitch moth. The spruce tip weevil usually causes minor damage to plantations of spruce along the coast and in the river bottoms, but away from the coast and on hillsides the damage to a spruce plantation can be extensive. Pine pitch moths are typically only a problem in pruned lodgepole pine plantations.

The diseases currently of concern include Swiss needle cast, dothistroma needle blight, fomes annosus, mistletoe, armillaria, and white pine blister rust. Swiss needle cast, while not as serious as in coastal Oregon, is increasing in intensity and is now causing damage on the QIR. Dothistroma needle blight, although endemic throughout the QIR and causing little damage to natural stands, causes extensive needle loss in lodgepole pine plantations.

Noxious weeds of concern found on the QIR include scotch broom, canary reed grass, knotweed, and gorse, though purple loosestrife and other aquatic species are being monitored.

Damaging animals include black bear, blacktail deer, Roosevelt elk, and Snowshoe hare.

Other damaging agents that are seen occasionally but are causing little to no damage on live trees include porcupine, western hemlock looper, Douglas-fir tussock moth, and several species of bark beetles.

Historically, it has been rare for a disease or insect to cause significant damage on the QIR. This is probably because of the natural mixed-species stands that are growing on the proper site for the species. More recently, however, some plantations have been planted to single species stands and/or have had the wrong species planted on a given site. This was especially a problem between 1972 and 1993. In the last decade, some incidents of disease problems have been on the rise. The most noticeable have been dothistroma needle blight (*Dothistroma pini*) and Swiss needle cast (*Phaeocryptopus gaeumannii).* As a result, pure plantations of Douglas-fir and Lodgepole pine are not being planted; instead, they are mixed in with other species.

Reserve Lands

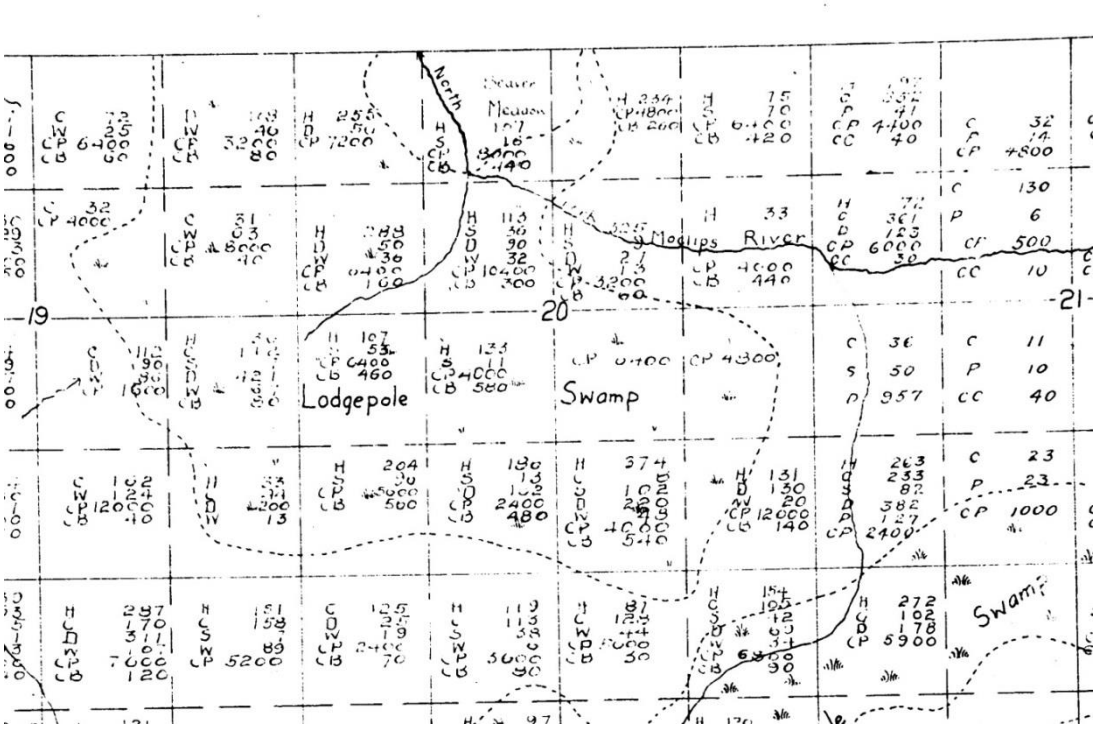
Several areas of the QIR have been set-aside for activities other than timber production. About 75 acres, referred to as the canoe stand, have been set aside as a reserve for the production of large western red cedar trees to be used in the construction of traditional canoes. About 175 acres, the Cape Elizabeth preserve, has been set aside for enjoyment and traditional use. Approximately 4,080 acres have been set-aside in a Conservation Easement Area (CEA) that consists of both old growth and second growth stands of trees. Together, these areas are referred to as the Reserved Lands and will be analyzed separately from the Commercial forestland.

2.3 Previous Inventories

The current stand based inventory cycle began in 1992 with the beginning of QDNR-forestry's stand based inventory system. Inventories conducted during or after 1992 will be discussed in the section below entitled "Stand Based Inventory System". Inventories conducted between 1915 and the end of 1991, as well as the CFI program, are discussed in this section and include the following:

1. Timber cruise conducted between 1915 and 1917
2. Reproductive surveys to asses natural regeneration between 1960 and 1971
3. 3-year and 5-year regeneration surveys (began in 1973) on recently planted land
4. Pre-commercial thinning (PCT) exams in 1979 and 1980
5. Stand exams in commercial stands between the late 1970s and the early 1980s
6. Installation and re-measurement of a CFI program

A timber cruise on the QIR was conducted by the BIA between 1915 and 1917 to identify potential timber sale units. The cruising method was a 1 chain strip cruise running twice through a forty acre allotment (a 10% cruise) or a single 1 chain strip cruise (5% cruise) where there appeared to be less than 10,000 board feet per acre. Tallying was by DBH and log lengths, with volumes taken from U. S. Forest Service tables for similar timber. Maps of the cruise, with the associated estimate of volume by species printed on the maps, is the only information available from this cruise.



Copy of one sheet from the original volume estimates from the 1915 – 1917 Strip cruise.

Beginning in 1960, and continuing sporadically until 1971, the BIA conducted surveys to determine how well natural regeneration of harvested lands was progressing. Several reports were written about the process of the surveys and the results, with the main finding being that areas of large slash accumulations or areas with high water tables were usually poorly stocked. Refer to the book "The Forests of the Quinault", page 195 and 196 for more information on these surveys.

Regeneration inventories became a yearly activity soon after the planting program began. Between 1973 and 1992 the inventories were conducted in the third and fifth years following planting. In 1992, the third year exams were replaced with second year exams. A fixed plot is used, usually 1/100th of an acre, with an intensity of about one plot for every 1 acre on the two year surveys and 1 plot for every 2 acres on the 5 year surveys. The acreage inventoried every year varies depending on the amount of harvesting in the previous 1 or 2 years. The objective of the 2- and 3-year exams is to measure the survival rate of the planted trees to determine the need for inter-planting, re-planting, or release from brush. The objective of the 5-year survey is to judge the overall survival of the plantation and look for potential conifer release needs and for future PCT need.

PCT treatments started on a very limited basis on the QIR in the 1960s. All of the stands thinned before 1979 have been harvested and most of the stands that were thinned in 1979 and 1980 have also been harvested. Although there are stand level data on these earlier PCT inventories, no plot level data have been found and there is no documentation as to how the data were collected, except for the fact that fixed plots were used. The area affected by these earlier PCT activities was less than 1,500 acres.

A stand based inventory system was developed for the QIR and implemented in the late 1970s. This inventory was based on about 40,000 acres of stand exams conducted by Washington Timber Management. This system was not maintained. Although some stand level data from these stand examinations exist today, the data are outdated and almost all the stands have been harvested. For a history of this early inventory system, please refer to the book "The Forests of the Quinault," a history of the QIR written in 1997, pages 268, 269, and 286.

A Continuous Forest Inventory (CFI) program began in 1982 and the second measurement was completed in 1992. Some plots were eliminated in 1992 when some land was moved from trust to fee status and some plots were added in 1992 as land entered trust status. The most notable additions to the Trust land base were the North Boundary Area (NBA) and the Tribal purchases from Rainier Timber Operating Company. The third measurement of the CFI plots was completed in 2003. No plots were intentionally added or removed in 2003, although 3 plots could not be relocated and were dropped. The Quinault's have completed the process of re-measuring the CFI plots for a fourth time and will complete the data analysis in 2017 with the help of a contractor. No plots were added or removed in these measurements; however, 74 plots were stem mapped to aid in calibrating the Nation's tree growth model. Due to the ever increasing acreage moving from Fee to Trust ownership, the plan is to add plots to the next CFI measurement in 2024.

In all four CFI measurements, the same plot structure was used and consists of 1/10th acre plots located 5 chains north and then 5 chains west from section quarter corners. Plots were only installed if the land was under Trust jurisdiction. Due to limited budgets, the installation of plots off the section corners was never installed, so there is half the number of plots originally designed. All trees 5 inches diameter at breast height (DBH) and larger were permanently tagged on each plot, with regeneration below 5 inches DBH being collected on

a subplot (using the same plot center) equaling 1/100th of an acre. As part of the current re-measurement, 74 plots have been identified for stem mapping, and on these plots, the permanently tagged trees are 3.5 inches DBH and larger. Most plot centers were geo-referenced with GPS devices during the last measurement. During this re-measurement, if a GPS plot center was found to be inaccurate, it was updated. All GPS plot centers not collected last time were collected this time.

The CFI is useful in identifying trends in forest activities, forest cover, mortality, and overall growth rates on a reservation wide basis. After stratifying the CFI plots, an even better estimate of these factors can be made on a Reservation scale basis. With regulatory restrictions being location specific, CFI is unable to adequately describe the effects of these restrictions at the stand level. When CFI is used in conjunction with a stand based inventory, it is useful in measuring growth rates of individual trees that can then be used to calibrate growth models. In turn, this information is used to estimate the growth of individual stands. For the QIN, this is the primary use for CFI data, and the stem mapped plots are designed to achieve this growth calibration. The QIN will also continue to use the CFI for trend analysis pertaining to growth, mortality, pest damage, and species diversification. The BIA will continue to use the CFI as a tool to monitor forest management activities on the QIR and as a check on the robustness of the stand based inventory. To this end, a FIAR based on the CFI measurements will be completed following the CFI field work using a contractor familiar with CFI and the needs of the BIA. Expected completion date is in 2017.

2.4 Stand Based Inventory System

The QIN began its current stand based forestland inventory system in 1992 with the creation of a GIS stand layer and subsequent stand exams based on the GIS stand layer. The inventory system currently in use is called ”Forest Inventory and Planning,” version 7.3, designed by James Arney and distributed by Forest Biometrics Research Institute, of which the Quinault’s are a member organization. The following paragraphs chronicle the development of the inventory system from its beginning in 1992 to the summer of 2015.

The QIN chose to use satellite imagery as the base information to create a stand ownership map. Images taken from a satellite in 1992 were used to produce groups of similar stands of vegetation based on species, size, and stocking levels. Similar stands were then given the same stand type code. For example: all predominantly Douglas-fir stands with normal stocking and an average stand DBH of 5 to 9 inches would receive a stand type code of “DF32.” At the end of 1994, there were 4,608 stands grouped into 68 stand types. The satellite imagery was also used to identify non-vegetative areas such as urban, water, sand, and prairies.

Although satellite imagery was useful on a QIR-wide (landscape) scale, it lacked the necessary detail at the stand level. Therefore, in 1997, the QIN and the BIA decided to create a new GIS stand layer based on air-photo interpretation. Stand types were developed using the same criteria that were used for the previous stand layer. This new stand layer was completed in April of 1999 and gets updated every year to account for stand changing activities such as harvests.

Every stand in a stand-based inventory system should be individually examined, and it is the goal of the QIN to have every stand inventoried. However, because of budget and time constraints, an inventory of every stand was not practical in the beginning. Therefore, a sampling of stands was examined so that every stand type would have an inventory cruise

on stands representing at least 10% of the acreage of each stand type. The remaining, un-cruised stands within the stand type are then described by the stand type average of the cruised stands. Currently, other than a couple minor stand types totaling less than 500 acres; all stand types have at least 27% of their acreage examined. As of the spring of 2015, 64% of the commercial forested acreage has been examined within the last 15 years. Additional stands have been examined, and the data is still used to describe the stand, but the data is older than 15 years, which is the cut-off date for determining if a stand on good tree growing ground should be re-examined. **Appendix A** lists the number and acres of stands cruised and un-cruised by stand type on the commercial land base.

Plantation exams are conducted in all stands two growing seasons after planting and five growing seasons after planting. Stands are assessed to determine plantation survival and free-to-grow Status. Plantation data are collected using a fixed plot, usually 1/100th of an acre, with an intensity of about one plot for every 1 or 2 acres. All trees on the plot are tallied by species and height group. Data on brush competition, animal damage, and disease are collected and recommendations for re-plant, fertilization, release, and animal damage control are recorded.

The current PCT program began in 1992 with stand exams being conducted in mostly 12- to 22-year old stands. These exams are referred to as "Timber Stand Improvement (TSI) exams" and are usually a 1/100th of an acre plot with about one plot for every two acres on small stands and one plot for every five acres on large stands. If a stand is thinned, tree data are collected during the thinning procedure as part of the contract inspection process using a fixed plot, usually 1/50th of an acre, with an intensity of about one plot for every two acres for all stands, regardless of acreage.

Stand exams are conducted using a variable plot for large trees and a fixed plot for small trees. Variable plot exams averaged about one plot per 3 acres in small acreage stands and about one plot per 5 acres in large acreage stands.

2.5 Stand Data Analysis Method

It was not possible to examine every stand in the inventory prior to this analysis. Thus, representative stands were sampled and the information was extended to analogous, un-sampled stands. This extrapolation of data was last completed in 2005 and from that point forward each stand is grown using its own site index. The extrapolation process used in 2005 is described below.

Each individual stand for which we had empirical data was compiled to arrive at stand specific data and, because the stand exams were done over a 13-year period, they were then projected by the Forest Projection System (FPS) to a common year of 2005. The data from each examined stand within one stand type was then averaged to arrive at an average stand table for the stand type and extended to analogous un-sampled stands. For example:

> Of the 372 stands with a stand type designation of WH33, 116 were examined. Each of the 116 carries its own specific stand data. The data from each examined stand were then averaged to arrive at average stand attributes for that stand type. These averaged attributes were then applied to the remaining 256 un-examined stands.

Stand types that had large enough acreages and adequate data were further divided into 3 site classes prior to the extrapolation process. This proved useful as the stand characteristics of merchantable western hemlock stands on site 60 are noticeably different

than on site 120. Since 2005, each stand grows on its own site index. As stands are examined, their extrapolated data is replaced with their exam data.

A detailed description of the stand data compiler, the extrapolation process, and the growth model used in this analysis can be found in ”Biometrics of Forest Inventory, Forest Growth and Forest Planning”, Technical Report No. 15. Copies of the document can be found in the QDNR library and in the Inventory Foresters Office, or one can be purchased from the Forest Biometrics Research Institute.

2.6 Land and Area Analysis Study

For purposes of analyzing forest attributes, the Trust land on the QIR has been divided into two parts; designated Reserves and Commercial Forestland. There are three designated reserves on the QIR (all 100% QIN owned and held in TRUST) that have a high component of large, old growth conifers that will not be available for harvest during this planning period, and whose forest attributes are significantly different from the Commercial Forestland. As these areas are designated reserves, they have no impact on the calculation of the AAC. Additionally, land held in non-tribal 100% Fee Patent is not part of this analysis. Map 4.1 (Appendix C) shows the breakdown between commercial forestland and Reserves.

For purposes of calculating an AAC, the reservation will have one AAC for the whole Trust land base as well as separate ones for each ownership group (100% QIN owned and Individual Indian Trust). Although both ownerships have their land in Trust status, different criteria are used to determine harvest location and timing, and both have different marketing processes. This is important to quantify because the sum of each owners AAC for this period is less than if they were combined. The reasons for this will be discussed in Section 2.9.

2.7 Summary of Stand Based Inventory Results

The following inventory results are based on stand exams completed through June 2015 and on a GIS stand layer last updated in June 2015. The data presented is for all Trust land (both 100% QIN owned and Individual Indian Trust). 100% Fee Patent owned land is not reported in this section. Commercial and Reserve Trust land is reported separately.

Current Stand Types

The forests of the QIR are stratified using stand types derived from stand attributes of species, size, and density. Currently, we have identified 101 forested stand types. For a complete list of the stand types, see **Appendix B**.

Volume

There are two categories of volume used on the QIR:

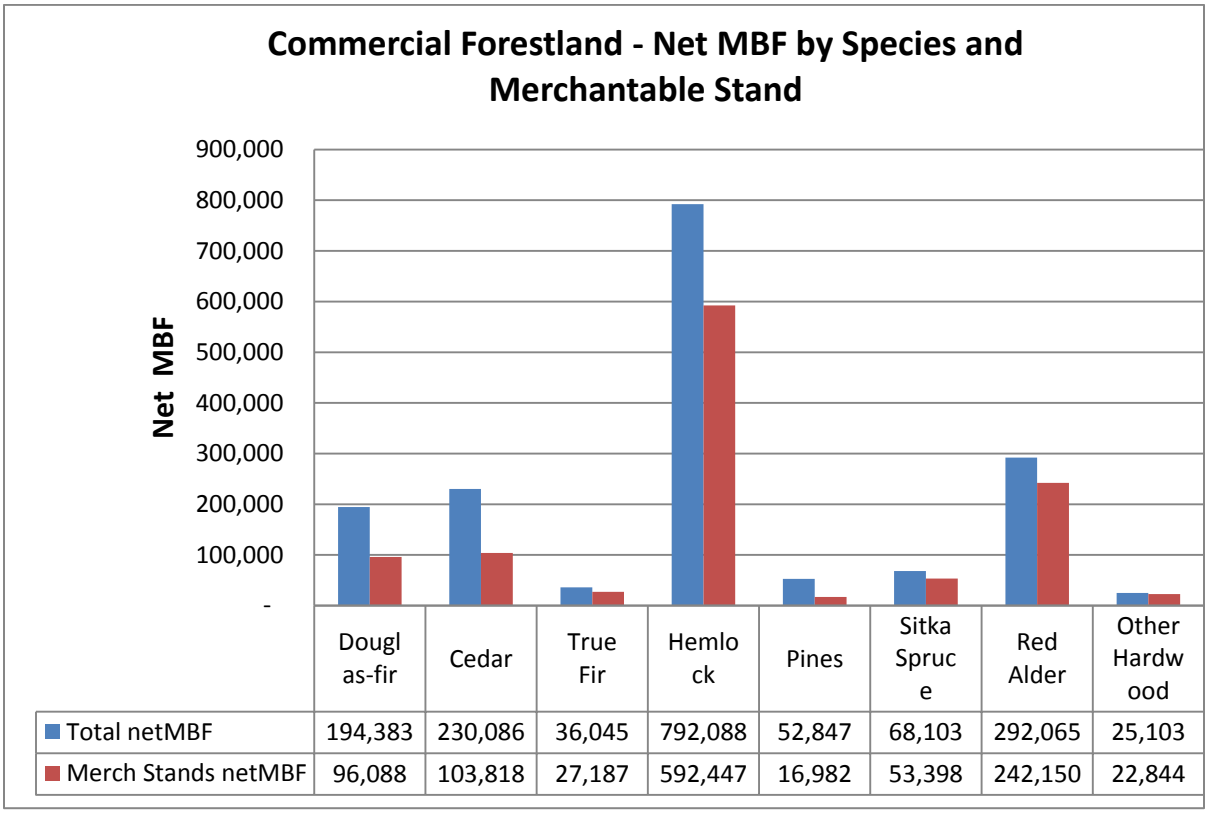
1. Total volume of all merchantable trees without consideration of whether or not they are located in a “merchantable stand.”
2. Total volume of only those merchantable trees that appear in merchantable stands.

These two categories are used to distinguish the volume in stands that are generally available for harvest verses those that are not available. There are many stands less than 40 years old with significant volume but under our current and planned FMP are not available for harvest except for a few specific reasons, such as salvage or being hardwood dominate. Additionally, some understocked stands and those on low sites can have volume,

but not enough to put a profitable sale together, unless combined with other nearby high volume units. As such, these stands with merchantable trees, but not in a merchantable stand, are not modeled as available for harvest in this 10-year FMP. As more volume comes from plantations and less from natural regenerated stands, it will be interesting to note the change in percentage between the two volume calculations. In addition, the minimum harvest age is getting younger and the implications of this with regards to volume in the plantations verse volume in the understocked, older, non-planted stands is of interest.

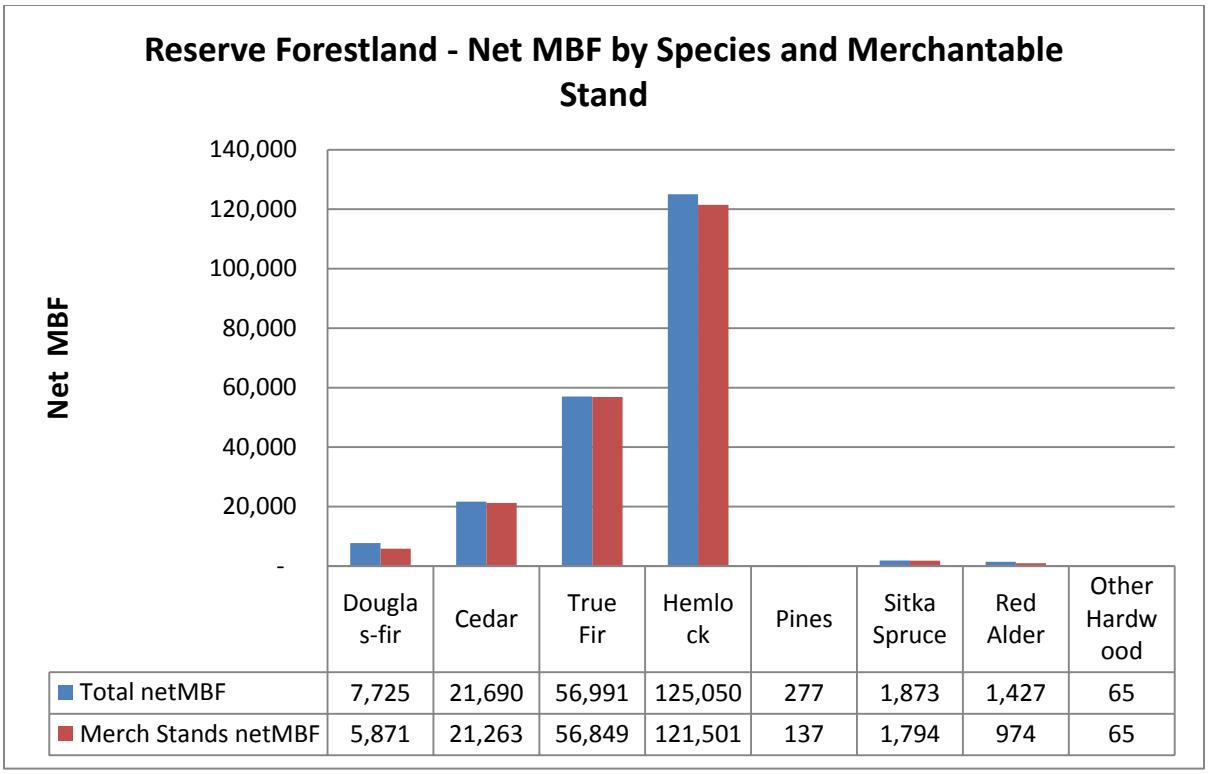
A merchantable tree is defined as one with an 8-inch DBH and the first log being 38 feet long with a diameter inside bark (DIB) of 5-inches (after the first log, additional 16 foot logs are allowed for volume calculations). The only notable exception is Red Alder which is merchandized in 24 foot logs with a 6 inch DIB. For the purposes of this analysis, a merchantable stand is defined as a stand with a volume of at least 18,000 net board feet per acre and more than 35 years old.

The total net timber volume of all merchantable trees on the commercial forestland is 1,691 million board feet (MMbf). When only trees within merchantable stands are used in the calculation, the total timber volume on commercial forestland is 1,155 MMbf. The total net timber volume in the reserves is 215 MMbf. When only trees within merchantable stands are used in the calculation, the total timber volume in the reserves is 208 MMbf.



	Douglas-fir	Cedar	True Fir	Hemlock	Pines	Sitka Spruce	Red Alder	Other Hardwood
Total netMBF	194,383	230,086	36,045	792,088	52,847	68,103	292,065	25,103
Merch Stands netMBF	96,088	103,818	27,187	592,447	16,982	53,398	242,150	22,844

Figure 2.2: Commercial forestland volume on the QIR by species and merchantable stands.



	Douglas-fir	Cedar	True Fir	Hemlock	Pines	Sitka Spruce	Red Alder	Other Hardwood
Total netMBF	7,725	21,690	56,991	125,050	277	1,873	1,427	65
Merch Stands netMBF	5,871	21,263	56,849	121,501	137	1,794	974	65

Figure 2.3: Reserve forestland volume on the QIR by species and merchantable stands.

Species Distribution

Using all trees greater than 1 foot tall, the predominant tree species found on the commercial forestland are western hemlock and western red cedar. If only merchantable trees are considered, then four tree species dominate the commercial forest land: western hemlock, red alder, Douglas-fir, and western red cedar, with red alder being predominately in the river and stream channel migration zones, thus a significant amount of the volume is not available for harvest. In the reserve area, using all trees over 1 foot tall, the predominant tree species is solely western hemlock. If only merchantable trees are considered, two species dominate the reserve area: western hemlock and Pacific silver fir.

Table 2.1 shows for the commercial forestland the number and percentage of total trees, the number and percentage of merchantable trees, and the total net board feet, by species. Table 2.2 shows the same information for the reserves.

Table 2.1. Commercial Forestland on the Reservation

SPECIES	Average TPA	Average TPA (%)	Merchantable (TPA)	Merchantable (%)	Net Volume (BF/acre)	Volume (%)
Bigleaf Maple	0.51	0.1%	0.2	0.2%	35	0.4%
Cottonwood	2.10	0.3%	0.38	0.3%	91	1.0%
Douglas-fir	61.16	8.6%	17.16	14.9%	998	10.5%
Grand Fir	0.00	0.0%	0.00	0.0%	0	0.0%
Lodgepole Pine	26.27	3.7%	2.97	2.6%	234	2.5%
Pacific Yew	6.86	1.0%	0.00	0.0%	0	0.0%
Red Alder	50.28	7.1%	18.61	16.2%	1,469	15.51%
Western Red-cedar	196.92	27.7%	17.97	15.6%	1,260	13.3%
Pacific Silver Fir	9.94	1.4%	2.89	2.5%	464	4.9%
Sitka Spruce	24.04	3.4%	2.66	2.3%	349	3.7%
Western Hemlock	325.85	45.8%	51.72	45.0%	4540	47.9%
Western White Pine	7.69	1.1%	0.47	0.4%	32	0.3%
Totals	711.63	100.0%	115.02	100.0%	9,472	100.0%

Table 2.2. Reserve Area on the Reservation

SPECIES	Average TPA	Average TPA (%)	Merchantable (TPA)	Merchantable (TPA in %)	Net Volume (BF/acre)	Volume (%)
Big leaf Maple	0.11	0.0%	0.01	0.0%	0	0.0%
Cottonwood	1.3	0.1%	0.02	0.0%	15	0.0%
Douglas-fir	40.04	4.3%	14.47	10.3%	1,815	3.6%
Grand Fir	0.00	0.0%	0.00	0.0%	0	0.0%
Lodgepole Pine	1.82	0.2%	0.64	0.5%	58.0	0.1%
Pacific Yew	0.0	0.0%	0.00	0.0%	0	0.0%
Red Alder	6.87	0.7%	3.19	2.3%	335	0.7%
Western Red-cedar	47.97	5.1%	7.50	5.3%	5,096	10.1%
Pacific Silver Fir	93.57	10.0%	34.93	24.8%	13,390	26.5%
Sitka Spruce	2.36	0.3%	0.63	0.4%	440.0	0.9%
Western Hemlock	744.91	79.2%	79.15	56.3%	29,381	58.1%
Western White Pine	0.58	0.1%	0.08	0.1%	7	0.0%
Totals	940.28	100.0%	140.63	100.0%	50,538	100.0%

Although there are many western red cedar trees on the commercial forestland (27.7% of the total trees), a large proportion of the trees are small (only 15.6% of the merchantable trees). In addition, even the merchantable western red cedar appears to be small and/or contain a lot of defect, making up just 13.3% of the net merchantable volume. Moreover, red alder appears to do just the opposite of western red cedar; red alder goes from 7.1% of all trees to 16.2% of all volume on the commercial forestland. The Pacific silver fir in the reserve areas displays a similar pattern as the red alder on the commercial forestland, with Pacific silver fir going from 10.0% of all trees to 24.8% of all volume in the reserve areas.

Douglas-fir and red cedar are interesting species to study when considering the effects of forest management. Douglas-fir was a minor species and red cedar was a major species on

the QIR prior to harvest activities on the Reservation and the subsequent planting of young trees following harvest operations. The majority of the Douglas-fir plantations are now at or approaching harvest age and size and many will be harvested for the first time in the next 15 years. Today Douglas-fir makes up almost 15% of the merchantable trees but only 10.5% of the volume, due to their just entering the merchantable size classes, but within 15 years the two percentages for Douglas-fir should be nearly the same. When looking at red-cedar, we see something very different. In the Reserves, red cedar volume is a higher percentage than its percentage of merchantable trees, yet on the commercial forestland the volume of red cedar is significantly less than its total TPA or its merchantable TPA. This is due mainly to red cedar being harvested in larger numbers in the 1960's, 1970's, and 1980's, while the planting program of that same time was mostly planting Douglas-fir and western hemlock. Very little red cedar was being grown in nurseries, therefore very little was being planted. This trend with the red cedar is being reversed somewhat by increasing the number of red cedar being planted and by leaving more red cedar in our pre-commercial thinning units. It is worth following the trend in the next 30 years to see if a significant change in the fortune of red cedar on the Reservation is occurring.

Also interesting to note is the volume difference per acre between the reserves and commercial forestland. Without the removal of merchantable stands due to harvest, wind throw, or fire, the trend is toward larger trees and eventually to old growth stands. This difference is what is expected to occur in riparian set-asides and other restricted harvest areas within the commercial forestland, especially as the acreage of set-asides become larger resulting in less blowdown.

Map 4.2 (Appendix C) shows the distribution of species, by stand, on the Commercial forestland and in the Reserves.

Size Class Distribution

Stands are grouped in diameter classes according to the average DBH of the main canopy layer. This provides an insight into the current size structure distribution. The future size class structure will be a function of site, stand density, species mixture, harvest intensity, and natural disturbance. There are six DBH size groupings (Map 4.3 in Appendix C illustrates five size groups and their distribution):

1. 0" – 4.9" (seedling/sapling)
2. 5" – 8.9" (post/pole)
3. 9" – 13.9" (small sawlog)
4. 14" – 19.9" (medium sawlog)
5. >=20" (large sawlog/old growth)

Table 2.3 delineates the acres and volume of forested land for each size category on both the commercial timberland and the reserves.

Table 2.3. Forested acres for each size category

Size Class	Stand DBH Range (inches)	Acres Commercial	Net BF/acre Commercial	Acres Reserves	Net BF/acre Reserves
1	0 to 4.9	21,590	0	0	0
2	5 to 8.9	30,508	236	171	84
3	9 to 13.9	60,734	7,362	739	7,887
4	14 to 19.9	47,436	24,303	558	41,182
5	>=20	1,741	47,835	2,788	66,821
Totals		162,009		4,256	

Size class 4 comparison between commercial and reserve land shows a large difference in the amount of BF/acre. This can best be described by past management activities. Almost all of the size class 4 stands in the Reserves are represented by well stocked plantations of trees that have been pre-commercially thinned, while on the Commercial land the size class 4 stands are represented by natural regenerated stands with a wide range of stocking, from understocked to overstocked. As the well-stocked plantations on the commercial land base continue to move into the size class 4 and as the understocked stands currently in size class 4 begin to get harvested, the average BF/acre should climb on the commercial land base.

Size class 3 has many acres on the commercial land base but not a lot of BF/acre. As the well-stocked plantations currently in size class 3 begin to move into the upper DBH range of size class 3 and into size class 4 over the next 10 years, it will be good to note in the next FIAR if the change will significantly affect the BF/acre and the acres in each size class.

Density Distribution

Stands are divided into four stocking groups: plantations/poorly stock, understocked, stocked, and overstocked. In plantation/poorly stocked stands and understocked stands, trees do not fully occupy the growing site and competition mortality is not significant. In stocked stands, dominants and co-dominants compete but do not cause significant mortality to each other while intermediates and suppressed trees do have significant competition mortality. In overstocked stands, intermediates and suppressed trees are mostly dead and competition mortality between co-dominants is significant.

Density composition of stands is based on many things, including planted verse naturally regenerated stands, pre-commercial thinning, site quality, and species composition. Consequently, there is no discernable pattern to density distributions over the reservation except that stocked stands have significantly more net BF/acre than understocked stands.

Age Class Distribution

The age class distribution on the commercial forestland is mainly a result of harvest practices dating back to the 1920s. Because most stands harvested prior to 1970 on the reservation were left to natural regeneration, the age composition of trees can vary significantly within the same stand as well as between stands harvested the same year. This is especially true on low sites, harvest units logged in different seasons, and in areas that were burned by wildfire. Thus, two factors make it difficult to obtain an accurate stand age:

1. The natural regeneration often occurred over a 10 to 20 year period (sometimes longer) with no predominant age group.
2. Stands are often composed of all-age, clumpy patches of trees with patches of brush between the clumps.

Stands harvested in the 1970s were planted, but many plantations failed due to wrong species selection. Around 1980, after tree planting with appropriate species became the standard operating procedure, stands tend to be even-aged and have the same age as other stands planted the same year. The NBA was managed by the United States Forest Service (USFS) prior to the QIN receiving ownership in 1988. Harvesting activities began in the NBA in the 1950s and nearly every stand harvested was replanted. The managed stands of the NBA are even-aged and have the same age as other stands planted the same year.

The age classes used are 1) age 0 to 10, 2) age 11 to 20, 3) age 21 to 30, 4) age 31 to 40, 5) age 41 to 50, 6) age 51 to 60, 7) age 61 to 80, 8) age 81 to 100, and 9) age 101 and above.

Table 2.4 shows the number of forested acres by age class for both the commercial forestland and the reserves. Map 4.4 (Appendix C) illustrates the distribution of the forested age classes on the commercial forestland and in the reserves.

Table 2.4. Forested acres by age class

Age Class	Acres Commercial	Net BF/acre Commercial	Acres Reserves	Net BF/acre Reserves
0 – 10	8,574	0	0	0
11 – 20	9,972	119	0	0
21 – 30	28,743	2,394	574	4,363
31 – 40	23,552	6,674	323	13,852
41 - 50	28,349	11,896	0	0
51 - 60	24,255	17,809	113	45,051
61 - 80	25,273	19,903	14	22,434
81 - 100	3,564	19,261	0	0
101 +	9,727	12,439	3,232	62,715

The age class table indicates low volume per acre for stands in the merchantable age group for the commercial area, specifically age 31 to 60, when compared with the Reserve area. This is a result of ½ of the stands in the commercial land base having a site index less than stands in the Reserves, coupled with the lack of good silviculture (site preparation, planting, release, and stocking control) on the lower reservation 40 years ago as compared to the Forest Service's silviculture 40 years ago. As plantations on the commercial land base continue to grow, expect to see the BF/acre volumes to increase in the 31 to 40 and 41 to 50 age groups.

Site Class Distribution

Site index is a measure of the relative productive capacity for trees to grow in a given area based on the height of the dominant and co-dominant trees in a stand measured at a given age. The site indices on the Reservation are based on the western hemlock 50-year Site

Index--Westside (Ken Wiley). Essentially, the higher the site index, the better the trees will grow.

Site indexes on forestland on the Reservation range from a low of about 40 to a high of about 140. The following example gives relative timber rotation lengths of various sites, assuming best management practices have been used on all stands and the volume at the time of harvest is about the same for each stand (25,000 net BF/acre). In actuality, the higher site stands will have significantly more volume even though they are harvested sooner. For example, Site 130 would have about 32,000 net BF/acre at age 35.

- Site 50 will yield a harvest in about 140 years
- Site 70 will yield a harvest in about 75 years
- Site 90 will yield a harvest in about 50 years
- Site 110 will yield a harvest in about 40 years
- Site 130 will yield a harvest in about 35 years

Site indexes on the Reservation are mostly a function of the soils. Soils that maintain standing water at or near the surface of the ground several months into the growing season have low site indexes and soils that maintain soil moisture in the root zone but not in a saturated condition, have higher site indexes. Length of the growing season, which is affected by elevation, growing season water availability, and proximity to the ocean, also has a minor effect on the site indexes on the Reservation. Map 4.5 (Appendix C) illustrates the distribution of the site classes.

Table 2.5. Site Class distribution on Commercial Land Base

Site Class group	Average Site Index	Acres	Average DBH per acre	Net BF/acre
1	135	220	11.7	38,675
2	121	41,530	8.2	17,842
3	107	43,268	7.6	13,919
4	79	31,334	6.5	6,726
5	53	45,657	5.2	2,782

Table 2.6. Site Class distribution on Reserves

Site Class group	Average Site Index	Acres	Average DBH per acre	Net BF/acre
1		0		
2	115	633	10.2	56,863
3	106	3,432	8.4	51,411
4	74	69	9.2	24,090
5	60	122	7.2	8,060

Growth

The CFI data collected in 1982, 1992, and again in 2002 will be used for now to estimate board foot growth. The CFI measurements currently being measured will not be available for input into this document until 2017. The Board foot growth estimate for the 1982 to 1992

period only used plots common to both measurements. The growth estimate between 1992 and 2002 used plots common to both of those measurements, which included new land entering the land-base that were previously in Fee, for the earlier growth estimate. The new plots installed in 1992 represented, on average, higher site ground that was better stocked than the original CFI plots. This should lead to a higher growth rate. In addition, plantations of well stocked stands that showed little or no board foot growth (due to their age) are now getting to the age where they are beginning to put on noticeable board foot growth. For these reasons, it is expected the board foot growth rate should increase each 10-year cycle until the 2013 to 2023 CFI measurements.

Table 2.7 shows the breakdown of growth based on CFI data comparing the 1992 and 1982 data, and the 2002 and 1992 data.

Table 2.7. Growth estimates (volume/acre/year).

		Total Net BF Growth
Growth Calculation Period	Land Base in Growth Estimate	All Species
CFI 1982 to 1992	Lower Reservation	267.2
CFI 1992 to 2002	Lower Reservation	352.3
Stand Based 2015 to 2016	All TRUST land	402.2

Using the stand based inventory and estimating the growth for a one year period, the estimated board foot per acre per year growth rate is 402.2 BF/acre/year. This estimate should be higher than the last CFI growth rate calculation since it includes many plantations that are merchantable today (2015) that were not merchantable during the growth period of 1992 to 2002. As the Commercial land base of the QIR continues to trend toward plantations and as older, understocked stands are harvested, expect to see continued increase in the Board Foot growth for the next 20 years. This trend should be apparent in the analysis of the current CFI to be completed in 2017.

The estimated growth rate using the Stand based inventory is 66.9 million board feet per year, significantly greater than the calculated 49.8 million AAC. The 66.9 million estimate includes all TRUST land, thus including areas not available for harvest such as riparian set-asides, coastal, lake, and prairie buffers (this is to keep the comparison with the CFI growth calculation the same). Another issue is the large number of well stocked, planted stands growing on good sites that are producing board foot volume but will not meet the FMP criteria for harvest in this 10-year plan, but count in the growth calculations for the CFI. Beginning with the 2025 to 2035 plan, expect the board foot growth on the commercial land base available for harvest to approach the volume expected in the AAC.

Statistics

Currently, cruise data are not available for every stand. The forest data representing the QIR are derived from a sub-sample of cruised stands from all original QIR stand types. Some small acreage stand types are represented by one examined stand and some large acreage stand types are represented by over 300 examined stands.

Appendix A shows, by stand type, the number and percentage of stands cruised, the number of stands un-cruised, and their associated acres for the commercial land base.

The overall net board foot error for all cruised stands in the commercial forestland is 0.7% and within the reserved lands is 4.0%.

Table 2.8 shows the net board foot error for the merchantable stand types on the Commercial forestland that have at least 50 MMBFnet.

Table 2.8. Net board foot error for Commercial Forestland.

Stand Type	Total Acres	Acres Cruised	Number of Stands Cruised	Volume error (%)	Volume Range (MMbf)
WH44	23,770	16,152	589	0.9	841 +/- 7.6
RA44	8,015	3,216	91	2.9	218 +/- 6.3
RC44	8,218	6,689	228	2.3	146 +/- 3.4
WH34	10,750	7,254	257	2.2	128 +/- 2.8
RC34	12,613	7,907	274	2.4	105 +/- 2.5
DF44	4,317	4,159	120	2.6	90 +/- 2.3
WH33	5,848	2,384	76	4.7	52 +/- 2.4

2.8 Allowable Cut

The allowable cut for this planning period has been calculated using the guidelines laid out in the Environmental Assessment for this FMP. GIS was used to determine the commercial land base available for harvest, and the inventory system was used to determine what was growing on the harvestable land base and the silviculture used in the growth of stands and in the harvest. The process used in calculating allowable cut provided the answers to three important questions:

1. Given the current inventory, what is the indicated allowable cut for the next 10 years?
2. What is the indicated long-term sustainable yield given the current level of management activities?
3. If the answers to the first two questions are significantly different, how long will it take and what needs to be done to attain the long-term sustainable yield?

To plan harvest activities and arrive at an allowable cut, three things were done with the inventory system:

1. Using FPS7 calibrated for western Washington, current stand attributes were projected out 150 years. Each stand was “grown” forward in 10-year increments, on its own site, for 15 planning periods. This produced an estimate of what the QIR would look like under a “no harvest” management prescription.
2. A regeneration yield table was created to simulate replanting trees into harvested stands. This was accomplished by taking the proportion of tree species currently planted in a stand of a given site and modeling the growth over time.
3. Silvicultural prescriptions were developed in FP7 to model the proposed harvest scenarios described in the Environmental Assessment.

GIS was used to analyze land area affected by harvest restrictions. The total land area of the QIR is about 207,066 acres. GIS was used to remove from the total area all non-forested areas (water, roads, villages, etc.), non-tribal fee patent lands, and the restricted areas (RMZs, WMZs, reserve areas, etc.) reducing the acreage available for timber production under QIN and BIA management to about 133,303 acres on the commercial forestland.

Table 2.9. Breakdown of acres to arrive at the commercial acres available for harvest

Commercial Forestland	Acres
Total Acres on the QIR	207,066
Subtract:	
Non-tribal Fee Patent acres	23,021
Reserve acres	4,256
Non-forested (residential, roads, gravel pits, rivers, prairies, etc.)	22,045
Set-aside acres*	23,159
Available Acres for Harvesting	***134,585***

*Includes buffers on prairies, coastline, streams, lakes, rivers, and unstable slopes (where applicable). Excludes set-aside areas already accounted for in non-forested areas.

Combining the spatial data from the GIS (how much acreage from each individual stand is available for harvest), with the stand data from the inventory system, the harvest scheduling program was run for a 150 year period to provide an idea of the sustainable harvest level for the next 10 years, as well as to provide an estimate of the long-term sustainable yield (LTSY). If the LTSY is significantly different than the sustainable harvest over the next 10 years, the model shows how long it will it take to arrive at a harvest level that would equal the long-term sustainable yield.

A detailed description of the harvest scheduling process can be found in “Biometrics of Forest Inventory, Forest Growth and Forest Planning”, Technical Report No. 15. Copies of the document can be found in the QDNR library and the Inventory Foresters Office, or one can be purchased from the Forest Biometrics Research Institute.

Allocation of the Annual Allowable Cut

The AAC for this planning period for the 100% owned Tribal Trust land is 14.2 MMbf/year and the AAC for the BIA managed Trust land is 32.8 MMbf/year. In order to obtain this volume, an estimated 1,450 acres would need to be harvested on the commercial forestland each year. This represents approximately 50% of the total available planning area shown on Map 3.1 in Appendix C.

It is interesting to note that when the Tribal and BIA trust land-base is combined for a harvest schedule run, the combined total projected harvest is significantly higher in the first 20 years than when each land-base is run separately. This is an example of the whole being greater than the sum of its parts. Combined for the first period, the AAC is 49.8 MMbf/year, while the QIN share is 14.2 MMbf/year and the BIA trust share is 32.8

MMbf/year, for a total of 47.0 MMbf/year, a difference of 2.8 MMbf/year from the combined total.

After examining many harvest schedule results, what is happening becomes apparent. The BIA managed land doesn't have any shortage of harvestable timber in the next 20 years; what they lack are sufficient stands coming on-line 10 years from now to raise their AAC above the projected amount in this 10-year plan. The result stays relatively constant no matter how the parameters of the harvest schedule are changed; there is very little shifting of harvest projected for this planning period into later planning periods or from later planning periods to this planning period. Essentially, the managed stands (plantations) on BIA managed land will not be in the majority of harvestable volume for another 30 years, so do not have a significant impact in this 10-year period.

As for the QIN managed land, there is a huge amount of harvest coming on-line in 10 to 20 years (all the RTOC, NBA, and other purchased land that was harvested in the early 1990's). This "wall of timber" poses some unique options for the QIN in the next planning period. How the QIN decides to spread-out the harvest of this future volume in the next two planning periods will have a noticeable impact on this 10-year plan. For the purposes of this plan, the chosen alternative has a minimum age of harvest of 40 years and that limit was modeled to be in effect for the foreseeable future.

There is synergy when adding the young "wall of timber" from the QIN ownership with the BIA's existing timber that results in a higher harvest level for this planning period. When the two managed land bases are combined, the model harvests more BIA timber than it otherwise would in the first period and harvests more QIN timber than it otherwise would in the second and third period. This can only occur when the two ownerships are combined. When they are modeled separately, BIA timberland cannot rely on the QIN's young "wall of timber" and the QIN timberland cannot rely on the BIA's supply of existing timber. Because a "non-declining even flow" volume model is used in this analysis, as per Tribal Council policy, the volume harvested in future planning periods cannot be less than any previous planning period, for each separately managed land base.

Table 2.10. Allowable cut value and the calculated long-term sustainable yield.

	100% QIN Owned	BIA managed Trust	AAC if Ownerships
10-year Period	Commercial Forestland	Commercial Forestland	**were Combined**
Midpoint	(MMbf)	(MMbf)	**(MMbf)**
2020	14.2	32.8	**49.8**
2030	17.6	35.5	**55.1**
2040	24.5	37.7	**59.0**
2050	25.6	39.6	**62.5**
2060	27.5	45.9	**75.1**
2070	27.8	46.3	**75.5**
2080	28.5	46.5	**75.5**
2090	29.4	46.9	**75.9**
Average BdFt/acre (LTSY)	***40,000***	***39,000***	***39,400***
LTSY MMbf	***30***	***49***	***79***
BdFt = Board Feet			
MMbf = Million board feet			

Table 2.10 illustrates the allowable cut in 10-year periods for the next 80 years, along with the calculated long-term sustainable yield. The combined ownerships are shown.

As the years continue and the timbered land base of the QIN Trust and the BIA managed Trust become similar in composition, the situation changes and the combined harvest is less than the individual ownerships (this occurs in the 3rd and 4th periods). Eventually, it will even out and the LTSY will not be significantly different when comparing the individual ownerships and the combined ownerships.

2.9 Allowable Cut Discussion

The following is a quote from the textbook "Forest Management" by Davis and Johnson.

> "For a particular land allocation and set of yields for existing and future stands, a harvest schedule under base harvest policy usually will reveal either a surplus or a deficit of timber in existing stands. A schedule indicates a surplus of timber in existing stands when lands allocated to timber production can provide more harvest volume from existing stands (including growth) than needed to maintain the harvest at the long-term sustained yield until the stands created when the existing stands are cut become available for harvest. We will call this condition 'a surplus of existing timber.' A schedule indicates a deficit of timber in existing stands when lands allocated to timber production cannot provide enough harvest volume from existing stands (including growth) to maintain the harvest at the long-term sustained yield until the stands created when the existing stands are cut become available for harvest. We will call this condition 'a shortage of existing timber.' "

Table 2.9-1 clearly illustrates that the commercial forestland on the QIR has a "shortage of existing timber". This "shortage" exists for several reasons, the most significant being the effect of past harvest practices on the land and the method used to re-establish new stands of trees. Up until the 1970's, harvesting of trees was done year round, with little regard given to the effects of compaction on soil and how it relates to the future productivity of the land base. There was also very little planting of trees on the QIR, and that which was done was usually on Fee land. Depending on the location and the time of year the harvest occurred, the resulting regeneration could result in a healthy, stocked stand of trees or a poorly stocked brush field, and often something in-between. Many years of this kind of forest management led to a situation where the tree stocking on the QIR was significantly below its potential. This is why the combined AAC is 49.8 MMbf/year compared to the estimated LTSY of 79 MMbf/year. Since the early 1980's, an effective tree planting program and adherence to best management practices when logging have laid the foundation for a substantial increase in timber harvesting and revenue in the future.

The current inventory situation on the QIR does not allow many significant harvest scheduling options for the chosen alternative other than the one stated as the indicated allowable cut, if the long-term sustainable yield of 30 MMbf is to be reached in a timely manner. Because the allowable cut is 14.2 MMbf and the LTSY is 30 MMbf, any deviations from the planned harvest that significantly increases timber harvest in this 10-year period will result in less harvest in the following 10-year period. This option is not allowed as it is the stated goal of the QIN to not decrease future yields below previous yields over a 10-year planning period.

In the case of a shortage of existing timber (which is the case on the QIR), shortening the rotation length of the first 10-year period will increase the harvest the first period, but will

usually reduce the amount of harvest in the following one or two 10-year periods under an even-flow constraint. Lengthening the rotation on the lower reservation to 60 or 70 years will significantly reduce the harvest for the next 30 years, but will result in a higher LTSY and thus greater revenue per acre in the future. However, since fewer acres can be harvested each year using a 70 year rotation, total revenue generated would be less.

Whenever projections are made (harvest scheduling and allowable cut calculations are good examples), any change in projected future events will change the projection. One of the ways the future allowable cut and LTSY can be altered is by changing forest management practices. Reducing the current pre-commercial thinning, planting programs, etc. will have an adverse effect on the future allowable cut and LTSY, reducing both of them. Conversely, accounting for gains in growth from current tree improvement programs or pest management programs would increase the future allowable cut and LTSY.

Reducing management activities does save money up front, but at the expense of future revenue. Furthermore, increasing the scope or amount of current management programs, and/or adding new management techniques such as fertilization and herbicide spraying at time of planting would have a positive effect on the future allowable cut and LTSY, increasing them both. Increasing the amount of up front funding on management activities would result in an increase in net revenues in the future, but would be a drain on current net revenue.

Another change in future projections comes from increases in forestland reserves and increases in no entry or limited entry buffers, which reduce projected harvests in the future. Changing the FMP rules used in the last 10 years to the rules in this current plan, will reduce the projected harvests by about 20 MMbf over the next 10 years. This results in a reduction of the LTSY on this plan of 2 MMbf per year as compared to the previous FMP (a reduction from 81 MMbf per year to 79 MMbf per year).

Obviously, unforeseen natural events can also affect allowable cut and LTSY projections; the most common on the QIR are wind and pest epidemics. Since the forest has mostly been converted to second growth, these natural events usually have a minimal impact on harvest levels on the QIR, with the windstorm of 2007 not having any noticeable effect for forest management on the QIR.

Finally, the easiest way to alter the allowable cut and LTSY is to increase or decrease the forestland ownership. Revenue from the sale of timber on the NBA is used by the QIN to purchase land on the lower reservation, some of which is in Fee Patent status. As land is added to the trust land base through purchases, the LTSY of the commercial forestland will increase. The effect on the near-term allowable cut, however, will depend on the age and merchantability of the stands being purchased.

2.10 Trends

To measure trends in forest characteristics, the underlying measurements need to be consistent between the measurement periods. This is difficult to do with a stand based inventory as many changes occur between growth periods that affect an apples-to-apples comparison of forest characteristics. New stands are always being examined (thus changing the values through new data and not growth), new techniques are employed in estimating data in non-examined stands (such as LiDAR), and changes to computer modeling software can affect volume as one switches from one version to the next (changes in taper models, data compiling, remerchandising, etc). Although most of these changes

can be small on a yearly basis, when viewed over a 10 year period, these changes will impact trend analysis.

The CFI measured every decade does not have the issues common to a stand based inventory when measuring trends. CFI uses individual tree measurements and compare trends based on the measurements of an individual to the same individual tree at a later period. When all these individual tree measurements are analyzed together, trends can be ascertained. The analysis of the current CFI is expected to be completed in 2017 and the trend section of this document will be updated when the data becomes available.

Some trends are obvious with the stand based inventory, but cannot be estimated with a high degree of confidence without a CFI. Some of these trends include:

- Douglas-fir is rare in natural stands on the QIR, but will become a major commercial species starting in about 10 years as plantations of Douglas-fir approach merchantability on a large scale.
- Board Foot growth rates should increase for at least the next 20 years, probably close to adding 15% to the current net growth rates for the commercial land base. Land that was harvested 30 to 80 years ago was left to naturally regenerate and sometimes came back understocked. Other understocked areas resulted from hot wildfires or heavy equipment that damaged the soil structure. These past events have left some of the land understocked which has decreased the board foot production. Harvesting these areas and then replanting the site (with improved seed) and maintaining good growth through silviculture (such as conifer releases and pre-commercial thinning) will increase the board foot production on the Reservation. The effect of bringing these areas back into full timber production over the next 30 years will cause a significant increase in the total volume growth because the stocking level of these stands will increase.
- In the commercial forestland, the age class structure will get flatter as older stands are harvested and replaced by plantations. Moreover, harvesting plantations based on economic maturity will also lead to a decrease in the average age of stands.

Some trends can be picked up by the stand based inventory, but are unlikely to be documented well with a CFI because they are sporadic and/or small in scale. Some of these trends are:

- Small groups of large trees will be left across the landscape as legacy and wildlife trees are left in the middle of harvest units.
- Retention of large conifers will increase within all riparian set-asides on the Reservation.

2.11 Recommendations

As part of the Analysis next time, consider analyzing the Commercial land base in 2 parts for analysis: Harvestable land base (where active harvest occurs) and Administrative set-asides (areas un-available to harvest due to rules and regulations – these acres change in each plan based on human decisions). The same analysis would be done as in this report between Commercial and Reserves, but then a further analysis between the harvestable

land base and the administrative set-asides. The effects of set-asides need to be analyzed as the trees in the set-asides will continue to age and begin to decay while the trees in the harvestable area will not.

Money needs to be invested in the collection of data for use in the stand based inventory. Without the use of contractors the inventory system will never achieve better than a 75% inventory of current exams.

All the individual databases used in Forestry for tracking projects need to be fully integrated with each other and with GIS.

The Growth model used in the inventory system needs to be calibrated using local data. These recommendations are described in more detail in the following paragraphs.

Overview of Current Inventory System

There are three basic components to every forest inventory system:

1. Data about the forest land base
2. A means to collect, store, and analyze data about the forest
3. Forestry staff

QDNR-forestry is well situated with the infrastructure necessary for the development of a good forest inventory system (includes parts of #2 and all of #3 above). The computer hardware and commercial computer software available includes a fully functional GIS, Forest Inventory System (FP7), and a well maintained network system. The forest inventory software used is Forest Biometrics Research Institutes' "Forest Inventory and Forest Planning Software." This is a Microsoft Access-based set of interlinking tables, queries, macros, and reports designed to store and manipulate forest data to user specified criteria, and can be linked on a one-to-one basis with a GIS stand layer.

The QDNR Forestry Division is staffed with foresters, forestry technicians, and GIS professionals who are knowledgeable in timber inventory techniques, database management, and GIS operations. Collecting and analyzing field data and creating maps is an almost weekly routine. The staff stays current with technological advances in forest inventory and GIS techniques through training sessions and conferences.

Inventory System Needs

The lack of empirical data on all stands is currently the weakest link in the inventory system. One of the goals of the inventory program is to obtain, at least once every 20 years, a stand exam for every stand. Management of the existing data from all disciplines within Forestry is another problem area; the data are often in non-related databases that are maintained by individual Foresters, so sharing of information within QDNR and the BIA – Taholah Agency is difficult. We are currently addressing both of these challenges.

Stand exams are needed on all trust forestland within the boundaries of the QIR. All plantations currently receive an exam at time of planting, a two-year survival survey, and a five-year free-to-grow survey. As needed, a 12- to 20-year stand improvement exam is conducted. Furthermore, a follow-up exam is completed after any intermediate stand improvement activity or harvest such as PCT or Commercial Thin (CT). Lastly, exams are scheduled about 8 to 15 years prior to expected harvest to assist with the development of

future management plans and to assist in preparing 10 year harvest plans. Some potential purchases or harvest units are examined with an intense pre-harvest cruise. Missing are exams in stands that are poorly stocked that are not expected to be harvested in the next 15 years.

All stands that have not been examined in the last 15 years are considered high priority. The exams are scheduled so that 25% of each stand type is sampled before continuing towards 100% sampled. The goal of sampling 100% of the stands will be considered met if all stands have been examined in the last 20 years for medium and good sites, and 30 years for the lower sites (site index 70 and below). On good sites (SI 110 or better on a 50-year base age), an exam should be conducted about every ten years once the stand becomes merchantable. On poor sites (SI 70 and below), since the trees grow much more slowly, 30 years may pass between exams. Stand exams are scheduled immediately if major changes are known to have occurred, such as excessive blowdown or excessive bear damage.

Given three inventory technicians and their workload, it would take about 15 years to obtain current stand exams on 75% of the trust acres. Because the goal is a 100% survey within the next 10 years, contractors will be used to accelerate the data collection process.

Link Together all Forestry Databases

The main components of the forest inventory system are FPS and GIS. In addition, each forestry project area maintains their own database inventory system to track data specific to their needs. To keep from duplicating information in multiple databases, a method of linking them is needed.

For example, the planting database and the stand inventory database should have one column that contains a unique value to their own database that is also common to both databases. This arrangement creates a link between the two databases so that information can be shared even though they are maintained independently. This arrangement needs to be developed for all forestry databases.

Calibration of Growth Model

FPS is best calibrated by locating permanent plots within the land base and measuring all trees on the plot at regular intervals. Plots need to be located to include the full range of age and site classes possible for each species of interest found, and the trees on the plots need to be stem mapped so tree-to-tree competition can be calculated. The most recent CFI took 74 existing plots and stem mapped them so their growth can be used to calibrate the FP7 growth model. QDNR-forestry will contract a project to use the current CFI and other data to calibrate the FP7 growth model.

2.12 Issues to Resolve

Several issues surfaced during these analyses that need to be addressed prior to the next report.

1. The most recent CFI data collection and analysis should be completed prior to the completion of this report. Most trends and the growth estimate are best observed using a CFI. The CFI data will be available and used in the mid-plan update.

2. The Stand Inventory needs field collected data for all stands that are planned to be harvested in the next 15 years. This additional data will assist in the calculation of the AAC and provide for more accurate 10-year operational harvest plans.
3. Data collection efforts have been sporadic as a result of funding. The last large scale collection of data for stands over 25 years of age occurred between 2000 and 2002. We have received funds for stand exams this year, but future funding is un-stable. We need an additional $42,000/year to meet our stated goal for stand exams while still meeting our other exam obligations.

Chapter 3. Timber Management Standards

This chapter discusses the management of the forest resources on the Quinault Indian Reservation. Included are specific details regarding timber management, harvest policy, specialized forest products, and riparian enhancement activities.

Separate allowable harvest levels are established for tribal lands and individually owned trust allotments. Based on current ownership patterns, the total allowable harvest for the next ten-year planning period (October, 2016 through October, 2026) is as follows: the QIN share of the AAC is 14.2 MMbf/year and the BIA trust share is 32.8 MMbf/year (see Chapter 2: Forest Inventory Analysis Report for further discussion). The actual volume of timber harvested in any given year will depend upon landowner needs, market conditions, access constraints, and the need for riparian enhancement actions.

Reserves already set aside for cultural needs, such as the Canoe Tree Stand, Cape Elizabeth old growth preserve, the North Boundary Area Conservation Easements Blocks, and other lands traditionally used as preserves, will be maintained for cultural purposes.

The provisions in this chapter constitute the entirety of management provisions for protection of cultural, vegetative, fish, wildlife, and environmental resources. Upon a demonstration of conservation necessity and following standards analogous to those set for in Secretarial Order 3206, additional protective measures may be incorporated into this Plan revision.

3.1 Harvest Policy

Forestland management activities on trust land are based on the objectives laid out in the National Indian Forest Resources Management Act of 1990 (25 USC Sec 3104) and the regulations set forth in 25 CFR Part 163 (General Forestry Regulations), Subpart B (Forest Management and Operations) of the Code of Federal Regulations (CFR) and Title 61 of the Quinault Tribal Code of Laws. Fee patent lands on the QIR are regulated under Title 61.

Timber harvesting is done on a sustained yield basis to ensure the perpetual availability of timber for harvest (25 CFR Part 163.3). Management activities are designed to sustain important physical and ecological processes while providing for economic use of the natural resources on the QIR.

3.2 Harvest Unit Planning and Design

Timber harvest planning considerations include identifying candidate sites by forest characteristics taking into account economic, physical, and ecological factors. Map 3.1 (Appendix C) identifies potential timber sale areas by major units or groups of allotments over the next ten-year planning period. Candidate sites are then screened for environmental constraints to ensure the protection and enhancement of natural resources and to meet forest management objectives.

3.3 Criteria for Harvest Unit Selection

Potential harvest units are selected using a number of criteria based on the forest inventory. Map 3.2.1 reflects those areas on the Quinault Indian Reservation that include commercially mature stands of timber for potential harvest in the next ten-year planning period.

Some criteria used to initiate sale planning include:

- Forest characteristics such as species, site index, stand age, stand health, and estimated volume per acre;
- Site specific conditions such as soil type, topography, existing stream channel processes, and existing roads;
- Management objectives such as income from timber, fish and/or wildlife habitat needs, and forest health; and
- Timing concerns such as soil compaction and/or erosion, and road use.

Criteria for Harvest Unit Selection on Individually Owned Trust Allotments

Individual Trust Allotments are managed to generate revenue flow to the allotted landowner(s), both present and future. The harvests are generally of second growth stands managed for harvest at financial maturity, (i.e., in the 40-year age class for conifer stands, 35-year age class for hardwood stands). This rotation is based on the assumption of a reasonably productive site index range of greater than 100. Thus, stands are initially selected for harvest based on age class. Because of the variability of site index, stand establishment, and stocking level control, initially selected stands are then evaluated for economic viability. This is a function of the log merchantability and the cost of getting the logs to market.

A large number of current stands on the QIR were established through natural regeneration. Some stands with inadequate regeneration and stocking due to this legacy will be harvested and replanted to the economic benefit of future landowners. In these cases, the stands are included with adjacent harvest units to remove the merchantable stems.

A few younger stands may experience extensive bear damage; this damage may reduce desired stocking of the stand and allow brush growth to invade. Stands that experience insect or pest damage that reduces the stands ability to remain healthy and viable to rotation will be considered for harvest.

The Forest Development Chapter (Chapter 5) elaborates on this process to also discuss the type of stands that are not included in a harvest unit timber sale. Once the stands are identified that initially meet the three basic criteria of (1) age class, (2) economic viability, and (3) potential rehabilitation, they are balanced against the annual allowable cut to ensure over harvesting does not occur. For those units that do not meet the minimum criteria for harvest unit selection, other economically viable harvesting alternatives may exist that could be identified through the ID Team process, e.g., individual operators.

Based on these issues, the size of the specific harvest unit can be adjusted to meet all of the management needs. Other management needs include but are not limited to cumulative impacts to water resources, wildlife and fish habitat, or culturally important sites. If the management needs cannot be met within the 10-year period, some harvest units may be deferred until the next 10-year planning period.

Selected harvest units are grouped into planning areas based mostly on adjacency. Planning area boundaries are often defined by size and access to haul routes. Planning areas tend to be 3-5 MMbf in size so that a larger number of prospective purchasers can financially participate. Planning areas are usually broken into smaller timber sale logging units. Often times, to better proportionate logging costs to the landowners, sales will be separated based on harvest method.

The QIR was initially harvested under township-size timber-cutting contracts over relatively short periods. The result has been large areas with trees in the same age and size classes. In an effort to break up these large, even-aged classes, some areas may be deferred to the next planning period and replaced with younger areas on high sites (> site class 100) with larger trees. Often times, size class is the primary selection criterion, especially because stand age information is not well documented and does not necessarily reflect merchantability.

Criteria for Harvest Unit Selection on Tribally Owned Land
The criterion for harvest unit selection on tribal land is similar to that used for individual trust land. Land consolidation is critical to the future of the QIN. Short of jeopardizing other resources, all available, economically viable timber is harvested to provide the shortest possible carrying time of the purchase investment. The stand age cutoff for these lands is 35 years for hardwoods, 40 years for conifers.

Because the QIN owns less than 50% of the QIR, the harvest schedule of the other landowners has a strong influence on where the Tribe pursues acquisition and subsequent harvest. Accessibility, survey needs, economic viability, silvicultural needs including the treatment of invasive species, wildlife and fish impacts, and forest enhancement needs are major factors affecting harvest unit selection. Other considerations include the rehabilitation of stands planted with off-site seed sources, insect, disease, and pest issues.

Illustration by Scott Kryskalla

3.4 Pre-sale Layout

Site visits, GIS review using the most updated layers and a review of past harvest records are all used to implement much of the early sale planning. Following these preliminary steps, potential harvest units are then put through a process of pre-sale layout. On tribal lands, Quinault Land and Timber Enterprise (QLTE) is responsible for any required surveying. On individual trust land, the successful bidder is responsible for any required surveying. Thus, survey needs are assessed for inclusion in the timber appraisal. Cutting unit boundaries are marked on both tribal and individual trust land. On tribal land, access roads are located and flagged. On

individual trust land, proposed access roads (and associated gravel pits) are photo mapped and some are field verified and flagged. On Individual Trust Allotments, cutting units are cruised according to standards developed for the agency.

3.5 Interdisciplinary (ID) Team:

The ID team is comprised of staff members identified by the Division to review proposed and active forest practices activities in order to ensure they are consistent with federal regulations [25 CFR Part 163] and with tribal codes [Title 61] and regulations applicable on trust and QIN-owned lands.

The role of the ID team is to ensure forest practices are carried out according to applicable laws and regulations, to review and implement technically-based and scientifically-sound site-specific operations, and to serve as a forum for resolving technical differences and disputes over proposed permit conditions. In order to achieve this, the ID team is responsible for reviewing all proposed and active forest practices on both QIN-owned and trust lands.

The ID team will be actively involved in the review of proposed forest practices, specifically those classified as a class III or class IV. The review process for proposed forest practices is achieved by holding a minimum of once a month ID team meetings, conducting field reviews, reviewing contracts before they are put out for bid, and conducting pre-work meetings with the operator prior to the commencement of forest practices.

Dispute Resolution

In the event that the ID Team process cannot resolve technical differences and disputes, the dispute resolution process will be implemented. Dispute resolution will be staged and may be applied at any stage of the dispute process. Any participant may invoke each succeeding stage, if agreement is not reached by the previous stage within the specified time (see below) or if agreements are not substantially implemented.

1. Stage one occurs within the ID Team. On technical issues, the ID Team shall have up to 3 months to reach a conclusion unless otherwise agreed to by the QDNR Director and the BIA Superintendent. Non-technical issues can be moved to the QDNR Director and the BIA Superintendent whenever they arise.
2. Stage two will be a review by the QDNR Director and the BIA Superintendent and will be completed within 1 month unless otherwise agreed to at the start of the stage. If no decision is agreed to within the allotted time, the issue will be elevated to stage three.
3. Stage three moves the issue to the QIN Business Committee and the BIA Superintendent, and will be completed within 1 month unless otherwise agreed to at the start of the stage. If no decision is agreed to within the allotted time, the issues will be elevated to stage four.
4. Stage four moves the issue to the QIN Business Committee and the BIA Northwest Regional Director.

3.6 Mapping Standards

Every effort will be made to locate existing corners. When allotment lines and/or corner monuments cannot be located and marked for harvest purposes, it is done by the BLM or by a Licensed Professional Land Surveyor to specifications approved by the BLM. Specification requirements are on file at the QDNR Forestry Department office.

Currently, all proposed harvest units are photomapped during layout. Individual Trust units are also traversed using either GPS or other survey instruments to determine gross and net harvestable acreage by allotment. For most Tribal units, photomapping during layout is sufficient. For single allotments surrounded with adjacent cutting, this is the only mapping required to transfer the data to a timber sale base map. GPS instruments are used to traverse each unit and provide a link to the GIS-Forest Inventory database for accurate accounting of harvested acres. After harvest of a unit, depletion photos are taken to record actual acres harvested, roads built, etc.

Picture 3.1: Lone Mountain. Courtesy of Larry Workman.

3.7 General Timber Layout Standards

Prior to any harvest, a QIN Forest Practices Application (FPA) must be approved and, if the unit is within 200' of a body of water, an approved QIN Hydraulic Project Application (HPA) is also required.

The following guidelines exist for timber harvest on the QIR:

Clearcutting is the preferred method of harvest. Commercial thinning may be used as an intermediate harvest method.

Conifer harvest is targeted to stands in the 40-year age class or older, depending on size, species, stocking, stand condition, and site class. Harvest of hardwoods is targeted to stands in the 35-year age class or older and will be determined on a site specific basis.

Soil Protections

Areas with Site Index less than 100

When soil moisture is high and unrestricted operation of ground-based equipment would result in unreasonable soil compaction as determined by the ID Team, mitigation measures will be implemented that minimize widespread soil compaction, or postponed until site conditions improve such that yarding may proceed without causing unreasonable soil compaction. If soils are saturated and rutting is occurring, or has the potential to occur, harvest operations will not be permitted until soil saturation decreases. On areas with site index less than 100, harvest operations with heavy equipment should be completed between **May 1st and October 15th.**

Cable yarding and helicopter yarding is permitted when soils are saturated.

Seed trees may be retained within clearcut areas with a site index of less than 100. Where available, they will be distributed across the harvest unit at 2-15 trees per acre. Where not available, they will be clumped to facilitate regeneration efforts.

Additional Requirements for Harvest within the Floodplain

Whenever possible, natural occurring characteristics of the floodplain are to be maintained. It is strongly advised to carefully plan harvest activities to occur between June 1st and September 30th to minimize impacts to natural resources. Operations will be allowed outside this window with the approval of the Forest Manager(s) and Environmental Protection Manager (upon consultation with the QDNR Roads Manager, Silviculturist, and Hydraulics Officer). If approval is granted, harvest within the floodplain will be completed by February of the soonest growing season, or coordinated with Forest Development to facilitate reforestation efforts. Floodplain soils are identified in a soils layer on GIS.

In order to maintain forest floor structure and habitat characteristics in the floodplain, downed wood 24 inches in diameter or greater may not be moved without permission from the Officer in Charge (OIC). Downed wood 24 inches in diameter or greater is not allowed to be removed from the floodplain as well.

All conifer individuals and groupings of conifer less than 1 acre in size will be retained. In patches of conifer (areas with greater than or equal to 50% basal area conifer) greater than 1 acre, 30 dominant/co-dominant conifers per acre will be retained. Sitka Spruce is the priority species for leave trees.

Riparian management zone enhancement actions may occur within the RMZ as identified by the ID team. This includes, but is not limited to, in-stream habitat restoration activities, felling of riparian trees for use in in-stream habitat restoration activities, felling of riparian trees for conifer restoration planting, and removal of cedar spaults and other fish passage barriers.

Requirements for harvest within the floodplain if authorized outside June 1st – September 30th
Harvest operations must be completed by February before the soonest growing season, or coordinated with Forest Development, to facilitate regeneration efforts.
If authorized to haul beyond September 30th, the logger should only cut and deck what s/he can load out to a landing or truck within three days.
Stream crossings will be sized for permanent structure specifications in order to provide fish passage and reduce the likelihood of culvert failure. These structures/culverts may be required to be removed by the operator after harvest or removed after free to grow, depending on ID team requirements.
Equipment may not be stored for long-term on the floodplain outside the target dates, (ie one month or more while waiting for floodwaters to recede).
If impending floods are occurring, the OIC may require the operator to move equipment to higher ground.
No in-stream work will occur in fish-bearing streams outside the hydraulic window (June 1st- September 30th).

Timber Management Standards to Benefit Wildlife

Clearcut size is not expected to exceed 240 contiguous acres inclusive of Trust or Tribal ownership boundaries. However, exemption to this guideline will be site specific and vetted through the ID Team process. Mitigation measures will be attempted to be developed and once vetted through the ID Team, will be requirements of the specific timber sale. There could be instances where the size limit is unavoidable due to priority circumstances.

An area large enough to be considered a logical harvest unit will separate clearcut blocks. If more than 400' of a common perimeter has less than a 300' width of separation, then the units are considered to be contiguous and the acres will be combined to determine clearcut size. **(See Figure 3.2 and Appendix G)**

Harvest unit design will incorporate big game habitat needs by meeting at least one of the following:

a. At least 30% of the unit's perimeter is 30 years of age or older; or
b. At least 60% of the unit's perimeter is 15 years of age or older; or
c. At least 90% of the unit's perimeter is 4.5 feet tall or greater.

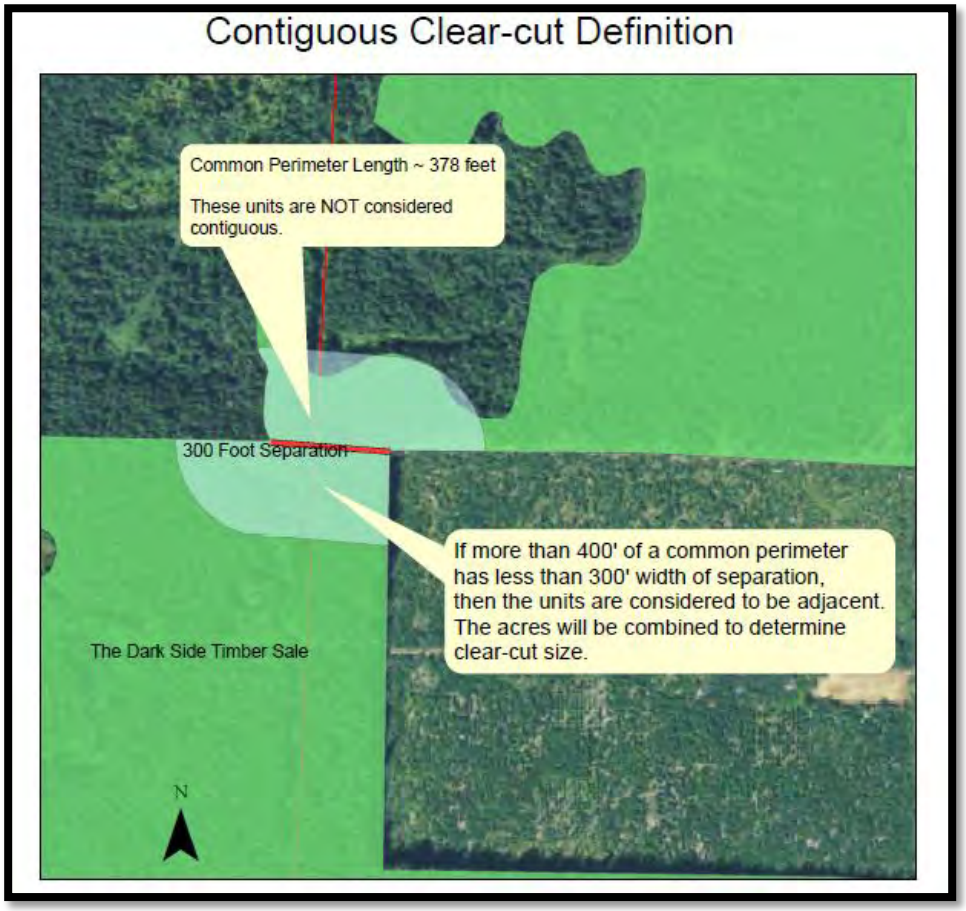
Non-tribal fee lands will be treated as a 30-year old stand.

When a proposed harvest may significantly degrade the forage and/or cover habitat of wildlife, the Wildlife Biologist may submit to the ID team an alternate harvest unit design, which will be considered through the ID Team process.

Wildlife Trees, Snags and Downed Wood

If a portion of the proposed clearcut harvest is greater than 800' from a designated leave area or other set aside of one acre or greater, green tree retention is required. A minimum of two green trees will be retained per acre for each acre that is greater than 800' from the set aside. Green trees must have a diameter at breast height of greater than 12 inches and be at least 6 feet tall. The pre-sale forester will work with the wildlife biologist to identify and tag trees to fulfill the green tree retention requirement.

Figure 3.2: Contiguous clear-cut example. These two units are not considered contiguous.



Two snags will be retained per acre where available. The size of each should be at least 10" in diameter and 10' in height. If snags present an occupational hazard, they may be cut with a feller-buncher to a minimum of 10' tall. Snags will be felled if they are less than two tree lengths from a road. If snags are not present, they may be created with a feller-buncher by cutting a green tree to a height the equipment can safely cut. The top of the tree may be harvested. Where possible, snags should be clumped in small groups and scattered across the landscape to prevent loss from fire and windthrow. When not in conflict with harvest operations, all remnant old growth snags will be retained.

Two downed logs will be left per acre following harvest. Downed wood will have a small-end diameter of 12" or greater and a length of 20' or greater. Live trees will not be felled to meet this requirement, unless the unit is determined to be deficient in downed wood. In that case, the ID Team may require some otherwise merchantable trees be left on the ground.

Helicopter Flight Restrictions

Protections for marbled Murrelets and northern spotted owls are limited to restricting helicopter flights below 500' over the conservation easements during the nesting season (March 1 through September 30).

Management for Cultural Resources

The Quinault Business Committee recognizes that there are areas on QIN owned lands where conditions meet mature-forest characteristics; these areas are of immeasurable value to the People. Areas that achieve these characteristics will be brought to the Committee for decision on whether they are to be harvested or set-aside.

Legacy Trees

Where available on QIN owned lands, legacy trees will be retained per timber sale. When legacy trees do not currently exist on QIN owned lands, potential legacy trees will be retained per timber sale. These trees are recognized as an important cultural investment by the Tribe to benefit future generations to be used for various cultural purposes (see Chapter 11: Cultural Resources). Western red cedar

Box 3.1: Terms and Definitions (for complete list see Glossary)

Legacy Tree: Legacy trees are defined as trees having achieved near-maximum size and age, which is significantly larger and older than the average trees in the stand. This distinguishes them from other residual trees which also have been spared from harvest but are not always larger and older than the average trees in the landscape. A legacy tree might possess some of the following characteristics: deeply furrowed bark, reiterated crown, basal fire-scars, platforms, cavities and one or more dead tops.

Mature forest : describes as stands with:
(i) A canopy closure of 60% or more and a layered, multispecies canopy where 50% or more of the canopy closure is provided by large overstory trees (typically, there should be at least 75 trees greater than 20 inches dbh per acre, or at least 35 trees 30 inches dbh or larger per acre); and
(ii) Three or more snags or trees 20 inches dbh or larger and 16 feet or more in height per acre with various deformities such as large cavities, broken tops, dwarf indications of decadence; and
(iii) More than two fallen trees 20 inches dbh or greater per acre and other woody debris on the ground.

is of highest priority. Across the unit, a minimum of 0.5 trees will be left per acre to be recruited as legacy trees (for example, 72 acre harvest unit will leave 36 trees as future legacy trees). In units where no suitable recruitment of legacy trees can be found, other suitable tree species will be chosen. These trees may be under-planted with cedar during reforestation. Legacy trees can be counted towards the green tree retention requirement and will be marked by the pre-sale forester during they layout process.

Unstable Slopes

Unstable slopes will be managed to minimize acceleration of the naturally occurring rate of landslides. Map 3.2 illustrates those known areas of shallow rapid mass-wasting events as well as those areas with low, moderate, and high susceptibility to mass-wasting. This map will be revised during the life of the plan using the most updated available data.

The Forest Practices Regulations will identify protection measures to safeguard slope stability if the following exist within a proposed harvest unit:

(vi) Inner gorges, convergent headwalls, and bedrock hollows steeper than 35 degrees (70%),
(vii) Toes of deep-seated landslides with slopes steeper than 33 degrees (65%),
(viii) Groundwater recharge areas for glacial deep-seated landslides,
(ix) Outer edge of a meander bend along a valley wall or high terrace of an unconfined meandering stream, or
(x) Areas that have the potential to threaten public safety, deliver sediment to a public resource, or threaten capital improvement.

Outside experts may be called upon if necessary to assist in developing protection measures and identifying unstable slopes.

Riparian Management Zones (RMZs)
Streams on the QIR are classified as either type D, type H, or type O waters. All waters have a 'riparian management zone' (RMZ) which is measured from the ordinary high water mark (OHWM) of the stream to an allotted amount, depending on the type of stream.

Management of Type D Waters:
Type D streams, those designated by the Quinault Indian Nation, include the following:

- Quinault River,
- Portion of the Queets River that flows through the QIR,
- Salmon River to the confluence point with the south fork of the Salmon River,
- Main stem of the Raft River to the confluence point with Meadow and Lunch Creeks,
- North fork of the Raft River to the confluence point with Wolf Creek,
- Main stem of Wreck Creek to the confluence point with the north fork of Wreck Creek,
- Main stem of the Moclips River to the confluence point with the north fork of the Moclips River,
- and Lake Quinault.

RMZs for type D waters: no-entry buffer of at least 200 feet in width measured from the OHWM.

Management of Type H waters:
Type H streams are those waters known to or presumed to provide fish habitat that are not classified as a type D stream. To meet the definition of a type H stream, a stream must have a defined channel with an average width of 2' or greater between the ordinary high water marks and a gradient of 16% or less.

For a type change from Type H stream to Type O due to gradient, the gradient must be 16% or greater for a minimum of 100 contiguous feet, at which point the break between Type H and Type O will occur at the initial 16% gradient point.

The presence of a waterfall 12 ft. or taller will be considered the break between a fish stream and non-fish stream.

Identified Large Type H Streams: No-entry buffer of 100 feet measured from the OHWM. See Map 2.3.

All other type H Streams: No-entry buffer of 80 feet measured from the OHWM.

The intent of these definitions is to protect fish habitat. The stream typing designation by the Hydraulics Officer will prevail unless overturned by the dispute resolution process.

Management of Type O waters:
Type O streams are those with a defined channel that are not classified as type D or H water. Where applicable (see **Table 3.3**), RMZs on these streams consist of a no-entry buffer of 50' measured horizontally from the ordinary high water mark.

Table 3.3: Management of Perennial type O Waters	
Stream Length	**Riparian Protection**
≥1000'	**50' no-entry buffer** measured from OHWM for 500' upstream of its junction with a type H or D stream or the determined fish-break point.
300'≤stream<1000'	**50' no-entry buffer** measured from OHWM for 300' or half the total length of the stream, whichever is greater, upstream of its junction with a type H or D stream or the determined fish-break point.
<300'	**50' no-entry buffer** measured from OHWM for the entire length upstream of its junction with a type H or D stream or the determined fish-break point.

Perennial type O streams entering type D or H waters will have a no-entry buffer of 50' measured from the junction of the type D or H stream water it flows into or the determined fish-break point, depending on its total length of perennial flow (**Table 3.3)**.

All perennial tributaries entering the buffered portion of these perennial type O streams will also receive a 50' no-entry buffer dependent upon total length as described above. A 30' equipment limitation zone, measured from the ordinary high water mark, will apply to non-buffered portions of these waters.

Perennial type O streams that do not enter a type D or H water will not receive a no-entry buffer; however, a 30' equipment limitation zone measured from the ordinary high water mark will apply for their entire length.

Side-slope seeps within 100' and connected by perennial overland flow to a perennial type O stream will receive a 50' no-entry buffer measured from the wetted edge of the spring.

Intermittent type O streams will not receive a no-entry buffer; however, a 30' equipment limitation zone measured from the ordinary high water mark will apply for their entire length.

Seeps, Springs or Headwalls
A 50' no-entry buffer will be applied to headwall seeps, headwall springs, and side-slope seeps with perennially saturated soils. This buffer will be measured from the outer perimeter of the perennially saturated soil zone.

Protections for Wetlands

Many wetlands exist on the QIR. Wetlands perform critical ecological functions such as providing wildlife habitat, water quality, and flood storage, all of which are beneficial to salmon.

A Wetland Management Plan will be developed within this 10-year planning period. Until this plan is finished, wetlands will be managed as follows:

Management of Forested Wetlands:
A forested wetland is any wetland or portion thereof that currently has, or at maturity will have, a crown closure of 30% or greater.

Forested wetlands will be harvested under the following conditions, as well as the conditions outlined in the section "**Areas with Site Index less than 100,**" unless otherwise approved by the ID Team.

- Harvest methods are limited to low-impact harvest or cable/tower systems. At least one end of the log will be suspended during cable yarding.
- Seed trees may be retained and will either be distributed across the stand at 2 to 15 trees per acre (if available) or clumped to facilitate regeneration efforts. If no suitable seed trees can be located and if suitable seed trees are lacking around the stand edge, then the area may be aerial seeded in conjunction with other forms of artificial regeneration.
- Non-merchantable trees will be left standing where feasible. Feasibility is partially based on how leave trees will impact regeneration and will be determined by the ID Team.

Box 3.3: Wetlands

"Wetland" or "wetlands" means areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. These wetlands provide many functional values in an ecosystem:

Stream bank protection. Stream bank vegetation absorbs the force of currents, protecting against erosion. Roots of wetland plants hold together stream banks.

Flood protection. By storing runoff from heavy rain and snowmelt, wetlands reduce flood damage.

Water quality protection. Wetlands store and filter pollutants such as sediment and the nutrients in sediment. Also, wetlands can transform some pollutants into non-polluting forms.

Groundwater recharge and discharge. Some wetlands recharge groundwater by moving surface water into the groundwater system. Groundwater discharge occurs when groundwater flows to the surface and into streams, lakes and wetlands. This discharge is especially important in summer by stream base flows critical to aquatic life.

Native Animal and plant habitat. Many animals spend their lives in wetlands, while others use wetlands for feeding, breeding, resting, nesting, escape cover, or travel corridors. Wetland plants provide food and shelter for many animal species. Many of the rare and culturally sensitive native plant species to the Quinault People are found in and in the forests surrounding wetlands.

Management of Non-Forested Wetlands:
A non-forested wetland is any wetland or portion thereof that currently has, or at maturity will have, a crown closure of less than 30%. These wetlands have been modeled in a GIS layer, which should be used in the pre-sale layout to identify potential wetlands in a proposed harvest unit. Protection measures are dependent upon size and are as follows:

- Non-forested wetlands greater than or equal to 5 acres in size will receive a 70' no-entry buffer for timber harvest measured from the edge of the non-forested portion of the wetland, or where crown cover is less than 30%.
- Non-forested wetlands greater than 1 acre but less than 5 acres in size will receive a 50' no-entry buffer for timber harvest measured from the edge of the non-forested portion of the wetland, or where crown cover is less than 30%.
- Non-forested wetlands between ½ acre and 1 acre in size will receive a 30' no-entry buffer for timber harvest measured from the edge of the non-forested portion of the wetland, or where the crown cover is less than 30%.

Wetlands associated with a fish-bearing stream will receive the same buffer as applied to the stream.

Management of Named Wetlands:
Five Named wetlands exist within the QIR- Chow Chow Prairie, Baker Prairie, Moses Prairie, Moclips Prairie, and O'Took Prairie. These wetlands are culturally and ecologically important and therefore will receive a **200' no-entry buffer** for timber harvest measured from the edge of the non-forested portion of the named wetland, or where crown cover is less than 30%. In the case that an already existing road is located within the 200' no-entry buffer of a named prairie, the buffer will extend through the road to the other side.

Management of Human-made Wetlands:
The ID Team will develop prescriptions for management of wetlands created as a result of past forest practices on a site-specific basis. In general, if the human-made wetland provides fish habitat, it should be maintained. If the human-made wetland is determined to not provide fish habitat, than the area should generally be restored to previous conditions.

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3.8 Site-Specific Management

Alternate plans allow Tribal and Trust Forestry to apply more site specific management flexibility than the timber harvest standards allow. Alternate plans are to be used to apply for a management plan that will maintain protection of the proposed unit's specific riparian and other ecological functions. If working within what would be considered an RMZ under general timber layout, a Fish Biologist will coordinate with the forester to ensure prescriptions meet minimal salmonid habitat requirements and protections.

Alternate plans may be used to create site-specific management to address forest needs such as:

a. Riparian restoration
b. Forest health (including but not limited to insect, disease and significant tree mortality)
c. Windthrow or other natural disasters
d. Fire salvage

Information Required in an Alternate Plan

Alternate plan proposals must include all of the following elements:

1. A map scaled to the size of the management unit showing the location of all affected streams, wetlands and other water bodies, unstable slopes, existing roads and roads proposed for construction, timber harvest units and other forest practices;
2. A written description of the site's environmental conditions. This should include: physical stream channel characteristics and in-stream fish habitat conditions; the health, age and structural conditions of the forest stand; geographic and/or other general factors that affect the site and are relevant to the management practices proposed by the alternate plan;
3. A description of how the alternate plan provides resource protection. This should include a description of the proposed alternate management and enhancement strategies;
4. A list of all Timber Harvest Standards that the alternate plan deviates from; and
5. When applicable, a description of the proposed implementation schedule and a monitoring and adaptive management strategy.

Alternate Plan Approval

An alternate plan proposal will be submitted to the ID team for review. The ID Team will conduct a site visit to help determine whether the management options outlined in the alternate plan provide adequate protection to natural resources. The ID Team will work to reach consensus on the efficacy of the plan. The ID Team will provide their collective professional opinion to the lead forester on the project. In some cases, the ID Team may approve some aspects of the plan and may recommend revisions to other parts of the plan.

Minimal Standards Required in an Alternate Plan

An alternate plan must include a minimum of a 30ft equipment limitation zone measured from the edge of the ordinary high water mark.

3.9 Timber Harvest Standards

While QNDR will continue to accommodate new technology for timber harvest, the following are the current systems used to log on the QIR.

Logging Systems
The selection of a logging system is based on:

- Ground conditions;
- Presence or absence of streams or wetlands;
- Soil conditions (e.g., low-lying wet areas with poor drainage that may be susceptible to compaction); or
- Type of product being harvested.

Cable harvest systems are targeted to be utilized on steep or broken topography (slopes of greater than 40% for longer than 200' measured from the top of the slope to the bottom), and may be used on soils that are wet or susceptible to compaction.

If approved by the officer in charge, shovel logging on slopes greater than 40% for longer than 200' measured from the top of the slope to the bottom may be utilized if a logging plan is presented outlining how soils and other resources will be protected through mitigation measures. The plan must be approved a week in advance by the officer in charge or approved during the pre-work meeting, and should be reviewed by the ID Team.

Felling & Bucking:
Timing of felling and bucking will be coordinated to reduce hazardous situations.

When harvesting trees on steep ground, faller safety shall be the primary consideration. Use comes secondarily as these large trees are felled and/or jacked into lead for yarding.

Cutting block design will consider the exclusion of hazardous falling and bucking situations such as steep, unstable slopes, and the presence of rock ledges. Trees will be felled and yarded away from the cutting block boundary lines, riparian and wetland buffers, and other excluded areas unless it is recommended that trees be felled to the lead to facilitate yarding as directed by the Officer in Charge.

Hazard trees in riparian or wetland buffers, outside of the cutting block boundary, or along transportation routes may be felled as directed by the Officer in Charge. Removal of a bearing tree or reference tree, if required for a hazard tree removal, would be done as directed by the Officer in Charge and in such a manner that the scribing and/or tags are preserved. Hazard trees that must be felled should be done so towards the stream channel and left as fish/wildlife habitat.

Feller bunchers will avoid rutting and soil compaction. If excessive rutting is occurring, operations will cease until the soils are not saturated. If rutting has occurred, the operator will need to mitigate the ruts by "fluffing" the skid trails with the grapples and if on steep ground may be required to also place some slash on the trail to prevent erosion concerns.

Skid/Shovel Trails:
The location of skid trails and skid operations will be designed to minimalize soil disturbance. Logging shovels will avoid rutting and soil compaction. If excessive rutting is occurring, operations will cease until the soils are not saturated. If rutting has occurred, the operator will need to mitigate the ruts by “fluffing” the skid trails with the grapples. If rutting has occurred on steep ground, the operator may be required to also place slash on the trail to prevent erosion concerns.

Skid trails are to be placed away from wildlife and cultural reserve trees. A slash mat should be kept under equipment.

Landings
The road design plan will be reviewed with the logging operator in order to minimize the number of landings and to ensure that landings are not larger than necessary for safe operation.

Landings will be located in well-drained areas. Slope the surface of the landing to drain water onto the forest floor. The number of landings is to be minimized, especially on steep slopes where large fills are necessary.

Avoid excessive cuts and fills, constructing landings on soils with potential for erosion, and constructing landings adjacent to streams or wetlands.

Landings should not be located in the following areas:
- Natural drainage channels
- Riparian buffers
- Within the 30’ ELZ of any stream.

Fill material used to construct landings should be free of loose stumps and other wood debris. Sufficient rock must be used on the surface of the landing and adequate drainage devices be installed if using the landing through the wet season.

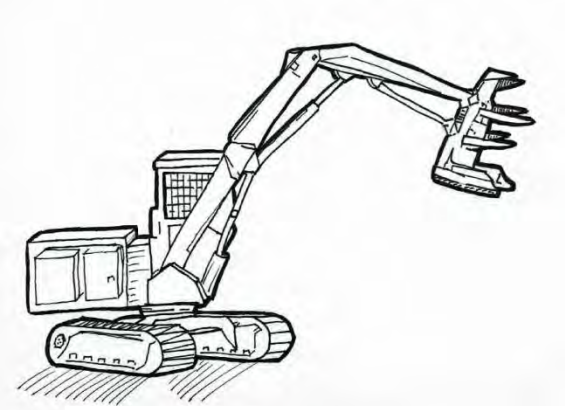


Illustration by Scott Kryskalla

Table 3.4: Yarding Methods and Restrictions
Wildlife snags shall not be left standing where they would constitute a hazard to personnel or running lines and equipment. Where operationally feasible, the snag should be cut to a height that would make it safe for retention (minimum height of 10ft). If not possible, they shall be felled and left on-site as designated by the wildlife biologist.
Yarding in cedar salvage sales is accomplished either by helicopter or by hand packing cedar products to the road. Heavy equipment can be used along roadsides for old landings or decks of cedar.
Any use of rubber-tired vehicles and tractors must be pre-approved by the ID Team. Designated skid roads would be mapped and flagged on the ground to minimize impacts. Restoration of skid roads may be necessary after logging is completed.
Total openings resulting from yarding corridors within riparian buffers must not exceed 20% of the stream length associated with the harvest operation (this percentage is intended to be a limitation on a per harvest unit basis). These corridors will be no wider or more numerous than necessary to accommodate safe and efficient transport of logs.
Ground-based machines approved by the Officer in Charge, such as hydraulic shovels are used wherever on-site conditions permit and are required to operate on a mat of slash while off-road and observe any equipment limitation zones.
Shovel yarding distances will not exceed 600 feet unless approved by the officer in charge.
Landing or roadside sorting and decking areas within 100 feet of flowing water must be avoided. However, in some cases, it may be necessary and will require prior approval by the Officer in Charge. Cases are: 1. Constructing a new road through non-tribal fee land where clearing limits have been identified and marked; 2. Pre-roading activity where the standing timber may not be felled for quite some time; 3. When terrain and ownership/property lines limit where sorting and decking can occur.
It may be necessary to pile and burn roadside slash.
On QIN owned units, any logs or wood pieces, except cedar, may be harvested for firewood by permit.
Cable yarding machinery (tower, line, carriage) will be fitted to the terrain, stream, and wetland protection areas, yarding distances, and timber size.
All operating lines and running blocks, with the exception of chokers, carriage tag lines, and tower guy lines and blocks, will be suspended above the ground and clear of logging debris and snags during periods of high fire danger.
Avoid throwing cull material over the edge of the landing on steep slopes. Pile the material on or near the landing for burning.

3.10 Post-harvest Standards

Mechanical Site Preparation for Pile Burning
Mechanical site preparation includes the use of low ground pressure, tracked machinery designed to either pile brush and/or logging slash, or to disturb the soil thus reducing the slash and/or vegetation for the creation of a planting spot. Mechanical site preparation activity is usually confined to the dry soil season months, generally June through October, to reduce the impacts of soil compaction.

The specifications for treating logging slash and/or brush are as follows:

- All logging debris within 100 feet of the running surface of any state or Federal highway, county road, railroad, or any road specified by the QIN Fire Management Officer must be pulled back and piled or scattered as determined by the officer in charge to produce a remaining average volume of forest debris of no greater than 9 tons to the acre of material, 3 inches or less in diameter. No pile should be located within 75 feet of the running surface of these roadways, or within 50 feet of the drip-line along the edge of the cutting block boundary, leave trees, snags, or riparian buffers.
- All logging debris concentrated along roads as a result of harvest must be treated, as directed by the officer in charge, to expose a total of at least 300 planting spots per acre.
- When a pre-plant exam determines there are less than 200 well distributed planting spots per acre, an adequate amount of the slash (under 4-inch diameter material) and noncommercial trees and brush may be piled so as to expose at least 300 distributed planting spots per acre.
- All living material (brush and/or noncommercial tree species) pulled out of the ground shall be shaken so as to remove as much dirt from the root system as possible before being piled.
- Piles may be placed at random with a minimum pile size of 10 feet in diameter by 4 feet in height. Piles should not exceed 40 feet in diameter. No pile width may be wider than ½ the height. Windrowing, piling on top of stumps, and piling stumps is forbidden. Distance between piles shall be a minimum of 10 feet. All material 8 feet or longer must be piled parallel within the pile.

Pile Burning

- Treatment must occur when fuel moisture in 10-hours fuels is greater than 13% and significant rainfall (at least .25 inches) has developed to reduce the risk of the fire spreading to surrounding fuels.
- Field inspection is completed on each unit scheduled for pile burning.
    - Access roads are flagged.
    - Piles are counted and measured for calculated tonnage.
    - Maps are produced.
    - Burn plans completed.
- Special safety regulations are followed when burning next to mainlines or public roads (See Job Hazard Analysis on file at QDNR).
- Every effort will be made to minimize impacts to local communities.

3.11 Specialized Forest Products Management

Specialized forest products are managed to provide and protect the opportunities for the gathering of cultural resources and provide and protect the opportunities for the commercial harvest of specialized minor forest products by tribal members.

On allotted trust land, the BIA schedules cedar salvage activities in response to owner request. Sale preparation, execution, and administration will conform to 25 CFR 163, agency procedures, and QIN applicable law and procedures.

Prior to any harvest, a QIN Forest Practices Application (FPA) must be approved and, if the unit is within 200' of a body of water, an approved QIN Hydraulic Project Application (HPA) is also required.

Box 3.4:Terms and Definitions
Cedar salvage: means the harvest of blocks from dead and downed cedar logs or stumps.

Snag: Any dead tree at least 10 inches in dbh and at least 10 feet tall. Snags are not available for cedar salvage.

QIN Cedar Salvage

The Quinault Indian Nation, through the Division of Natural Resources, determined minimum guidelines for the harvesting of specialized forest products from the Quinault Indian Reservation. Additional information on QIN policies and procedures regarding western red cedar salvage and other specialized minor forest products can be found in the **Lower Reservation Cedar Salvage Operations Manual.**

Program Goals:

- Implement the cedar salvage program in a consistent manner;
- Provide opportunities for long-term employment to tribal members (see resolution 15-06(a)-93)
- Promote cedar salvage entrepreneurship within the tribal membership;
- Manage the cedar salvage resources in an effective and efficient manner; and
- Reserve cultural use areas for exclusive use by tribal members.

Cedar Salvage Standards

Riparian Areas
The same standards that apply to green timber harvest will apply to cedar salvage harvest with regards to riparian management and protections, except in the case of Type-O intermittent streams, which receive a 25 ft no-entry buffer measured from the edge of the OHWM.

Table 3.5: Riparian Management Zones, Cedar Salvage

Riparian Buffer Widths[1]	
Stream Type	Width (feet)
Type D	200 ft
Type H	80-100 ft[2]
Perennial Type O	50 ft[3]

[1]Measured from the ordinary high water mark
[2] Identified Type H streams that receive a no-entry buffer of 100 feet under green timber Harvest will also receive a 100' no-entry buffer in cedar salvage.
[3] Type O streams receive a buffer where the stream would receive a buffer under green tree harvest rules.

Management of Wetlands:
During the sale layout, the wetland GIS layer will be consulted to see if a wetland exists within the unit. If a wetland exists but is not field verified, it may need to be verified by an ID Team member. The same standards that apply to green timber harvest will apply to cedar salvage harvest with regards to wetland management.

A non-forested wetland is any wetland or portion thereof that currently has, or at maturity will have, a crown closure of less than 30%.

Table 3.6: Wetland Management Zones, Cedar Salvage

Wetland Category	Wetland Buffer Zone (No-Entry)[1/2]
Non-forested Wetlands	≥ 5 acres: 70 ft 1-5 acres: 50 ft 0.5- <1 acre: 30 ft
Named Wetlands[3]	200 ft
Manmade Wetlands	Evaluated by the ID team.

[1]No-entry buffers measured horizontally from the non-forested edge.
[2]Wetlands associated with a fish-bearing stream will receive the same buffer applied to the stream.
[3]Five named wetlands exist on the QIR- Chow Chow, Baker, Moses, Moclips, and O'Took.

Hazard Trees
All snags will be retained unless posing an occupational hazard to cedar salvage operations. Authorization will be obtained from the OIC prior to removal and the downed snag will not be available for salvage.

Hauls and Flights
All haul routes must be pre-approved in writing by the Officer in Charge and a haul permit must be obtained prior to haul.

The operator is responsible for completing all road maintenance or reconstruction that may be necessary within the proposed harvest unit.

Protections for federally protected wildlife species are limited to restricting helicopter flights **below 500' over the conservation easements** during the nesting season (**March 1 through September 30**).

3.12 Contract Policies

The following are policies and standards related to the timber sale contract.

Product Size and Merchantability Standards
Product size and merchantability standards are listed by species in the timber sale contract developed for each timber sale. Following are the general specifications used in the contract for sawlogs:

Minimum length: 8 feet
Minimum scaling diameter: 5 inches
Minimum net scale in % of gross scale: 33 1/3%
Minimum net scale: 10 board feet
Number of minimum size products per tree: two

Individual Trust sales are usually based on predetermined volumes, with lump sum payments required prior to cutting and periodically throughout the contract period regardless of whether or not the purchaser removes the volume.

Tribal sales are usually scaled sales and, on that basis, rules published by the Northwest Log Rules Advisory Group determine the scaled volume of a given timber sale. Low market wood (usually pulp) may be left in the woods or at the landings as conditions dictate. Free use firewood permits are available to tribal members on QIN owned allotments.

Cedar salvage may be sold on a per cord basis as shake material with a 24-inch minimum length; Flatsaw with a 24-inch minimum length (in wood not qualifying as shake material); and Shingle with a 16-inch minimum length (in wood not qualifying as shake material). Cedar salvage may also be sold as a lump sum.

Market Area and Solicitation Policy
Timber from Individual Trust land is usually sold lump sum on the open market to the highest bidder. The BIA maintains an extensive mailing list of potential bidders who have requested information on future timber sales. Prospectuses are sent to those on the mailing list and a number of local U.S. Post Offices and other BIA agencies within the Northwest Regional Area. Furthermore, an advertisement is run in one to three local newspapers.

Tribal sales are marketed through QLTE to a number of markets in western Washington, Oregon, and Pacific Rim countries in Asia. Individual Trust timber sale purchasers use those same marketing areas. Marketing responsibility may change during the life of the plan.

Cedar Salvage sales are primarily sold lump sum by the BIA to local Grays Harbor area operators. The processes for appraisal and mailing of prospectuses to potential bidders and the newspaper advertisement are similar to that of green-timber sales.

Under a current Tribal Resolution, tribal cedar salvage sales are sold to tribal members that are on the established salvage operator list. Paid Permits can be either lump sum or stumpage paid on scale at the time of “flyout.” Flyout refers to the time of helicopter yarding of slings of material to a prearranged scaling location. QDNR staff is present to verify the

volumes removed if sold as a scaled permit. Tribal Salvage sales are transitioning to all lump sum permits.

Scaling Policies

Most BIA sales are predetermined volume sales; therefore, the timber cruise becomes the means of final volume determination. No further scaling is required. Prospective purchasers may contract for scaling services separately, if required.

Tribal sales are usually marketed as scaled sales through QLTE. Scaling is done primarily through the Pacific Rim Scaling Bureau. The current Log Scaling & Grading Rules for the bureaus is included by reference in the timber sale contract.

Scaling services are provided at a variety of designated sites, depending on log destination.

Weekly scale summaries and load tickets are provided to the QDNR Forestry Clerk, who compiles them in a database. Volumes are reconciled quarterly with QLTE delivery schedules prior to issuing stumpage invoices.

When sold as a scaled permit, the QIN Forestry Officer in Charge scales cedar salvage products at the time of flyout. Operators and the helicopter company must previously notify the BIA and QDNR of scheduled flyouts so that the Officer in Charge may be present at the scaling location when the products are flown from the forest. The volume (in cords) of product is verified at the time of flyout. Tribal salvage permits are transitioning to all lump sum permits; all permits will likely be lump sum payments by the end of the life of this plan.

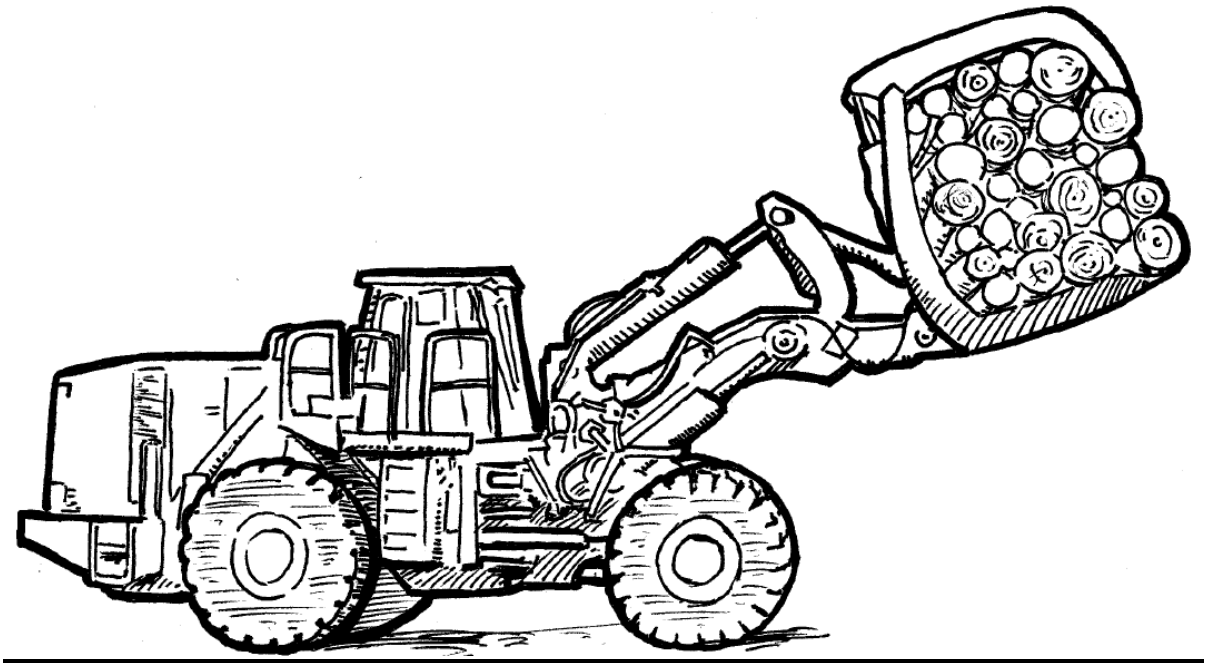


Illustration by Scott Kryskalla

Chapter 4: Roads and Mineral Pits Management

This chapter defines BIA Forest Roads, describes the evolution of the QIR's forest roads and their current condition, lists the goals and objectives for managing the roads, and describes the construction/reconstruction and maintenance standards. Finally, this chapter defines the difference between road closure and road abandonment, delineates the different types of closure and the conditions under which closure occurs, describes procedures for emergency road maintenance and describes the procedures for road closure.

4.1 Roads Management

Goals for BIA Forest Road System on the QIR

1. Provide efficient access for management activities for all ownerships.
2. Minimize water crossings and separate forest road systems from streams and other bodies of water.
3. Limit stream crossings and ensure that they meet fish passage standards for all life stages of fish.
4. Control erosion by various means to minimize sediment delivery to streams.
5. Protect fish habitat, water quality, and financial investments by properly maintaining roads.
6. Avoid sediment delivery to streams by controlling water runoff and diverting it to the forest floor.
7. Minimize soil disturbance so that road construction activity creates little or no erosion or sediment delivery to streams.

In order to meet these goals, a QIR Road Management Plan will be developed and implemented for all roads on the QIR within the life of this forest management plan. The Road Management Plan will include provisions for:

- Inventory of all QIR roads and assessment of their condition,
- Removing all artificial fish passage barriers that exist on QIR roads as identified by the culvert inventory,
- Permanent bridges and culverts will be installed so that woody debris will pass through unobstructed,
- Planning and implementation of a proper maintenance plan for existing roads,
- Develop prioritization of road repair projects,
- Abandonment of roads that cannot be brought up to standard,
- Minimizing new road construction through consideration of existing roads,
- Ensuring drainage structures meet 100-year flood levels, and
- Best management practices for road construction, maintenance and hauling.

Box 4. 1: Definitions of Forest Roads.
The BIA Forest Roads System includes forestry and logging roads whose access may be restricted to only natural resource management purposes including primary, secondary, and spur roads.

Primary Roads include forestry and logging roads whose access may be restricted to only natural resource management purposes when identified by the ID team to be necessary. These roads can also be used for cultural access and management of cultural resources on the reservation as well.

Secondary Roads are designed and constructed for the purpose of timber haul. The construction standard of each segment depends upon how much timber volume was under that particular contract. Besides the transportation of forest products, these roads provide access for forestry crews while managing forest products. Secondary roads also provide an avenue for tribal members to hunt, fish, and to find and enjoy culturally important sites.

Any secondary road constructed under this plan will meet the following requirements if it will remain open post-harvest:

- They will be surfaced for all weather use.
- They will have drainage structures, i.e. culverts, bridges, and ditches that are installed to allow for the passage of water and fish.
- They will be used for multiple entries to harvest forest products---especially for timber and cedar salvage harvest.
- If necessary, vertical and horizontal curves will be engineered.

History of Management on QIR Forest Roads
The forest road system was built to provide access to the timber on individual trust allotments. Harvest involved either large blocks of timber under combined allotment timber sales or single allotments. The combining of allotments allowed the amortization of road construction costs; single allotment sales carried the burden of the cost of road construction on the volume harvested from the particular allotment. Roads to the larger logging units (i.e., Crane Creek, Taholah, etc.) were built under the cost umbrella of a master timber sale contract that mandated submission of a road construction plan. Single allotment timber harvest tended to be less focused on the development of a complete road system.

The areas logged south of the Quinault River were (nearly all) completed between the 1920s and late 1940s. The fire access roads (F Roads) were built because, during the logging of the southern portion of the QIR, several forest fires forced the need for access roads. These F Roads were some of the original truck roads built on the QIR. By the mid-1970s, many of the original roads had become impassable. Road construction standards prior to the 1960s were far less than what is currently acceptable. The road system was managed piecemeal until the roads that were built to access the two remaining large logging units (Crane Creek and Taholah) were about to become orphaned because of the expiration of these two contracts.

When the BIA assumed the responsibility of road management, the QIR road system was not treated as a system. The system was a mix of logging access methodologies consisting of several railroad grades that had been converted to truck roads, a few truck roads built for logging allotments located outside of areas under the large contracts, and several fire access roads built by the BIA.

The North Boundary Area (NBA) was received in trust by the BIA for the QIN in 1988 from the Olympic National Forest. The U. S. Forest Service managed this area for multiple use and roaded it to provide public access to the entire NBA. The roads were built for multiple entries and include standard construction/maintenance specifications for public and commercial traffic safety. Forest Service road maintenance prior to 1988 was adequately funded but primarily through the activities of timber sales.

Historically, the BIA has never been funded the cost of road maintenance on the QIR. Maintenance was a burden that was not performed unless a long-term contract covered the roads in question—in which case, the purchaser was held responsible for maintenance. With the closure of the long-term timber contracts, the BIA proposed to assume the management of the road system in 1984. It was agreed upon that the BIA would issue individual road-use permits allowing the use of the existing roads and would collect deferred maintenance fees and road-user fees from commercial timber and gravel haul operations.

The road system that is maintained has been gradually upgraded through requirements placed on individual road users either through the respective timber contract or the road-use agreement that is issued. Work performed by the road user is completed as a condition of haul. The maintenance fees are treated as a revolving access road-maintenance fund. Funds collected are used on all roads on the lower reservation as necessary. By definition, most of the monies are applied to mainline roads for routine maintenance (primarily grading, ditching, brushing, and culvert replacement/upgrade).

Work on a given haul route that is completed prior to the sale of allotted timber is also accomplished using the road-maintenance fund. In this case, the roads (generally mainline) that are to be used for haul for a given timber sale are upgraded as directed by the BIA. The advantage of performing work prior to a timber sale is that the BIA can deal directly with a road-maintenance contractor rather than a purchaser representative whose primary motive is to move logs from the unit to market. The purchaser also benefits because the roads are ready for haul without delay at a cost that is built into the contract. The purchaser pays the cost of the upgrade to reimburse the road-maintenance fund at the time of the timber sale.

Box 4. 1: Definitions of Forest Roads (continued)

Spur Roads are usually constructed for one entry only for an activity such as a clearcut harvest. These roads are not engineered and usually do not have all of the common construction items described for secondary roads. Spur roads are normally located to avoid fish bearing streams. Regardless of their location, they will have installed drainage that will permit water flow and fish passage. Spur roads may be closed following completion of required forest practice operations. Some spur roads will be closed by the logger, some will be closed after free-to-grow status is achieved, and others may not be closed and left open for further stand management activities or access to other timber stands.

Right-of-Way is the legal right to cross tribal land or individually owned Indian land for a specific purpose, including but not limited to building and operating a line or road. This term may also refer to the land subject to the grant of right-of-way. Right of way for forest management activities is coordinated by the BIA.

Current Condition of Forest Roads
The forest road system consists of roads constructed over individual trust allotments, QIN allotments, and over allotted lands that have been purchased in fee by individuals and/or timber companies. The BIA assumed administration of all roads within the QIR (except roads that are completely within a given fee ownership) because of the fragmented ownership of the QIR. The consolidation of road management was necessary because of the amount of time necessary to contact all individual owners on a given road segment in order to haul commercial forest products when, in fact, all owners would eventually need the same permission for the haul of their forest products.

As stated in the discussion concerning the evolution of management of forest roads on the QIR, the road management system in use today is the culmination of a series of meetings between all beneficial parties. The beneficial parties include all persons who own forest-land and who have plans to someday take advantage of the value of the resource. The timber represents a sustainable resource that will provide income for many generations. To reap the benefits of forest management, access to the resource will always have to be considered an investment for the landowners.

Methods and Responsibilities for Monitoring and Reporting Road Conditions
Road conditions are monitored by QIN and BIA employees and others who report the conditions to the BIA. The BIA acts as coordinator and lead in accomplishing necessary road repair on an “as needed” basis.

Current Standards for Condition Rating
The BIA will not allow commercial haul on a substandard road. This principle was adopted to apply to all phases of commercial haul and includes being cognizant of the condition of the particular road surface, ditch-lines, culverts, and bridges.

The QIN/BIA forest roads manager is the focal point for road management and permit issues. When a harvest action is planned or a request for road use is received, the road manager assesses the roads proposed for use and determines whether or not the road needs work prior to product haul. Work required to bring the particular road(s) into compliance is then written into the timber harvest contract or is a condition the Road Use Agreement.

Road users have historically been the primary source of road improvement work on the QIR. However, there are a number of road related issues that impact the environment, specifically fish passage. The QIN/BIA forest roads manager consistently seeks outside sources for funding specific projects. These sources include road rehabilitation funds available through grants.

The rating for a proposed road is given in terms of requirements necessary to access each particular sale. This work may be performed prior to the sale and billed to the purchaser or may be a contractual requirement. Road standards are reviewed for adequacy in terms of resource protection with considerable discussion concerning the overall goals and objectives of the transportation system.

Permitting Process
Timber and/or gravel haul on existing roads within the QIR require that the road user enter into a Road Use Agreement that is prepared by the QIN/BIA forest roads manager or that the roads planned for use be addressed in a timber contract prepared by the QDNR (harvest on tribal land) or the BIA (harvest on individually owned trust land). In each instance, the BIA-Taholah Agency Superintendent must approve the document.

When new road construction is necessary on trust lands, the affected individual landowners are contacted by the BIA-Taholah Agency for permission. Once Power of Attorney is granted, a revocable permit may be issued by the Superintendent. Location and road construction standards are addressed in the revocable permit.

Road Management Guidelines
Road Location
Road location is identified by the QIN/BIA forester as part of the sample contract/permit, including centerline flagging and determination of the volume of surface material needed for road construction. If the purchaser and/or operator wish to vary from the proposed road location, they must submit a detailed road location plan to the Officer in Charge and centerline flag the location within 30 days of contract approval. The Officer in Charge will approve or disapprove the proposal with input from the ID team.

The size and type of stream crossing structures and drainage structures will be determined by the hydraulics officer and the QIN/BIA forest roads manager.

Road location will consider the following:
- Reduce duplication of roads. Investigate using existing roads across another ownership before constructing new roads. Consider using an existing road if it is in the appropriate location and fits the needs of the project. Consider using an existing road if new construction will have more impacts on resources than using the existing road.
- Locate roads where the risk of sediment entering water is minimized and where there will be the least disturbance to stream channels, lakes, wetlands, and floodplains.
- Choose location for roads that limits water crossings.
- Minimize the risk of slope collapses or slides.
- Avoid or minimize roads in the following locations:
    - On side slopes greater than 60%,
    - On unstable slopes and landforms,
    - In areas with a history of road failures or slides,
    - Within 300’ of a typed water or wetland, or
    - Where seeps or springs are evident.
- When unavoidable, roads located in slide-prone areas, will be constructed of a full bench approach and waste will be end-hauled to an approved designated site.
- Road should include adequate drainage.
- End-hauling may be required if there is potential for displaced material to enter a wetland or typed stream or in full bench areas.
- Ensure the sub-grade can support log and rock haul.
- Avoid creating sunken roads, which are lower than the surrounding ground level.
- Design road shape (crowned, inslope, outslope) to support the anticipated haul of timber, rock, or other forest products.

Stream Crossings

Stream crossings should be limited and roads should find optimal water crossings first. Wetlands, including forested wetlands, should be avoided when planning roads. Natural topography should be utilized to keep runoff out of streams and in some cases where topographic benches exist, should be used to disconnect stream crossings and landings. Natural grade breaks should be where drainage structures are located. Waste material must me end-hauled to an approved waste site when constructing roads adjacent to or on side slopes greater than 60%.

Road Construction and Maintenance

The provisions of timber sale contracts govern most road construction, reconstruction, and maintenance on all Individual Trust and Tribal timber sales.

Roads are to be constructed when moisture and soil conditions are not likely to result in excessive erosion or soil movement, but have sufficient moisture to achieve proper compaction. Advance planning and use of the right equipment will minimize the construction footprint and reduce the cost of mitigating soil disturbance. The intended use of the road in construction should be considered and the road built to accommodate that use. The surface of roads should be surfaced to provide all-weather access, reduce road maintenance costs, and improve water quality protection. The road sub-grade should be compacted, to ensure a solid structure with minimal potential for failure, and furthermore extends the life of the road surface, and reduces sediment runoff. Non compacted roads should be given several weeks to settle before log-haul or heavy truck use takes place.

Maintenance requirements extend for the life of the contract, and include cleaning and opening culverts, brushing and cleaning ditches, surface blading, spot rocking of soft spots in the road surface, replacement of old or damaged culverts, cleanup of slides or slumps, and other road protection measures.

The following best management practices should be followed for road maintenance work:

- Grade roads before the surface reaches severe stages of pothole formation, washboarding, or water begins to pool.
- Mark culverts on the ground before grading.
- Avoid grading roads unnecessarily or when soils are saturated or excessively dry.
- Install and/or replace culverts during the dry season.
- Remove debris from culverts during the dry season, unless deemed an emergency. Remove wood from the culvert inlet and relocate downstream in a way where it interacts with the stream but does not inhibit fish passage as directed by the hydraulics officer.
- Check road surface material prior to harvest or heavy use, and especially during the rainy season; additional surfacing material may be needed.
- Do not use roads during excessively wet or freeze/thaw conditions.
- Reduce any sediment that has the potential to enter streams or wetlands; measures include using fabric or spreading straw to stabilize surfaces prone to erosion and not using the road.
- Exposed soil can be seeded with native grass along roadsides to help control erosion, provide forage, and minimize vegetation maintenance costs if work is done within the seeding window (February 1- May 1 and September 1- October 15).
- Control roadside vegetation where it interferes with drainage. If using chemicals, keep them away from streams and wetlands unless manufactured for approved aquatic use.

- When plowing snow, leave 2 to 4" on the surface and provide breaks in the snow berm to allow road drainage. Avoid locating breaks where runoff will drain to a wetland or stream.
- Any downed wood that blocks vehicular traffic on stream-adjacent parallel roads will be removed and placed on the side of the road closest to the adjacent water.

Emergency means an immediate threat to life, public or private property, or an immediate threat of serious environmental degradation, arising from weather or stream flow conditions, other natural conditions, or fire.

Emergency Road Maintenance

Emergency road repairs including replacement of stream crossing structures can be done outside of the normal operating season (June 1st to September 30th) when the storm damage blocks primary access routes to communities and services; or, if the storm damage, left unchecked, would lead to further aquatic habitat degradation due to ongoing erosion and unchecked sediment input to streams. The landowner or operator shall seek approval from the Division prior to commencing work, and the Division shall immediately upon request issue a verbal decision to approve or deny for emergency road repairs. See Title 61 for the complete code regarding approval for emergency permits.

Drainage & Erosion Control

- Construct a crowned road—sloped to both sides from the centerline at 3 to 5%-- for high use roads, when drainage structures can be routinely maintained, on double-lane main haul routes, or in areas that experience slippery or icy road conditions.
- Construct an outsloped road—sloped from the cutslope to outside road edge 3 to 5%-- on gentle grades (<8%), when maintaining drainage structures is not feasible, on low use or unused roads, or in areas where the outlsope can be maintained to prevent rutting.
- Construct an insloped road—sloped from the outside edge to the ditch 3 to 5%-- when surface drainage needs to be carried to a ditch line, if outsloping would cause fill erosion, to avoid runoff from directly entering a stream, in areas that experience slippery road conditions, or on steeper road grades.
- Avoid sediment delivery to all streams. Even the smallest streams carry sediment down to fish habitat.
- Place cross-drains in locations to take water off the road surface quickly and direct runoff to a stable, forest floor for filtering and dissipation.
- Reduce sedimentation by:
    - Building check dams in ditch lines,
    - Installing slash filter wind rows on fill slopes below the road,
    - Installing a double ditch to carry water over stream crossings, or
    - Placing straw wattles, silt fencing, logs in road ditches perpendicular to the slope to filter and slow flow.
- Stabilize soils disturbed by construction, especially near stream crossings.
- Cover exposed soils with bio-matting, straw, tree boughs, or hydro mulching to prevent rain drop erosion and loosening soils.
- Re-vegetate all exposed soils with non-invasive locally native plants or native seed.
- Schedule construction during dry conditions only.

Hauling Policies, Safety, and Routing

Haul routes are an important part of the overall timber sale process because of the need to calculate with some degree of accuracy the amount of road-use fees and road-maintenance fees or allowances. Hauling routes and periods for all timber sales are addressed in detail in the contract and during the preparation of the Logging Plan of Operations for each sale or unit.

Coordination of hauling is accomplished if operations on adjacent ownerships are involved.

The BIA has oversight authority in these cases. Each log truck must have a load ticket stapled to the rear of the load when it leaves the landing; a “mule train” trailer for short logs or pulp must also have a separate load ticket. Depending on the destination of cedar products, a QIR haul permit and a Washington State haul permit may be required.

Seasonal restrictions in periods of high fire danger or during wet weather are also addressed in the Plan of Operations.

Road Closures

Timber sale roads are usually kept open for at least 1 year after completion of harvest to allow for necessary slash disposal and tree planting work to be completed. Following reforestation, secondary and spur roads may be closed to protect natural resources. These include wildlife management, resource or personal property theft, risk of mid-slope road failure, stream adjacent parallel roads, roads in special management areas, roads on unstable ground, roads not needed for management of the forest lands, etc. A road plan will be created for each harvest unit to determine which roads will be closed. A secondary or spur road may remain open if the ID team determines it necessary.

To close a road means to restrict motor vehicle traffic by means of a ditch, gate, cement barrier, or guardrail, but does not require the removal of culverts and bridges. However, culverts requiring annual debris removal or showing signs of frequent (every year or two) overflow resulting in road/ditch erosion will be removed or replaced with properly sized culverts or bridges. Road closures may be temporary, seasonal, or long term as determined by the ID team.

Temporary closures are roads that are closed for a short period of time to all vehicle traffic by a removable structure, such as a gate or berm. A temporary road closure is usually necessitated by a resource activity such as a timber sale.

Seasonal closures are roads that are closed to all vehicle traffic by a removable structure for a specific period of time. The Director of QDNR sets the time period based on input from resource managers. An example of a seasonal road closure is closing the road for hunting season.

Long Term closures are roads that are closed to all vehicular traffic by reclamation of the road, by installation of a road closure ditch, or by placing a non-removable structure across the road surface. Long-term closure of a road requires thorough review of existing ditches and drainage functions for possible removal or management.

Table 4.1: Drainage Structures used on the QIN	
Ditches	a) Ditch water should not flow directly into streams and/or wetlands. b) Ditch water should be directed towards the forest floor or other vegetated areas at regular intervals through ditch-outs or relief culverts. c) Use sediment traps in ditch lines if water cannot be diverted to the forest floor so flow can filter before entering stream or wetland courses. d) Seed exposed soils on road edges with native grasses to minimize surface runoff.
Relief Culverts	a) Install relief culverts to manage and control ditch water. b) Relief culverts must be at least 18" in diameter. c) Install cross-drains or ditch relief culverts on crowned or in-sloped roads to divert water and sediment away from streams and onto the forest floor. d) Protect steep slopes and erodible fill at drainage structure outfalls with flumes to carry the water to a safe location or use energy dissipaters such as large rocks or heavy wood material. e) Drainage structures should be installed: ▪ As close to the stream as possible, ▪ In natural drainage area for seeps and springs, ▪ In a location that prevents piracy of water from one basin to another, ▪ At the bottom of vertical curves, or ▪ Where there is evidence of insufficient drainage.
Water Bars	a) Use water bars to divert water from ditches and the road surface. b) Install so that water bar runs the width of the road surface and is sufficient to drain water to a ditch, the forest floor, or a vegetated surface. c) Use energy dissipaters, such as rocks, at the outlet to minimize erosion. d) Most effective on low-use roads.
Rolling Dip	a) Slope to carry water to the outside edge of the road. b) Use energy dissipaters, such as rocks, at the outlet to minimize erosion. c) Construct to accommodate truck haul if that is the intended use.
Berms	a) Construct using a grader to create short earthen barriers along the edge of the road. b) Use where a road parallels a stream or wetland. c) Should be kept to a minimum length. d) And water that flows along the berm edge need to be routed to the forest floor in an area that will not affect a stream or wetland.
Ditch Out	a) Use when the terrain allows ditch water to be drained away from the road on the same side the ditch is on. b) Use on ridge tops and switchbacks. c) Do not use where water will drain towards an unstable slope or directly into a stream or wetland.

Procedures for closure:
The ID Team will review closure projects or activities prior to implementation of closure. Future needs will be considered prior to closure, such as, forest regeneration activities, fertilization or conifer release activities, potential thinning or salvage activities, special minor forest product harvest, habitat restoration and enhancement activities, hunting and fishing access, or other use by tribal members. Considered as well is the cost and/or risk of leaving the road open.

Roads proposed for reclamation will be inventoried for necessary road stabilization and proper drainage. Stabilization and proper drainage will be accomplished prior to the placement of a non-removable structure or a road closure ditch. Ditches will be constructed with a backhoe or other mechanized ditch construction equipment.

Secondary road closures will leave room for a vehicle to turn-around.

Road Abandonment
To abandon a road means to permanently close it by preparing the ground for vegetative growth and to revert to its original profile. Abandoning the road includes removing ditch lines, culverts, and bridges; stabilizing cut and fill slopes; and (where necessary to prevent erosion) seeding, fertilizing, and mulching of bare mineral soil (and other ID Team approved measures). Roads to be considered for abandonment will be those with chronic problems that require frequent maintenance to protect public resources such as those:

- Adjacent to a stream,
- Within a riparian management zone,
- Inhibiting natural stream processes,
- With areas of uncontrollable erosion and/or sediment delivery to typed waters,
- Water crossing failures, or
- Cut and fill slope failures.

Box 4.1: Procedures for Abandonment **If the ID team determines a road should be abandoned, the following must be completed:**
Remove side cast and fills if failures have the potential to damage a public resource or pose a risk to public safety. Areas to look for include cracks and/or slumps in the road surface or shoulder, unstable slopes or landforms, and areas where the weight and volume of side cast material could cause a slide. This material should be end hauled to a stable location or placed against the cut slope or in another stable location. Material should not be placed in areas on the road surface that will allow water to pond or on the road surface of steep slopes in high rainfall areas. This material will become saturated and unstable.
Remove water crossing structures to restore the natural drainage of streams. When removing water crossing structures: • Re-establish the natural streambed as close to the original location as possible and so it matches the up and downstream width and gradient characteristics. • Place all excavated material in stable locations. • Leave stream channels and side slopes at a stable angle that matches adjacent topography.
Install self-maintaining drainage structures that will not require future maintenance.
Provide for drainage by removing relief culverts, removing berms or punching holes in them so they drain to a stable location, ripping the road surface to promote re-vegetation, and ensuring side slopes are left at a stable angle.
Install non-drivable water bars to intercept the ditch making sure to key the water bar into the road cut-slope. The outflow will be directed onto stable locations. Water bars will be appropriately skewed. For roads greater than 3% grade, skew at least 30 degrees from perpendicular to the centerline. For roads less than 3% grade or at the bottom of a dip, install them perpendicular to the centerline. Water bars should be spaced to disperse runoff and minimize erosion and sedimentation. Water bars will be installed at natural drainage points.

4.2 Mineral Pits Management

This section describes the management of mineral pits from opening to closure. It defines the requirements for a Mineral Pit Management Plan including a Pit Development Plan and a Pit Reclamation Plan. It also includes a description of how the permitted use of the QIR's mineral resources is accomplished.

Management of mineral pits includes procedures that govern the activities within pits from opening to closing. Pit management is meant to control the commercial development and use of the mineral resources on the QIR. This is necessary because of the value of the resources; the safety and health of QIR citizens, QIN employees and contractors or permittees; and the potential for adverse environmental impacts from un-controlled use of the resource. Most of the mineral resources consist of rock used for road construction, including black rock. There is, however, commercial and free use of sand, black rock, and river rocks.

Mineral Pit Management Plan
Management of mineral pits will require a comprehensive plan for the development and final reclamation of a mineralized area that is now open or will be opened for the severance, extraction, or removal of minerals. A Pit Management Plan is required for each pit located on the QIR. These plans will be completed before a new pit is opened and with the next entry into an existing pit—until all pits have plans. All Pit Management Plans will comply with Quinault Tribal Code of Laws and particularly with Title 61.

The Pit Management Plan will include a background and description of the mineralized area, a Pit Development Plan, a Pit Reclamation Plan, and a sketch map of the planned pit area. The course of management may change during the life of the pit because of new laws/regulations, receipt of greater knowledge of the pit minerals, invasive species, or changes in management goals and objectives.

Mineral Pit Development Plan
A Pit Development Plan must describe how the physical changes from the undeveloped land to a developed mineral pit will be accomplished. It must describe phases of accomplishment; vegetative and mineral development specifications; and the minimum or maximum size of equipment for pit development. Pit development includes the opening of a new pit and subsequent management throughout its life—a pit is always in the developing stage until it is closed. Permitted activities comply with both QIN Forest Practice Regulations and Title 61 for rock pit operations. A Pit Development Plan will include:

- Clearing and grubbing specifications and limitations
- Slash and stump disposal
- Disposal of merchantable forest products from clearing activities
- Extraction sequencing, including staging and pit levels by elevation
- Storage areas for overburden
- Storage areas for oversized rock, crushed rock, and pit run rock
- Erosion control measures for each entry and for the entire pit area
- Drainage and water management
- Provide control for more than one permittee if the pit is large enough
- Orderly closure and reclamation

Mineral Pit Reclamation Plan
A Pit Reclamation Plan must describe the pit's vegetation and landscape appearance when it has been closed and the steps taken to close it. Pits can be closed in phases or all at once depending on the amount of rock available and the depletion of pit rock. Reclamation is primarily protective of water quality and soil erosion. The plan will include:

- Possible alternate uses for the pit
- Drainage and water management
- Spreading of the stored overburden
- Closing road access to pits as necessary
- Water and erosion control for all areas without vegetative cover
- Reforestation or other re-vegetation of the pit area
- Treating invasive species

Permitted Use
Permitted use of the QIR's mineral resources is accomplished through the use of a form called 'Permit for Sale of Sand, Gravel, Pumice, and Building Stone' permit, commonly referred to as a Sand and Gravel (S&G) Permit. Minerals on the QIR are primarily sand, soil, or rock and are located in a rock pit. The following are procedures for permitting pit activity:

- The pre-sale forester and the QIN/BIA forest roads manager will initiate the selection and permitting of a pit(s) for use to ensure gravel is available (including volume and landowner approval) prior to sale advertisement.
- Purchaser and/or operator will apply for a permit to the QIN Harvest Section or the BIA-Taholah Agency Forestry Section.
- The permit application will be completed and fees applied by the QIN Harvest Section or the BIA-Taholah Agency Forestry Section.
- S&G Permits will include an attached "Pit Operating Plan" for the Permittee that shows where the rock is located within the pit area, how to dispose of any pit overburden, and in what condition to leave the pit when activity is complete.
- The permittee will not operate on the permitted area until all applicable permits are obtained and all fees paid.
- Mineral purchase fees will be disbursed to the landowner.

A "Reclamation Surcharge" may be collected and deposited in the Indian Forest Land Assistance Account (IFLAA) for payment of pit reclamation activities.

Chapter 5: Forest Development

A healthy, managed forest can sustain live, vigorous trees and vegetation that resists pests and other disturbances that can cause unstable forest systems. Healthy forests can support air and water quality as well as a variety of fish and wildlife species. The QDNR Forest Development program manages the implementation of all silvicultural treatments used to establish, promote, enhance, and/or maintain stand growth and health to the full productive capacity on the QIR. The main overarching goal of the program is to produce perpetual yields of desirable forest products including timber and carbon sequestration. Forest development projects include genetic tree improvement/pest management, regeneration (including mechanical site preparation), and timber stand improvement activities.

This Chapter of the FMP describes the background of forest health problems, pest risks and the pest management program, as well as projects, activities, and goals of the QDNR Forest Development program. This chapter will guide the strategy, planning, and implementation of the Forest Development program for the 10-year planning period.

5.1 Background of the Forest Health Problems

The old growth forest of the QIR consisted of a diverse species mixture of conifers including western hemlock, Douglas-fir, Sitka spruce, western white pine, lodgepole pine, and a large component of western red cedar. On both fee patent and trust lands between 1920 and 1971, large areas were clearcut and left to regenerate naturally. These areas often became occupied by woody brush species with heavy slash loadings and did not fully regenerate. Yarding equipment, such as dozers, had an impact to the long-term soil productivity across the QIR; in some areas, the skid trails are still evident today, with no conifers growing in them. Furthermore, in the floodplains a large portion of the conifers were removed and red alder became the dominant species.

Prior to 1970 the BIA was responsible for forest management and active reforestation was not a prescription. The ideology at the time was that natural regeneration would suffice. Early in the 1970s, the QIN reforestation program was created to reestablish fully stocked stands following logging on all trust lands. The Mitchell suit (Mitchell v. U.S. 1983) resulted in the United States being accountable in money damages for alleged breaches of trust in connection with its management of forest resources on allotted lands of the Quinault Reservation. At about the same time in the early 1980's the QIN started a prescribed burning program to prepare the logged areas for successful regeneration. Some of the early regeneration efforts on the QIR, however, concentrated on planting monocultures of Douglas-fir regardless of soil types and proximity to the coast and were not always successful. Various silvicultural treatments are now used to improve conditions in stands that may not be adequately stocked and address the problems encountered from planting off-site stock.

Illustration by Scott Kryskalla

5.2 Forest Health

A healthy, managed forest can sustain live, vigorous trees and vegetation that resist pests and other disturbances that can cause unstable forest systems. Healthy forests can support air and water quality as well as a variety of fish and wildlife species. Several components of forest health management are important to timber production, carbon sequestration, and forest protection. These include:

a) Species mix and age diversity (discussed in Chapter 2),
b) Soil conditions,
c) Genetic diversity,
d) Prevention and control of pests.

Some areas are in need of rehabilitation. Rehabilitation may be necessary because of overstocking, understocking, or because of undesired species composition. If a stand is overstocked, competition is intense for light, moisture, and nutrients and may result in a reduction in volume growth. These areas need stocking control. Other areas in need of rehabilitation have less than desired stocking and/or may not include the desired species.
Soil types and slope largely determine the capability and effectiveness of treating and converting the understocked areas into productive stands of timber. Stand health becomes threatened when tree vigor is reduced over large tracts of land. Some areas that were planted as monocultures (and sometimes with inappropriate species) are being infected with red band needle blight and Swiss needle cast. Many of these stands are in the sapling/pole size class.

This section will focus on the final component, prevention and control of pests, and will be discussed as follows:

a) Specific Pest Risks,
b) Damage Estimates,
c) Program Coordination,
d) Pest Management Program,
e) Invasive Species Program.

Specific Pest Risks

Forest pests consist of noxious weeds; animals that inflict damage on young plantations and established stands of trees; and insects and diseases that affect the growth, development, and health of native tree species. Noxious weeds currently include knotweed species (including bohemian, Himalayan, Japanese and giant knotweeds), tansy ragwort, Himalayan and evergreen blackberry, reed canary grass, scotch broom and gorse, though environmental protection staff are monitoring for other aquatic and terrestrial species.

Animals known to cause damage to trees include blacktailed deer, Roosevelt elk, mountain beaver, Snowshoe hare, porcupine, and black bear. Insects currently of concern are spruce weevil (white pine weevil), western hemlock looper, and pine pitch moths. Diseases of concern include Swiss needle cast (SNC), dothistroma needle blight, annosus root rot, armillaria root rot, mistletoe, and white pine blister rust.

Damage Estimates

In general, bear damage can range from loss of growth (and thus volume) to mortality that could require rehabilitation and replanting. The damage estimates for QIR forests vary by location and site type from zero to several thousand dollars per acre for rehabilitation. In addition, harvest of the next rotation may be delayed for 10 to 20 years, or in other cases may necessitate a rotation several years before target age due to extreme mortality and damage. Because black bears occurred in high densities on the QIR, tree damage by bears was widespread and resulted in significant financial impact to the QIN (J. Plampin, pers. comm.). The guided non-tribal black bear hunt has successfully reduced tree damage caused by bears on the QIR as documented by annual aerial surveys (US Forest Service (USFS) Region 6 Forest Insect & Disease Aerial Detection Surveys) and personal observations of the QDNR Forestry Field Inventory crew (L. Wiechelman, pers. comm.).

SNC affects Douglas-fir stands, and has been monitored through WA Department of Natural Resources (WA-DNR) aerial pest flights. According to the 2015 aerial surveys, approximately 10 percent (21,121 acres) of the Reservation forest is infected with SNC. SNC affects trees through loss of foliage which in turn can reduce the growth rate of the tree and time to final rotation. Most of the Douglas-fir stands on the reservation are moderately infected by SNC and a few along the coast are severely infected. Most Douglas-fir stands are mixed with hemlock and other minor species so the impacts are minimized compared to Douglas-fir monoculture stands.

Box 5.1: Program Coordination of the QDNR Forestry Pest Management

The QDNR Forestry Pest Management will be coordinated by the Pest Management Officer (PMO) and Noxious Weed Management will be coordinated by the QDNR Environmental Protection Invasive Species Specialist (ISS).

External coordination: The PMO and ISS coordinate the QDNR-Forestry Pest Management Program with the BIA, USFS, WA State, National Park Service (NPS), County, the adjacent landowners, and the USFS Westside Service Center (USFS-WSC). Day-to-day coordination will proceed through local cooperative arrangements with Tree Improvement, Washington Forest Protection Association (WFPA), and with the WSC. The PMO is responsible for coordinating field visits, training, and special projects with the WSC. Other cooperatives specific to current pest problems are being investigated and membership is being considered (such as with the Swiss Needle Cast Cooperative). The ISS will also coordinate with the Queets Quinault Cooperative Weed Management Area (QQCWMA) and the Olympic Knotweed Working Group. Both groups are made up of land managers in the Queets and Quinault Watersheds and agencies involved in Western Washington knotweed control projects. The ISS is responsible for obtaining grants to control noxious weeds.

Internal coordination: The PMO will coordinate the QDNR-Forestry Pest Management Program with the various departments, divisions, and sections within the QDNR and BIA-Taholah Agency. These include coordinating invasive species monitoring and treatment plans with Harvest, Stand Improvement, Regeneration, Silviculture, Inventory, Environmental Protection, and Fisheries sections. The ISS coordinates with foresters and operators to minimize the spread of invasive species during timber sale operations (see Chapter 7: Forest Invasive Species).

Pest Management Program
The Pest Management Program's primary method for the control of pests is prevention, whereas suppression will be used when prevention is not adequate.

Prevention will be accomplished by using various silvicultural methods, some of which might include a combination of species selection, stand density management, genetic resistance, alternate host suppression, fertilization, pruning, tubing, timing of planting, guided bear hunting, harvest, and cleaning of equipment. Coordination between timber sale administrators, timber sale contract officers, and the ISS will aim to prevent the spread of noxious weeds during timber operations. Coordination between QDNR Fisheries department and the ISS will aim to prevent the spread of aquatic noxious weeds and other pests and diseases.

Genetic Resistance.
The Pest Management Program will use genetics to develop strains of commercially important tree species that are resistant to specific pests and diseases. Genetically developed resistance does not entirely eliminate damage, but has been shown to cost-effectively reduce it to acceptable levels and reduce the need for expensive and environmentally unfriendly chemicals. Some of this work has already begun, some is just beginning, and some will arise as new pests present themselves.

The Pest Management Program predicts which pests will be significant problems and develops resistant strains prior to major damage occurring. Currently, the program uses locally tested seed sources for reforestation thus minimizing damage from pests. The Tree Improvement Program consists of hundreds of local tree families that provide this local adaptation, along with an archive of thousands of local parents as a resource for future resistance breeding. Unless they are tested locally, offsite seed sources are typically much more susceptible to disease and their use is avoided. In addition, the following genetic resistance programs are in progress:

Western white pine (WWP) blister rust. There were 49 selected morphologically tolerant trees from the QIR that went through a screening program at the USFS Dorena Tree Improvement Center in Oregon. This test was completed, and resistant material was planted into a seed orchard block in 2002. Furthermore, the QDNR Forestry Division has entered into a seed orchard cooperative with the USFS-Olympic National Forest, which already has a block of rust-resistant WWP trees in an existing seed orchard.

Spruce weevil. A spruce orchard with weevil resistant spruce families from Canada was established in 2002 and should start to produce cones in the near future.

Lodgepole pine Dothistroma needle blight. Lodgepole pine is not planted in pure stands but rather mixed with other species to lessen the effect of the needle blight and maintain a healthy forest stand.

Douglas-fir SNC**.** El Nino and climate change has also raised concern over this disease, and the epidemic condition of Oregon's coastal area has caused the exploration of options including the development of resistance to this disease. QIN received an Animal and Plant Health Inspection Service (APHIS) grant to evaluate the second generation Douglas-fir family test sites for genetic resistance, which occurred on 3 test sites in 2014. At the same time 3 test sites have been planted near the coast with top ranked second generation Douglas-fir seedlings to evaluate the comparison of SNC infection between the new test site

and the older established test sites. The resistant families' seed will be selected for use during the reforestation process in high-risk areas or widespread if the disease becomes epidemic.

Suppression.
Suppression will be accomplished through various methods such as harvest, thinning, pruning, fertilization, bear hunting, and the application of pesticides. Policies for suppression will be developed to comply with tribal environmental regulations and Federal requirements, and will be coordinated with other QIR programs, other Federal agencies, and adjacent landowners where applicable.

Monitoring.
The QDNR Forestry Division monitors disease and wildlife damage on the QIR. Information from the cooperative annual insect and disease aerial detection surveys conducted by the USFS and WA-DNR augmented by local reconnaissance will be recorded by the PMO and discussed with the staff at the USFS-WSC.

Ground-based field observations and inventories will be used to delineate specific areas to be put on a regimented inspection schedule so that prevention and suppression treatments can be planned. The next scheduled continuous forest inventory (CFI) will include additional problem and severity codes added to tree records to monitor insects, pests, and diseases.

Reporting Procedure.
All forestry and other QIR field staff will report pest incidents to the PMO and ISS. These reports will be compiled and categorized into High- Medium- Low-concern and will be forwarded to the Silviculturist and ISS for review. Reports of serious problems will be forwarded immediately to the BIA and USFS-WSC. Other pest status issues will be reported annually for consideration for funding for prevention/suppression dollars.

Silvicultural Considerations for Forest Health
In general, the incidence and intensity of forest-pest damage is directly related to the cutting patterns across the landscape and to the selection of tree species for reforestation. Off-site or untested trees or monoculture stands are more likely to have pest problems than those that are naturally suited to a location. Forest health will be monitored and if an area of infection is discovered, the best available science will be employed to address the problem.

Some areas are in need of rehabilitation. If a stand is overstocked, competition is intense for light, moisture, and nutrients and may result in a reduction in volume growth. These areas need stocking control. Other areas in need of rehabilitation have less than desired stocking and/or may not include the desired species.

Soil types and slope largely determine the capability and effectiveness of treating and converting the understocked areas into productive stands of timber. Stand health becomes threatened when tree vigor is lessened over large tracts of land. Some areas that were planted as monocultures (and sometimes with inappropriate species) are being infected with red band needle blight and Swiss needle cast. Many of these stands are in the sapling/pole size class.

Table 5.1: Pests of Concern. A description of each pest of concern, areas it is likely to affect, some of the conditions that are likely to affect its movement across the landscape, and some considerations for minimizing damage:	
Spruce Weevil	Spruce weevil damage is largely restricted to Sitka spruce. It attacks the leader of young spruce, killing the top portion of the tree, and resulting in growth loss and disfigurement of the main bole. In mixed species stands, attacked trees frequently are overtopped and suppressed by non-host trees. The spruce weevil is most damaging in warm, non-fog belt regions. River bottoms and coastal areas, which are cooler and have associated fog, have light to moderate of damage, unless insect populations reach significant outbreak levels. Damage can be minimized by properly matching the re-establishment of spruce with areas known to be within the fog-belt (Queets, Quinault, Salmon, Raft, Wreck, and Moclips River corridors and associated drainages, within 100 feet of Type D and some Type H waters and the coastal strip). Damage can be expected if spruce is planted in other areas, planted at wide spacing, and/or planted in large contiguous blocks. In the floodplain, damage can be reduced by planting a mix of alder and spruce and in the upland areas, planting a mix of other conifer species.
Western Hemlock Looper	The western hemlock looper is a pest of mature (80 years and older) hemlock forests. Larvae feed upon tree foliage causing growth loss, top kill, and tree mortality. Although western hemlock is the preferred host, intermixed Douglas-fir, Sitka spruce, and Pacific silver fir are also fed on during outbreaks. Outbreaks occur sporadically and usually decline after 3 years because of parasitism, predation, and disease. Western hemlock is intolerant of defoliation and trees frequently die when more than 50 percent of their crowns are removed. Severe infestations that cause complete defoliation can kill trees in 1 year. Young, vigorously growing stands of western hemlock are fairly resistant to looper outbreaks. Outbreaks in mature stands may be suppressed with B.t.k. (Bacillus thuringiensis var. kurstaki), a bacterial insecticide.
Pitch Moth	The Sequoia pitch moth and the Douglas-fir pitch moth are attracted to wounds that exude pitch in lodgepole pine, western white pine, and a variety of other conifer species. On the QIR, these species currently are associated with the pruning of lodgepole pine or western white pine to minimize Dothistroma needle blight or white pine blister rust. The larvae enter the cambium surrounding the pruning wound and feed locally for several years, causing pitch blister and ultimately pitch-seam formation. Their feeding sometimes also creates a point of weakness in the tree that contributes to stem breakage. Vigorous trees of 10 to 50 years old are most seriously affected. Damage can be minimized by conducting pruning activities outside the period of active flight (typically from May through August).
Swiss Needle Cast (SNC)	This disease most severely affects off-site Douglas-fir. The causal fungus spreads through rain splash and degrades or kills the foliage, resulting in stunted growth or, in severe cases, mortality. Needle wetness is the key factor in the development of SNC. Needles begin to discolor after the first year and often become mottled with yellow, green, and brown. Infected needles are cast prematurely. In extreme cases, crowns may be yellow and retain only the current year's foliage. In recent years, the disease has intensified in areas where Douglas-fir has been planted, especially along the coast and within the fog zone. The severe effects of this disease can be minimized by planting Douglas-fir outside a 1-2 mile radius of the coast and diversifying stands planted with Douglas-fir with other species. Planting other species, such as hemlock, cedar and pine in a mix, will provide for diversity and for a healthy stand.
Dothistroma Needle Blight	Dothistroma (red band needle blight) is a significant disease of pines worldwide. Lodgepole and ponderosa pines are highly susceptible, while Douglas-fir and Sitka spruce are much less susceptible. The fungus attacks the needles causing them to die and drop off. Infected needles get yellow or brownish spots that spread to form reddish brown bands around the needle in autumn. Then needles die from the tip back, while the needle bases remain green, and are cast usually during the year after infection. Growth reduction becomes measurable when 25% of the foliage has been killed. When 50% of the foliage is killed, diameter increment is reduced by half, and height growth is reduced. Trees less than 10 years old are the most susceptible. Under certain environmental conditions, this disease can completely defoliate pines in a few weeks and eventually kill the infected trees. Even though the disease is found naturally in low areas, it can reach epidemic levels anywhere infection centers occur. The disease is transmitted via rain and associated fog/mist from May to October. Duration of free moisture on foliage is the key factor in disease development. Infection centers are likely to be in areas heavy with pine and which have poor airflow. These areas usually include natural depressions or frost pockets, lakebed soils, or other low-lying areas. Once the conifers grow out of the zone of poor airflow, the infection potential is reduced. Because lodgepole pine is largely planted in low, wet areas, the damage potential is high in plantations. Timber harvest patterns that result in young pine stands in areas where natural air drainage is inhibited often produce infection centers. Planting other species, such as hemlock and cedar, in a mix will provide for diversity and for a healthy stand.

Table 5.1 Continued: Pests of Concern	
Annosus Root Rot	Western hemlock and Pacific silver fir are highly susceptible to infection by this disease and can be severely damaged. Lodgepole pine is moderately susceptible and sometimes damaged. Douglas-fir, western red cedar, western white pine, and Sitka spruce are slightly susceptible and rarely damaged. The Annosum root rot fungus (Heterobasidion annosum) infects its hosts in two ways: • By windblown spores being deposited and germinating on freshly exposed wood (either a cut face or a wound); and • By mycelial growth from diseased roots to healthy roots via contact. Small stumps created by precommercial thinning might become colonized, but the fungus usually dies out within a few years. Small infested stumps are not a serious threat to trees more than 3 feet away. The fungus can survive in large resinous stumps for a very long time. Hemlock is much more likely to suffer butt decay, thereby increasing defect and increasing susceptibility to windthrow. Management recommendations include: • Manage hemlock stands in rotations of 40 to 100 years. • Minimize tree wounding during thinning. • Do not delay thinning in overstocked stands because the volume gained through thinning greatly offsets losses from the disease. • Retain other tree species such as Douglas-fir and western red cedar to maintain mixed-species stands. Currently known infection centers are largely located in small pockets within the lower reservation with a high occurrence within Range 10, Townships 22 and 23. In these areas, if the disease is noted after a harvest operation, stands are replanted largely with Douglas-fir.
Armillaria Root Rot	The Armillaria fungus attacks the roots and boles of trees of all ages, killing the cambium and inner bark and causing the decay of both sapwood and heartwood. In younger trees, the pathogen advances rapidly through the inner bark to the root collar, where it girdles and kills the tree. Armillaria is found within all areas and corridors across the QIR. Generally a saprophyte, it usually only kills live trees if the tree is already stressed and predisposed to mortality. Armillaria can act as a natural thinning agent in overstocked stands, or cause widespread mortality in overly stressed stands. The best way to avoid this disease is to carefully match planted species to areas; offsite species are highly susceptible to infection. The largest losses across the QIR have been to Douglas-fir in the lakebeds, till plains, and Moclips brush fields.
Dwarf Mistletoe	Dwarf mistletoes are parasitic plants and derive the majority of their nutrition from the host's vascular tissues; it is solely dependent on their host for water. Transmission of the infection depends on an explosive mechanism; During maturation, the dwarf mistletoe fruits swell with water and build up pressure. At maturity, the water pressure explosively discharges the seeds. Seeds travel horizontally 30 to 40 feet and, with the aid of wind, seeds may travel as far as 100 feet.
White Pine Blister Rust	This disease was introduced into the Pacific Northwest in approximately 1930 on seedlings of eastern white pine grown in Europe. Its introduction to North America resulted in one of the most serious disease outbreaks on conifers in the country. It has caused more damage and has cost more to control than any other conifer disease. When the main stem of the tree is invaded, death or top kill is imminent. This disease is an alternate host disease and requires both *Ribes spp.* (currant) and white pine to complete its life cycle. Spores from infected white pine burst in the spring and can travel long distances to infect *Ribes*. Cool, moist conditions favor transmission of the disease; warm, dry conditions are unfavorable. The spores of infected *Ribes* species are carried in moist air masses usually for short distances and infect pine needles during late summer and early autumn. Infection of pine requires at least 2 days of saturated atmosphere and temperatures not exceeding 68°F. One to 2 years after infection, the fungus penetrates the needle into the stem where it causes a blistering canker. This canker then grows at various rates toward the bole. On arrival, the canker grows around and girdles the tree. Branch cankers that are more than 24 inches away from the bole usually girdle the branch before the canker can reach the bole. When the branch dies, the infection dies out because the fungus cannot survive on dead tissue. Branches with cankers between 4 and 24 inches from the bole are potentially lethal, yet prunable. Branch cankers closer than 4 inches from the bole cannot be pruned. Where western white pine is desired as a crop tree, pruning all branches up to 18 feet (not exceeding one-half of the tree's height) reduces future infections and greatly improves the butt-log quality. Pruning is not usually practiced due to cost; furthermore, the planting of rust resistant white pine has reduced the infection rate. Even though this disease is found across the entire landscape, its biggest effect is in areas of poor air drainage (cool and wet). The poor air-drainage areas are the lakebeds, till plains, prairies, and low depressions. Because *Ribes* is the host species and is largely found in the Quinault River corridor, harvest activities that stimulate reproduction of this plant will aid disease transmission. Also, if harvest areas extend in and out of locations where *Ribes* is found, the rate of transmission of infectious spores in the air may be increased. Planting other species, such as hemlock, Douglas-fir and cedar in a mix as well as planting genetically resistant seedlings, will provide for diversity and for a healthy stand.

Table 5.1 Continued: Pests of Concern	
Deer, Elk, Mountain Beaver, and Snowshoe Hare	These animals they cause browse damage to young, planted seedlings. Elk can cause significant damage to planted western red cedar in an individual plantation, especially if the cedar is a large component of the stand. Elk can also cause damage by trampling, browsing, and pulling the seedlings out of the ground. Mixing no more than 10-15 percent of a plantation to cedar will help keep browse damage to a minimum. Mountain beaver cause damage to young seedlings by clipping branches and the main stem at the ground line. When the trees are pole size, the beaver chew on the roots causing reduction in growth and, possibly, mortality. Mountain beaver can be found primarily on slopes where the soil is conducive to burrowing for den building. If extensive damage is caused to a new plantation the seedlings can be protected with vexar tubing until the trees are large enough to withstand clipping of the main stem. Snowshoe hare populations can cause severe browse damage, depending largely on forage and cover availability, in areas comprised of brush and slash. Areas on the QIR that contain a large mix of poorly stocked or non-stocked forests contain larger populations of rabbits and increase the potential for severe browse damage in adjacent plantations. These areas are largely in the till plains, Taholah Unit, Moclips burn, and scattered locations across the landscape. An aggressive reforestation program aimed at converting under-stocked areas to fully stocked plantations would reduce severe problems. If extensive damage is caused to a new plantation, the seedlings can be protected with vexar tubing until the trees are large enough to withstand clipping of the main stem.
Black Bear	Black bears can cause damage to timber resources by peeling bark off coniferous trees to feed on the sugar-rich cambium layer underneath, causing damage or death to the trees. Tree damage occurs most frequently in the spring after bears emerge from their winter dens and generally declines as other foods (e.g., berries) become available in the summer (Noble and Meslow 1998, Stewart et al. 1999, Partridge et al. 2001). Because black bears occurred in high densities on the QIR, tree damage by bears was widespread and resulted in significant financial impact to the QIN (J. Plampin, pers. comm.). The QDNR began a supplemental feeding program in areas incurring severe tree damage. When the feeding program was unsuccessful with tree damage reduction, the QIN established a guided bear hunting program to lower bear numbers. Through the new program, non-tribal hunters are allowed to hunt black bears over bait stations under the guidance of an official tribal guide. The program began in 2004 with just four bear guides and 12 tags sold and has since grown to 12 tribal guides, more than 300 bear tags sold per year, and over 200 bears harvested in 2013. The guided non-tribal black bear hunt has successfully reduced tree damage caused by bears on the QIR as documented by annual aerial surveys (USFS Region 6 Forest Insect & Disease Aerial Detection Surveys) and personal observations of the QDNR Forestry Field Inventory crew (L. Wiechelman, pers. comm.). There exists, however, a dearth of information regarding the population status of black bears on the QIR and the effects of the nine-month baiting season on bear behavior. Now that tree damage reduction goals are being reached, the guided bear hunt program should be re-evaluated and information is needed regarding the status of QIR's black bear populations and the long-term sustainability of the current hunting pressure.

Future Management Projects and Considerations
Projects planned for the next 10 years include:

- Maintain GIS layer of existing pests as funding allows,
- Continue to survey pest issues from the air and adding the information to the GIS,
- Develop inventory procedures to accommodate pest information in existing inventories,
- Train forestry staff in the identification of forest pests,
- Develop procedures for evaluating levels of pest impacts and appropriate prevention or control measures,
- Continue the development of blister rust resistant Western White Pine seed production;
- Continue the development of weevil resistant Sitka Spruce seed production,
- Evaluate Douglas-fir test sites using genetically improved seed for tolerance to Swiss Needle Cast,
- Continue to upgrade evaluation procedures as new information becomes available,
- Continue to assist with the evaluation of the effectiveness of the guided bear hunting program,
- Conduct mark-recapture study to obtain abundance and density estimates of black bear on the QIR; continue to quantify black bear timber damage and examine relationship with bear numbers; and develop protocol for long-term monitoring of bear population and harvest.

5.3 Forest Development Programs

The Forest Development Section is comprised of the following three programs:

- Tree Improvement/Pest Management,
- Regeneration/Site Preparation,
- Stand Improvement.

The scope and objectives will be addressed for each program, along with details on technical specifications and monitoring.

Illustration by Scott Kryskalla

Tree Improvement/Pest Management
Tree improvement and pest management are combined under the same program. The tree improvement program is operated in cooperation with the Northwest Tree Improvement Cooperative (NWTIC), Hemlock Tree Improvement Cooperative, Coastal Douglas-fir cooperative and Washington Gen3 DF cooperative. The Tree Improvement Program has cooperative agreements with WA DNR Seed Orchard, USFS Denny Ahl Seed Orchard and an agreement with Green Crow Corporation for exchange of seed.

The following discussion of the tree improvement component of Forest Development has three parts:

1. Program Goals,
2. Tree Improvement Plan,
3. Seed Needs.

Program Goals
The overarching goal of the program is to provide for the production of superior seed based on the selection of phenotypically and genotypically superior trees. The seed will be used for sowing and out-planting following harvest or rehabilitation activities. The most important goals of this program are:

- Increased growth, tree form and yield.
- Increased resistance to insects and disease.
- Improved wood quality.
- SNC tolerance.
- Reforestation of all acres requiring Douglas-fir and western hemlock in the 0 to 2,000-foot elevation range utilizing seed from genetically tested seed orchards. Western white pine and Sitka spruce QIN orchards will continue to be developed and provide seed with resistance to white pine blister rust and tip weevil possibly by 2017. Tip weevil resistant seed has been and will continue to be utilized from the USFS Denny Ahl seed orchard.
- Protection of the natural resources from insect and disease through silvicultural treatments.
- Seed will be broadly adapted to ensure against climate change.

Tree Improvement Plan

A Tree Improvement Plan was prepared in 1978, with western hemlock and Douglas-fir being the primary species. The plan was updated in 2001 and is on file in the tree improvement office. It provides specific information and establishes program direction for the major categories of the Tree Improvement Program. The major categories are:

1. Select trees (includes species, selection criteria, and maintenance) and progeny test sites (includes objectives, test design criteria, documentation procedures).

Hemlock Tree Improvement Cooperative (HEMTIC) is a second generation western hemlock cooperative that spans existing cooperatives in Oregon, Washington, and British Columbia. It included top families from several cooperatives combined into a breeding and testing program that resulted in new second generation test sites being installed in 2001. QIN has one of these sites.

WA Coast Douglas-fir cooperative is a second generation cooperative that incorporates several other breeding zones to the Douglas-fir breeding zone for the reservation. The NWTIC, Rayonier and WA DNR, along with QIN, are the primary cooperators.

In 1989 the Tree Improvement program entered into a Sitka spruce program that had orginiated by Rayonier. Data from four test sites for 86 parent trees and 30 seeds each from the original collections from these parents was obtained. Two seedling orchards were installed with the best material, each about 1 acre in size. Demonstration plots were also installed using this material to visibly show the family growth differences. Seed from the orchard could be available by 2017.

2. Evaluation plantations (includes objectives and documentation procedures).

In addition to the progeny test sites, several evaluation/demonstration plantations have been out-planted to track the field gain of hemlock and a genetic gain trial was initiated by NWTIC for Douglas-fir. The Douglas-fir genetic gain trial was also initiated by the Stand Management Cooperative (QIN is a member) and will test 3 levels of genetics, 2 levels of site preparation and various initial spacing levels. 9 years of data have been collected and will continue. This information will be used for silvicultural prescriptions and growth and yield models of young Douglas-fir plantations.

3. Seed orchards (includes establishment, maintenance, pollen management, stimulation, seed collection, and monitoring).

As of 2015, the seed orchard has over 1200 hemlock ramets on 6-7 acres and over 1000 Douglas-fir ramets on 8-9 acres and over 280 forward selections from the 2nd gen DF program in the seed orchard expansion area, also another 200 plus 2nd gen hemlock ramets potted in a greenhouse. The data from the progeny tests have been used to rogue the seed orchard, removing the lower ranked families. Under optimal management, the seed produced from the field orchard will have 10 to 20 percent volume gains over camp run. The greenhouse, which contains HEMTIC material, will eventually produce seed with a 15 to 20 percent volume gain.

4. Tip weevil resistant Sitka spruce (includes testing for tip weevil resistance).

In 1992, the QIN agreed to participate in a spruce weevil resistance test program that the Canadian forest service was researching. Trees were received from Canada and two weevil resistant spruce test sites were planted on the QIR, one in 1992 and another in 1993. These contain approximately 80 families. Seed could be available by 2017. Seed was purchased from Canada in 2013 and will be used to grow seedlings for outplant until the seed from the orchard is available.

5. Blister rust resistant western white pine (includes testing for blister rust resistance).

A white pine blister rust resistant program was begun in 1992 with the selection of seven trees. Cones from these and 42 more trees selected in 1993 were sown in the U.S.F.S. screening program at Dorena, Oregon. Screening results showed 13 trees with resistance. Currently there are approximately 80 grafted trees in the QIN seed orchard that could start producing cones by 2017. In 2013, an additional 50 seedlings were planted in the QIN orchard.

Blister rust resistance seed is currently collected from USFS Denny Ahl Seed Orchard and is used for reforestation on the QIR.

Seed Needs

The tree improvement program, in conjunction with the regeneration program and harvest program, will assess the need for seed to meet reforestation requirements on an annual basis. Seed needs are typically projected 1 to 2 years out for immediate sowing needs and 2 to 8 years out for a supply to meet future needs. Seed can be collected from the seed orchard, from select trees on the QIR, a camp-run collection, from select or camp-run trees off reservation within the designated seed zones, or the seed can be purchased. Seed trees may be needed to be felled for seed collection purposes. Individual trees may be cut or pruned to allow for seed collection.

Once the cones are collected they are transferred to a cone processing/seed extraction company for processing. The seed is then tested for germination, purity, and seeds per pound. On the average, seed is re-tested every 8 years. The Nation contracts the storage of the seed to reliable companies who supply the Nation with inventory reports, and ships seed to contracted nurseries upon request.

Regeneration Program

The major goal of the Regeneration Program is to establish healthy, fully stocked stands within 2 years of harvest that reach free to grow status by the fifth growing season. The desired stocking at the time of planting is 400 trees per acre, on the lower reservation and North Boundary and a mix of 70% spruce or conifer and 30% red alder in the floodplains. In the floodplains where conifer can be established the desired species mix and stocking levels will vary. Sitka spruce will be the primary conifer planted with a mix of red alder to lessen the impacts of the spruce tip weevil. The density of the two species will vary; red alder at approximately 100 trees per acre and spruce at approximately 300 trees per acre. The regeneration discussion is broken into seven components including:

a) Composition of species planted,

b) Contract specifications and activities surrounding nursery stock,
c) Planting contracts and monitoring requirements,
d) Seed tree retention and selection criteria,
e) Post-harvest regeneration monitoring requirements, the need for fertilizer, and
f) Conifer release requirements and techniques.

Species

What species to plant is mostly determined by the soil type, site index, geographic location, presence of insect or disease, and the naturally occurring species removed during current and past harvest (old growth species). The species out-planted on the QIR include Douglas-fir, western hemlock, Sitka spruce, lodgepole pine, western red cedar, western white pine, red alder, and, possibly, Pacific silver fir and Alaska yellow cedar.

The flood plain areas are planted with red alder and Sitka spruce at a density of 400 trees/acre when intermixed, 680 trees per acre if pure alder and 500 trees per acre if pure spruce. Within these areas, the spruce are either planted separately in blocks to facilitate future vegetation management or intermixed with alder, usually 70% conifer and 30% alder.

The coastal zone, which stretches from the coastline inland approximately 2 miles, is affected by Swiss needle cast, and is predominantly planted with western hemlock and Sitka spruce, intermixed on some sites with western red cedar, western white pine and/or lodgepole pine. Further inland from the coastal zone the higher quality sites are planted predominantly with Douglas-fir and western hemlock with a possible mix of the minor species. The medium productive sites are planted predominantly with western hemlock and a possible mix of Douglas-fir and/or some minor species. The lower productive sites are planted with a mixture of the minor species and western hemlock with seed trees left in the unit to assist with artificial planting.

The most critical insect and disease considerations for selection of species to be planted include:

a) The presence of Swiss needle cast affecting the Douglas-fir, primarily along the coastal zone and up to 5 miles inland,
b) The presence of tip weevil affecting Sitka spruce,
c) The presence of red band needle blight affecting lodgepole pine,
d) The presence of white pine blister rust,
e) The presence of root rots,
f) The presence of dwarf mistletoe affecting western hemlock.

Other considerations when selecting species to plant include water drainage, amount of vegetation present or expected, aspect, location (e.g., floodplain or upland, coastal or inland), and browse by elk (larger planting stock).

On the steep slopes of the North Boundary Area where soil depth can be shallow and access is limited, the units are sometimes planted with 1-year-old container seedlings; otherwise 2 year old stock is used. The rest of the QIR is usually planted with 2-year-old bareroot and or large 1-year-old container conifer seedlings and 1-year-old red alder bareroot stock.

Nursery Stock

Nursery contract specifications for morphology and physiology are set forth in the contracts for seedlings. These specifications are often higher than industry standards because of the

restriction of herbicides for site preparation and conifer release vegetation control. Nurseries are usually visited twice a year, once in the spring to assess germination and transplanting and again in the fall to assess growth, morphology, physiology, vigor, inventory, and pack out and delivery plans. When the seedlings are delivered to the QIN, lots are sampled to measure stem height, root length, caliper, and general health and form of the seedlings.

Planting

Site preparation may be necessary to increase the amount of planting spots needed to meet reforestation objectives. After harvest is completed the Regeneration Forester will determine if site preparation is needed by conducting a walk through in the logging unit. After the walk through, the Forester will determine if all or portions of a logging unit may need site preparation. If the walk through is insufficient then the area will be inventoried for plantable spots. Site preparation is conducted using a shovel/excavator equipped with a slash grapple to pile the fine slash material. Large logs are left out of the piles. The piling activity usually occurs during the summer months to avoid saturated soils that can become compacted and degraded. The piles are then burned in the fall by the Fire crew.

The use of herbicides for site preparation may be necessary on steep slopes where shovel/excavators cannot safely work, in areas with a large amount of concentrated live vegetation, or on allotments that were harvested and never re-planted where brush has outcompeted natural seedlings. On some Fee lands that were harvested and not planted the brush growth is extensive and may need to be treated with herbicides to affectively start a new plantation. Steep slopes that were logged in the past that were either planted or not or failed to maintain may have extensive understory brush that would need to be treated with herbicides to meet reforestation Forest Practice Regulations (Forest Chemicals Section).

The QIN employs seasonal tribal tree planters and, given the large number of acres to reforest every year, contracts tree-planting crews to assist with the needs of the regeneration program.

Both the contractor crew and tribal crew are inspected daily to ensure quality control and proper tree care and handling. One plot per acre is sampled for above- and below- ground quality and density. The Regeneration Program has specific inspection guidelines and procedures written in the Inspection Procedures Manual and the Tribal Tree Planter Payment Manual. The data collected by the inspectors is entered into a regeneration database and queried for various reports.

Units are surveyed once or twice during the planting season to detect signs of rabbit and/or mountain beaver damage to seedlings. If a significant amount of damage is occurring, the seedlings will be protected using vexar tubing UV=0. Depending on the severity of the damage either every tree or every other tree will be protected.

Seed Trees

Seed trees may be retained within clearcut units on low sites (site index of less than 100) to assist with the artificial regeneration program, and be either distributed across the stand at 2 to 15 trees per acre (if available) or clumped to facilitate regeneration efforts. If no suitable seed trees can be located, and if suitable seed trees are lacking around the stand edge, then the clearcut area may be aerial seeded in conjunction with artificial and natural regeneration. The objective is to obtain natural regeneration on a site beneath individually selected trees or small clumps of trees distributed uniformly over the site.

If an existing seed source is sufficient to meet regeneration goals then it may not be necessary to leave clumped or individual seed trees within the clearcut areas or portions thereof. The size and shape of the clearcut has a direct influence on the above listed considerations.

Seed trees and/or clumps will be marked with paint at the stump and at or above 6 feet on the bole. In some circumstances, seed trees will not be marked and may be selected by the operator with the timber sale administrator overseeing the selection. Seed trees will be selected from among the dominant and co-dominant individuals within the stand. Normally shade tolerant species will be favored.

Species preference is as follows:

1. Western hemlock,
2. Western red cedar,
3. Western white pine,
4. Douglas-fir,
5. Finally, lodgepole pine and Pacific silver fir, if others are not available.

Selected leave trees should be as disease free as possible. Species preference is a higher-priority selection criterion than lightly diseased or damaged trees. A tree with mechanical injuries may still be a suitable seed tree. Trees with minor damages occurring from bears or logging injury will not be discriminated against if they meet other criteria of a suitable seed tree. No single selection criterion is sufficient.

Other selection criteria include:

a) Straight bole and absence of forking
b) A minimum 30% crown ratio, live crown to the top, and minimal dead branch ends
c) Good vigor with little chlorosis
d) The ability to produce cones or is producing cones as evidenced by cones in the crown and/or on the ground

Individually selected leave trees are subject to windthrow. However, the use of the following selection criteria may help to minimize this problem:

a) Select leave trees that are not growing on hummocks or nurse logs especially if large portions of their roots are visible above ground.
b) Avoid trees that are leaning or have some curve in the bole.
c) Clump trees that are growing in areas where water tends to pond significantly. Single leave trees are at higher risk to blowdown because of the high water table softening the soil and the high wind rocking the tree.
d) If possible, avoid trees growing on or near ridge tops.
e) Locate trees away from openings, where they will be less prone to the effect of wind.

Monitoring

Each unit is surveyed upon completion of the first growing season to quickly determine the need for replanting or animal protection. Each unit is then formally inventoried on completion of the second and fifth growing season. Both the 2- and 5-year inventory information is used to assess the need for replanting, animal protection, conifer release, and fertilization. The fifth year inventory is specifically used to compare stocking densities to minimum acceptable stocking requirements as outlined in the QIN Forest Practice

Regulations. There are no minimum height requirements. If a stand is deemed free-to-grow, the Roads Manager will review the timber sale for any road closures, culverts that need pulling and/or bridge removal, where necessary. A 10-15 year survey will be conducted on selected units for the purpose of pre-commercial thinning, conifer release, and or fertilization.

Fertilization

The 2, 5, and 10-year inventories, along with incidental observation, determine the need for application of fertilizer to young stands that have not reached crown closure and are experiencing signs of poor health and vigor. It is important to ascertain the reasons for the poor health and vigor before prescribing the treatment. Factors to consider are soil type, available soil nutrients and chemistry, height of water table during the year, presence of insects or disease, site preparation (hot slash burns or mechanical treatment with excessive removal of organic layer), soil compaction, amount of competing vegetation, and species planted.

These young stands are treated with a fertilizer designed to address the needs of the stand and will be applied by experienced personnel and/or contractors, either by manual or aerial application, in accordance with the QIN Forest Practice Regulations. In young plantations (2-5 years old) with manual application, typically each best tree on a 10-by 10-foot spacing receives about 4 ounces of fertilizer (covering an area 3.5 feet by 3.5 feet). Other forms of fertilizer may be used during the planning period at various rates and spacing given new information from research trials and recommendations from the Stand Management Cooperative.

Fertilizer not only improves health, vigor, and growth, but also increases the tree's ability to produce shade in riparian management zones and shortens the plantation's time to become hiding cover for big game.

Conifer Release

Stands are continually monitored if the 2, 5, or 10 to 15-year inventories reveal significant brush or hardwood competition. Conifers planted in the floodplains are monitored more closely because of the rapid brush growth in these high site areas. Units are treated if the stocking levels are expected to fall below the minimum stocking requirements as set forth in the QIN Forest Practice Regulations.

The QIN has been reluctant to use herbicides for brush control because of the amount of annual rainfall, significant number of streams, fisheries, big game, and recreational and gathering uses. Herbicides are usually not an option for release treatment because of the presence of hemlock or other susceptible species in the stands. Herbicides could possibly be used during the planning period to include aerial, baseline, and ground applications with sprayers.

The release treatment is typically performed by mechanically cutting all competing brush and hardwoods 20 feet away from any conifer within the unit. Specifications for the release treatment are listed in Attachment A of Conifer Release Contracts. Timing of release is critical to success. Removal of competing vegetation between July and late September proves to be the most effective period to hinder regrowth during the following spring. Furthermore, to make the release effective and limit the number of releases on any one unit, the conifer should be in their second to fourth growing season, exhibiting rapid height growth, and/or just beginning to become overtopped by competing vegetation. On very

young stands on sites with slow brush and seedling growth, hand fertilization of seedlings may be used to increase their growth and allow them to out- compete the brush.

Stand Improvement Program
The main goal of the Stand Improvement Program is to maintain forest stands in a healthy, free-to-grow state. Stand Improvement Programs include those activities whose objectives are aimed at promoting tree survival and maintaining or enhancing growth and quality during the first 35 years following reforestation. It is estimated that 700 acres per year will be treated during the planning period.

Activities addressed under this program include fertilization and thinning. The Stand Improvement Program maintains guidelines and specifications for determining if and when treatments are needed, type of treatment necessary, and the desired results of treatment. These determinations are based on stand exams, models, aerial reconnaissance, research, and site visits.

Aerial Fertilization
Fertilizing through aerial application methods is done to enhance a stand's growth and vigor. In some cases, fertilization may decrease pest and disease problems by increasing the vigor of the stand. For a stand to be considered for aerial fertilization, it must fall into one of the following five categories:

1. The site class of the majority of the stand or project area must be on sites ≥100 according to the most current stand inventory or from measured site trees.
2. Well-stocked stands that are in need of crown closure.
3. Chlorotic stands that are growing on nutrient deficient sites.
4. Stands that have been recently thinned.
5. Previously thinned stands 10-15 years from harvest.

Fertilizer may be applied to a stand up to 10 to 15 years before final harvest to promote growth, provide the carryover effect of the fertilizer to the new plantation and keep the cost of the project minimal by recapturing the cost in a relatively short period of time. Typically, the stands scheduled for fertilization have been precommercially thinned, but there may be times when an unthinned stand would be fertilized. A fertilizer designed to address the needs of the stand will be used and applied by experienced personnel and contractors, in accordance with the QIN FPRs.

Each unit proposed for aerial fertilization will undergo an environmental checklist to finalize any environmental concerns and mitigation measures. Following are some general application guidelines (for a full description of mitigation measures refer to the FMP environmental assessment):

- Fertilizer is typically applied in the early spring months to coincide with new root growth.
- Fertilizer may be applied within riparian management zones.
- Fertilizer pellets will be of sufficient size and weight so as not to drift out of the application area.
- Care will be taken to prevent any overground flow from occurring during application or expected to occur in the project area for at least 2 days after application.
- The use of specialized weather forecasts will be used to determine when operations can occur.

- Fertilizer will not be applied on snow when the slope of the ground is over 10% or when the snow level is deeper than 2 inches.

Further specifications and details can be found in the Aerial Fertilization Contract. Changes to the contract will be developed over the planning period if there are new developments in fertilizers, research and/or environmental concerns.

Thinning

There are three types of thinning used on the QIR as a stand improvement treatment:

Precommercial Thinning (PCT): A thinning from below in young stands mostly focused on spacing. PCT is done to reduce competition for growing space. The smaller, less healthy stems are removed to allow the larger healthy stems more access to light, moisture, and nutrients. Eligibility for PCT is based on diameter at breast height (dbh), age (approximately 10 to 25 years old, depending on species) and density.

Density is broken down into three categories:

- Stands with 1,000+ TPA—Highest priority
- Stands with 500 to 999 TPA—Second priority
- Stands with 300 to 500 TPA—Lowest priority

Stands with less than 300 TPA are not eligible for PCT. The maximum cut diameter, measured at breast height, is 7 inches. General thinning specifications are delineated in Attachment A of the Stand Improvement Contract, and are subject to minor changes over the planning period.

Precommercial Timber Stand Improvement Thinning (TSI): Timber Stand Improvement thinning is also from below and is done in stands that are considered backlog (an overstocked stand that is at least 15 years old). Reasons for doing a TSI thinning include growth enhancement, reducing the need for site preparation, conifer release, and/or reduction of piece handling during harvest. Density requirements are similar to those for PCT, however these stands are generally older than PCT stands and exhibit slightly more crown closure and lower live crown ratios. Stands with less than 400 TPA are given the lowest priority and probably will not receive treatment. Along with age and density, other eligibility considerations include:

- Accessibility of the stand,
- Stands that are in close proximity to PCT units,
- Soil and site potential and nutrient limitations as well as sensitivity to compaction and degradation by machinery,
- Stand is 15-30 years from scheduled harvest,
- Growth enhancement; the crop trees within the stand should have an average live crown ratio of at least 30%,
- Species, current dbh classes, and potential for the enhancement of log quality (stem characteristics and volume per stem) are considered for growth enhancement prescriptions
- Potential for reducing slash loading at the time of harvest and the enhancement of planting spots
- Potential for benefits from the reduction of piece handling at the time of harvest by possibly reducing harvest costs
- Potential for the reduction of fire hazard after harvest.

As with PCT, the maximum cut diameter, measured at breast height, is 7 inches. General thinning specifications are delineated in Attachment A of the Stand Improvement Contract and are subject to minor changes over the planning period.

Commercial Thinning (CT): Commercial thinning is an intermediate stand treatment that is done to benefit the residual stand quality by redistributing and maximizing growth potential on the most desirable trees. A secondary objective is to capture volume that would otherwise be lost to mortality. Most commercial thinning is from below; however, a thin from above may occur particularly in response to forest health issues.

Unless thinning is timed properly, crown recession can continue to the point where release becomes problematic.

Windthrow can be problematic in recently thinned stands in this region. Following is a list of windthrow risk factors that have been identified on the QIR (without attempting to order them or quantify the risk associated with each):

Natural windthrow factors:
- Shallow rooting in predominantly western hemlock and Sitka spruce stands,
- Large open areas,
- Exposure to storm winds, topography,
- Wet soils,
- Shallow soils,
- Stands that were initially very dense before thinning, which have not had the opportunity to develop wind firmness,
- Stands heavily infected with root rots.

Management windthrow factors:
- Stands adjacent to clearcut units that occur within a few years after thinning,
- Stands with height to diameter (H/D) ratios approaching or exceeding 80,
- Stands 50 years and greater in age that have not been thinned in the past,
- Narrow buffer strips between clearcut units and roads and/or clearcut units and streams.

Blowdown tends to occur in these areas during winter storm events, particularly after heavy rains have saturated soils. Where blowdown is a significant risk, some steps can be taken to minimize the risk:

- Density. Thinning to a density level that does not open the stand to blowdown must be considered. Some Alaska studies indicate that no more than about 1/3 of a stand's basal area should be removed if blowdown is a significant risk.
- Edges. Windward edges (or potential windward edges) of the stand can be left unthinned to serve as a windscreen, and density should then be reduced as you proceed toward the interior of the stand until the desired stocking is reached.
- Gaps. Any created gaps should be kept small and should be located in sheltered areas of the stands.
- Orientation: units can be designed in such a manner to reduce the amount of stand "sail" for known prevailing wind, thus buffering the force of the wind.

The following criteria are considered prior to choosing a stand for commercial thinning harvest:

- Typically, stands will be between the ages of 25 and 45 years old and preferred to have been precommercially thinned.
- Potential stands will be at or near crown closure.
- Average crown ratio of crop trees will also be a consideration as a predictor for potential response to thinning. The minimum live crown ratio for all species of leave trees will be 40 percent; however, 45 to 60 percent is the preferred crown ratio.
- The potential for forest health issues before and after the thinning treatment.
- Relative density may be used as an indicator of overstocked conditions.
- Typically, selected stands will have an average height of at least 80 feet and height-to-diameter ratios less than 80 (80:1 for Douglas-fir, e.g., 80 feet tall tree x 12 inches dbh = 80).
- The distance to a market for small wood products is an economic consideration as is the current and predicted log prices for small diameter wood.

Stands, on the average, need at least 15 to 20 years between treatments or between the treatment and final harvest to realize the optimum benefits of commercial thinning.

The process for recommending a stand for commercial thinning will be the same as for the regeneration harvest: it will be reviewed by the Interdisciplinary Team and, if approved for harvest, the Presale staff will formulate the required documents and layout and mark the stand.

Thinning Criteria

For a stand to be considered eligible for any of the three thinning treatments, a review of the area is conducted to determine if established guidelines and criteria have been met. Candidate stands are reviewed by aerial photo interpretation to identify stand types. The soils and site indices of the area are recorded and verified from the NRCS Soil Survey of the QIR, and the QIN inventory. Stands with a site index of at least 100 are given the highest priority for treatment.

Once chosen, the stand is reviewed by the inventory forester or stand improvement forester to determine if there are records of a stand exam. If not, a field review (walk thru) is conducted to estimate total trees per acre (TPA) for PCT and TSI, or basal area for CT.

Currently, units with less than 300 TPA are not eligible PCT or TSI; however, CT would still be an option. Rather than using a TPA requirement, commercial thinning is evaluated on a variety of criteria with emphasis on basal area. If a stand meets the planning criteria, a pre-treatment inventory is conducted and another field review may be scheduled to re-establish boundaries. Following these preliminary procedures, a more defined prescription must be written. Prescriptions may include “no treatment” or “deferred treatment” for stands or parts of stands that fall outside of the thinning guidelines.

5.4 Forest Chemicals

Currently Approved Use
Forest chemicals may be used at the seed orchard to maintain the health and vigor of the seed orchard trees for conifer seed production and at other developed sites for vegetation control. Also, triclopyr may be used to control gorse or scotch broom on the QIR. The QIN has been actively restoring riparian forest habitat by removing invasive Japanese knotweed species. For these activities, glyphosate and imazapyr herbicides have been approved for use in all knotweed control projects.

For the purposes of this discussion, forest chemicals include pesticides and herbicides. The use of fertilizer is addressed in the Stand Improvement component of this section.

Process for Future Forest Chemical Use
Following ID Team recommendation and approval from the Business Committee, forest chemicals may be used on lands within the QIR boundaries to protect trust and tribal resources, to maintain road right of ways, maintain weed free rock pits, and for forest development activities (such as site preparation and conifer release) in accordance with all QIN laws and regulations. All label requirements will be followed. Consideration will be given to avoid chemical application in riparian areas.

The use of forest chemicals (outside the seed orchard and developed sites) must be approved by the QIN Business Committee (through the Land and Natural Resources Committee). Once this approval has been granted, the process for approval continues with an FPA. The Manager of the Forestry Department must be informed of the need and the FPA submitted to the QIN EP Department for review and approval. An HPA will be required if applying forest chemicals within 200' of a body of water. Once approval is granted through EP, the FPA and HPA must be submitted to the Director of QDNR for approval.

Table 5.2: Forest Chemicals. Following is a list of forest chemicals that may be used and is not to be considered exhaustive:	
• Glyphosate	• Triclopyr
• 2, 4-D	• Amitrole
• Bromacil	• Dicamba
• Fosamine	• Hexazinone
• Imazapyr	• Metsulfuron
• Picloram	

In the event of an emergency insect or disease outbreak, insecticides or fungicides may be considered.

Guidelines for Forest Chemical Use
Use of forest chemicals will be managed to meet water quality standards and to avoid harm to the environment, with particular attention to protecting riparian and wetland vegetation.

All label requirements will be followed.

Attempt to the fullest extent possible to have zero drift and zero entry of aerially applied forest chemicals into water. However, with current technology and operational needs, it is not practical to achieve zero drift. Recognizing this, the QIN FPRs will be amended to implement best management practices designed to eliminate the direct entry of chemicals to water (defined as the entry of medium to large droplets), while minimizing off-target drift. In addition, the FPRs will be revised to minimize entry into riparian areas at levels that would cause damage to vegetation.

Guidelines for Aerial Application of Forest Chemicals:
To keep chemicals out of surface water and wetlands, a buffer will be left on all typed waters and wetlands, as set forth in the following table. Operators will maintain an offset from the outer edge of riparian and wetland buffers. These application requirements do not apply to Bacillus thurengensis (Bt) which is a biological control. When applying Bt, however, the operator will be required to meet all label requirements.

To protect riparian vegetation, chemicals will not be applied within any riparian buffers.

Operators applying aerial chemicals will apply the initial swath parallel to the buffer strip identified in the preceding table unless a deviation is approved in advance by the ID Team. Drift control agents shall be required adjacent to buffer strips. Operators applying aerial chemicals will use a bucket or spray device capable of immediate shutoff. Operators applying aerial chemicals will shut off spray equipment during turns and over riparian buffers, wetland buffers, and open water.

Table 5.3: Buffers on streams and wetlands for aerial application.
***Adapted from Title 222 WAC-Forest Practice Rules Chapter 222-38 WAC-Forest Chemicals.**

		WIND			
		Favorable		Calm or Unfavorable	
Nozzle Type	Application Height	Buffer on water	Offset from Riparian Buffer	Buffer on water	Offset from Riparian Buffer
Regular Nozzle	Low (<16')	Width of the Riparian Buffer	As needed for safety	Width of the Riparian Buffer	50 feet
	Medium (17-50')	Width of the Riparian Buffer	As needed for safety	250'	N/A
	High (51-65')	Width of the Riparian Buffer	As needed for safety	325'	N/A
Accu-flo Nozzle or equivalent**	Low (<16')	Width of the Riparian Buffer	As needed for safety	Width of the Riparian Buffer	20 feet
	Medium (17-50')	Width of the Riparian Buffer	As needed for safety	Width of the Riparian Buffer	20 feet
	High (51-65')	Width of the Riparian Buffer	As needed for safety	Width of the Riparian Buffer	20 feet

*Dry (no surface water at the time of application) type O streams segments do not require a buffer unless the chemical used has a half-life that extends into the wet season.
**Any nozzle set up that creates less than 1% fine droplets by volume that are under 105 microns.

Operators applying aerial chemicals will leave a 200-foot buffer strip around residences and 100-foot buffer strip adjacent to lands used for agriculture unless such residence or farmland is owned by the forest landowner or the aerial application is acceptable to the resident or landowner.

Guidelines for Ground Application of Forest Chemicals with Power Equipment
Ground application of chemicals with power equipment will not be permitted within 50 feet of Type D and H waters, unless prescribed for hardwood conversion or as necessary to meet requirements for noxious weed control. In any event, operators are to leave a 25-foot buffer strip on each side of wetlands and all other surface waters. However, dry stream segments (i.e., with no surface water at the time of application) do not require a buffer unless the chemical used has a half-life that extends into the wet season. The use of machinery for roadside or road right-of-way applications for vegetation control or noxious weed control will follow the rules for ground application.

Guidelines for Hand Application of Forest Chemicals
Hand application of forest chemicals will only be applied to specific targets, such as vegetation, trees, stumps, and burrows, or as bait or in traps. No chemicals will be applied by hand within the riparian buffers of any Type D and H waters, unless prescribed for restoration/hardwood conversion or as necessary to meet requirements for noxious weed control.

Operator Education and Licensing
Operations managers and field supervisors are encouraged to include a minimum of 10 hours of training on forest best management practices and water quality issues every 5 years, with no more than 3-1/2 hours in any one year. Training similar to that required for the applicators and operators should also be required for the operations managers and field supervisors. Private and Commercial applicators applying restricted use pesticides (RUPs) in Indian country must be federally certified, unless the tribe is covered under another EPA-approved or EPA-implemented plan. Private applicators also have the option of obtaining the federal certification by submitting a signed application form and proof of completing the training requirement. See the application or website for more details on the training requirement. Applicators and supervisors may also be required to be licensed or certified by the State of Washington.

Management Actions
In addition to the specific Forest Development activities previously cited, adaptive forest management will require evolving techniques and program development to meet changing needs and/or opportunities. These may include:

- New or advanced opportunities to use genetics,
- New science on disease resistance or prevention,
- New science or techniques for thinning or stand management,
- New science or techniques for site preparation or reforestation,
- Removal or alteration of vegetation to respond to management needs or for pest protection.

Chapter 6: Forest Invasive Species

Plants either provide a service or a disservice to the ecosystem. Invasive plants do a disservice to the ecosystem and the natural resources important to the people of the land. These invasive plants inhibit timber production, degrade salmon habitat, lower nutritional forage availability to wildlife, and outcompete cultural native plant resources. The effects of invasive species are detrimental to the Nation's economic and subsistence resources.

Control of invasive species on the QIR began in 1998 with the treatment of an isolated Gorse population. A larger invasive species control effort started in 2007 with the treatment of knotweed in Prairie Creek. In 2011 the Quinault Indian Nation hired its first Invasive Species Specialist with grant funded dollars. In 2014, the position was made a full-time permanent position funded by tribal dollars.

A Vegetation Management Plan is needed to develop a strategy to control invasive species on the QIR and within the Usual and Accustomed area. The plan will be developed based on the needs of the QIN, the level of threat of specific invasive plants to the QIN's resources, and the most cost-effective and ecologically conscious control methods.

6.1 Goals and Objectives

(1) Protect timber, fish and wildlife resources on the QIR from the negative impacts of invasive plant species.

(2) Coordinate efforts with other members of Cooperative Weed Management Areas.

(3) Cooperate in BIA/QIN ID Team meetings and field reviews.

(4) Develop and implement land management measures to prevent further spread of invasive plant species during management activities.

(5) Identify and prioritize invasive/noxious weeds and areas for treatment.

(6) Develop and maintain inventory.

(7) Develop and maintain funding.

(8) Educate the community.

6.2 Invasive Species Prioritization Strategy

Establish adherence to management of noxious weeds in accordance with area priorities as follows:

1. Prevention of potential invaders. Invasive species in the vicinity of the QIR include English laurel, Herb-Robert, knapweed species, loosestrife species, English ivy, Eurasian watermilfoil, Brazilian elodea, parrotfeather, yellow arcangel, yellow flag iris, *Arundo donax*, pampas grass and similar ornamental grasses, cordgrass species, garlic mustard, starthistle species, and more.

2. Control of new and invading species new to a particular part of the QIR. It takes less time and energy to eradicate a small isolated population of a newly introduced species than it would if the species were allowed to take off. To date species in that are controlled this way include **English holly** and **butterfly bush**.

3. Containment and management efforts on established stands. Of the many number non-native plant species on the QIR, the weeds that will be focused on are the ones that degrade timber, fish and wildlife resources and other things important to the QIN. These are **Japanese, Himalayan, giant and Bohemian knotweed**, **Scotch broom, gorse**, **Himalayan and evergreen blackberry**, and **reed canarygrass**.

6.3 Priority areas to control invasive species

1. Small isolated populations. (i.e. English holly and butterfly bush locations)
2. High use areas are likely to spread weeds: gravel pits, boat launches, roads, parking lots, etc.
3. Timber sale harvest units. For timber stand improvement and prevention of further spread due to management activities.
4. Riparian and wetland habitat for salmon habitat and water quality issues: knotweed control is a top-down eradication approach. For other priority invasive species that are widespread (i.e. Reed canarygrass) riparian habitats will have to be further prioritized (i.e. by sub-watershed) for management.
5. Wildlife habitat. Control of vegetation in regards to forage quality, animal behavior and other issues.
6. Culturally significant areas (QIR prairie complexes, canoe stand, cemeteries, Villages of Queets and Taholah, Point Grenville).

6.4 Regulatory Procedures

Pesticide Applicator's License/Aquatic Endorsement
To apply herbicides, applicator must have a Washington State Department of Agriculture (WSDA) pesticide license or be under the supervision of a license holder. Furthermore, an aquatic endorsement is required to apply herbicide in riparian areas. The pesticide license and aquatic endorsement can be obtained by passing two exams provided by the WSDA. License must remain up to date. http://agr.wa.gov/PestFert/LicensingEd/Licensing.aspx

EPA Pesticide Applicator Certification in Indian Country
In order to apply herbicide in Indian Country, an EPA Pesticide Applicator Certification must be obtained. This can be obtained by filling out an appropriate form and mailing it in with a copy of the WSDA pesticide license. http://www2.epa.gov/pesticide-applicator-certification-indian-country

National Pollutant Discharge Elimination System (NPDES) permit
A permit must be obtained from the Washington Department of Ecology prior to applying aquatically formulated herbicide within 25 feet of a body of water. The amount of herbicide and the acreage of treatment within 25 feet of water will have to be reported at the end of the year. https://secureaccess.wa.gov/

Hydraulic Project Application
An HPA permit must be obtained by the QDNR Hydraulics Officer in order to apply herbicide within 25 feet of water on the QIR.

Landowner Permission
Permission must be granted to survey and treat invasive species. There is a standing agreement with the BIA and the QIN to treat invasive species on trust and tribal land. In order to survey and/or treat invasive species on fee, private, state, or other federal land permission must be obtained. This is either done through the Quinault/Queets/Clearwater Weed Management Area or by written agreement from the landowners. The County Noxious Weed Control Board provides a contracted service of contacting landowners and obtaining permission.

Herbicide Application Best Management Practices
Transporting, storing, mixing and applying herbicides must adhere to standard regulations found on the herbicide label. This includes application rates, PPE, spill kits, MSDS, etc.

Herbicide Application Record
A WSDA herbicide application record must be filled out completely for each day and project area where herbicide is applied.

Posting Notice
Notice of herbicide application must be posted 24 hours prior.

Table 6.1 Description of Priority Invasive Species

Priority	I: Eradication: completely eliminate	II: Containment: prevent further spread		III: Management: Prioritize areas to control		IV: Eradication of newly introduced priority invasive species	
Species	Knotweed Species. Japanese (*Fallopia japonica* or *Polygonum cuspidatum*), Himalayan (*P. polysatchyum*), giant (*P. sachalinense*) and Bohemian (*Polygonum x bohemicum*)	Gorse (*Ulex europaeus*)	Scotch broom (*Cytisus scoparius*)	Reed canarygrass (*Phalaris arundinacea*)	Himalayan and evergreen blackberry (*Rubus armeniacus* and *R. laciniatus*)	Butterfly bush (*Buddleia davidii*)	English holly (*Ilex aquifolium*)
Effect on QIR resources	Out competes native vegetation, causes erosion, increases water temperature, decreases forage nutrition and availability, inhibits timber production, and more	Inhibits timber production in the harvest units	Inhibits timber production in the harvest units, inhibits forest succession on the Quinault River floodplain, is a nuisance on roads, and more.	Out-competes native vegetation and changes hydrology due to sedimentation	Erosion on stream banks, inhibits some forest development, and is a nuisance for traversing the land for recreation and management activities	Inhibits forest succession on gravel bars of streams and rivers	Inhibit timber production
Methods of reproduction	Stem and root fragments as well as up to 30 foot rhizomes	Heavy seed set that can remain viable in the soil for 60 years	Heavy seed set that can remain viable in the soil for 60 years	Produces a heavy seed set, can reproduce at every node on the stem and spreads by the rhizome	Seed and canes root upon contact with ground	Seed and rhizome	Seed
Methods of Spread	Spread down streams, during management activities, and wildlife.	Thought to have been brought onto the QIR by being attached to a vehicle.	Vehicle tires and gravel from pits containing seeds	Spread downstream, by wind, wildlife, and management activities	Long distance dispersal by birds	Water, air, management activities	Birds, management activities
Extend of infestation on QIR	Mainly found in the Quinault River floodplain, along tributaries, gravel pits, harvest units, road sides, in Taholah, and various other places	Five known Gorse sites on the QIR	Gravel pits, roads, gravels bars on the mainstem Quinault River and its tributaries, and often harvest units	Being investigated	Being investigated	One reported butterfly bush in the QIR forest and there are many residential gardens in the surrounding area	A few trees reported in the QIR forests
Control efforts	Actively controlled since 2007	Actively controlled since 1998	Little to no previous efforts. Management plan underway.	Some treatment since 2011. Better	Little to no previous control efforts.	Treated but also disrupted by brushing activity	Locations mapped

6.5 Treatment prescription

Treatment prescriptions are made based on most cost-effective and ecological conscious method. These prescriptions may change as technology advances. Although not always practical, mechanical methods are always preferred to reduce chemical output into the environment. Cut-stump treatment (if appropriate for the species) is the next preferred method as it is cost-effective and has the least impact on surrounding plants and the environment. Mechanical or cut-stump should be used in areas where people gather to ensure that there is no risk of herbicide exposure.

7. **Knotweed species** (*Polygonum* sp.). Herbicide treatment only. Most effective later in growing season. Knotweed treatment season July-October.
    a. Foliar herbicide application. Broadcast spray using backpack sprayers. Water solution made of 1% imazapyr aquatically labeled (Habitat, Polaris), 1 % aquatic labeled modified vegetable oil surfactant (Competitor) and dye. For spraying near a well use water solution of 5% aquatically labeled glyphosate (AquaMaster or AquaNeat), 1 % aquatic labeled modified vegetable oil surfactant (Competitor) and dye

8. **Scotch broom** (*Cytisus scoparius*) and **gorse (***Ulex europaeus*) Pull, cut, cut-stump, or foliar. Pull or cut-stump is preferred.
    a. Cut-stump: hand sprayer application. Apply just a drop on the cut stem or enough to cover cut stump. Water solution made of 40% glyphosate (AquaMaster or AquaNeat), dash of non-ionic surfactant (Dyne-Amic), dash of dye
    b. Foliar: Backpack sprayer application. Water solution of 5% garlon 3A (triclopyr), 2% non-ionic surfactant (Dyne-Amic) and dye.

9. **Reed canarygrass** (*Phalaris arundinacea*) Foliar herbicide application. Selective & careful spot spray from backpack. Water solution made up of 1.5% aquatically labeled glyphosate (AquaMaster of AquaNeat), 1 % aquatic labeled modified vegetable oil surfactant (Competitor) and dye.

10. **Himalayan** and **evergreen blackberry** (*Rubus armeniacus* and *R. laciniatus*) Pull, cut-stump, mow or foliar. Pull, mow or cut-stump is preferred.
    a. Cut-stump: hand sprayer application. Apply just a drop on the cut stem or enough to cover cut stump. Water solution made up of 40% aquatic glyphosate (AquaMaster or AquaNeat), a dash of modified vegetable oil surfactant (Competitor) and a dash of dye.
    b. Foliar: Backpack sprayer application. Water solution made up of 5% aquatically labeled glyphosate (AquaMaster or AquaNeat), 1 % aquatic labeled modified vegetable oil surfactant (Competitor), and dye.

11. **Butterfly bush** (*Buddleia davidii*) Cut-stump treatment using a hand sprayer. Water solution made up of 40% aquatic glyphosate (AquaMaster of AquaNeat), a dash of modified vegetable oil surfactant (Competitor) and a dash of dye.

12. **English holly** (Ilex aquifolium) Cut-stump treatment using a hand sprayer. Water solution made up of 40% aquatic glyphosate (AquaMaster of AquaNeat), a dash of modified vegetable oil surfactant (Competitor) and a dash of dye.

6.6 Other invasive species

Other invasive species may be controlled in special circumstances. For example, all non-native invasive species are a priority in the prairie complexes on the QIR. In addition, conditions or information may change in the future that may make these weeds present on the QIR a priority. The following are such species found on the QIR that are generally low priority:

Low **Priority** Invasive Species			
Species	Tansy ragwort (*Senecio jacobaea*)	Purple foxglove (*Digitalis purpurea*)	Canada thistle (*Cirsium arvense*)
Effect on QIR resources	Toxic to cattle. Out-competes native vegetation.	Out-competes native vegetation.	Out-competes native vegetation.
Methods of reproduction	Seed. Biennial species- rosette in first year, flower/seed second year.	Seed. Biennial species-rosette in first year, flower/seed second year.	Seed. Rhizome.
Methods of Spread	Wind-born seed, water, roadways.	Water, roadways.	Air, water, roadways.
Extend of infestation on QIR	On roadsides and gravel bars of streams and rivers. In clear-cuts.	On roadsides and gravel bars of streams and rivers. In clear-cuts. Decommissioned roads.	On gravel bars of streams and rivers. Roadsides.
Treatment	Pull	Pull	Foliar herbicide treatment with aquatic labeled glyphosate (5%).
Control efforts	Tansy pulled at mouth of Queets 2015.	Foxglove pulled along trail leading to Moses Prairie in 2015.	Sprayed on the Clearwater river 2014, 2015.

6.7 Invasive Species Prevention Strategies

Prevention Strategy	Description
Treat existing infestations	Treat existing target invasive plant infestations with appropriate methods before ground disturbing activities begin if timing and resources allow. Treat target invasive plant infestations in the project area upon completion of the project in order to prevent invasive plants from colonizing the disturbed ground.
Work in infested areas	Quinault Department of Natural Resources will flag and map locations of target invasive plant infestations prior to the start of activity in the project area. Maps will be provided to all relevant parties at IDT and pre-work meetings. These areas should be avoided during the planning phase and during activity in the project area. If directed to work in infested area, the contractor should be required to prevent spreading the infestation into un-infested areas by coordinating treatment plans.
Equipment	Prior to moving off-road vehicles and equipment used during management activities to and from the project area, seeds, soil, vegetative matter, and other debris that could hold seeds and viable cuttings should be removed.
Weed-free material	All material (e.g. soil, gravel, sand borrow, aggregate, etc.) transported onto Quinault Indian Reservation land or incorporated into the work should be weed-free. If this is not possible, see “Work in infested areas”.
Disposal of infested fill	Fill material from the project site, containing or suspected to contain invasive plants, should be stockpiled within the project area and as close to the infested source area as possible. The material should not be broadcast for disposal.
Weed-free mulch	Mulch used in project areas should be weed-free. Refer to Invasive Species Specialist for guidance.
Weed-free seed	Seed used in the project areas should be weed-free and meet state and local noxious weed laws. Refer to Invasive Species Specialist for guidance.
Plant natives	Give priority to seed mixes and plantings with local native species. If local native species seed mixes are not practical, second priority should be seed mixes local to the Pacific Northwest region. Seed mixes with species of European and Asian origin should not be used. Refer to Invasive Species Specialist for guidance.

Chapter 7: Air and Water Quality

7.1 Air Quality

The air we breathe affects our health and can even have negative effects on the environment. Poor air quality can result in increased hospital visits for those with respiratory and other health issues in individuals of all ages, cause visibility impairment, and environmental damage as well. Two activities on Quinault forests have the potential to affect air quality: wildfire and prescribed fire.

Air quality on the QIR is generally excellent because of the close proximity to the Pacific Ocean and westerly prevailing winds, and the absence of urbanization and smoke emitting industry. Thus, the amount of smoke impacting public roadways, local communities, Class One air sheds, and designated areas is minimized through management. This can be accomplished by using historical experience, current and predicted weather forecasts, satellite weather imagery, and consultation with the WA-DNR - Smoke Management Division.

Good air quality is important to the health of the reservation and those living on it. The Federal Clean Air Act (CAA) is the main law regulating air quality. Under the law, the EPA sets air quality standards, known as The National Ambient Air Quality Standards (NAAQS). Authority is delegated to the tribe to implement the Federal Air Rules for Reservations (FARR). In accordance with FARR, it is our job to minimize the negative health and environmental effects on Reservation caused by forestry related activities. The FARR applies to all persons (both Tribal members and non-Tribal members) and businesses located within the federally recognized exterior boundaries of the QIR regardless of ownership status of the land.

7.2 Water Quality

The Quinault Water Quality Program is funded by the EPA with the goal of monitoring, assessing, and improving surface water conditions within the QIR. Consistent water monitoring and assessment provides quantitative data and scientific understanding of changes occurring in the water. Ideally, the Water Quality Program will identify any water quality issues that threaten human health or aquatic life, assess the cause or causes, and manage the issue through regulation or restoration.

Illustration by Scott Kryskalla

Water Quality Standards

Water Quality Standards are regulations that specify the quality necessary to maintain a water body's intended uses by protecting it from degradation. It is important that our Water Quality Standards clearly designate how much pollution our water bodies can absorb and still safely support these intended uses. Standards need to be in place to assure that hazardous levels are avoided that may threaten QIR water uses such as recreation and salmon habitat.

After appropriate water quality data are collected and analyzed, the Water Quality Program intends to negotiate with the EPA for approval of Tribal Water Quality Standards unique to, determined by, and regulated by the QIN.

Timber Harvest and Water Quality

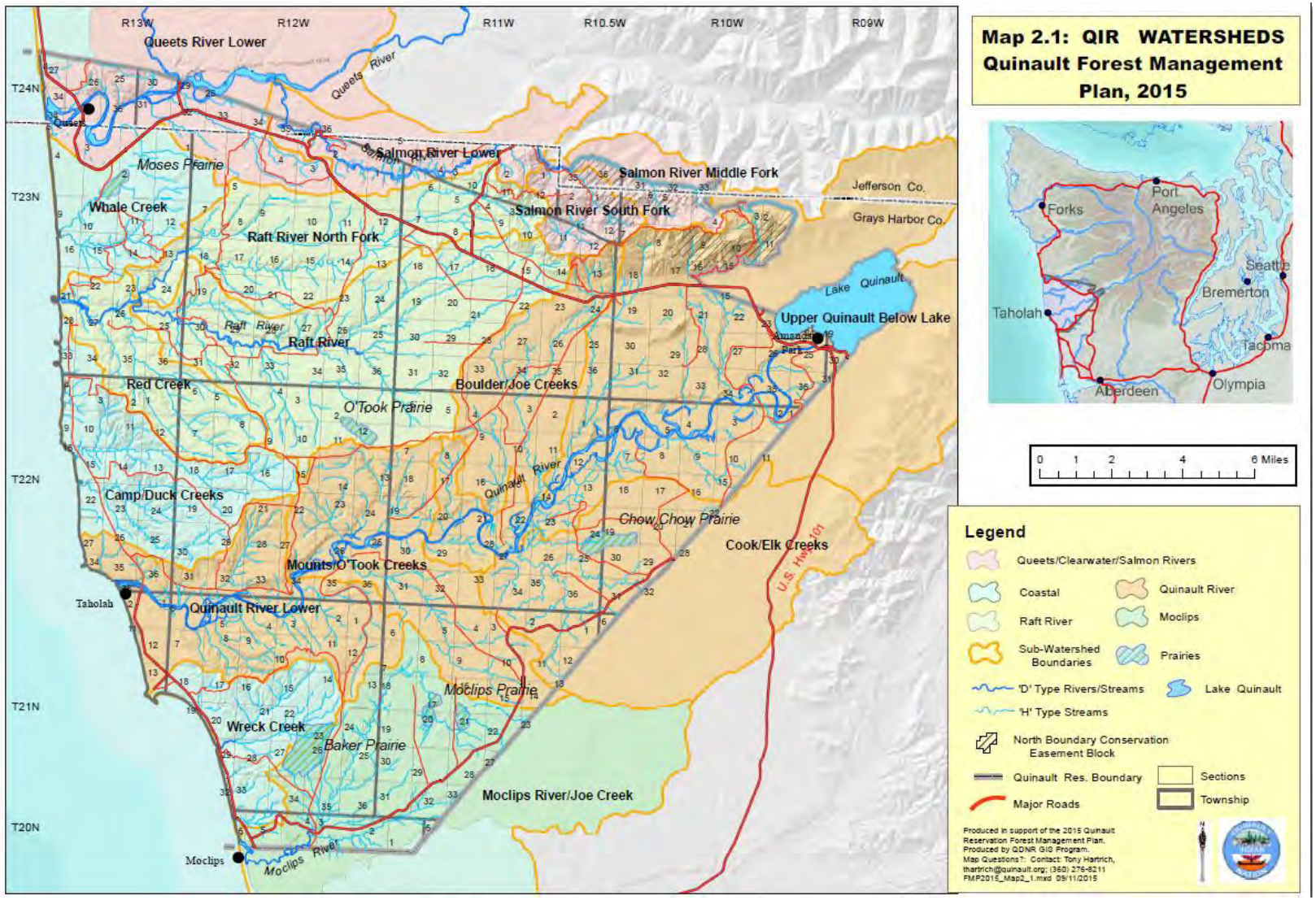
Water quality is significantly affected by Forest Management Practices. Riparian trees regulate aquatic ecosystem processes such as inputs of light, organic matter, nutrients, and sediment that can be altered dramatically when these trees are harvested. Riparian buffers are widely used to mitigate the impact of clear-cut logging on aquatic ecosystems.

Timber harvest invariably creates an increase in solar energy to streams, which affects factors such as water temperature, primary production, and insect abundance (Kiffney et al. 2003). In a study conducted in British Columbia on the effects of timber harvesting on streams with various sizes of riparian buffers, they found that at the most intensively logged

sites (28% of the basal area removed), daily maximum temperatures were significantly higher (4 degrees C) for about 6 weeks in the first summer after logging than in pre-logging years or at the reference sites (Kreutzweiser et al. 2009). Buffer widths that have been measured to preserve stream shading range from 80 feet to 150 feet on each side of the stream (Beschta et al. 1987; Cederholm 1994).

One of the greatest water quality issues associated with timber harvest is an increase in sediment delivery to streams, which can cover stream substrates and negatively affect stream organisms. Erosion from gravel roads is of particular concern because a high proportion of the eroded sediment is introduced directly to streams; most of this sediment is finer than 2mm, which is the most harmful sediment size to fish and water quality (Reid, 1984). Positive correlations between fine sediments in salmon spawning gravel and total road length in a basin have been established (Anderson, 1954). It has been shown that a paved road yields less than 1% as much sediment as a heavily used road with a gravel surface (Reid, 1984). Skid trails (temporary roads that loggers use to move logs or trees from the stump to a landing) are also of concern because they typically represent 2% to 10% of a timber harvest's area (Sawyers, 2012). Even in areas where unstable landforms make up only a small portion of the land base, surface erosion and mass failures affect a large proportion of the stream system, as the stream transports the sediment throughout its length (Everest et al. 1987).

QIN natural resource managers are striving to minimize these effects on water and fish viability by maintaining riparian buffer zones and by conducting riparian restoration efforts in areas that have undergone land use change or damage to create a sustainable timber extraction program. Best Management Practices to minimize erosion on roads include using filter fabric, aggregate berm, straw bales/wattles, biofilter bags, sand bags, brush barrier, check dams, diversion dikes/swales, and/or sediment fences will be developed as a requirement of the FMP.



Map 7.1: Waters of the QIR and surrounding areas.

Water of the Quinault Indian Reservation
The QIR has over 1,300 miles of rivers and streams. The major rivers of the QIR are the Queets, Quinault, Raft, Salmon, and Moclips.

(i) The Quinault River is 69 miles long, and its watershed is 279,785 acres in size of which 90,017 acres are within the QIR. Its main tributaries include the North Fork Quinault River, Graves Creek, and Cook Creek.

(ii) The Queets River is 56 miles long; its watershed is approximately 302,048 acres, with 21,201 acres contained within the QIR. Its main tributaries include the Clearwater River, Salmon River, Sam's River, Matheny Creek, and Tshletshy Creek, as well as the Clearwater's main tributaries, the Snahapish River and Solleks River.

(iii) The North Fork Salmon River, Middle Fork Salmon River, and South Fork Salmon River, combine to form the Salmon River, which empties into the Queets River. The river's length, including its longest source tributary, is 18 miles and its watershed is 20,404 acres in size with approximately 8,498 acres contained within the QIR.

(iv) The Raft's watershed is approximately 50,390 acres and entirely contained within the QIR. The Moclips' watershed is approximately 29,795 acres of which 16,673 acres are within the QIR.

The QIR is also home to Lake Quinault, which covers 3,609 acres, and is part of the natural habitat for the unique Blueback salmon, one of only seven evolutionarily significant sockeye salmon units in the Pacific Northwest. The QIR also has a huge number of wetlands, the number and extent of which are currently being mapped. However a National Wetland Inventory estimated from aerial photographs that there are approximately 5,800 acres of wetlands on the QIR.

Current Water Conditions of the Quinault Indian Reservation

Temperature:
Temperature affects dissolved oxygen levels in the water, photosynthesis of aquatic plants, metabolic rates of aquatic organisms, and the sensitivity of these organisms to pollution, parasites and disease. Salmonids are particularly sensitive to thermal increase, which can block migration, lead to reduced growth, stress fish, affect reproduction, inhibit smoltification, and create disease problems (Carter, 2005). Salmonids seek temperatures below 15^{o}C, and deviations from the normal pattern can affect survival (Spence et al. 1996)

From 2010 to 2015 water temperatures in the Queets Watershed have been intensively monitored with 89 continuous water and air thermistors during the summer months. In 2014, the Water Quality Program found that the seven day average daily maximum (7DADM - calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date) temperatures in the Queets main-stem were hottest at the end of July and the beginning of August, when averaged temperatures were consistently between 21 ^{o}C and 22 ^{o}C During the same time period, the Clearwater also had average temperatures of 21 ^{o}C and 22 ^{o}C for several weeks, and the Salmon River had a 7DADM of 19 ^{o}C for the majority of July and August.

These temperatures are significantly higher than recorded temperatures taken in 1996, 1997, and 1998 in the Queets watershed, when official monitoring began. The main-stem Queets had a recorded temperature of 17.6 ^{o}C in 1996, and 17.0 ^{o}C in 1998, although these were not taken continuously or averaged. The Clearwater's highest recorded temperature from 1996 was 19.83 ^{o}C, and although it was not continuously monitored, this shows that temperature has not changed drastically in the past twenty years.

Temperature within the other basins have not been taken continuously, but summer temperatures have been shown to go only slightly above 16 ^{o}C during the hottest months in both the Quinault River and Moclips River, the Raft however appears to maintain cool temperatures, ideal for salmonids, throughout the summer.

pH (Acidity):
The pH of water is a measurement of how acidic or basic water is. It is measured on a scale from 0-14. Acidic values are from 0-7, with 0 being the most acidic. Neutral pH is 7, which is ideal for reservation surface waters. The pH scale is logarithmic, which means that water with a pH of 5 is 10 times more acidic than water with a pH of 6.

The Raft River has low pH values, with readings in certain areas as low as 4.79. The Moclips River also has low pH, with readings as low as 4.2 in certain areas. These are below the EPA's pH criterion of 6.5 to 9 for the protection of freshwater aquatic life. It is suspected that these low levels are naturally occurring due to sphagnum bogs, particularly because certain tributaries with extremely low pH levels are often areas with more significant wetland cover, and these readings have been consistently low since monitoring began twenty years ago. Even if these low pH levels are naturally occurring however, acidic water can have a negative effect on hatching success of fish eggs and reduce populations of macro invertebrates and amphibians.

Dissolved Oxygen:
Dissolved oxygen is necessary to many forms of life including fish, invertebrates, bacteria, and plants, which use oxygen for respiration. Coldwater fish like trout and salmon are significantly affected by low dissolved oxygen levels. When dissolved oxygen falls below 6 mg/L (considered normal for most other fish), the vast majority of trout and salmon eggs will die (Carter, 2005).

Readings of 5 mg/L are not uncommon in QIR waters, showing up in legacy monitoring records for the Salmon, the North Fork Moclips, the Moclips, the Quinault, the Clearwater, and the Raft, however only sporadically, they are not consistently that low in any QIR rivers.

E. coli:
Members of two bacteria groups, coliforms and fecal streptococci, are used as indicators of possible sewage contamination because they are commonly found in human and animal feces. Sources of fecal contamination to surface waters include wastewater treatment plants, on-site septic systems, domestic and wild animal manure, and storm runoff. *E. coli* is a species of fecal coliform bacteria that is specific to fecal material from humans and other warm-blooded animals. EPA recommends *E. coli* as the best indicator of health risk from water contact in recreational waters.

E. coli levels at 16 sites throughout the QIR have been monitored regularly since 2011. The risk level that we are monitoring for is 126 colony forming units (cfu) per 100 ml sample, which is predicted to cause gastro-intestinal illness in about 3% of people that come into

contact with waters at this level. The last time this level was reached was on October 16, 2014, after a large rain event, when levels of 126 cfu were exceeded at monitoring stations on the Moclips, the Lower Quinault, the Queets, and the Clearwater. The Raft however did not have high *E. coli* levels.

Flow:
Stream flow, or discharge, is the volume of water that moves over a designated point over a fixed period of time. It is often expressed as cubic feet per second (ft^3/sec). It is important because of its impact on water quality and on the living organisms and habitats in the stream. When there is a greater water volume and velocity, water is less affected by pollution, sedimentation, and has higher dissolved oxygen levels from aeration, which benefits fish.

There are continuous stream gages with long term period of record installed on the Quinault River (Highway 101 crossing), and the Queets River, and gages with shorter periods of record on Quinault River (Chow Chow Bridge site), the Salmon River, and Cook Creek. These have been identified as important flows to monitor particularly in relation to fish habitat and health.

The Quinault River at the highway 101 bridge was at its lowest flow in 101 years at 233 cfs on August 26th, 2015. The mean flow for the same day from the past 101 years is 861 cfs. The Queets had a flow of 405 cfs on August 26th, 2015, with the mean flow for the same day being 1060 cfs.

Objectives & Future Considerations

Over the next decade, the Water Quality Program intends to undertake a comprehensive, integrated approach to address water quality concerns, including:

- The development and expansion of water quality monitoring.
- Evaluation and assessment of data collected on water parameters, particularly in light of climate change projections.
- The pursuit and fulfillment of restoration and mitigation projects that will target damaged riparian zones and wetlands.
- Development and implementation of Quinault Water Quality Standards.
- The achievement of Treatment as a State from the EPA in regards to Water Quality.
- Providing public information and education to increase ecosystem awareness and knowledge.

The goal of the QIN Water Quality Program is to move toward the Preferred Future Condition for Land as expressed in the QIN's 2012 Strategic Plan: *"The waters, lakes and rivers that flow through the Quinault homeland are clean and cold and support the needs of our blueback and other salmon species and steelhead at all life stages. Wetlands, groundwater recharge areas, and all waterways are protected and enhanced to capture water and help mitigate low summer flows and the threat of high water temperatures. Quinault water needs for community use and to support our fisheries are secure."*

7.3 Climate Change

Scientific evidence and peer reviewed consensus affirm that climate change is happening. While the climate has gone through changes since the beginning of time, studies have shown that the rate at which those changes are occurring has increased dramatically due to anthropogenic (human caused) interference. The most potent research to date indicates that the extent and direction (warming or cooling) of climate change could be much greater and faster than previously predicted. Presently, extensive efforts are being made to better understand what is happening and why. Aside from being financially beneficial, forests contribute to the wellbeing of humans, wildlife, and the Reservation as a whole. For these reasons, it is of critical importance to achieve sustainable forest management by adapting forestry practices to the potential impacts of climate change.

While we can't say for certain how specifically our forests will be affected by climate change, studies and modeling suggest that a number of different scenarios are possible for Pacific Northwest Forests. Climate change has the potential to compromise the health of forests but also to increase their productivity due to warmer temperatures and the increase in carbon dioxide (CO2) available. While scenarios range from projections of forest expansion to dieback, most likely, forests will see increased primary productivity in the near future until a threshold is reached and temperature increases overwhelm the ability of trees to make use of high levels of CO2 and an increase in winter precipitation.

Other potential impacts include but aren't limited to: species loss, replacement of native species by non-native species that are more tolerant to rapid change, changes in species composition, density, and shifts in ranges, loss of biodiversity, introduction of invasive species, warmer, drier, & longer fire seasons which will increase the fuel load, risk of wildfires, and an increase in the frequency & intensity of wildfires, drought, extreme precipitation patterns, increase in the frequency of extreme weather events, etc.

In order to achieve our goal of maintaining a sustainable forest, we must continue to learn about the impending effects of climate change and modify our plans to mitigate them. This can be done through periodic assessments of forest health, observed changes, and assessing species vulnerability along with keeping up to date on current climate science and forestry applications. Ultimately, it is up to us to maintain a healthy forest ecosystem that will be able to withstand changes over time through our forestry management practices.

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Chapter 8: Fish and Wildlife Habitat

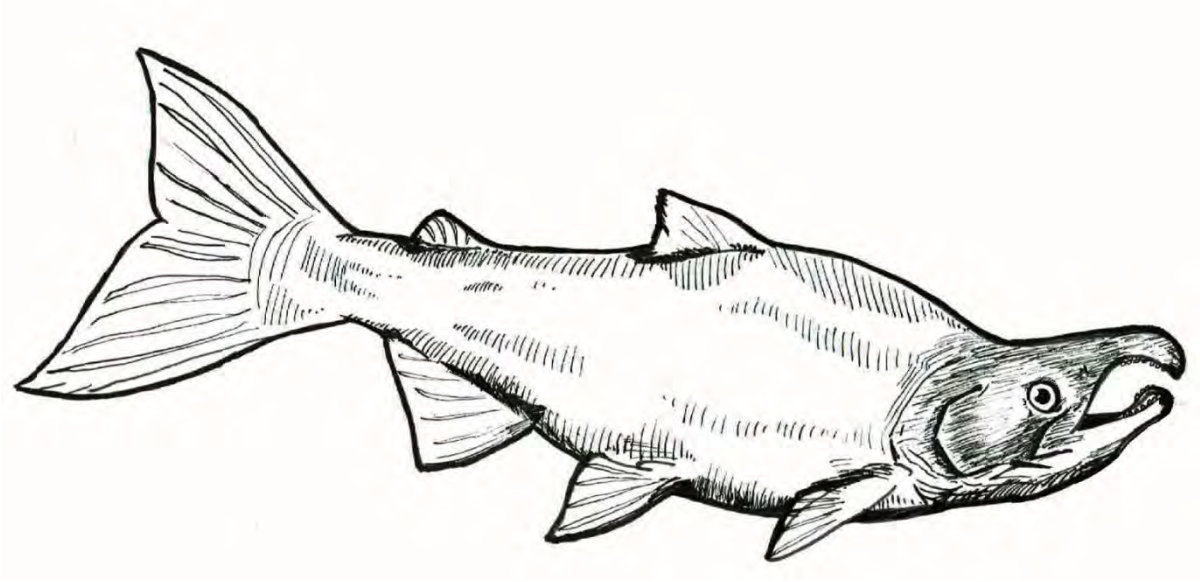


Illustration by Scott Kryskalla

8.1 Fish and Fish Habitat

This section discusses fish and fish habitat within the QIR in three parts:

(1) Effects of historic practices on fish habitat,

(2) Current fish habitat conditions, and

(3) Current conditions of fisheries.

Effects of Historic Practices on Fish Habitat

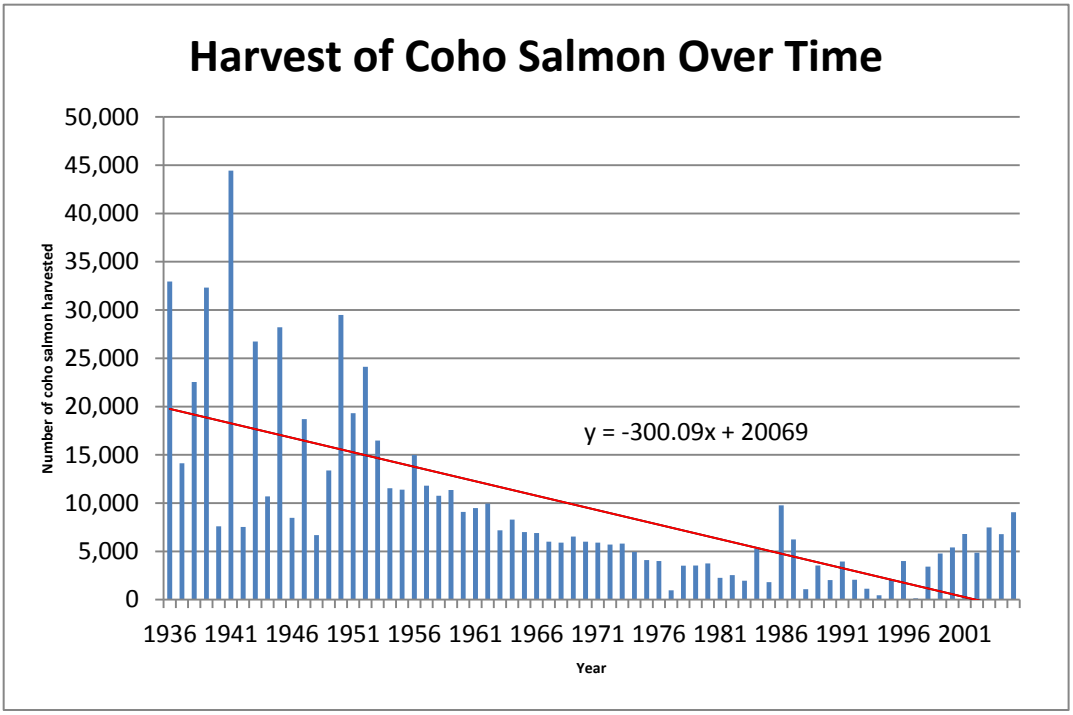
The Quinault people have depended upon various fish species for sustenance and livelihood since time immemorial. Pacific salmon (*Oncorhynchus* spp.) in particular are an iconic species integral to both the culture and heritage of the Quinault and other tribes throughout the greater Pacific Northwest (Pulwarty and Redmond 1997). Pacific salmon have historically served as a primary source of subsistence and income to many by supporting cultural, commercial, and recreational fisheries throughout the region.

Fisheries throughout the QIR have been significantly impacted by historic timber harvest practices, which have cumulatively contributed to the current degraded condition of QIN fisheries. The large-scale harvesting of mature riparian forests from the 1920's through the 1980's disrupted forest regeneration cycles within the floodplain. This historic approach to timber harvests led to an increase in road densities, the installation of fish passage barriers, the degradation of in-stream habitat, and the removal of in-stream, habitat-forming woody debris. Research has shown that such practices have considerably negative impacts on aquatic species, particularly Pacific salmon (Lichatowich 1999). Thus it is assumed that all species known to occur within the QIR were impacted by historic timber harvest practices.

Historically robust populations of Pacific salmon, which once occupied virtually all accessible and suitable habitats within the QIR and greater Pacific Northwest (Fulton 1968), have declined precipitously over the past century as a result of human activity (Matthews and Waples 1991; NRC 1996). Pacific salmon populations experienced four detrimental impacts that led to population declines: heavy fishing pressure in the early 1900s (Levin and Schiewe 2001); habitat destruction resulting from ill managed timber harvests (Pearse 1982; Lichatowich 1999); the construction of hydropower projects throughout the mid-1900s (Levin and Tolimieri 2001); and the development of supplemental hatcheries (Mann and Plummer 2000). These impacts were then compounded by a natural downturn in ocean productivity (Beamish et al. 1999), which has resulted in alarming population level impacts. Despite recent restoration efforts and improving forest practices to better protect riparian areas, the habitat for fish on the QIR is significantly impacted from the accumulation of these historic activities.

Current Pacific salmon stocks produced from the waters of the QIR are diminished from historic abundance (QDFi 1981; QDFi 2008; QDFi unpublished data). Estimates of salmon and steelhead harvests and escapements from the Queets and Quinault River's indicate that natural salmon produced from waters of the QIR may be reduced by as much as 70 percent since the 1940's and 1950's (QDFi unpublished data). Of the salmon stocks on the QIR, natural coho salmon (*Oncorhynchus kisutch)* escapement data provide a good indicator to demonstrate declines of salmon production associated with forest removal and habitat loss (**Figure 8.1**) particularly because coho utilize a range of stream types and accessible wetlands across the QIR.

Figure 8.1. Historic harvest of natural coho salmon in the Quinault River, including trend line. *Consistency of regulations governing schedules and fishing effort makes these data a robust index of relative stock abundance. The trend line illustrates the decline of coho salmon populations on the Quinault River.*



Forest management practices in riparian areas on the QIR began improving in the 1980s through more conscientious management decision and the implementation of Washington State Forest Practice Regulations. QDNR developed and implemented modernized silviculture practices and forest management program in the 1990s which improved commercial forest stand management on QIN and Indian Trust lands compared to the previous BIA forest management regime. Modernization of silviculture and forest practices on the QIR has led to improvements in commercial forest stand conditions with the goal of establishing sustainable timber production from QIN and individual Indian Trust lands.

With implementation of the QIR Forest Management Plan in 2003, forest management on QIN and Indian Trust lands included establishing minimal protections to fish bearing aquatic habitats using riparian buffers. QDNR started removing fish barriers and improving roads management practices to reestablish access for anadromous fish and to reduce potential road related impacts to riparian and aquatic habitats. QDNR also implemented an intensive invasive plant species treatment program to control knotweed and reed canary grass in infested aquatic habitats, floodplains, and road corridors. These actions have led to improvements in riparian forest conditions in select riparian areas on the QIR.

Current Fish Habitat Conditions

The QIR contains the entire Raft River watershed and portions of the Queets, Quinault, Salmon, Clearwater, and Moclips River watersheds. In addition, there are nine small independent watersheds draining directly to the Pacific Ocean that are partially or entirely contained within the QIR. In total there is an estimated 1,294 miles of rivers and streams and approximately 2,301 acres of wetlands on the QIR (QDNR 2014). There are more than 400 known fish passage barriers on the QIR, with many miles of streams that are at various levels of inaccessibility to anadromous fish (QDNR 2014).

Unfortunately physical and ecological data for watersheds within the QIR is limited and quantitative assessment concerning the status of riparian functions and aquatic habitats not yet feasible. Therefore, scientific literature was relied upon to qualitatively determine baseline conditions for salmonid habitat to represent all fish habitat on the QIR.

Salmonid Habitat Conditions

Salmonids require a diverse range of complex in-stream and riparian habitats to satisfy multiple life history stages specific to each species. Salmonids require access and use of a broad range of aquatic habitat types. These habitats range from the smallest, accessible intermittent streams and wetlands to the largest perennial mainstem river channels – if the aquatic habitat is accessible and of suitable quality and function for the species, there is a high probability that salmonids are utilizing it.

In naturally functioning riparian forest systems, floodplain forest regeneration cycles, floodplain development, and aquatic habitats are never truly static as they go through a continuous process of successional development, transitioning over time at varying rates in response to natural and anthropogenic disturbances.

On the QIR, anthropogenic disturbances from forest management activities can substantially impact salmonid habitat. For example, the harvests of timber in riparian areas result in a reduction of shading capacity; the reduction of shade leads to an increase in water temperature. Subsequently, increases of water temperature can have implications on aquatic flora and fauna, which require clean, cool, well-oxygenated water for optimum

growing conditions. Furthermore, forestry activities that affect salmonid habitat may have an impact on invertebrate communities within streams that form the main food source for fish (Campbell and Doeg, 1989).

Research has shown that timber harvest practices can increase the direct input of sediment to the stream channel (Swanson et al. 1987) as a result of: stream adjacent harvest and subsequent erosion (Scrivener and Brownlee 1989); surface runoff from harvest roads; and from large scale landslides (Cederholm et al. 1981; Swanson et al. 1987; Cederholm and Reid 1987).

Impacts of forest practices on salmonid habitat also include elevated concentrations of dissolved salts and suspended solids and nutrients, especially during peak flows, which contribute to a degradation of water quality (Campbell and Doeg 1989). Any chronic or acute increase in suspended fine sediment reduces the quality of habitat for salmonids and other aquatic species. Fine sediment that settles in streams or moves in suspension can reduce salmonid viability (Hicks et al 1991). While salmonids have exhibited adaptability to ambient sediment levels because of natural variations in sedimentation due to brief periods of high flow, overall increased fine sediment in spawning gravels and food production areas for salmonids leads to both reduced spawning success and a reduced food supply (Hicks et al 1991). Furthermore, fine sediment deposited in spawning gravel can reduce interstitial water flow, which can lead to a decrease in dissolved oxygen concentrations (Campbell and Doeg 1989).

Current Conditions of Fisheries

The watersheds of the QIR contain a diverse assemblage of salmonid and non-salmonid native fish species. Based on the geographic range of each species, at least twenty-eight species of fish are presumed present in aquatic habitats on the QIR (Appendix B).
Six salmonid species have been identified by Quinault Department of Fisheries (QDFi) as "species of cultural and biological significance" to QIN. The species include chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), sockeye (Blueback) salmon (*O. nerka*), chum salmon (*O. keta*), steelhead trout (*O. mykiss*), and cutthroat trout (*O. clarkii*). Non-salmonid species considered of value by QIN that have been observed or are presumed present in waters of the QIR include eulachon (*Theleichthys pacificus*), Pacific lamprey (*Lampetra tridentata*), and white sturgeon (*Acipenser transmontanus*).

Pacific salmon stocks produced from waters of the QIR support valuable tribal fisheries including commercial, subsistence, and sport fisheries. Most commercial and subsistence harvest by QIN fishermen on the QIR occurs in terminal fishing grounds located in the lower Quinault River and lower Queets River. Small commercial and subsistence tribal fisheries also occur periodically in the Moclips and Raft Rivers; and a few other small independent watersheds within the QIR. There is also some tribal harvest in ocean troll fisheries.

Status of Salmonid Stocks

There are reportedly forty-eight (48) Pacific salmon populations produced from watersheds entirely within or flowing through the QIR (QIN 2008 and QIN 2012). These stocks are identified as being of natural, integrated, composite or hatchery origin. There are also very small stocks that are observed occasionally in waters on QIR, but little is known about their origins; these stocks include pink salmon, summer-run sockeye salmon, summer-run coho salmon, summer-run chum salmon and summer-run steelhead (QIN 2008).

Determining the status of a salmonid species or salmon population varies depending upon the procedures applied and intent of the analysis (e.g. ESA listing versus fisheries management). The methods used to assess status of salmonid stocks reported here include those applied by Huntington et al. (1996) and QDFI (2008 and 2014), respectively.

Huntington et al. (1996) applied three criteria to identify and assess the status of native stocks:

(1) the stock is recognized by fishery managers as a separate stock,
(2) the stock has adapted to its local environment during a period of centuries, and
(3) stock fitness is not substantially reduced by artificial propagation or stock transfers.

Stocks identified as "healthy" by Huntington et al. (1996) also satisfied the following four criteria:

(1) at least one-third as abundant as expected in the absence of human impacts,
(2) abundant relative to current habitat capacity,
(3) self-sustaining with natural reproduction, and
(4) not previously identified as being at substantial risk of extinction.

Huntington et al. (1996) identified Queets fall chinook, Queets winter steelhead, and Quinault winter steelhead as "healthy" native stocks.

Table 8.1: Ratings of stock status for Pacific salmon in the Quinault and Queets River systems (QDFi, 2008; QDFi, 2014).

Stock [a]		Origin [b]	Lineage [c]	Risk Status [d]
Quinault River				
Chinook	Fall	Integrated	Composite	Low
	Spring/Summer	Natural	Wild	Moderate
Chum		Natural	Composite	Moderate
		Hatchery	Composite	Moderate
Coho		Natural	Composite	Low
		Hatchery	Composite	Low
Sockeye		Natural	Wild	High
Steelhead		Hatchery	Hatchery	Low
Queets River				
Chinook	Fall	Natural	Wild	Low
	Spring/Summer	Natural	Wild	Moderate
Chum		Natural	Wild	Moderate
Coho		Natural	Wild	Low
		Hatchery	Composite	Low
Steelhead		Natural	Wild	Low
		Hatchery	Composite	Low

[a]Stock: A stock may be made up of several breeding populations.
[b]Origin: The proximate source of annual runs.
[c]Lineage: Known history of genetic sources to the population; composite refers to a population that is derived from both wild and hatchery sources.
[d]Status: Qualitative rating of risk for continued decline or virtual extinction

Quinault Department of Fisheries (QDFi) (2008 and 2014) completed a qualitative review and risk analysis for Quinault and Queets River natural, integrated, and hatchery origin salmon stocks (**Table 8.1**). A stock or *meta-population* consists of a group of spatially separated sub-populations of the same species which interact at some level in a watershed scale. This definition was selected because it is the opinion of QDFi fishery managers and scientists that there is a lack of sufficient information to identify with confidence, specific salmon sub-population or sub-stock structure such as those reported by QIN (2012).

QDFi ratings of salmon stock status were categorized as low, moderate, high or unknown in the context of risk for further decline or in the case of Quinault sockeye salmon, virtual extinction. The Quinault River sockeye stock was rated high risk for continued decline or even virtual extinction. Quinault spring/summer chinook, Quinault River chum, and Queets River chum were rated as moderate for risk of further decline. The status of salmon stocks from the Raft River, Moclips River and the small independent coastal watersheds is unknown due to lack of sufficient information about their origins or population structure.

Status of Cutthroat Trout and Native Char Fisheries

Recreational sport and non-terminal subsistence fisheries in waters on the QIR also target anadromous and non-anadromous (resident) cutthroat trout and native char, which could be either Dolly Varden (*Salvelinus malma*) or bull trout (*Salvelinus confluentus*).

Cutthroat Trout

Resident cutthroat trout tend to inhabit very small streams in headwaters (Hartman and Gill 1968) and are often found upstream of steelhead trout (Hartman and Gill 1968) and coho salmon (Lowry 1965). Resident cutthroat trout are likely widespread across the QIR, but actual distribution and abundance, including that of anadromous cutthroat trout, is unknown.

Native Char

There are presumed to be three native char (Dolly Varden/bull trout) stocks present in waters of the QIR (QIN 2012). Bull trout are native to western North America, but were separated as a distinct species in 1978 (Meehan and Bjornn 1991). Prior to 1978, most bull trout populations in the west were called Dolly Varden. The Coastal-Puget Sound population segment of bull trout was federally listed as threatened in 1999.

Bull trout are very similar to Dolly Varden in their morphological characteristics and are usually differentiated through genetic characteristics. Bull trout and Dolly Varden, collectively referred to as native char, can exhibit migratory and resident (fluvial or adfluvial) life history forms. While in river and stream environments, they reside in colder water (usually 2-12 degrees C) with complex substrates of cobbles and woody debris and little fine sediments (U.S. Fish and Wildlife Service 1998). Migratory bull trout usually mature after 4 years in the river or stream environment before entering the lake or ocean and then returning later to natal streams to spawn (Rieman and McIntyre 1993).

Bull trout have been confirmed upstream of Lake Quinault and in the Queets River (Washington Department of Ecology 2008). Native char are frequently encountered in the lower Quinault River however, there are no known data confirming presence of bull trout in the Quinault River or tributaries below Lake Quinault.

Native char also occur in the Quinault River. Electrophoretic testing to determine whether these char are bull trout or Dolly Varden has not been conducted on specimens collected in the

Quinault River below Lake Quinault. Electrophoretic testing has confirmed the presence of bull trout in the Quinault River above Lake Quinault (Leary and Allendorf 1997). Surveys also have determined that bull trout are present in the Queets River. Their presence in other rivers on the QIR is unknown at this time, but they are assumed to be present until survey protocols are developed and used to detect their absence in the rivers on the QIR.

Fish Habitat Protection and Restoration

Riparian Management Zones

Riparian Management Zones (RMZs) are land and vegetation areas next to streams where management practices are modified to protect water quality, fish and other aquatic resources. These areas are complex ecosystems that provide food, habitat and movement corridors for both aquatic and terrestrial communities. Also, because these areas are next to water, RMZs help minimize non-point source pollution impacts to surface waters.

RMZs help to:

- Prevent or minimize excess sedimentation delivery to streams. As runoff water moves through plants and the duff layer (needles, leaves and decaying matter), it slows and drops sediments that has been carried along.

- Provides large woody debris input to streams. Large woody debris increases fish habitat quality and complexity.

- Shade Streams. In most cases, plants and trees along stream banks are necessary for shade, keeping water from becoming too warm for aquatic life in the summer.

- Stabilize stream banks. Trees and plants along stream banks reduce soil erosion because they 1) reduce the impact of raindrops on exposed soil, and 2) provide roots that hold the soil together which makes it more difficult for runoff to wash the soil away.

RMZs are verified by a member of the ID Team during the ID Team field review, ensuring that adequate protection are given to maintain fish habit.

8.2 Wildlife and Wildlife Habitat

Forest management practices can significantly affect wildlife species that occur within and surrounding the QIR. The diverse array of wildlife species interact with each other and the other components of the ecosystem to shape the development and health of the forest. These contributions and interactions have implications to forest development and forest health. Aside from the ecological contributions of wildlife, some species are valued for hunting purposes while other species are valued for cultural traditions.

QIN strives to promote healthy ecosystems to achieve objectives for sustained resource utilization, rather than single resources. The QIN has developed an ecosystem management policy that focuses "on productive ecosystems to achieve objectives for sustained resource utilization, rather than single resources" where "management actions will not jeopardize the continued existence of a species" (QIN Resolution No. 95, 1995). The way in which we practice forest management under the provisions of this plan will significantly influence wildlife well into the future.

The wildlife section of the FMP is divided into three parts:

(1) Current habitat conditions for wildlife, specifically for non-game and game species of importance to the Quinault People, including descriptions of how habitat conditions are evaluated.

(2) QIN's current procedures with regard to responsibilities to the ESA and Secretarial Order 3206 in order to promote healthy ecosystems for all species occurring on the QIR.

(3) Management directions for wildlife, specifically information on how the conditions of wildlife and their habitat will be monitored and how control measures will be implemented.

Current Conditions

Wildlife habitat on the QIR is diverse, and includes forests, riparian zones, prairies, estuaries, and the foothills of the Olympic Mountains; these habitats provide cover and forage for many species of mammals, birds, amphibians, and reptiles. Currently, wildlife habitat that exists on the QIR is primarily low elevation temperate forests that exhibit past and present human disturbance effects, primarily due to timber harvest and road construction. There are limited natural disturbances caused by fire and wind throw.

Limited population data is available for most wildlife species. With the exception of the bald eagle (*Haliaeetus leucocephalus*), there are currently no monitoring programs for any populations of non-game wildlife species on the QIR. Data for Roosevelt elk (*Cervus canadensis roosevelti*) and bald eagle is available through the Environmental Protection Department of QDNR. Population studies for cougar, black-tailed deer, and black bear are being developed. Historic data is available for marbled murrelet and northern spotted owl.

Increased monitoring of wildlife populations is necessary to provide the data required to analyze the condition of wildlife on the QIR and the cumulative impacts of timber management. It is a challenge to wildlife biologists to monitor the health of wildlife populations, to recommend

management prescriptions and to measure responses to management with little to no population data. Monitoring information will be used periodically throughout the life of the next FMP to inform adaptive management to improve wildlife habitat and decrease negative impacts.

Specific habitat components important to wildlife have not been maintained over the past ten years and would benefit from increased protection. Snags, legacy trees and green-tree retention are lacking across the landscape, limiting important wildlife habitat components. Course woody debris is currently represented across the landscape at acceptable levels, however current firewood extraction and cedar salvage operations are diminishing the large pieces, therefore monitoring and increased preservation may be necessary in the future.

Non-Game Wildlife Species of Importance

There are several non-game wildlife species of importance to the QIN. Bald eagles are not only culturally significant to the Quinault Indian Nation, but also are protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Act. Three species listed under the ESA: the northern spotted owl, marbled murrelet and bull trout, are known to occur within the QIR, and are protected from impact from forest management activities within the Conservation Easement, located in the North Boundary Area of the QIR.

(i) Bald Eagles. Bald eagle populations were severely impacted by the use of DDT and loss of old-growth nest trees in the mid-20th century and were formally listed as endangered under the Endangered Species Act in 1967, the Washington Population in 1978. Since then, DDT has been banned and nesting habitat has been protected, prompting the recovery of bald eagle numbers and the subsequent de-listing in 2007. The bald eagle is still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act, and has cultural value for the Quinault people. The QIN wildlife department has been conducting bald eagle occupancy and nesting surveys since 1998. The abundance of coastline and rivers within the boundaries of the QIR create a unique habitat for both nesting and non-nesting bald eagles.

Bald eagle nests are monitored, in helicopter and fixed-wing airplane, and surveyed over the major shorelines of the reservation. Bald eagles occupy territories near their foraging habitat; large rivers, the Pacific Ocean and Quinault Lake on the QIR. Nesting territories usually consist of at least one nest (often multiple with one active), and multiple roost trees; used as foraging perches, territorial lookouts and resting perches. Very large, old, emergent trees, commonly Sitka spruce (*Picea sitchensis*) and black cottonwood (*Populus trichocarpa*) are necessary for nest and roost trees. Bald eagles build the largest nests of any North American bird, up to 13 feet deep, 4.5 feet wide and weighing over one ton. Surrounding cover is also important to protect the nest from the elements as well as from nest predators such as crows and ravens.

Current suitable habitat for nesting and roosting bald eagles occurs along the Quinault, Raft, Salmon, Queets Rivers, Cook Creek, Lake Quinault & the Coast. Suitable bald eagle nesting habitat includes nests that are found in emergent trees that can support large nest structures and have unobstructed views of the surrounding area. Bald eagles within the QIR have been observed nesting in a variety of tree species such as black cottonwood (*Populus balsamitera*), western hemlock (*Tusuga heterophylla*) and most commonly Sitka spruce (*Picea silchensis*). Additional components of bald eagle habitat include perching and fledging trees, alternate nest trees and forested buffer trees protecting the nest tree from wind damage or wind throw. In addition to canopy structure, bald eagle nesting habitat on the QIR is all located near water bodies that will support adequate food supply. Wintering habitat for bald eagles on the QIR

require perches with great foraging proximity and a canopy structure that provides both protection and communal night roosts.

(ii) Northern Spotted Owls. Northern spotted owls were ESA listed as threatened throughout their range in 1990. Threats include loss of habitat to timber harvest and increased competition by the barred owl. Spotted owls typically occur in closed-canopy, structurally complex, uneven-aged, late-successional and old-growth forest. Forest stands as young as 50 years old may contain the habitat features necessary to support nesting owls (WDFW, 2012). Spotted owls eat a variety of small forest mammals, most importantly the northern flying squirrel on the Olympic Peninsula (Forsman et al, 2001). They require cavities in large, old-growth snags or tree platforms for nest sites and typically prefer riparian areas which provide thermal regulation in the summer. Territories of spotted owls are large, particularly on the Olympic Peninsula. Home range territories on the peninsula are estimated to average 2.7 miles around the nest site or approximately 23 square miles (Hanson *et al.* 1993). Spotted owls typically form long-term pairs for breeding and use the same territory year after year. One spotted owl territory historically occurred within the boundaries of the QIR, near the headwaters of Prairie Creek in the North Boundary Area (NBA). Six other spotted owl home range territories overlap the boundaries of the QIR. The nest sites for these territories occur within adjacent Olympic National Forest and Olympic National Park lands.

Suitable nesting habitat for Northern spotted owls exists in the North Boundary Conservation Easements of the QIR. This habitat is in long-term conservation status and has not been surveyed for owls recently. Tribal crews surveyed the entire NBA for spotted owls, from 1991 through 1997, using protocols endorsed by the USFWS. From 1993 through 1997, tribal crews surveyed adjacent Olympic National Forest lands to the north of the NBA. Additionally, the U.S. Forest Service and non-governmental agency personnel surveyed lands adjacent to the QIR for spotted owls. The results of these surveys are documented in the Washington Department of Fish and Wildlife (WDFW) spotted owl database.

(iii) Marbled Murrelets. Marbled murrelets were ESA listed as threatened throughout their range in 1992. Murrelets, as with northern spotted owls, primarily depend on old-growth forests for their inland habitat (Hamer and Nelson 1995). However, they forage for fish in the marine environment, flying back and forth from the marine environment to their nesting habitat in the forest environment during the breeding season.

Murrelets nest in large diameter trees with large branches draped in thick moss. They form a nest in the thick moss called a nest cup. Murrelets also can nest on mistletoe brooms. However, with either type of nest platform they need some amount of canopy cover to protect the nest and developing young from predators, such as the crow (*Corvus* spp.) Nests have been found to occur as much as 62 miles from salt water where they feed (Hamer and Nelson 1995).

Murrelets fly quickly, usually in the early morning hours and use large rivers, streams and sometimes roadways as flight paths to their nest habitat.

Suitable nesting habitat for marbled murrelets on the QIR exists mainly within the North Boundary Conservation Easements which are in long-term protected status. Murrelet population size is strongly and positively correlated with the amount of nesting habitat (Falaxa et al, 2011) therefore small patches of suitable nesting habitat that exist on the lower reservation are low-quality and likely not very productive. Riparian corridors along the main rivers of QIR connecting

the Pacific Ocean with high-quality nesting habitat in the Olympic Mountains provides important cover for migrating murrelets during nesting season.

Most of the surveys for marbled murrelets on the QIR were conducted in the NBA. Portions of the NBA were inventoried in 1991 and 1992 for marbled murrelets; however, these surveys were not conducted using protocols endorsed by the USFWS. Between 1993 and 1997, almost the entire NBA was surveyed for marbled murrelets using protocols adopted by the Pacific Seabird Group and endorsed by the USFWS. The results of these surveys showed occupied murrelet habitat or areas with murrelet detections over much of the NBA.

Game Species

Roosevelt elk (*Cervus elaphus roosevelti*) and black-tailed deer (*Odocoileus hemionus*) are the species on the QIR that are most frequently hunted for subsistence harvest. Black bears are hunted on the QIR to reduce timber damage and provide employment to tribal members.

(i) Roosevelt Elk. Roosevelt elk are the species most frequently hunted for subsistence and ceremonial purposes on the QIR. Elk select habitat that will include all features of the landscape necessary to support a viable population. Logging on the QIR is an important factor effecting elk habitat. The maximum number of elk that can exist in any habitat is generally controlled by forage both in terms of quantity and quality. Previous studies of Roosevelt elk habitat in coastal Washington indicate that old-growth coniferous forests, deciduous forests in valley bottoms and riparian areas and younger age classes of regenerating stands (6-15 years) of age were important habitats selected year round due to the abundant forage (Witmer and

Illustration by Scott Kryskalla

DeCalesta 1985, Jenkins and Starkey 1984).

Both quantity and quality of forage created by timber harvest is important to the long term sustainability of elk on the QIR. Reproductive success of Roosevelt elk has been tightly linked to the nutritional value of the diet. The benefits of clear cuts are short-lived; even-aged stands receive little use by elk. The pole-sized and mature stands reduce forage quantity as the canopy closes. The QIR contains a high density of roads resulting from timber harvest and extraction. Roads can have a negative impact on elk both through removal of potential cover habitat and disturbance from vehicle traffic.

(ii) Black-Tailed Deer. Black-tailed deer have the same core components of habitat as elk do, these consist of water, food and cover that must be interspersed in a way to deliver the necessary nutrition and cover for survival and reproduction. Black-tailed deer are more selective foragers than elk and will select a quality of forage over quantity (Nelson et al 2008). Deer are primarily browsers that select leaves, grass, twigs and buds of woody shrubs. Both early and late successional forests create more browsing opportunities on forested landscapes than closed canopy habitats for deer. In general smaller openings in a mosaic or patchy patterns that create edge habitat that will be more beneficial than one large clearing. Timber harvest strategies that mimic gap-phase forest dynamics have the most potential for retaining habitat for deer through all successional stages (Nelson et al 2008).

(iii) Black Bears: Black Bears (*Ursus americanus*) are often described as "umbrella" species because their broad habitat and space-use requirements encompass those of many other species (Noss et al. 1996). Washington State hosts one of the largest black bear populations in the lower 48 states (WDFW 1997), and the species occupies much of its historic range on the Olympic Peninsula. Black bear populations in this region face a wide range of land and wildlife management practices, from full protection in the Olympic National Park to aggressive population reduction programs on commercial tree plantations. The black bear's delayed sexual maturity, low reproductive rate, and long breeding intervals can make them vulnerable to overexploitation (Bunnell and Tait 1981, Miller 1990, Hummel and Pettigrew 1991). Understanding the black bear's relationship with habitat characteristics and human activities in this region is important because their delayed sexual maturity, low reproductive rate, and long breeding intervals can make them vulnerable to overexploitation (Bunnell and Tait 1981, Miller 1990, Hummel and Pettigrew 1991).

Black bear home range sizes are usually directly related to the amount and availability of resources (e.g., food, water, shelter) in the area (Jonkel & Cowan 1971, Mitchell & Powell 2007, Immell et al. 2014). In western Washington, reported black bear home range sizes vary greatly by geographic location. Average female home range size was 2 km^2 in southwest Washington (Lindzey and Meslow 1977), 15.9 km2 on the northwest corner of the Olympic Peninsula (McCoy 2008), and 28 km^2 in the southwest region of the Olympic Peninsula near the QIR (Koehler & Pierce 2003). Black bear home ranges on the QIR are likely influenced both by harvest practices—where clear-cut openings can produce abundant fruiting shrubs as forage—and by supplemental feeding from the baited hunting program. Home range sizes for black bears on the QIR are currently unknown; acquiring this information could provide valuable insight into black bear behavior and the response of bears to different management practices.

Females are particularly important to the productivity of a population (Elowe & Dodge 1989, Kasworm and Thier 1994, Obbard and Howe 2008, Malcom & Van Deelen 2010). Reproduction in black bears is density-independent and controlled by habitat quality and quantity (i.e., food abundance; Bunnell & Tait 1981, Elowe & Dodge 1989, Schwartz & Franzmann 1992). Thus, it

is essential to understand how females interact with their environment and the resulting effect on their reproductive rates. In northeastern Minnesota, Rogers (1989) observed greater growth rates and reproduction in black bears whose diets were supplemented with human garbage than in bears that consumed natural foods only. There is currently no data regarding the effects of bait barrel feeding on QIR black bear litter size, age at primiparity, and other factors of productivity. Yet assessment of a population's reproductive potential is critical to evaluate factors limiting bear densities, model population viability, and develop management strategies that promote long-term persistence of bears on the landscape.

Knowledge of the movement of bears on the landscape can also help biologists evaluate whether management practices are sustainable. A black bear population may be able to sustain high harvest rates of sub-adult males if high immigration rates also exist (Schwartz & Franzmann 1992). However, females exhibit a high degree of philopatry and tend not to disperse (Elowe & Dodge 1989, Costello et al. 2008, Costello 2010) so recruitment of new females through dispersal is unlikely (Schwartz & Franzmann 1992). Managers need to understand both the productivity of a population and the movement of individuals on the landscape to assess the probability of and the mechanisms underlying a population's persistence.

Winter hibernation is a critical life history trait of the American black bear and dens must protect bears from inclement weather and provide security from disturbance over an extended period (Davis et al. 2012). Persistent rainfall and the lack of permanent snow cover in coastal temperate forests limit the range of structure types that bears can use as dens. Therefore, bears in coastal forests rely primarily on large wooden structures for den sites: large-diameter trees, stumps, root boles, or logs (Davis 1996). Intensive management practices that harvest late-successional forest types and maintain young rotation ages may reduce the quality and availability of these denning structures (Davis et al. 2012, Immell et al. 2013). Understanding local den site characteristics and timing of den entry and emergence are vital to assessing the effects of current forest management practices on local bear populations.

Prior telemetry studies on black bears were conducted on the Olympic Peninsula and provided valuable information on black bear habitat use, home ranges, and/or productivity (e.g., Koehler and Pierce 2003, McCoy 2008, Sager-Fradkin et al. 2008). However, these studies were not conducted under the same combination of land management and hunting practices that occur on the QIR.

As tree damage reduction goals are being reached, the Wildlife Section seeks to evaluate the status of bears on the QIR and ensure long-term sustainability of the population. In 2015, QDNR biologists launched an intensive black bear population study. The biologists will estimate bear abundance and density using non-invasive genetic sampling, where DNA extracted from captured bear hair can yield sex, individual identification, and relatedness of black bears.

The hair-snag portion of the study will be conducted over a period of 8 weeks during the summer months. In addition, QDNR biologists plant to capture live bears and fit them with GPS collars. The data acquired from collared bears will provide valuable information regarding resource selection, movements, home-range sizes, and reproduction of black bears on the QIR. The Wildlife Section hopes to use the data from both the hair sampling and the GPS collars for input into future models of black bear population viability and sustainable harvest rates.

SO 3206 and ESA Responsibilities
The ESA was passed into Federal law in 1973 to conserve threatened and endangered species and their habitats and to bring about their recovery. Section 7 of the ESA, Interagency Cooperation, requires that any action authorized, funded, or carried out by a Federal agency (BIA) does not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species.

The Department of the Interior and the Department of Commerce issued Secretarial order 3206 (SO 3206), entitled "American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act", which was the culmination of months of negotiations between agency officials and tribal representatives. The order's overarching theme was to harmonize the federal trust responsibility to tribes and the statutory missions of the Departments of the Interior and Commerce in implementing the ESA. SO 3206 laid out five principles that the departments must adhere to.

The principles included working directly with Indian tribes on a government-to-government basis to promote healthy ecosystems; recognize that Indian lands are not subject to the same federal control as federal public lands; acknowledging that Indian tribes are appropriate governmental entities to manage their lands and tribal trust responsibilities and support tribal measures that preclude the need for conservation restrictions; be sensitive to Indian culture, religion, and spirituality; and to facilitate the mutual exchange of information (SO 3206, 1997).

Under SO 3206, QIN strives to promote healthy ecosystems to achieve objectives for sustained resource utilization, rather than single resources. The QIN has developed an ecosystem management policy that focuses "on productive ecosystems to achieve objectives for sustained resource utilization, rather than single resources" where "management actions will not jeopardize the continued existence of a species" (QIN Resolution No. 95, 1995). This philosophy provides for a sustainable management of resources on the QIR, which will subsequently provide habitat for ESA listed species.

Wildlife Management Direction
The following wildlife management measures have been incorporated into this FMP to provide self-sustaining populations of wildlife species of particular concern on the QIR.

(a) Bald Eagles. Bald eagle habitat will be maintained and developed in riparian and coastal areas throughout the life of the FMP on the QIR. Primarily, protection of potential and existing eagle nesting habitat will occur within RMZs (see Chapter 3.7 for RMZ widths). Some eagle habitat that occurs outside of RMZs however, will be maintained through individual timber sale planning, per the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) as well as the Migratory Bird Treaty Act of 1918.

(b) Federally Protected Species. Management for federally protected species (such as marbled murrelet) will be concentrated within the remaining old-growth habitat in the NBA.

(c) Salmonids. Salmonid habitat will be managed primarily through the measures designed to protect the rivers and streams from any potential negative impacts of forest management. RMZs will provide shade and coarse woody debris to the rivers and streams, which in turn will provide desirable stream temperatures and substrate characteristics for bull trout. See Chapter 3.7 for specific prescriptions for RMZs. Prescriptions for road maintenance, road construction,

and culvert and bridge replacement and installation also will minimize negative impacts to Bull trout habitat. See Chapter 4 for specific prescriptions for road management.

(d) Roosevelt Elk and Black-Tailed Deer. Green-up requirements to provide for elk and deer cover habitat are a part of the harvest strategy in the FMP (see Chapter 3: Timber Management Standards).

Roosevelt elk populations are assessed for a variety of characteristics on the QIR to include herd composition counts and population size and trends. Herd composition counts are done annually in the spring time flights that estimate proportions of elk age and sex classes that occur in the population. Population objectives are determined by staff that includes factors such as: consistent subsistence harvest levels and seasons, current population estimates, harvest levels, nutritional status, current condition of available forage, occupied summer and winter ranges and current land use practices. In addition to the herd composition counts the QIR wildlife section continues to monitor current and future of population dynamics and habitat selection of Roosevelt elk. This is done through capturing and radio-collaring Roosevelt elk on the QIR and on adjacent lands. Radio telemetry data including satellite collars allow for determination of the current status and survival rates of Roosevelt elk that are tribally managed and hunted. The data collected will be used to model elk population estimates with the data collected through herd composition population counts, mortality rates and harvest. In addition to the population monitoring Wildlife managers used the radio telemetry data to determine Roosevelt elk home range size and habitat selection to manage for and maintain for viable and productive Roosevelt elk populations.

Black-tailed deer populations are difficult to survey there are still many unknowns about black-tailed deer and population dynamics on the QIR. Management directions in the future will be developed into standardized survey protocols or population models for black-tailed deer. Spotlight surveys will be conducted in the spring and fall to estimate deer composition. The goal of deer population on the QIR is to maintain relatively stable populations with the available habitat on the QIR.

(e) Black Bears. The management focus on black bears is primarily related to the damage they cause by feeding on the cambium layer of vigorously growing trees in spring and early summer (see Chapter 5: Forest Development). In order to reduce bear damage a guided bear hunting program has been implemented.

The goals for black bear management on the QIN are to 1) manage black bear to reduce damage caused by bears to coniferous trees, 2) minimize threats to public safety from bears, 3) manage populations for sustained yield and provide income opportunities through guiding and 4) manage the population for a variety of recreational, educational, cultural and aesthetic purposes. More information is needed to accurately monitor and model black bear populations.

Some amount of bear damage to trees should be expected because this is a natural occurrence in managed and unmanaged forests. Other methods that have been and will continue to be implemented include planting at higher conifer stocking densities and with a mix of species. Both may help to further reduce damage (Stewart *et al*. 1999). However, the amount and distribution of young stands on the QIR, combined with favorable coastal growing conditions for shrubs, will continue to support a substantial bear population.

Other ways to significantly reduce the amount of bear damage to trees include altering the amount and distribution of young stands through other silvicultural prescriptions (commercial thinning, smaller clearcut size, selective harvest, etc.), and through landscape planning. In response to bear damage a guided bear hunting program was established in 2004. Tree damage flights have indicated a decline in dead trees per acre on the QIR since the guided hunting program was established.

Throughout the life of this Plan, current and potential control methods will be evaluated to determine which are most effective in limiting damage to a tolerable level. The current population and home range size of the bear population on QIR will be studied in order to determine the appropriate level of control. Upon bear population modeling and estimates, the bear hunting program should be adjusted to maintain a sustainable harvest on the population in order to both reduce damage of timber and to maintain the population of bears.

8.3 Timber Management Considerations for Wildlife and Fish

Big Game Habitat Requirements for Timber Sales:

To maintain adequate hide and cover for big game on the QIR, a maximum clearcut size of 240 acres will be allowed.

If a portion of the proposed clearcut harvest is greater than 800' from a designated leave area or other set aside of one acre or greater, green tree retention is required. A minimum of two green trees will be retained per acre for each acre that is greater than 800' from the set aside.

Two snags will be retained per acre. The size of each should be at least 12" in diameter and 6' in height. Where possible, snags should be clumped in small groups and scattered across the landscape to prevent loss from fire. When not in conflict with harvest operations, all remnant old growth snags with minimal merchantable value will be retained.

Two downed logs will be left per acre following harvest. Downed wood will have a small-end diameter of 12" or greater and a length of 20' or greater. Live trees will not be felled to meet this requirement. If the wildlife biologist determines that the unit is deficient in downed wood, the ID Team may require some otherwise merchantable trees be left.

Table 8.2 Big Game habitat recommendations for timber sales
Retain connected “clumps” of trees rather than isolated individual leave trees in clear cuts to provide more effective thermal and security cover.
Maintain small forest openings: less than 50 acres on critical habitat for big game. Intensive timber harvest can benefit elk from the increase in forage. A mixture of open and closed canopy habitat is optimal.
Close or limit access to open roads into critical big game habitat such as riparian harvest and prairies.
Conifers have a low forage value for deer and elk but they will use them as winter forage so selecting red and yellow cedar should be favored over the retention of Douglas-fir, hemlock and spruce.
Buffer important habitat features such as ridge tops, knolls, meadows, wetlands and riparian zones.
Avoid broad slash piles or extensive slash fields that hinder or prevent big game travel.
Retain intact old-growth forests and roadless riparian areas that provide critical habitat.

Federally Protected Wildlife
Protections for marbled murrelets and northern spotted owls are limited to restricting helicopter flights below 500’ over the conservation easements during the nesting season (March 1 through September 30).

Bald eagles are not only a species culturally important to the Quinault People, but also protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). Bald eagles on the QIR will be managed per the Bald and Golden Eagle Protection Act and under any permits that the Nation receives under the Act.

Chapter 9: Cultural Resources

No right is more sacred to a nation, a people, than the right to freely determine its social, economic, political, and cultural future without external interference… We call the exercise of this right Self Determination." Joseph De la Cruz, Quinault Indian Nation 1989

Cultural resources represent the historic heritage as well as the current-day living culture of the Quinault people. Cultural resources include prehistoric and historic archeological sites; areas of traditional or spiritual significance as well as the time honored traditional fishing, gathering and harvest areas for medicinal plants, foods, and supplies. Cultural resources comprise all elements of the natural environment including the plants, animals, fish, water, air, and the physical landscape. These elements possess an intrinsic value for the family(s), band(s) and/or tribe(s) of people that inhabit, use and continue these practices, on the Quinault Indian Reservation.

Although the Quinault people participate in the social and economic activities of today's society, they maintain their cultural identities through spiritual and cultural pursuits such as ceremonies, traditional gathering, and vigilance of ancestral burial grounds and habitation sites. The spiritual and cultural survival of the Quinault people is largely dependent upon the forestlands because of the many ceremonial locations, burial sites, traditional gathering areas, and archaeological sites located upon them. These areas contribute to the tribal community's way of life, their identity, and their traditional practices and cohesiveness.

These resources do not exist in a vacuum; instead they are situated in an environment that is frequently changing and often times being developed or modified. Thus, management decisions on how to address protective measures, mitigation or other trade-offs should be developed by diverse group of QDNR staff or agency personnel and tribal members.

Of equal importance with respect to management procedures is the limited inventory of cultural resources, resource locations, and current cultural needs of the Quinault people. Such fundamental baseline data are limited. The harvesting of plant resources (some commercially valuable species are considered Special Forest Products) is crucial to the Quinault people because harvest is an important way of transmitting traditional knowledge to the next generations about ecology and management of native species. Current uses of native species and their products are diverse in their cultural use for foods, medicine, tool making, weaving, and ceremony.

This chapter contains the following sections:

- Regulation
- Current Conditions of Cultural Resources
- Management Direction

Terms and Definitions

Cultural Resources.: Cultural resources include archaeological and historic sites, artifacts, traditional sites and objects used by Native Americans. These are found throughout, both above and below ground and above and below water level. Examples of cultural resources include graves, cave or rock shelters, culturally modified trees, tools, cracked rock, shells, shipwrecks, bones, weapons, and many others. Some date back thousands of years, and may be invisible to the unknowing eye.

Prehistoric and Ethnohistoric Native American Archaeological Sites: Prehistoric sites represent the material remains of Native American societies and their activities. Ethnohistoric sites are defined as Native American settlements occupied after the arrival of European settlers. Such sites include villages, seasonal and temporary camps, ancient and historic trails, hunting blinds, butchering sites, and cemeteries or burial sites. In the Pacific Northwest, there is a high correlation for prehistoric sites to be associated with riparian areas primarily due to waterways being used as transportation routes and domestic habitation. These sites are current favorites for contemporary resource extraction, development, and recreation. With proper archaeological investigation these types of sites can verify or illustrate how the earlier period Quinaults interrelated with their environment.

9.1 Regulation

Regulations for Cultural Resource Protection and Management for the Quinault Indian Reservation could be developed. However, when QIN does not have guidelines established the governing regulatory tool thus defaults to - The National Environmental Policy Act (NEPA) unless specific activities are covered by tribal policy. NEPA can be a powerful tool for managing the impacts of the modern world on "cultural resources" such as historic buildings, historic districts, archeological sites, Native American traditional places, and traditional ways of life. A variety of other acts, policies, laws, and executive orders also serve as guiding mechanisms (see **Appendix H**).

9.2 Current Conditions

Culture and resources are within our everyday world and they do not exist in a vacuum. There is a daily threat to Quinault cultural resources due to resource extraction and other activities. A balance must be found between protective measures and adaptive management resource extraction.

Inventory and/or baseline data. Often times due to the sensitive nature of cultural resources, tribal members will withhold their location and are often held in confidence and secrecy so as not to be exploited; although some sites are disclosed when land management decisions may affect them. Establishing standard procedures for attaining and ensuring confidentiality of this information is essential.

A major shortcoming for proactive management of cultural resources is the limited inventory of resources, resource locations, and current cultural needs of the Quinault people. Such fundamental baseline data are limited and the data that do exist are often project specific and do not include the entire QIR landscape. A landscape survey and establishment of a searchable confidential database would be very beneficial.

Few efforts have been made to record and preserve the traditional cultural knowledge and lifestyle of the Quinault people. One such effort is the ethnographic compilation of “The Quinault Indians” by Ronald Olson (1936). From this effort, archaeologist Gary Wessen (1978) and others have conducted limited field investigations along the Quinault River and the Lake Quinault areas. Regrettably, they have not located any significant archaeological sites.

Traditional Harvest Activities. Understanding traditional harvest activities helps to promote valued habitats for cultural resources and broader restoration objectives. Quinault practitioners today, as in the past, adapt and respond to areas of the landscape affected by fires and timber industry activities to acquire resources of value. Tribal communities rely on the diversity of landscapes to maintain a variety of cultural traditions such as hunting, basket making, food gathering and ceremonies.

Prairies. Traditionally, prairies were very important habitats. These areas offered the preferred environment for foraging for food and medicinal plants, as well as big game. Prairies were burned to promote a diverse habitat for their needs and essentials. Fire management reduced the competing vegetation and provided nutrients for desired plant communities. Several plant species require fire both for persistence and for maintenance of desired growth forms and quality. In the absence of fire, many of these species will decline in abundance and/or mature to a condition where the plant material is not suitable for traditional cultural uses. The use of fire reduces competing brush and young trees, and cleans the by-products leftover from harvest activities. Burning also encourages browse species by producing a timber edge effect that entices deer, elk, and migratory birds into the prairie environment. A lack of fire can pose a threat to the sustainable production of these essentials in the quantity and quality desired by Quinaults to sustain traditional life ways and livelihoods. One of the principal beneficiaries of a culturally maintained landscape is the basket weavers as they often harvest individual plants or patches at specific habitats within the environment.

Beargrass. Beargrass is an important plant in the understory of conifer forests. The decline in abundance may be due in part to the exclusion of fire however, in the Quinault area the direst threat is the illegal harvest activities. For the Quinault, beargrass is an important basketry species. The floral industry demand for beargrass adds to increased harvest levels. The influx of outside harvesters concerned only with bulk collection distresses the quality and integrity of the plant. Insensitive harvest techniques affect the quality of weaving products and the damage to the beargrass populations incurred requires a much longer regeneration period. Consequently, efforts to replicate traditional burning, policing efforts, in addition to an educational component regarding proper harvest techniques would

Terms and Definitions

Historic Sites: Historic sites include historic land uses, such as homestead residences; roads and trails; bridges; Civilian Conservation Corp facilities; railroad grades; and logging, mining, and recreational landscapes. Many of the areas favored by ancient people were also favored by modern-day people. Development does not always mean that a site disappears as there may be undisturbed remnants below the contemporary development or activity that could with proper archaeological field methods provide a valuable glimpse into the past lives of the ancient Quinault people. Primarily these types of sites provide a glimpse into the transitional phases of the old ways to modern civilization.

Traditional Heritage Resources: Traditional heritage resources include areas of special religious or spiritual significance where traditional practices are performed. These sites play an important role and give the Quinault people a strong sense of place. These resources might or might not be associated with culturally modified material remains or landscapes. They can include riparian locations, old forest settings, mountains, traditional hunting or meeting places, traditional plant gathering and fishing places, and burial sites.

be necessary to ensure that beargrass habitat is perpetuated. In beargrass, fire spurs rhizome growth and it improves the quality of the leaves for basketry by decreasing sclerified tissue, thereby increasing pliability for weaving.

Special Forest Products. Many other special forest products that merit consideration include but are not limited to be western white pine, salal, moss, sword fern, chanterelle mushrooms and cedar.

Western Red cedar. Traditionally, the western red cedar tree has played a vital role in the Quinault lifestyle. Continuation of this product is of the utmost importance for cultural uses. Currently, a preserve known as the Canoe stand has been set aside, but the trees from this stand are a finite product. An inventory to ascertain what is there should be conducted as soon as possible. Plus, the QIN needs to evaluate the feasibility of plantations for new cedar groves for future cultural uses.

9.3 Management Direction

Although current regulations deter disturbance or destruction of archaeological sites, the QIN and BIA must strive to ensure protective measures and continued safeguarding of prehistoric and historic village sites, burial grounds, and other cultural resources. Potential impacts of forest management practices on cultural and archeological sites may be identified and addressed through the ID Team process. Cultural Resources discovered during timber sale preparation, timber harvest, or any forest related activity may be addressed by the Cultural Resource staff however if human remains or an archaeological site is uncovered a professional archaeologist may be called in to handle the discovery. Inadvertent discoveries are protected by Federal regulations, policies, or Executive Orders. The Officer in Charge may promulgate any modifications of the operation necessary to protect the resource.

Cultural resource management and protection is not singular dimension archaeology, it encompasses many laws, acts, regulations, and executive orders. It is within the best interests of the Nation to establish a Tribal Historic Preservation Office (THPO), create an on-reservation cultural resource department or a cultural committee is responsible for reviewing harvest proposals and identifying cultural resource concerns within a proposed timber harvest area. A review period of at least 60 days is required to adequately address these concerns.

When applicable, cultural resource surveys may be conducted per federal and Tribal regulations and standards. A controlled access electronic database/inventory of archaeological and historical sites, traditional uses areas, and burial sites is suggested to be created, maintained and continually updated. All findings will be reported to responsible tribal cultural staff. They would be responsible for defining whether or not the item or area is culturally relevant. The information will be held in confidence for the QIN and authorized use and dissemination of this information will only be given out by approved QIN representatives. The Natural Resource Department should employ cultural resource technicians and/or staff.

1. **Cultural Resources Inventory.** The QIN lacks a current inventory of cultural resources, and baseline data are not available for prehistoric sites, historic sites, or traditional heritage sites and may never be complete given the need for sensitivity and confidentiality. Through recent watershed analyses on the Quinault, Salmon, and Raft Rivers, a GIS data bank has been established, but is far from exhaustive. Pre-sale harvest activities should include a review of current databanks and conferring with appropriate staff.

Ideally, the QIN should endeavor to identify all cultural resources and traditional cultural properties within the boundaries of the QIR. This includes all resources that are critical to the survival and well-being of the Quinault people such as salmon, plants, forests, and other resources of significance. Issues that should be considerated include the identification and protection of archaeological sites and the adaptive management of prairies and harvest and/or gathering areas.

The relationship of management activities and perpetuation of traditional knowledge of the types of treatments needed to foster desirable plant species has not been fully investigated. Currently, the impact of forest management activities on cultural resources is undocumented. A useful inventory would entail devising methodology to identify and evaluate valuable cultural resources on the QIR. To accomplish this, guidelines may be established for protecting plants or plant gathering areas of special importance within the scheme of timber harvest management.

2. **Ethnobotany in the Land of the Quinault.** The objective of the ethnobotany project is to provide an overview and to stress the urgency to capture, preserve and revitalize the rapidly vanishing ethnobotanical knowledge in the Quinault community. Even though the project intends to capture vanishing knowledge we must still be aware of protecting intellectual property rights of the people and the QIN. Additionally, ethnobotanical knowledge is a cultural heritage and this knowledge must be captured and transmitted to current and future generations of Quinault people.

   To accomplish this, the project will establish ethnobotanical documentation. Data gathering will include oral interviews, collecting plant information and possibly plant specimens, and photographing plants. The ethnobotany information will be compiled into a useable data base preferably a guidebook for tribal member distribution. The guidebook may additionally be used in adaptive management schemes for propagating culturally desired plants and devising timber harvest management guidelines.

Chapter 10: Fire Management

The following discussion documents the Wildland Fire Program including the Fire/Fuels Section and defines the strategies that are used to manage wildland and prescribed fires. The discussion has five parts:

(1) Description of the area including protection responsibility; access; and the fire environment, management zones, and occurrence,
(2) Description of the values to be protected,
(3) Fire management strategy,
(4) Fuels management strategy,
(5) Policy and analysis, and
(6) Cultural use.

The Secretary of the Interior, through the Wildland Fire Bureau Director and the Deputy Commissioner of Indian Affairs, is responsible for wildland fire management activities of the Department of the Interior on tribal and individual trust lands (including such activities when compacted for, whole or in part, with other agencies or Tribes). The authority, responsibility, and policy are set forth in 25 CFR Part 163. For the QIR, the authority lies with the Quinault Business Committee. Through a compact with the United States of America, the QIN oversees all fire pre-suppression, Fire Dispatching, Fire Prevention, Fire Investigation, Prescribed Fire and Fuels Management, training, Fire Weather Systems including data collection and station maintenance, and Communication Systems.

Funding to support Fire/Fuels Management is determined through the National Fire Management Analysis System (NFMAS). Through the NFMAS process, the QIN submits a Fire Management Preparedness Analysis (FMPA) to the BIA for review and approval to determine funding and program staffing levels. Treatments of activity fuels (fuel generated through any silvicultural operation, e.g., slash created from a logging operation) are not funded through the FMPA process, but generally are funded by FMDs and investigation activities on the QIR.

Illustration by Scott Kryskalla

10.1 Description of Area—Initial Attack Zone

The State of Washington, through the Master Cooperative Fire Protection Agreement between the BIA Northwest Regional Office (NWRO) and the WA-DNR currently provides fire protection on 90,000 acres of forested tribal and individual trust lands within the boundaries of the QIR. QIN provides protection on 117,000 acres and provides fire protection to include 7,530 acres of fee land south of the Quinault River. Through the compact with the

United States of America, QIN —Tribal Fire/Fuels Management provides oversight for this agreement.

The extensive road system associated with human forest activities has resulted in inadequate access to fires. Many of these existing roads are overgrown with brush and not readily accessible. These areas are of limited concern; however, because most fires on the QIR are human caused and, if access to humans is restricted, fires will generally not occur. This extensive road system when combined with modern communication systems facilitates efficient fire reporting.

10.2 Fire Environment.

The climate of the QIR is influenced heavily by the Pacific Ocean. The elevation of the QIR ranges from sea level on the west side to 2,769 feet above sea level in the northeast. Temperatures remain mild throughout the year ranging from an average temperature of 59° F in the summer to 41°F in the winter. Average annual precipitation ranges from about 80 inches in lower elevations to 150 inches in higher elevations.

Frequency and intensity. Fire, both natural and human-caused, has played a significant role in the evolution of the QIR. Fires influence the forest environment through effects on individual

Box 10.1: Fire Management Goals and Objectives, continued in Box 10.2.

Goals	Objectives
Manage a wildland fire program that provides for firefighter and public safety, is cost-effective, and is responsive to land stewardship needs and other resource management goals and objectives.	• Comply with the National Wildfire Coordinating Group standards for wildland fire. • Complete an approved FMPA through the NFMAS process. • Maintain a position on the BIA/QIN ID team.
Provide for a safe working environment by strictly adhering to federal standards for safety, qualifications, physical fitness, and personal protective equipment.	• Comply with the National Wildfire Coordinating Group (NWCG) standards for wildland fire • Advertise and administer the national fitness test every year. • Maintain fire fighter records to ensure compliance with national standards.
Assist and coordinate with state and other Federal agencies to aggressively protect QIN resources from wildland fire commensurate with the resource values at risk.	• Control all fires 95% of the time at or below 1 acre at all fire intensity levels. • Contain 95% of all fires by the next operational period. • Limit high-severity wildland fire burned acres, per decade, to 50 acres in all fuel models. • Enforce forest fire protection regulations for operations on or near forestland in accordance with the QIN Forest Practice Regulations and Title 61 of the QIN Tribal Code of Laws.
Assume the responsibilities of the Washington State/QIN fire suppression agreement to accomplish faster initial response, more timely fire equipment inspections, and increase fire prevention awareness.	• Update and maintain necessary initial attack fire suppression equipment. • Acquire, train, and maintain fire-qualified staff. • For initial attack and extended attack, develop cooperative agreements with local volunteer fire departments. • Develop a cooperative agreement with the State of Washington to replace the current fire suppression agreement.

species and communities. The fire environment consists mostly of the coastal zone which is comprised of three species: Sitka spruce, western hemlock, western red cedar. The climatic conditions of this zone limit the frequency and intensity of naturally occurring fires. A natural fire return interval has been estimated to be between 100-200 years. The timberlands in this zone are dominated by lethal fire regimes, so the typical severity level of fire is high, even though the fires may be of moderate intensity. Fires are usually stand replacement events because of the fire-sensitive nature of the major tree species. Although the climatic conditions result in infrequent fire events, the potential for large, high-intensity fires is high because of the accumulation of fuels between fire occurrences and the decrease in broadcast burning as a site preparation tool.

Danger. Because of the moderate climate and short dry season, fire danger ratings are seldom extreme. Location, climate, and elevation all influence the low frequency of lightning caused

Box 10.2: Fire Management Goals and Objectives, continued from Box 10.1

Goals

Objectives, cont'd

Develop, maintain, and enhance a program of fuels management and prescribed fire that achieves multiple resource management objectives including forest protection and sound silviculture.

- Provide opportunities, through the ID team process, for prescribed fire use. This includes, but is not limited to, fuels management for wildfire hazard reduction, restoration of desired vegetative conditions, management of wildlife habitat, and silvicultural treatments.
- Maintain a prescribed fire program for site preparation, hazard reduction of fuels, and vegetation manipulation for forestry, wildlife, and cultural objectives.
- Identify areas needing hazard reduction and/or site preparation resulting from timber harvesting, forest development activities, and climatic events.
- Establish fuels management prescriptions that address the environmental impacts on soils, fisheries, wildlife, rivers and streams, and air quality.

Develop, maintain, and enhance a prevention program that reduces human caused wildland fires, in addition to complying with the Washington State fire agreement.

- Conduct three to five Smokey Bear programs each year in the local schools.
- Include in all QIN Forest Practice applications fire season instructions specific to the shut-down zone where operations occur.
- Use specific contract language addressing fire prevention in all timber and salvage sales administered by the QIN and the BIA.
- Constantly monitor the fire danger and the Industrial Fire Precaution Levels and hold discussions regularly between QIN Fire/Fuels staff and adjacent Federal, state, and private cooperators.
- Maintain to the most current technology available one remote automated weather station— Black Knob 450325.

Provide career and seasonal employment opportunities for tribal members and those supporting tribal members in support of local and national fire management operations.

- Provide training through the North West Coordination Group and through local training.
- Provide enough firefighters to support at least one Type II fire crew through training and recruitment of staff and community members.

Participate actively in interagency fire management operations through planning and sharing of resources under formal agreements.

- Maintain an active role with Washington State Department of Natural Resources (WDNR) Forks Office.
- Submit annually a list of QIN resources and contact procedures.
- Submit a resource availability list weekly during fire season.
- Maintain cooperative status through the Taholah Agency using the Agreement for Fire Protection.
- Maintain dispatch agreement with the Puget Sound Interagency Coordination Center.

fires. Fires typically occur in slash, not green timber, and have slow rates of spread with very high resistance to control. Currently, cedar slash (National Forest Fuel Loading {NFFL} fuel model 13) is the largest component affecting fire behavior on the QIR. There are vast areas of cedar slash in various stages of decomposition. Fuels treatment was not performed following past logging and salvage practices. Many of these clear-cuts are bordered by trust lands and, consequently, pose a significant threat.

Fire Management Zones.
Fire Management Zones (FMZs) are areas of like fire behavior within a geographic area. The QIR is located entirely within one FMZ (Zone — WAP06Q1). However, many areas on the QIR have very dissimilar fire behavior. These areas are typical of areas subjected to west side clearcut harvest practices. Vast areas with a checkerboard pattern of logging slash (NFFL fuel models 12 and 13) exist adjacent to standing timber (NFFL fuel models 8 and 10), which are owned by various entities. This checkerboard ownership and fuel load variation makes all phases of fire management activity extremely time consuming. Therefore, a more detailed breakdown of the fire environment is warranted to manage this geographic area:

(i) The Fog Zone (649) encompasses an area from the Pacific Ocean eastward for about 3 miles. This area is frequently blanketed with fog during the fire season, resulting in a low fire danger. This low fire danger is significant enough to be reflected by Industrial Fire Precaution Level — Shut Down Zone 649N. Fuel moistures tend to be two to three points higher because of increased humidity. However, whenever extended periods of time (4 to 7 days) occur without fog, this zone equalizes with the adjoining inland zone.

(ii) The Lowland Zone (650) encompasses the largest part of the QIR, extending eastward, with a gradual westward slope, from the fog zone to the base of the mountainous uplands. Slopes within this area are gentle, 0 to 50%, with local relief generally less than 200 feet in elevation. Slash accumulations resulting from activities associated with clearcut harvest methods have the greatest effect on fire behavior within this zone.

(iii) The Mountainous Upland Zone (652) is located in the northern section of the QIR. The terrain consists of steep mountain slopes (50 to 90%); narrow ridge tops; and narrow, well-incised stream valleys. Local relief is as much as 1,000 feet in elevation. Access is limited to major developed roads, which are located mostly on ridges. This area is the most prone to lightning and has experienced lightning fires in the past. Steep slopes and aspect are the primary factor influencing fire behavior and rates of spread.

10.3 Values to Be Protected

1. Life, Property, Natural Resources, Firefighters, and Public Safety. Consistent with direction from the Federal Wildland Fire Management Policy and Program Review, firefighter and public safety is the first priority in all phases of QIN fire and/or fuels activities.

2. Wildland-Urban Interface. Six Wildland-Urban Interface communities are at risk— Taholah, Queets, Amanda Park, Santiago, Clearwater School, and the Qui-nai-elt Village, along with other scattered developed areas adjacent to forestlands. Because of the absence of wildfire and reduced prescribed burning, the wildland fuels in these communities have accumulated to high levels and the hazards continue to build from year to year. All of these communities are surrounded by forestlands resulting in natural and man-made fuel accumulations. Fuel-reduction projects should be implemented in all Wildland-Urban Interface Communities to minimize risk of wildland fires.

3. Timber and Specialized Forest Products. Fire can play a dual role in forest management; it can destroy a valuable revenue resource causing a major impact on local economies and, at the same time, fire can clean up unwanted natural and activity fuel and prepare a site for natural and artificial regeneration.

4. Cultural/Historical/Religious. All practical measures shall be taken to protect known cultural, historical, and religious sites as well as any discovered sites during the firefighting effort. These sites include:

   (i) *Cape Elizabeth Old Growth Preserve*. This is a 150-acre stand of old growth timber bordering the Pacific Ocean just north of Taholah. It is one of the last stands of old growth on the Washington coast outside of the Olympic National Park. This preserve has been set aside by the Quinault Business Committee to remain in its natural state forever.
   (ii) *Canoe Stand*. This is a 40-acre stand of old growth western red cedar located in what is commonly known as the North Boundary Area of the QIR. This stand was set aside by the Quinault Business Committee to be used by future generations of Quinault people as a source of trees suitable for the carving of canoes.
   (iii) *Cemeteries*. Several known cemeteries are located in forested areas, as well as other possible burial sites along the Quinault and Queets river corridors.

5. Air Quality. Air quality on the QIR is generally excellent because of the close proximity to the Pacific Ocean and westerly prevailing winds, and the absence of urbanization and smoke emitting industry. Thus, we must minimize the amount of smoke impacting public roadways, local communities, Class One air sheds, and designated areas. This can be accomplished by using historical experience, current and predicted weather forecasts, satellite weather imagery, and consultation with the WA-DNR — Smoke Management Division. During prescribed burning and in consultation with QDNR Air Quality Program, every effort is made to minimize the amount of smoke impacting public roadways, local communities, Class One air sheds, and designated areas.

6. Water Quality. Protection must be provided for water improvements, rivers, streams, lakes, and ponds from direct and indirect wildland fire damage. This is accomplished by implementing soil erosion control techniques where applicable and by designing fire and fuels treatments, strategies, practices, and activities to minimize disturbance of riparian groundcover and vegetation.

7. Fish Habitat. Fisheries and its associated industries are extremely important to the Quinault people both culturally and economically. Water quality is considered very good and efforts to keep it that way must be kept at a high level. Approximately 967 miles of rivers and streams exist on the QIR. These watersheds and associated riparian management zones are especially important in the protection and minimization of the effects from wildland fire.

8. Coastline. The Pacific Ocean, the Copalis National Wildlife Refuge, and the Olympic Coast National Marine Sanctuary border the QIR for approximately 23 miles of coastline.

9. Lake Quinault. Lake Quinault (3,700 acres) is owned by the QIN, and is the largest body of water on the QIR. Presently, Lake Quinault is used for recreational boating, fishing, and swimming. It is also used by juvenile sockeye salmon as a nursery, and by pre-spawning adult sockeye salmon. Many of the homes on the lakeshore draw their water directly from the lake. The QIN has a penned salmon rearing facility that depends exclusively on lake

water for its success. Even though most of the adjacent land surrounding the lake is not on the QIR, the importance of protecting these steep mountain drainages that feed directly into the lake warrants mention.

10. Wildlife Habitat. The QIN and BIA recognize the ecological contribution of fire in the creation of wildlife habitat; however, fire can also destroy habitat. Thus, wild fires will be suppressed that threaten critical habitat for big game and wildlife of cultural and economic significance to the QIN, to avoid loss of other wildlife habitat, and to protect wildlife improvements, plantations, and snags whenever and wherever feasible.

10.4 Fire Management Strategy

Organization. The responsibility for wildland fire management activities is assigned to the QDNR, Division of Forestry – Fire Management Program. The Forest Manager has oversight responsibility for all forestry functions, including fire. The Fire Management Section has three full-time employees—a Fire Management Officer (FMO), an Assistant Fire Chief for the structural fire program, a Fire and Fuels Management Specialist (FFMS) for the wildland fire program, and a dispatcher. Funding for the FMO, Fire/Fuels Specialist and dispatcher comes from fire preparedness funds and is currently funded for 52 weeks per year. Fire facilities; agreements; cooperators; shared resources; and training, fitness, physicals, & qualifications records are continuously updated and can be found in the QIN FMPA and/or Mobilization Plan.

Mobilization Strategy—Initial Attack. The BIA Northwest Regional Office has entered into a Cooperative Fire Protection Agreement with the WA-DNR for wildland fire suppression on the forested trust lands. The QIN provides a significant presence during initial attack for fires on the QIR; the QIN is naturally the closest available resource when using normal dispatching procedures to meet the incidents specific need.

Illustration by Scott Kryskalla

Initial attack resources are dispatched in a variety of ways. During regular business hours, initial attack resources are dispatched from the main fire office in Taholah, WA. Any employee qualified for engine operations is required, during fire season, to be available by radio during business hours. After business hours, these employees carry radios and are available through the cell phone system.

Any of QIN's fire resources can be requested for mutual aid by other agencies directly from the QIN. (See the Washington State Mobilization Guide 2015 on file in the Fire Office)

The QIN supports at least one Type II fire crew and its miscellaneous overhead. Crews and overhead are used for local, regional, and national assignments. The Fire Management Program office dispatches the fire resources and provides organization, transportation, personnel, leadership, and equipment for the crews. Requests for crews and overhead are received from several sources. Locally, any neighboring agency can directly order from the QIN. For fires out of the local area requiring additional support personnel, requests come through the Puget Sound Interagency Coordination Center. (See the FMPA and WA Fire Mobilization Plan.)

Prevention Strategy. Wildfires that have the potential to cause damage to natural or human developed resources will be prevented if possible. This is accomplished through a variety of methods including hazard reduction, fire prevention education, engineering, and enforcement. Until the QIN assumes the responsibilities of the WA-DNR fire suppression agreement, the official policy is to assist the WA-DNR in the enforcement of its fire regulations. After assuming its responsibilities, the QIN will continue to cooperate with the State.

- During the fire season, timber sale administrators are responsible for keeping forest operators informed of state fire laws, special restrictions or closures, and for assisting the WA-DNR in conducting industrial inspections. Copies of completed inspection reports are forwarded to the Olympic Region-WA-DNR.

- A bulletin board is maintained in the QIN Fire/Fuels Office, by the Fire/Fuels staff, on which the fire precaution level of the day is posted. The Fire Management Officer and the local WA-DNR Manager are responsible for the implementation of any special fire restrictions. These special restrictions are approved in advance by the QIN FMO. The FMO also handles all coordination efforts.

- All operations must comply with the requirements outlined in this section of the Forest Management Plan. These operations are subject to inspection. Failure to meet these requirements may result in shutdown of the operation until corrections are made, a citation is issued, or both.

- If a fire occurs in a land clearing, right-of-way clearing, or landowner operation, the fire will be fought to the full limit of available employees and equipment. The fire must be reported to the WA-DNR in a timely fashion. The WA-DNR reports the fire to the QIN if on their protective areas. Such firefighting effort shall continue as necessary to suppress the fire.

- When, in the opinion of the QIN, any or all forested area(s) of the QIN are particularly exposed to high fire danger, the QIN may designate such land as an area of extra fire

hazard subject to closure, and/or issue an order suspending any and all burning permits in that area.

General Fire Prevention Requirements. All landowners, timber owners, firewood cutters, salvagers, or operators shall furnish and maintain, in good and serviceable condition, such fire tools and equipment and provide such fire protection as may be required by the QIN and/or the WA-DNR. In the absence of specific QIN regulations, the requirements shall not be less than those required under the laws of the State of Washington.

- There is a shutdown zone number on each QIN forest practice notification/application that corresponds to the zone in which the operator will be conducting the forest operation. The QIR has been divided into zones (see "Fire Management Zones" on page 32) based on elevation, historical weather data, and slope exposure. During high forest fire danger periods, restrictions on the use of spark-emitting equipment may occur within any or all zones.
- If restrictions are imposed, notification will occur by public radio or recorded phone message at the Olympic Region of the WA-DNR and would stipulate shutdown zones affected and the type of restrictions imposed.

10.5 Industrial Restrictions.

When, in the opinion of the QIN and/or the WA-DNR, weather conditions arise that present a hazard to the forested lands of the QIR, whereby life and property might be endangered, the QIN FMO may designate Industrial Fire Precaution Levels that regulate logging, land clearing, or other forest operations that might cause a fire on, or adjacent to, forestlands.

In making a decision as to when restrictions or shutdowns should occur, the FMO shall utilize available information relating to current and projected fire danger, current and projected weather, and current local fire activity. The decision to designate the Industrial Fire Precaution Levels is largely consistent with the WA-DNR's recommendations.

All persons performing logging, land clearing, salvage, firewood cutting, or other operations that might cause a fire to start on or adjacent to forestlands, shall comply with the restrictions described in the designated Industrial Precaution Level.

Industrial Fire Precaution Levels.

LEVEL I: Closed season (Fire season). Fire precaution requirements are in effect. A Fire Watch/Fire Security is required at this and all higher levels unless otherwise waived.

LEVEL II: Partial Hootowl. The following may operate only between the hours of 8 P.M. and 1 P.M.:

- Power saws, except at loading sites;
- Cable yarding;
- Blasting, welding, or cutting of metal.

LEVEL III: Partial shutdown. The following are prohibited:

- Cable yarding - except that gravity-operated logging systems employing non-motorized carriages may be operated between the hours of 8 P.M. and 1 P.M. local time when all

blocks and moving lines are 10 feet or more above the ground, excluding the line between the carriage and the choker.
- Power saws - except at loading sites and on tractor/skidder operations between the hours of 8 P.M. and 1 P.M.
- In addition, the following are permitted only between the hours of 8 P.M. and 1 P.M.:
    - Tractor/skidder operations
    - Mechanized loading and hauling
    - Blasting
    - Welding or cutting of metal
    - Any other spark-emitting operation not specifically mentioned

LEVEL IV General shutdown. All operations are prohibited. With QIN consent, the WA-DNR may issue an advance written waiver of the above precautions.

Definitions. The following definitions shall apply to the above listed Industrial Fire Precaution Levels.

- Cable yarding systems: A yarding system employing cables and winches in a fixed position.
- Closed Season (Fire Precautionary Period): The season of the year when a fire hazard exists (as described in FPR-44-030 (A)).
- Hauling: Where hauling involves transit through more than one shutdown zone/regulated use area, the precaution level at the forested site shall govern the level of haul restrictions, unless prohibited by other than the Industrial Fire Precaution Level System.
- Loading sites/woods site: A place where any product or material (including but not limited to logs, firewood, slash, soil, rock, poles, posts, etc.) is placed in or upon a truck or other vehicle.
- Tractor/Skidder Operations: A harvesting operation, or portion of a harvesting operation where tracked machines, or other harvesting equipment capable of constructing fireline, are actively yarding forest products and can quickly reach and effectively attack a fire start.

Operators. Operator(s) shall, on a daily basis, obtain the predicted Industrial Fire Precaution Level from the WA-DNR for the zone in which they are working. When the Industrial Fire Precautions Level is I or higher, unless waived by the WA-DNR and mutually agreed to by the QIN, the operator will designate a person as "firewatch." The designated person will be capable of operating the purchaser's communications and firefighting equipment, excluding helicopters, and of directing the activities of the purchaser's personnel on forest fires. Such person must report any fire detected to WA-DNR within 15 minutes of detection (QIN FMPA, QIN FPRs).

QIN Fire Management office currently has a burn permit system. This burn permit system only addresses burning in noncommercial forestlands.

10.6 Appropriate Management Response Strategy.

The QIN establishes the following response strategy:

1. All fires are aggressively attacked and controlled. The overarching goal is to control all fires 95% of the time at or below one acre at all fire intensity levels, and contain 95% of all fires by the next operational period.
2. Initial attack response is handled jointly between the WA-DNR Olympic Region Interagency Systematic Dispatch System and the QDNR Fire Management Office. An Incident Commander (IC) will be identified immediately when the systematic dispatch is

implemented. The IC may adjust the level of dispatch at any time based on current and projected burning conditions.

Fire Management Constraints. Fire management constraints that affect fire management decisions and activities are based on QIN/BIA policies, environmental concerns, and hazards. They include:

1. Keeping the health and well-being of human lives as a top priority in all fire management decisions.
2. Protecting with all efforts wildland-urban interface communities.
3. Limiting use of heavy equipment to what will cause the least amount of impact on the land. All efforts must be made to keep heavy equipment out of and away from streams, rivers, headwalls, wetlands, slumps, bogs, and prairies, obtaining an emergency permit if stream entry occurs.
4. Using cold trail and wet line methods when they are a practical and effective fire use tool.
5. Using all fire practices in efforts to protect threatened and endangered wildlife species and their habitat.
6. Using all efforts to protect known and discovered cultural resource sites.
7. Rehabilitating all fire control lines, especially those with the potential to impact wetlands and watercourses.

10.7 Policy and Analysis

Environmental Policy. The FMP EA identifies the impacts of activities in general terms QIR-wide. Further environmental analyses may take place on individual projects as needed.

Wildland Fire Situation Analysis (WFSA). A WFSA is prepared by the WA-DNR when a fire exceeds initial attack and is (or will) not be contained prior to the peak of the next burning period. The Director of the QDNR will provide the WA-DNR with the resource management objectives for the specific area. The WFSA must be signed by the QDNR Director as the QIN representative and the Trust Officer as the BIA representative. The local QIN/BIA IDT assesses all burned areas requiring rehabilitation outside of the scope of normal fire operations. The FMO initiates activation of the team. This team references the Emergency Stabilization & Rehabilitation Handbook for guidance.

10.8 Historical/Cultural Use of Fire

Prior to European contact, the Quinault played a complex role in shaping the landscapes through activities such as burning and harvesting that were regular and long term. These practices often substantially altered the composition and structure of plant associations and influenced species distributions. Management practices also led to the establishment of vegetation communities in locations where they would not otherwise have existed. For example, despite the high precipitation and low natural fire frequency in western Washington, the Quinault prairies were dominant components of the Olympic Peninsula lowlands prior to European settlement due to anthropogenic management. Indeed, anthropogenic fire was the most important tool of environmental manipulation throughout the Pacific Northwest. The primary reasons for the burns were generally to manage land for big game such as black tail deer and Roosevelt elk in an otherwise forested landscape. A secondary reason was to maintain food plants such as camas. Camas was traditionally a fundamental food plant. Thirdly, the burns enhanced the habitat for weaving plants such as beargrass. The plant products also provided

and/or enhanced forage for the big game and bird populations. Due to privatization of the land base and the Quinault Indian reservation being issued to tribal members as private family allotments, the Cultural use of fire has not been used in recent times, but is planned to be reintroduced on a prairie restoration project.

Chapter 11. Economic Benefits

As with most rural communities, the residents living on the QIR face economic challenges of low employment and little diversification in the local economy. Most of the economy is derived from timber, fish, or government programs (tribal, state, and federal).
This chapter will discuss the anticipated revenue to be generated for the QIN and individual landowners from utilization of forest resources on the QIR over the upcoming planning period. Also discussed will be the direct benefits to employment related to these forest management activities, the direct and indirect economic benefits to the regional economy, and the projected economic trends for the region.

11.1 Forest Resource Revenue

Timber provides an important source of revenue to the QIN as well as individual Indian landowners. Today's timber harvest levels are affected by not only the current management standards employed, but also by the legacy of the management practices of the last harvest cycle. Likewise, as we move into the future, the management standards that we choose to employ today will have an impact on the harvest levels of the next harvest cycle.

The QIR forest is managed on a sustained yield basis. This management approach is desirable because it allows for a predictable, continuous flow of timber over time and stable management needs, which translates into stable employment. This is a benefit to the local community by providing stable jobs and income. It also benefits business itself by ensuring that the skilled workforce needed to accomplish the work will be maintained.

The following two tables summarize the annual volume of wood harvested and stumpage paid, for Green Timber and Cedar Salvage from 2003 through 2014 for both tribal and allotted lands, as well as the total Forest Management Deduction (FMD) collected (**Table 5-1** and **Table 5-2**). These values came from BIA Taholah Agency and QIN General Council annual reports.

The revenue collected from harvest activities is a direct benefit to the landowners. Revenue generated from tribal timber sale receipts is deposited into the Tribal General Fund for various public services with the exception of the revenue generated from the North Boundary Area which is used for land purchase on the QIR. The landowners of land in trust (individual Indians and the QIN) receive all stumpage proceeds from the sale of timber less an FMD percentage. The FMD on the QIR is 6% for green timber and 3% for cedar salvage. The FMD provides funds for vital forest management activities such as reforestation, pre-commercial thinning, and other silvicultural applications that help develop and improve the quality and value of the timber resource.

Table 11.1. Green Timber Harvest Summary 2003 thru 2014 :

	TRIBAL		BIA TRUST		TOTAL		
Year	Volume MBF	Value ($)	Volume MBF	Value	Volume MBF	Value	FMD 6%
2003	5,203	788,037	9,804	2,203,633	15,007	2,991,670	179,500
2004	6,870	766,264	22,211	5,530,053	29,081	6,296,317	377,779
2005	7,888	1,292,305	23,919	7,982,968	31,807	9,275,273	556,516
2006	8,501	1,667,384	15,246	4,920,602	23,747	6,587,986	395,279
2007	5,564	1,570,490	12,100	4,394,924	17,664	5,965,414	357,925
2008	8,304	2,063,810	21,181	4,995,800	29,485	7,059,610	423,577
2009	13,227	1,572,146	9,846	1,754,875	23,073	3,327,021	199,621
2010	15,099	2,811,734	34,438	9,726,452	49,537	12,538,186	752,291
2011	13,033	4,005,878	34,020	12,272,899	47,053	16,278,777	976,727
2012	6,197	1,495,944	14,234	4,329,344	20,431	5,825,288	349,517
2013	4,851	1,641,579	22,400	8,500,000	27,251	10,141,579	608,495
2014	14,890	3,926,101	14,000	4,000,000	28,890	7,926,101	475,566
			Twelve Year Average		**28,586**	**$7,851,102**	**$471,066**
			Average $ per MBF			**$275**	

Table 11.2. Cedar Salvage Harvest Summary 2003 thru 2014 :

	TRIBAL		BIA TRUST		TOTAL		
Year	Volume Cords	Value ($)	Volume Cords	Value	Volume Cords	Value ($)	FMD 3%
2003	6,086	232,869	1,166	312,861	7,252	545,730	16,372
2004	4,240	159,673	694	260,600	4,934	420,273	12,608
2005	6,086	232,869	796	209,330	6,882	442,199	13,266
2006	6,680	191,907	1,024	403,309	7,704	595,216	17,856
2007	2,124	181,942	512	518,698	2,636	700,640	21,019
2008	2,580	199,482	1,482	793,500	4,062	992,982	29,789
2009	3,055	58,385	0	0	3,055	58,385	1,752
2010	1,504	49,069	0	0	1,504	49,069	1,472
2011	4,349	94,701	752	104,220	5,101	198,921	5,968
2012	2,817	155,855	412	192,755	3,229	348,610	10,458
			Ten Year Average		**4,636**	**$435,202.5**	**$13,056**
			Average $ per cord			**$94**	

The estimated allowable cut for the 10-year planning period (October 2016 thru September 2024) is 47 MMbf; the Tribal share is 14.2 MMbf and the individual trust landowner share is 32.8 MMbf. Using the average MBF price for the past ten years, that represents an estimated $35,750,000 revenue to QIN and $74,965,000 (total revenue minus 6% FMD) revenue to individual trust owners over the next ten years.

Other than green timber harvest, the highest percentage of income derived by Indian operators generates from salvage of western red cedar for shakes and shingles. The Cedar Salvage Program, in FY 2013, had up to 11 active Tribal operators working on the Lower Reservation and the North Boundary. Although prices for cedar shakes and shingles are relatively good in today's market, cedar salvage is a non-renewable resource and cannot be counted upon indefinitely for income opportunities.

There are also indirect benefits to Quinaults that result from harvest activities; harvest activities pay for much of the cost associated with maintaining forest roads, by providing access for cultural and religious harvest of forest products, firewood cutting, wildlife viewing, and recreation.

11.2 Employment

The Quinault Indian Nation as a whole, including the Quinault Beach Resort and Casino, is the second largest employer in Grays Harbor County, secondary to the Grays Harbor Community Hospital, employing 667 people in 2009 (RC&EDD, 2009). Wages paid through forestry program activities include wages earned by full time and seasonal employees as well as contracts for planting, pre-commercial thinning, et cetera.

Yearly QIN forestry activities result in $1,211,072 in wages paid on average to 22 full-time forestry staff employees of the Quinault Indian Nation. Nine of the 22 are Native Americans. The QDNR Division of Forestry also employs eight seasonal workers of which three are American Indians.

The BIA Trust Forestry staff has 14 full-time employees with $884,776.00 paid in wages on average per year. Five of those BIA employees are American Indians.

Wages earned through employment with the Quinault Land & Timber Enterprise (QLTE) was $331,128 (FY2014), which includes both Indian and Non-Indian employees.

Self-Employment Income

Income to individuals awarded contract work through the forestry division, or employed by other entities that work through a contract with the forestry division or the Joint Venture (QLTE and the Quinault Logging Company), is considered to be self-employment income. This income may be earned from planting, thinning, conifer release, and other silviculture contracts. On average, these contracts totaled approximately $844,464. This annual figure is not expected to change drastically over the next 10 years due to funding availability.

The Joint Venture has a number of contracts with logging operators. Depending on the scale of the contract, the operators employ 6 to 20 loggers; all are considered seasonal. An exact dollar figure is difficult to estimate, but should remain constant barring any unforeseen changes.

<u>Personal Use Benefits</u>
In FY2013, three tribal members and two cedar salvage operators harvested non-timber specialized forest products from tribal lands on the lower reservation. These products include Salal, Cascara bark, and cedar boughs. Fees generated by this activity totaled $3,600.00 for the tribe.

11.3 Regional Economic Benefits

History

Grays Harbor County is dominated by the forest resource industry. Over 88% of the county's land area is in renewable forests. The county is also an industry center for forest management, forest product manufacturing, and related support services. In Grays Harbor County, timber harvesting began to replace fishing as an economic base in 1880 when the first mill was built in the town of Cosmopolis. Dreams of wealth for certain heavy investors were well realized. By the end of the century, Grays Harbor had become a major lumber supplier to the outside world as well as a famous seaport and shipbuilding center widely known for its innovations in design and construction. The last of the great steam schooners was built here in the early 1920s. Plywood plants, furniture factories, and woodworking plants followed the ship building industry. In 1927, the Grays Harbor Pulp Company was started and a paper mill was added the following year. The depression in the 1920s and the advancing twentieth century technology brought sharp changes to the area, especially its wood products and industries.

Although, in 2006 and 2007 the region enjoyed a dramatic increase in employment due to real estate and housing development, 2008 was the exact opposite. The Great Recession of 2009 took a severe toll on the housing market as well as on employment. As a direct result of downturns in the housing market, major employers such as Weyerhauser and Hoquiam Plywood were been forced to close large and small mills that for decades provided family-wage jobs throughout the region. The closure of these industries has displaced over 1,000 skilled mill workers and forced families to leave the region in search of jobs further resulting in a glut of unsold real estate. Weyerhaeuser also saw staggering cuts in employment, from employing over 1000 employees in the 1990's to an estimated 10-19 employees in 2010. (RC&EDD, 2010)

In 2010, the unemployment rate peaked at a dismal 16%. However, the local economy has been showing some signs of recovery; the unemployment rate in Grays Harbor has been on a decline year-over-year since January of 2012. Even with the improvements in unemployment, Grays Harbor has consistently one of the highest unemployment rates in Western Washington. Other industries have experienced employment growth to offset some of the decline in forest products. The forest products industry itself has diversified, and value-added wood manufacturing businesses are popping up throughout the region.

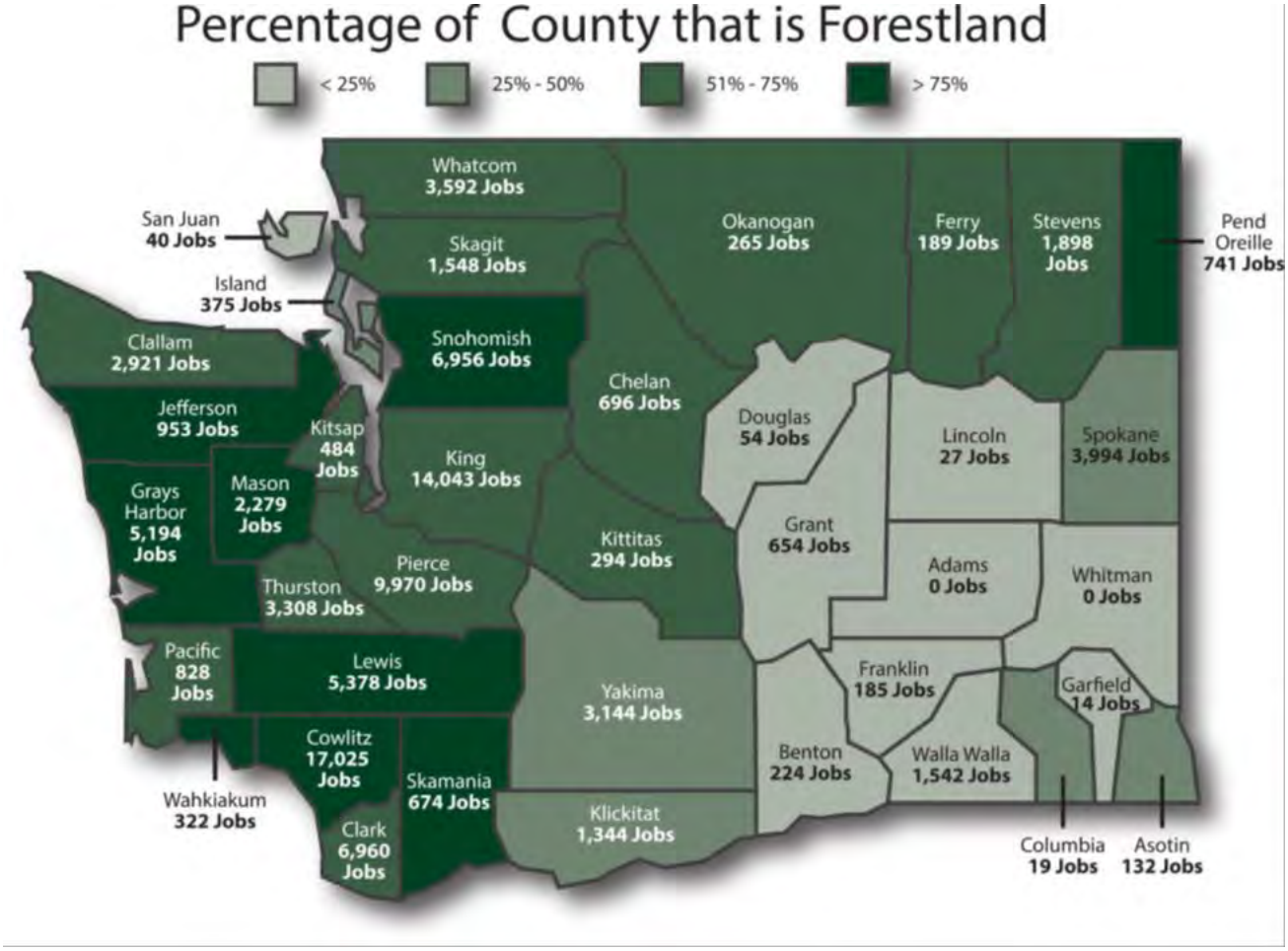
Box 11.1: Economy Recovery: Key post-recession accomplishments
Harbor Paper in Hoquiam re-opened the paper mill
Sierra Pacific opens mill
Satsop partnered with Grays Harbor College to manage the Park's 1,200 acres of timberlands for the Forestry Technician Training program
Facility agreements signed between the Port and Willis Enterprises to lease T3 in Hoquiam for wood chipping and barge shipments
D'Korum shipped logs to Korea for the first Pacific shipment in many years resulting in the Port realizing an increased trade volume of 16% including a record year for dry bulk exports by AGP
Cosmo Specialty Fibers purchased old Weyerhaeuser mill, exporting sheets of bleached fiber to China and hiring 200 employees
Reopening of Pacific Veneer formerly owned by Weyerhauser

Employment

Even throughout the economic difficulties of the past ten years, the timber industry in the region remains an important resource locally and to Washington. Overall, the four-county area (Grays Harbor, Pacific, Mason, and Wahkiakum) still accounts for more than ¼ of the timber harvest in Washington State, 85% of it occurring on private lands. (RC&EDD, 2010)

The manufacturing and employment base in Grays Harbor is still dominated by lumber and wood processing plants. In 2013, even though there have been declines in the local timber-based economy due to the Great Recession, the timber industry accounted for over half of all manufacturing employment. Forest product activities are defined to include jobs in forestry, lumber and wood products, and pulp and paper. Washington Forest Protection Association (WFPA) reports that the annual revenue of forest products in Grays Harbor is $1,233,779,945 (WFPA, 2014). Furthermore, there is an estimated 6,087 total jobs in Grays Harbor as a result of the timber industry paying $275,444,811 (WFPA, 2014).

Figure 11.1: The percentage of a given county in Washington State that is forested, as well as the number of jobs in the forestry sector for each corresponding county (Forest Facts and Figures, 2014).



The Washington Labor Market report, released by the Washington State Department of Employment Security, indicates that second and third growth timber is coming available at the southern end of the Olympic Peninsula and is expected to support a very healthy forest product industry. That opportunity is specifically focused on the Grays Harbor area where Sierra Pacific Industries has built a $45 million mill that was sited to take advantage of log availability. The facility employs 220 people and produces 210 million board feet of lumber annually. (Grays Harbor Economic Vitality Index, 2013)

Table 11.3: The major timber-related companies and the number of individuals employed.

Largest Timber Employers in Grays Harbor County	Number of Employees
Sierra Pacific	220
Cosmo Specialty Fibers	172
Simpson Door Plant	160
Hoquiam Plywood	86
Girard Wood Products	63

Source: Grays Harbor Economic Vitality Index (2013)

11.4 Economic Future

The forest products industry is the dominant economic activity in the region and, despite significant downsizing and restructuring, is likely to remain a significant economic activity due to the vast forest resources in Grays Harbor County and Washington state. The forest products industry in Washington is the second largest in the nation behind Oregon, with about 10% of the nation's total private establishments and employment. Washington's forest products industry accounts for over 13% of total U.S. softwood lumber production and about 7% of the total U.S. plywood production. (Washington Forest Protection Association, 2015)

The forest products industry is the second largest manufacturing sector in the state after transportation (primarily aircraft), representing more than 14% of total manufacturing in Washington. A recent study conducted by the University of Washington has projected private forestlands, which currently produce 66% of the timber harvest in the state, will be able to produce even more trees in the future. Based on predicted market conditions, industrial timber supplies should climb steadily and increase by more than 20% by 2090. (Washington Forest Protection Association, 2015).

More than 5000 different consumer products are made with trees grown in Washington. In addition to their use for lumber, building materials and paper, trees are processed into wood pulp, cellulose and cellulose derivatives. These tree-based products are used in many ways that contribute to and improve the quality of our daily lives. The diversity of timber-based products creates an environment in Grays Harbor County of resilience in spite of serious degradation over the past two decades-- both physical infrastructure and local know-how are intact for rapid recovery and regrowth of the industry.

The economy is slowly recovering from the Great Recession of 2009. Unemployment is coming down and the housing market continues to show positive signs. Log and lumber prices were fairly flat in 2011 and 2012, but have come up in 2013. Based on increased confidence in a

genuine recovery of the housing market, prices are estimated to continue to increase modestly, over the next several years. This is supported by the fact that second and third growth timber is coming available, which many are expecting to continue to support a healthy forest product industry; this opportunity is specifically focused on Grays Harbor area, where Sierra Pacific Industries built a $45 million mill sited to take advantage of log availability, and employing an estimated 150 residents.

The Future for QIN

The fundamental management strategy for the QIR forest is to manage it for a sustained even flow harvest that will provide a predictable and dependable level of economic benefit to the Quinault Indian Nation and individual trust allotment owners, today and into the future. As management, as guided by the FMP, takes place across the QIR landscape and the legacy forest of past practices transitions to a intensively managed, regulated forest of the future, the yield will continue to increase providing a secure economic base for the Quinault People for generations to come.

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Glossary

7-Day Average Daily Maximum (7DADM): Applied as a limit on summer maximum temperature the 7DADM is an average of maximum temperatures that may be experienced during the seven day period of the hottest one to two weeks of the year, though the average temperatures approaching the 7DADM can be experienced for longer periods depending on the magnitude of diurnal and seasonal swings in temperature. Because it is an average, some actual stream temperatures during the hottest days will likely be higher than this seven day average.

Bedrock Hollow: Landforms which are commonly spoon-shaped areas of convergent topography (upward or contour concavity) within unchannelled valleys on hill slopes. Hollows are formed on slopes of varying steepness and tend to be longitudinally linear on the slope. The upper ends can extend to the ridge, or begin as much as several hundred feet below. Most hollows are approximately 75 to 200 feet wide at the top and may narrow to 30 to 60 feet downhill. They terminate at distinct channels, either at the point of the channel initiation or along a streamside. Unless they have recently experienced scouring by landslide or debris flow, bedrock hollows are partially or completely filled with colluvial soils that are typically deeper than those on the adjacent spurs and planar slopes. Hollows that are completely filled with colluvium may show no surface continuity. Many hollows have no surface water, but others contain seeps and springs. Hollows should not be confused with other hill slope concavities such as small valleys, the bodies of large landslides, tree-throw holes, or low-gradient grassy swales. Bedrock hollows typically experience episodic evacuation of debris by shallow-rapid mass movement, followed by slow refilling with colluvium. Debris slides that begin within bedrock hollows commonly evolve into debris torrents, which have the potential to reach great distances downhill and downstream.

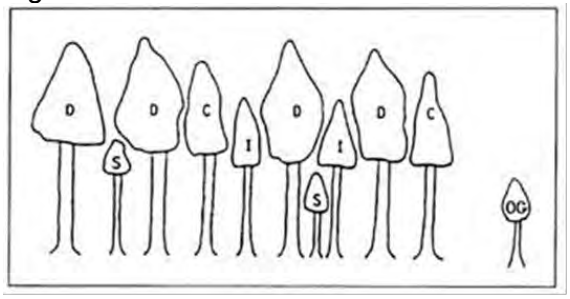
Borrow Pit: an excavation site outside the limits of construction, to provide material necessary to that construction, such as fill material for the embankments

Business Day: days the Quinault Indian Nation administrative offices are open for business, not including weekends, federal and Quinault holidays, and day the Nation is closed more than four hours for emergencies or as authorized by the President of the Nation

Class of Forest Practices: there are four classes of forest practices created by Title 61. The division determines the classification of each forest practices proposal.

Co-dominant Tree: A tree that extends its crown into the canopy and receives direct sunlight from above but limited sunlight from the sides. One or more sides of a co-dominant tree are crowded by the crowns of dominant trees.

Figure 1. Crown Position Classes.



D: Dominant
C: Co-dominant
I: Intermediate
S: Suppressed
OG: Open-growth

Commercial Tree Species: any species which are capable of producing a merchantable stand of timber on the particular site, or which is being grown as part of a Christmas tree or ornamental tree-growing operation

Contamination: the introducing into the atmosphere, soil, or water, sufficient quantities of substances as may be injurious to health, safety or welfare, or to domestic, commercial, industrial, agriculture or recreational uses, or to livestock, wildlife, fish or other aquatic life.

Convergent Headwall: Landforms which are teardrop-shaped, broad at the ridge top, and terminate where headwaters converge into a single channel. They are broadly concave both longitudinally and across the slope, but may contain sharp ridges that separate the headwater channels. Convergent headwalls generally range in size from about 30 to 300 acres; slope gradients are typically steeper than 35 degrees and may exceed 45 degrees. Unlike bedrock hollows, which exhibit a wide range of gradients, only very steep convergent landforms with obvious history of landslides are called convergent headwalls. Soils are thin because slides are frequent in these landforms. It is the arrangement of bedrock hollows and first-order channels on the landscape that cause a convergent headwall to be a unique mass-wasting feature. The highly convergent shape of the slopes, coupled with thin soils, allows rapid saturation during rainfall and/or snowmelt. The mass-wasting response of these areas to storms, to natural disturbances such as fire, and to forest practices is much greater than is observed on other steep hill slopes in the same geologic settings. Convergent headwalls are also prone to surface erosion. Landslides that evolve into debris flows in convergent headwalls typically deliver debris to larger channels downstream. Channel gradients are extremely steep within headwalls, and generally remain so for long distances downstream. Channels that exit the bottoms of headwalls have been formed by repeated debris flows and have forms and gradients that are efficient at conducting them. Convergent headwalls commonly have debris fans at the base of their slopes.

Conversion to A Use Other Than Commercial Timber Operation: a bona fide conversion to an active use which is incompatible with timber growing.

Completion of Harvest:

(1)Completion of removal of timber from the portions of forest lands harvested in the smallest logical unit that will not be disturbed by continued logging or an approved slash disposal plan for adjacent areas, or

(2)Scheduled completion of any slash disposal operations where the Department and the applicant agree within six (6) months of completion of yarding that slash disposal is necessary or desirable to facilitate reforestation and agree to a time schedule for such slash disposal, or

(3)Scheduled completion of any site preparation or rehabilitation of adjoining lands approved at the time of approval of the application or receipt of a notification, PROVIDED, that delay of reforestation under this sub-paragraph (3) is permitted only to the extent reforestation would prevent or unreasonably hinder such site preparation or rehabilitation of adjoining lands.

Deep-seated Landslide: Landslides in which the zone of movement is below the maximum rooting depth of forest trees, to depths of tens to hundreds of feet. Deep-seated landslides can vary greatly in size (up to thousands of acres) and activity level and can occur almost anywhere on the hill slope. Deep-seated landslides are usually formed in incompetent materials such as glacial deposits, volcanoclastic rocks, and fault gauges. Commonly, development of a deep-seated landslide begins after a slope has been over-steepened by glacial and fluvial under

towing; however the initiation of such slides has also been associated with changes in land use, increases in ground-water levels, and the degradation of material strength through natural processes. Movement can be translational, rotational, or complex, range from slow to rapid, and include small to large displacements. Deep-seated landslides in bedrock commonly occur in masses that are relatively weak. These can include bodies in which the rocks themselves are incompetent, such as certain types of clay-rich sediments and volcanics (e.g., some shales and tuffs), or low-grade metamorphic rocks (e.g., phyllite) or in highly weathered materials, such as deeply weathered rock and saprolite. In other cases, the geologic structure weakens the rock strength; bedding planes, joints, and faults commonly act as planes of weakness that can become slide surfaces. Deep-seated landslides are common in thick glacial deposits, usually where very permeable and impermeable materials are juxtaposed. Impermeable deposits can perch ground water, causing elevated pore-water pressures in the overlying deposits, which can then slide out and downward. Groundwater recharge areas for glacial deep-seated slides are the area upslope that can contribute water to the landslide. This assumes that there is an impermeable perching layer in or under a deep-seated landslide in glacial deposits. It is assumed to be equivalent to the topographically defined sub-basin directly above the active slide. The spatial extent of the groundwater recharge area can be identified in the field using one of several accepted methods as explained in greater details in the Washington State Forest Practices Board Manual. Many deep-seated landslides occur in the lower portions of hillslopes and extend directly into stream channels. In such situations, streams can undercut the landslide toes, promoting further movement; such over-steepened toes can also be sensitive to changes caused by harvest and road construction. On the other hand, deep-seated landslides confined to the upper slopes may not have the ability to deposit material directly into stream channels. The ability of scarps and marginal streams to deliver sediment to waters or structures varies with local topography. Steep marginal streams can be subject to debris-flow initiation.

Debris: woody vegetative residue less than three (3) cubic feet in size resulting from forest practices activities which would reasonably be expected to cause significant damage to a reservation resource.

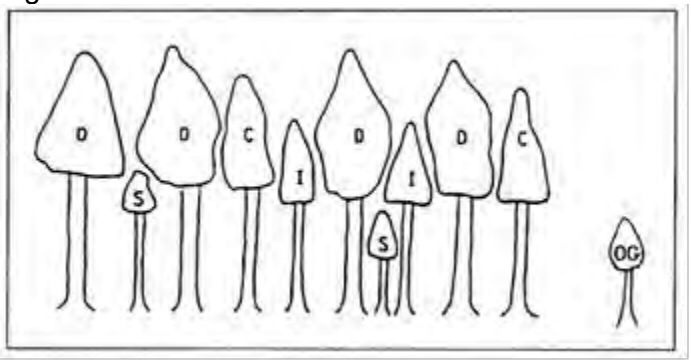
Department: Forestry, Environmental Protection, and Fisheries

Designated Agent: the individual representing the operator on-site in his or her absence

Division: Quinault Indian Nation Division of Natural Resources or its successor.

Dominant Tree: A tree that extends above surrounding individuals and capture sunlight from above and around the crown.

Figure 2. Crown Position Classes.



Emergent Conifer: Scattered and isolated conifers that emerge above the main continuous canopy layer of the stand.

Emergency: an immediate threat to life, public or private property, or an immediate threat of serious environmental degradation, arising from weather or stream flow conditions, other natural conditions, or fire

End Hauling: the removal and transportation of excavated material, pit or quarry overburden, or landing or road cut material from the excavation site to a deposit site not adjacent to the point of removal.

Enforcement Officer: law enforcement officers authorized by the Quinault Indian Nation to enforce Title 61

Environmental Clean Air Act (CAA) - Long-standing federal legislation that is the legal basis for national clean air standards; first passed in 1970, last amended 1990.

Environmental Protection Agency - Federal agency established for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by congress.

Equipment Limitation Zone: 30' measured horizontally from the ordinary high water mark of any water. No more than 10% of the soil within the equipment limitation zone will be disturbed as a result of ground-based equipment, skid trails, stream crossings, or partially suspended cabled logs.

Erodible Soils: those soils exposed or displaced by a forest practice operation that would be readily moved by water.

Federal Air Rules for Reservations (FARR) - Federally enforceable rules set to protect air quality on 39 Indian Reservations in Idaho, Oregon, and Washington State established under the Clean Air Act. The FARR applies to all persons (both tribal and non-Tribal members) and businesses.

Fertilizers: any substance or any combination or mixture substances used principally as a source of plant food or soil amendment.

Floodplain soils: Floodplain soils will be determined by the ID team based on NRCS soil survey, LiDAR- digital elevation model derived products such as hill shaded relief and 2' contours, and landforms identified in the field.

Flood Level – 50 Year: For purposes of field interpretation of these regulations, the fifty (50) year flood level shall be considered to refer to an additional vertical water height above the height of the ordinary high-water mark, such addition vertical height being 125% of the vertical distance between the average stream bed and the ordinary high-water mark; and an additional horizontal distance which shall not exceed two (2) times the ordinary channel width as measured between the ordinary high-water marks and added to each side of the channel, unless a different area is specified by the Department based on identifiable topographic or vegetative features.

Forest or Forest Land: an ecosystem at least one acre in size, including timberland and woodland, which is characterized by a more or less dense and extensive tree cover; contains, or once contained, at least ten percent tree crown cover, and is not developed or planned for exclusive non-forest resource use [25 CFR 163.1]

Forest Biomass: material from trees and woody plants that are by-products of forest management, ecosystem restoration, or hazardous fuel reduction treatments on forest land. Although stumps are a by-product of these activities, only those removed for the purpose of road and landing construction, forest health treatments, or conversion may qualify as forest biomass.

Forest Chemicals: substances applied to forest lands or timber to accomplish specific purposes and includes pesticides, insecticides, rodenticides, plant growth regulators, fungicides, fertilizers, desiccants, fire retardants when used in controlled burning, repellents, oil, dust-control agents (other than water), salt and other materials that may present hazards to the environment

Forest Landowners: any person in actual control of forest land, whether such control is based either on legal or equitable title, or on any other interest entitling the holder to sell or otherwise dispose of any or all of the timber on such land is any manner: PROVIDED, that any lessee or other person is possession of forest land without legal or equitable title to such land shall be excluded from the definition of "forest landowner" unless such lessee or other person has the right to sell or otherwise dispose of any or all of the timber located on such forest land.

Forest Practice: any activity conducted on or directed pertaining to forest land and relating to growing, harvesting, or processing forest products for commercial purposes from forest land, included but not limited to:

(1) Forest road construction;
(2) Reforestation;
(3) Pre-commercial thinning;
(4) Use of forest chemicals;
(5) Salvage of trees, and
(6) Brush control.

"Forest Practice" does not include preparatory work such as nursery operations, tree marking, surveying and road flagging; and ancillary non-commercial removal of incidental vegetation from forest lands such as berries, ferns, greenery, mistletoe, herbs, mushrooms, and other products.

Forest Product: merchantable products extracted from the Quinault Indian forests, such as: timber; timber products, including lumber, logs, and pulpwood; bark; non-timber including but not limited to Christmas trees, standing/downed dead cedar wood, grasses, branches, firewood; and oil and gravel that is extracted from forest land [25 CFR 163.1]

Groundwater Recharge Area: the area of drainage of an aquifer that contributes to the hydrologic process where water moves downward from surface water to ground water.

Headwall seep: A seep of water located at the toe of the edge of a cliff and at the head of a type O stream which connects to the stream by overland flow, and is recognized by loose substrate and/or fractured bedrock with perennial water at or near the surface throughout the year.

Headwall spring: A permanent spring at the head of a perennial channel.

Herbicide: any substance or mixture of substances intended to prevent, destroy, repel, or mitigate any tree, bush, weed, or algae and other aquatic weeds.

Hydraulic Fracturing: the subsurface emplacement of fluids by well injection, and excludes (i) the underground injection of natural gas for purposes of storage, and (ii) the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities [from SDWA, 40 CFR]

Hydraulic Project: the performance of any work or activities within two hundred (200) feet of the ordinary high water mark of a water body.

Hydrologic Floodplain: The surface of strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regiment, and covered with water when the river overflows its banks. It is built of alluvium carried by the river during floods and deposited in the sluggish water beyond the influence of the swiftest current. A river has one floodplain and may have one or more terraces representing abandoned floodplains.

Improved Stock: seed or seedlings resulting from a tree improvement program, tested and verified.

Indian Forest Land: Indian land, including commercial, non-commercial, productive and non-productive timberland and woodland, that are considered chiefly valuable for the production of forest products or to maintain watershed or other land values enhanced by a forest cover, regardless of whether a formal inspection and land classification action has been taken [25 CFR 163.1]

Indian Land: land title which is held by: the United States in trust for an Indian, an individual of Indian or Alaska Native ancestry who is not a member of a federally-recognized Indian tribe, or an Indian tribe; or by an Indian, an individual of Indian or Alaska Native ancestry who is not a member of a federally recognized tribe, or an Indian tribe subject to a restriction by the United States against alienation [25 CFR 163.1]

Individual Trust Lands: Lands owned in trust status by individual Indian landowners.

Inner Gorges: Canyon walls created by a combination of the down cutting and undercutting action of a stream and mass movement on the slope walls. Inner gorges may show evidence of recent movement, such as obvious landslides, vertical tracks of disturbance vegetation, or areas that are concave in contour and/or profile. In competent bedrock, slope gradients of 35 degrees or steeper can be maintained, but soil mantles are increasingly sensitive to root-strength loss at these angles; slope gradients as gently as 28 degrees can be unstable in gorges cut into incompetent bedrock. The top of the inner gorge is typically a distinct break in slope but in some places the upper boundary is a subtle zone where the slope becomes markedly steeper or convex downhill. Inner gorge walls can be continuous for great lengths, as along a highly confines stream that is actively down cutting; or they can be discontinuous, as along a floodplain channel that is undercutting the adjacent hill slopes in isolated places where the stream has meandered to the valley edge. Inner gorges experiencing mass wasted are likely to deliver sediment to waters or structures downhill. Inner gorges are distinguished from ordinary steep valley sides; ordinary valleys can be V-shaped with distinct slope breaks at the top, but they commonly do not show evidence of recent movement. In practice, a minimum vertical height of 10 feet should be applied to distinguish between inner gorges and slightly incised streams. The

upper boundary of an inner gorge is assumed to be a line along the first break in slope of at least 10 degrees or the line above which slope gradients are typically gentler than 30 degrees.

Insecticide: any substance or mixture of substances intended to prevent, destroy, repel, or mitigate any insect, other arthropods or mollusks.

Key Wildlife Habitat: the habitat of any threatened or endangered species, or where specific management practices are needed to prevent critical wildlife habitat destruction.

Legacy Tree: Legacy Trees: (Franklin 1990) Legacy trees are defined as trees having achieved near-maximum size and age, which is significantly larger and older than the average trees on the landscape. This distinguishes them from other residual trees which also have been spared from harvest but are not always larger and older than the average trees in the landscape. Characteristics may include some: deeply furrowed bark, reiterated crown, basal fire-scars, platforms, cavities and one or more dead tops. (Mazurek 2003)

Limits of Construction: the area occupied by the completed roadway or landing, including the cut bank, fill slope, and the area cleared for the purpose of constructing the roadway or landing.

Load Bearing Portion: that part of the road, landing, etc., which is supportive soil, earth, rock or other material directly below the working surface and only the associated earth structure necessary for support.

Major Tractor Road: one which involves extensive sidecasting or similar disturbance of soil which may cause material damage to a reservation resource or would destroy the integrity of a Streamside Management Zone.

Merchantable: of sufficient value at least to cover the costs of harvest and transportation to available markets

Merchantable Tree: A tree with at least one 16-foot log with a diameter inside the bark (dib) of 5 inches.

Merchantable Stand: A stand with an average stand diameter at breast height (dbh) greater than 8 inches (using trees in the stand that are greater than 5 inches dbh) and with a volume of at least 10,000 board feet per acre.

Minerals: includes both metalliferous and non-metalliferous minerals; all hydrocarbons, including oil and gas, coal and lignite of all ranks; geothermal resources; and includes but is not limited to sand, gravel, pumice, sphagnum (peat) moss, cinders, granite, building stone, limestone, clay, silt, or any other energy or non-energy mineral or subsurface geologic material [25 CFR 225.3 + moss + other geologic material]

Mining: the science, technique, and business of mineral development, including but not limited to: opencast work, underground work, in-situ leaching, or other methods directed to severance and treatment of minerals or other geological materials, including but not limited to sphagnum (peat) moss, oil, coal, methane, oil shale, gemstones; however, when sand, gravel, pumice, cinders, granite, building stone, limestone, clay or silt is the subject material, an enterprise is considered ‘mining’ only if the extraction of such a mineral exceeds 5,000 cubic yards in any given year [25 CFR 225.3]

Minor Forest Product: merchantable forest products that are non-timber including but not limited to standing/downed dead cedar wood, Christmas trees, bark, grasses, branches, firewood, berries, mosses, mushrooms, herbs, specialty wood, and like forest materials.

Minor Forest Product Harvest: harvest of minor forest products

Nation: Quinault Indian Nation

National Ambient Air Quality Standards (NAAQS) Pollutant concentration limits that apply to ambient (outdoor) air, established by the EPA to protect human health and welfare. The NAAQS are divided into primary and secondary standards. Primary standards set limits to protect public health, including the health of 'sensitive' populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare including visibility, animals, crops, vegetation, and buildings.

Natural Resource: all the benefits derived from forest land, including forest products, soil productivity, water, fisheries, wildlife, recreation, and aesthetic or other traditional values of forest land

North Boundary Area (NBA): The upper reservation, approximately 12,000 acres, was acquired on November 8, 1988 and borders the foothills of the Olympic Mountains.

Notice to Comply: a notice issued by the Department and may require initiation and/or completion of action necessary to prevent, correct and/or compensate for material damage to reservation resources which resulted from forest practices.

Oil: all non-gaseous hydrocarbon substances other than coal, oil shale, or gilsonite (including all vein-type solid hydrocarbons). Oil includes liquefiable hydrocarbon substances such as drip gasoline and other natural condensates recovered or recoverable in a liquid state from produced gas without resorting to a manufacturing process [25 CFR 225.3]

Operator: any person engaging in forest practices except an employee of the operator with wages as his/her sole compensation.

Ordinary High-Water Mark: **(OHWM)**: the mark on the shores of all waters, which will be found by examining the beds and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation. Provided, that in any areas where the ordinary high-water mark cannot be found, the ordinary high-water mark adjoining salt water shall be the line of mean high tide and the ordinary high-water adjoining fresh water shall be the line of mean high-water.

Partial Cutting: the removal of a portion of the merchantable volume in a stand of timber so as to leave a well-distributed stand of residual, healthy trees that will reasonably utilize the productivity of the soil.

Pesticide: any insecticide, herbicide or rodenticide but does not include non-toxic repellents or other chemicals.

Plant-able Area: an area capable of supporting a commercial stand of timber excluding lands devoted to permanent roads, utility right-of-way, that portion of Streamside Management Zones

where scarification is not permitted, and any other area devoted to a use incompatible with commercial timber growing.

Power Equipment: all machinery operated with fuel burning or electrical motors, including heavy machinery, chain saws, portable generators, pumps, and powered backpack devices.

Quinault Indian Nation (QIN): A party, along with the United States, to the Treaty of Olympia of 1855 (12 STAT. 97; II Kappler719); federal recognition of the QIN has continued to this day. The QIN is organized under a constitution adopted by the membership on March 22, 1975. The Quinault Business Committee (QBC) is the duly constituted governing body of the QIN by the authority of Article V of the Constitution and Bylaws of the QIN.

Quinault Indian Reservation (QIR): The QIR was created on July 1, 1855 and expanded in 1873 and again on November 8, 1988 when the NBA was acquired. The Enabling Act under which Washington was admitted to statehood did not become law until February 22, 1889, and the State was not admitted to the Union until November 11, 1889. Thus, the QIR predates the existence of the State of Washington.

Rehabilitation: the act of renewing, or making usable and reforesting forest land which was poorly stocked or previously non-stocked with commercial species.

Relief Culvert: a structure to relieve surface runoff from roadside ditches to prevent excessive buildup in water volume and velocity.

Reservation: the land and waters within the exterior boundaries of the Quinault Indian Reservation

Reservation Resources: land, water, fish, and wildlife and in addition shall mean capital improvements of the Quinault Indian Reservation.

Residual Old-Growth: the stand of timber remaining after harvest of a portion of the volume of an old-growth stand.

Rodenticide: any substance or mixture of substances intended to prevent, destroy, or mitigate rodents or any other vertebrae animal which may be declared to be a pest.

Salvage: the removal of snags, down logs, windthrow, or dead and dying material.

Scarification: loosening the topsoil and/or disrupting the forest floor in preparation for regeneration.

Side Casting: the act of moving excavated material to the side and depositing such material within the limits of construction or dumping over the side and outside the limits of construction.

Side-slope seep: A seep within 100’ of a type O stream located on side-slopes which are greater than 20%, connected to the stream channel network by overland flow, and characterized by loose substrate and fractured bedrock, excluding muck with perennial water at or near the surface throughout the year. Water delivery to the type O stream is visible by someone standing in or near the stream.

Skid Trail: a route used by tracked or wheeled skidders to move logs to a landing or road.

Slash: pieces of woody material containing more than three (3) cubic feet resulting from forest practice activities.

Snag: Any dead tree at least 10 inches in dbh and at least 10 feet tall.

Class 1: All limbs and branches are present. The top is pointed. 100 percent of bark remaining. Intact sapwood is sound, incipient decay, hard, original color. Heartwood condition is sound, hard, original color.

Class 2: Few limbs and no fine branches. Top is broken. Percentage of bark remaining is variable. Sapwood is sloughing, and in advanced stages of decay. It is fibrous, firm to soft, and light brown. The heartwood is sound at the base, incipient decay in outer edge of upper bole, hard, light to reddish brown.

Class 3: Limbs are limited to stubs only. Percentage of bark remaining is variable. Sapwood is sloughing, fibrous, soft, and light to reddish brown. Heartwood shows incipient decay at the base, advanced decay throughout the upper bole, fibrous, hard to firm, and reddish brown.

Class 4: There are few or no stubs left. The percentage of remaining bark is variable and the sapwood is sloughing. Sapwood is cubicle, soft, and reddish to dark brown. Heartwood shows advanced decay at the base. Sloughing from the upper bole, fibrous to cubical, soft, and dark reddish brown.

Class 5: There are no limbs or branches, and only about 20 percent of the bark remains. All sapwood is gone. Heartwood is sloughing, cubical, soft, dark brown; or fibrous, very soft, dark reddish brown, and encased in a hard shell.

Spoil: excess material removed as overburden or generated during road or landing construction which is not used within limits of construction.

Stop Work Order: the "Stop Work Order" described in FPR-52-040, and may be issued by the Department to stop violations of the Forest Practice Act or to prevent damage and/or to correct and/or compensate for damages to reservation resources resulting from forest practices.

Stream Typing:

Type D Waters: Designated Waters. All waters designated as type D by the Quinault Indian Nation. These waters include the entire reach of the Quinault River; all of the Queets that flows through the QIR, the Salmon River up to the confluence point with the south fork; the main stem of the Raft River up to the confluence point with Meadow and Lunch Creeks; the north fork of the Raft up to the confluence point with Wolf Creek; the main stem of the Wreck up to the confluence point with the north fork; the main stem of the Moclips River up to the confluence point with the north fork; and all of Lake Quinault.

Type H Waters: Type H streams are those waters known to or presumed to provide fish habitat that are not classified as a type D stream. To meet the definition of a type H stream, a stream must have a defined channel with an average width of 2’ or greater between the ordinary high water marks and a gradient of 16% or less. For a type change from Type H stream to Type O due to gradient, the gradient must be 16% or greater for a minimum of 100 contiguous feet, at which point the break between Type H and Type O will occur at the initial 16% gradient point. The presence of a waterfall 12 ft. or taller will be considered the break between a fish stream and non-fish stream.

Type O Waters: All natural stream segments with a defined channel not classified as a type D or type H.

Timber: standing live forest trees of a commercial species

Trespass: the removal of forest products from, or damaging forest products on, Indian forest land, except when authorized by law and applicable federal or tribal regulations. Trespass can include any damage to forest resources on Indian forest land resulting from activities under contracts or permits or from fire [25 CFR 163.1]

Tribal Lands: Lands owned in either trust or fee status by the Quinault Indian Nation.

Unauthorized Cutting: trespass

Water Bar: a diversion ditch and/or hump in a trail or road for the purpose of carrying surface water runoff into the vegetation duff, ditch, or other dispersion area so that it does not gain the volume and velocity which causes soil movement and erosion.

Weed: any plant which tends to overgrow or choke out more desirable vegetation.

Windthrow: a natural process by which trees are uprooted or sustain severe trunk damage by the wind.

Wetlands:

Forested Wetland: Any wetland or portion thereof that has, or if the trees where mature would have, a crown closure of > 30 percent

Non-forested Wetland: Any wetland or portion thereof that has, or if the trees where mature would have, a crown closure of < 30 percent.

Prairie: Five named prairies exist within the boundaries of the QIR: Chow Chow, Baker, Moses, Moclips, and O'Took.

Manmade Wetland: Wetlands that have been created in last five years due to forest practices.

Bog: Wetlands that have the following characteristics: Hydric organic soils (peat and/or muck) typically 16 inches or more in depth (except over bedrock or hardpan); and vegetation such as sphagnum moss, Labrador tea, bog laurel, bog rosemary, sundews, and sedges; bogs may have an overstory of spruce, western hemlock, lodgepole pine, western red cedar, western white pine, Oregon crabapple, or quaking aspen, and may be associated with open water.

Wildlife Reserve Tree: Defective, dead, damaged, or dying trees which provide or have the potential to provide habitat for those wildlife species dependent on standing trees. Wildlife reserve trees are categorized into the following:

Type 1: Defective or deformed live trees that have observably sound tops, limbs, trunks, and roots. They may have part of the top broken out or have evidence of other severe defects that include: 'cat face' (partially healed or gorwn-over wound) animal chewing, old logging wounds, weather injury, insect attack, or lightning strike. Unless approved by the ID team, only green with visible cavities, nests, or obvious severe defects capable of supporting cavity dependent species shall be considered as Type I. These trees must be stable and pose the least hazard for workers.

Type 2: Dead Type 1 trees with sound tops, limbs, trunks, and roots.

Type 3: Live or dead trees with unstable tops or upper portions. Unless approved by the ID team, only green trees with visible cavities, nests, or obvious severe defects capable of supporting cavity dependent species shall be considered as Type 3. Although the

roots and main portion of the trunk are sound, these reserve trees post high hazard because of the defect in live or dead wood higher up in the tree.
Type 4: Live or dead trees with unstable trunks or roots, with or without bark. This includes 'soft' snags as well as live trees with unstable roots caused by root rot or fire. These trees are unstable and pose a high hazard to workers.

Works Cited

Franklin, J.F. 1990. Biological legacies: a critical management concept from Mount St. Helens. Trans N. Am. Wildlands Nat. Resource Conf. 55, 216-219
Mazurek, M.J. and Zielinski, W. J.2003. Individual legacy trees influence vertebrate wildlife diversity in commercial forests. Forest Ecology and Management. 193, 321-334.

Appendices

Appendix A: Existing Inventory of Cruised Stands
Appendix B: Fish Species Presumed Present
Appendix C: Maps
Appendix D: Organizational Charts
Appendix E: Cultural Resources Legislation

Appendix A: Existing Inventory of Cruised Stands

Existing Inventory Status of Cruised Stands

Type	....Cruised....		...Un-cruised..		....%Sample....	
	Tally	Area	Tally	Area	%Tally	%Area
BC14	1	11.1	0	0.0	100	100
BC23	3	79.2	0	0.0	100	100
BC24	1	59.2	0	0.0	100	100
BC34	5	138.5	0	0.0	100	100
BC42	0	0.0	2	56.9	0	0
BC43	1	41.4	1	22.0	50	65
BC44	1	21.3	3	43.5	25	33
BM42	1	24.3	0	0.0	100	100
BM44	1	23.4	0	0.0	100	100
DF11	58	1682.9	56	1157.0	51	59
DF12	7	159.4	1	3.8	88	98
DF13	3	33.8	0	0.0	100	100
DF21	5	286.9	1	16.6	83	95
DF22	37	1002.0	14	255.8	73	80
DF23	71	2257.6	14	176.3	84	93
DF24	23	959.1	1	1.8	96	100
DF32	3	88.5	1	13.5	75	87
DF33	84	4057.4	27	405.0	76	91
DF34	119	5023.1	27	169.2	82	97
DF42	2	62.2	0	0.0	100	100
DF43	19	846.0	0	0.0	100	100
DF44	120	4158.7	10	92.5	92	98
LP11	99	3859.8	17	155.7	85	96
LP12	24	818.2	3	21.7	89	97
LP13	5	324.3	1	7.2	83	98
LP21	2	32.4	0	0.0	100	100
LP22	18	423.9	6	66.2	75	86
LP23	20	640.6	6	99.7	77	87
LP24	9	271.4	0	0.0	100	100
LP33	18	516.8	8	115.9	69	82
LP34	14	278.1	0	0.0	100	100
LP43	5	170.6	0	0.0	100	100
LP44	18	484.9	0	0.0	100	100
RA11	8	366.9	11	183.4	42	67
RA12	11	353.2	5	110.9	69	76
RA13	13	223.6	0	0.0	100	100
RA14	6	53.6	0	0.0	100	100
RA21	0	0.0	7	106.1	0	0
RA22	8	172.3	23	246.5	26	41
RA23	14	259.7	27	353.7	34	42
RA24	16	242.1	2	47.0	89	84
RA31	0	0.0	2	9.0	0	0
RA32	0	0.0	3	36.6	0	0
RA33	24	580.1	116	1445.9	17	29
RA34	48	1307.4	47	770.6	51	63
RA41	1	15.5	0	0.0	100	100
RA42	5	151.6	12	155.6	29	49
RA43	19	1019.4	13	234.1	59	81
RA44	91	3215.8	285	4757.9	24	40
RA52	1	58.7	0	0.0	100	100
RA53	1	18.6	0	0.0	100	100

RC11	59	1581.2	31	445.1	66	78
RC12	19	763.3	11	228.5	63	77
RC13	5	323.8	0	0.0	100	100
RC21	3	130.4	9	106.5	25	55
RC22	45	1702.7	207	3880.3	18	30
RC23	99	4055.1	130	2204.6	43	65
RC24	52	1680.0	12	203.1	81	89
RC32	2	35.1	2	9.5	50	79
RC33	40	1035.6	205	2858.6	16	27
RC34	276	7990.1	337	4599.6	45	63
RC42	1	12.5	1	2.9	50	81
RC43	14	490.7	3	95.2	82	84
RC44	228	6688.8	118	1358.9	66	83
RC53	1	28.3	0	0.0	100	100
SF34	0	0.0	1	10.3	0	0
SF44	1	87.1	0	0.0	100	100
SS11	13	655.9	0	0.0	100	100
SS12	10	586.9	1	23.6	91	96
SS13	1	14.2	0	0.0	100	100
SS21	1	11.3	0	0.0	100	100
SS22	3	67.0	3	70.4	50	49
SS23	6	124.2	3	20.1	67	86
SS24	5	168.4	0	0.0	100	100
SS31	0	0.0	1	3.4	0	0
SS32	2	33.0	0	0.0	100	100
SS33	4	136.8	0	0.0	100	100
SS34	12	443.8	1	7.0	92	98
SS42	1	26.4	0	0.0	100	100
SS43	9	127.7	1	4.5	90	97
SS44	10	183.6	0	0.0	100	100
SS53	1	11.5	0	0.0	100	100
WH11	107	3878.4	283	5791.2	27	40
WH12	43	1672.9	75	1350.2	36	55
WH13	39	1477.4	3	14.5	93	99
WH14	27	625.1	0	0.0	100	100
WH21	5	180.9	12	190.8	29	49
WH22	44	1447.7	128	2173.9	26	40
WH23	86	3457.4	270	3707.1	24	48
WH24	116	4247.0	5	93.7	96	98
WH32	2	31.3	10	132.0	17	19
WH33	81	2534.8	212	3206.2	28	44
WH34	261	7344.4	290	3105.2	47	70
WH43	26	632.0	9	98.4	74	87
WH44	591	16204.6	405	4568.2	59	78
WP11	3	119.9	0	0.0	100	100
WP21	1	17.7	0	0.0	100	100
WP23	1	10.2	0	0.0	100	100
WP33	2	75.8	0	0.0	100	100
WP43	1	50.1	0	0.0	100	100
WP44	1	29.4	0	0.0	100	100
Total:	3423	110108.1 +	3531	51901.1 =	6954	162009.1
Percent:					49	68

Appendix B – Fish Species Presumed Present

Resident Fish Species Presumed Present on QIR.

Common Name	Scientific Name
Western Brook Lamprey	*Lampetra richardsoni*
Mountain Whitefish	*Prosopium williamsoni*
Cutthroat Trout	*Oncorhynchus clarki*
Rainbow Trout	*Oncorhynchus mykiss*
Dolly Varden	*Salvelinus malma*
Bull Trout	*Salvelinus confluentus*
Brook Trout	*Salvelinus fontinalis*
Olympic Mudminnow	*Novumbra hubbsi*
Common Carp	*Cyprinis carpio*
Redside Shiner	*Richardsonius balteatus*
Longnose Dace	*Rhinichthys cataractae*
Speckled Dace	*Rhinichthys osculus*
Peamouth	*Mylocheilus caurinus*
Largescale Sucker	*Catostomus macrocheilus*
Threespine Stickleback	*Gasterosteus aculeatus*
Coastrange Sculpin	*Cottus aleuticus*
Torrent Sculpin	*Cottus rhotheus*
Prickly Sculpin	*Cottus asper*
Riffle Sculpin	*Cottus gulosus*
Reticulate Sculpin	*Cottus perplexus*

Anadromous Fish Species Presumed Present on QIR.

Common Name	Scientific Name
Pacific Lamprey	*Lampetra tridentate*
White Sturgeon	*Acipenser transmontanus*
Green Sturgeon	*Acipenser medirostris*
Cutthroat Trout	*Oncorhynchus clarki*
Steelhead	*Oncorhynchus mykiss*
Dolly Varden	*Salvelinus malma*
Pink Salmon	*Oncorhynchus gorbuscha*
Coho Salmon	*Oncorhynchus kisutch*
Chinook Salmon	*Oncorhynchus tshawytscha*
Chum Salmon	*Oncorhynchus keta*
Sockeye Salmon	*Oncorhynchus nerka*
Eulachon	*Thaleichthys pacificus*
Threespine Stickleback	*Gasterosteus aculeatus*

Appendix C: Maps

Map 1.1: QIR Ownership

Map 2.1: QIR Watersheds

Map 2.2: QIR Rivers, Streams, and Wetlands

Map 2.3: Identified Type-H Streams

Map 3.1: FMP 10-Year Potential Harvest Units

Map 3.2: Slope Morphology and Rapid Mass-Wasting Events

Map 3.3: QIR Transportation Systems

Map 4.1: Land Use Pattern

Map 4.2: Species Distribution

Map 4.3: Size Class Distribution

Map 4.4: Age Class Distribution

Map 4.5: Site Class Distribution

Map 1.1: QIR OWNERSHIP
Quinault Forest Management Plan, 2017

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Queets
Salmon River
Jefferson Co.
Grays Harbor Co.
Amanda Park
Lake Quinault
Raft River
Quinault River
Taholah
Moclips
Moclips River
U.S. Hwy 101

0 1 2 4 6 Miles

Legend

Ownership Classes

- 100% Quinault Parcel *
- Fee Parcel
- Trust Allotment **
- Misc. Ownership
- North Boundary Conservation Easement Block
- Quinault Res. Boundary
- Sections
- Major Roads
- Township
- Rivers/Streams
- Lake Quinault

* Most 100% QIN parcels in Trust status; some in Fee status.

** May include QIN-owned and/or non-Indian Fee undivided interests..

Produced in support of the 2017 Quinault Reservation Forest Management Plan.
Produced by QDNR GIS Program.
Map Questions?: Contact: Tony Hartrich, thartrich@quinault.org; (360) 276-8211

QDNR GIS: C:\Users\thartrich\Documents\ArcGIS\FMP2017maps\FMP2017_Map1_1.mxd --- 2/16/2017

Map 2.1: QIR WATERSHEDS
Quinault Forest Management Plan, 2017

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River Lower
Queets River
Queets
Salmon River Lower
Salmon River
Salmon River Middle Fork
Salmon River South Fork
Jefferson Co.
Grays Harbor Co.
Moses Prairie
Whale Creek
Raft River North Fork
Raft River
Raft River
Lake Quinault
Upper Quinault Below Lake
Amanda Park
Red Creek
Boulder/Joe Creeks
O'Took Prairie
Camp/Duck Creeks
Quinault River
Chow Chow Prairie
Cook/Elk Creeks
U.S. Hwy 101
Mounts/O'Took Creeks
Taholah
Quinault River Lower
Moclips Prairie
Wreck Creek
Baker Prairie
Moclips River/Joe Creek
Moclips
Moclips River

0 1 2 4 6 Miles

Legend

- Queets/Clearwater/Salmon Rivers
- Coastal
- Raft River
- Sub-Watershed Boundaries
- Quinault River
- Moclips
- Prairies
- 'D' Type Rivers/Streams
- Lake Quinault
- 'H' Type Streams
- North Boundary Conservation Easement Block
- Quinault Res. Boundary
- Sections
- Major Roads
- Township

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Map 2.2: QIR RIVERS, STREAMS & WETLANDS Quinault Forest Management Plan, 2017

0 1 2 4 6 Miles

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Salmon River
Raft River
Quinault River
Moclips River
Lake Quinault
Amanda Park
Queets
Taholah
Moclips
Jefferson Co.
Grays Harbor Co.
Moses Prairie
O'Took Prairie
Baker Prairie
Moclips Prairie
Chow Chow Prairie
U.S. Hwy 101

Legend

- Wetlands (USFWS National Wetlands Inventory (NWI))
- Named Wetlands
- 'D' Type Rivers/Streams
- 'H' Type Streams
- 'O' Type Streams
- Lake Quinault
- North Boundary Conservation Easement Block
- Quinault Res. Boundary
- Sections
- Major Roads
- Township

Produced in support of the 2017 Quinault Reservation Forest Management Plan.
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Map 2.3: IDENTIFIED TYPE 'H' STREAMS Quinault Forest Management Plan, 2017

0 1 2 4 6 Miles

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets
Queets River
Salmon River
Jefferson Co.
Grays Harbor Co.
Lake Quinault
Amanda Park
Raft River
Quinault River
U.S. Hwy 101
Taholah
Moclips
Moclips River

Legend

LiDAR Derived River/Stream Network (on reservation only)

- LargeType 'H' Stream
- Type 'D' River/Stream
- Type 'H' Stream
- LiDAR DEM-Derived Hillshade
- North Boundary Conservation Easement Block
- Lake Quinault
- Quinault Res. Boundary
- Sections
- Major Roads
- Township

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Map 3.1: FMP 10-YEAR POTENTIAL HARVEST UNITS Quinault Forest Management Plan, 2017

0 1 2 4 6 Miles

Legend

- FMP 10-Year Potential Harvest Units on QIN and Trust Allotments
- 'D' Type Rivers/Streams
- 'H' Type Streams
- 'O' Type Streams
- Lake Quinault
- North Boundary Conservation Easement Block
- Quinault Res. Boundary
- Sections
- Major Roads
- Township

Produced in support of the 2017 Quinault Reservation Forest Management Plan.
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Map 3.2: SLOPE MORPHOLOGY & RAPID MASS-WASTING EVENTS Quinault Forest Management Plan, 2017

0 1 2 4 6 Miles

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Salmon River
Raft River
Quinault River
Moclips River
Lake Quinault
Amanda Park
Queets
Taholah
Moclips
Jefferson Co.
Grays Harbor Co.
U.S. Hwy 101

Legend

- Mapped Shallow-Rapid & Deep-Seated Mass-Wasting Events From the Quinault, Raft & Salmon River Watershed Analyses
- High Probability Area To Slope Failure
- Moderate Probability Area To Slope Failure
- 'D' Type Rivers/Streams
- 'H' Type Streams
- 'O' Type Streams
- Lake Quinault
- North Boundary Conservation Easement Block
- Quinault Res. Boundary
- Sections
- Major Roads
- Township

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Map 3.3: QIR TRANSPORTATION SYSTEMS
Quinault Forest Management Plan, 2017

0 1 2 4 6 Miles

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Salmon River
Raft River
Quinault River
Lake Quinault
Amanda Park
Jefferson Co.
Grays Harbor Co.
U.S. Hwy 101
Queets
Taholah
Moclips
Moclips River

Legend

RoadType
- Highway
- Primary
- Secondary
- Spur
- Abandoned; Decomissioned

'D' Type Rivers/Streams
'H' Type Streams
'O' Type Streams
Lake Quinault

North Boundary Conservation Easement Block
Quinault Res. Boundary
Sections
Major Roads
Township

Produced in support of the 2017 Quinault Reservation Forest Management Plan.
Produced by QDNR GIS Program.
Map Questions?: Contact: Tony Hartrich, thartrich@quinault.org; (360) 276-8211

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Map 4.1 LAND USE PATTERN
Quinault Forest Management Plan, 2017

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Salmon River
Raft River
Quinault River
Moclips River
Lake Quinault
Amanda Park
Queets
Taholah
Moclips
Jefferson Co.
Grays Harbor Co.
U.S. Hwy 101

0 1 2 4 6 Miles

Legend

Land Type

- Reserves
- Commercial Timberland
- Non-Tribal Fee And Other Misc.
- Non-Forest
- North Boundary Conservation Easement Block
- Rivers/Streams
- Quinault Res. Boundary
- Major Roads
- Sections
- Township

Produced in support of the 2017 Quinault Reservation Forest Management Plan.
Produced by QDNR GIS Program.
Map Questions?: Contact: Tony Hartrich, thartrich@quinault.org; (360) 276-8211

QDNR GIS: C:\Users\thartrich\Documents\ArcGIS\FMP2017maps\FMP2017_Map4_1.mxd --- 2/16/2017

Map 4.2: SPECIES DISTRIBUTION
Quinault Forest Management Plan, 2017

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Queets
Salmon River
Jefferson Co.
Grays Harbor Co.
Lake Quinault
Amanda Park
Raft River
Quinault River
U.S. Hwy 101
Taholah
Moclips
Moclips River

0 1 2 4 6 Miles

Legend

Species

- Douglas-fir
- Cedar
- Hardwoods
- Pines
- Sitka Spruce
- Western Hemlock

North Boundary Conservation Easement Block

Rivers/Streams

Quinault Res. Boundary

Major Roads

Sections

Township

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Produced by QDNR GIS Program.
Map Questions?: Contact: Tony Hartrich, thartrich@quinault.org; (360) 276-8211

QDNR GIS: C:\Users\thartrich\Documents\ArcGIS\FMP2017maps\FMP2017_Map4_2.mxd --- 2/16/2017

Map 4.3: TREE SIZE CLASS DISTRIBUTION
Quinault Forest Management Plan, 2017

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Salmon River
Raft River
Quinault River
Moclips River
Lake Quinault
Amanda Park
Queets
Taholah
Moclips
Jefferson Co.
Grays Harbor Co.
U.S. Hwy 101

0 1 2 4 6 Miles

Legend

Size Class

- Seedling/Sapling 0 - 4.9 inch DBH
- Poles/Pulpwood 5 - 8.9 inch DBH
- Small Sawlog 9 - 13.9 inch DBH
- Medium Sawlog 14 - 19.9 inch DBH
- Large Sawlog/Old Growth 20+ inch DBH

North Boundary Conservation Easement Block
Rivers/Streams
Quinault Res. Boundary
Major Roads
Sections
Township

Produced in support of the 2017 Quinault Reservation Forest Management Plan.
Produced by QDNR GIS Program.
Map Questions?: Contact: Tony Hartrich, thartrich@quinault.org; (360) 276-8211

QDNR GIS: C:\Users\thartrich\Documents\ArcGIS\FMP2017maps\FMP2017_Map4_3.mxd --- 2/16/2017

Map 4.4: TREE AGE CLASS DISTRIBUTION
Quinault Forest Management Plan, 2017

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Salmon River
Raft River
Quinault River
Moclips River
Lake Quinault
Amanda Park
Queets
Taholah
Moclips
Jefferson Co.
Grays Harbor Co.
U.S. Hwy 101

0 1 2 4 6 Miles

Legend

Age Class (in Years)

- 0 - 10
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 50
- 51 - 60
- 61 - 80
- 81 - 100
- >= 101

North Boundary Conservation Easement Block

Rivers/Streams

Quinault Res. Boundary

Major Roads

Sections

Township

Produced in support of the 2017 Quinault Reservation Forest Management Plan.
Produced by QDNR GIS Program.
Map Questions?: Contact: Tony Hartrich, thartrich@quinault.org; (360) 276-8211

QDNR GIS: C:\Users\thartrich\Documents\ArcGIS\FMP2017maps\FMP2017_Map4_4.mxd --- 2/16/2017

Map 4.5: SITE CLASS DISTRIBUTION
Quinault Forest Management Plan, 2017

0 1 2 4 6 Miles

R13W R12W R11W R10.5W R10W R09W

T24N T23N T22N T21N T20N

Queets River
Salmon River
Raft River
Quinault River
Lake Quinault
Amanda Park
Jefferson Co.
Grays Harbor Co.
U.S. Hwy 101
Queets
Taholah
Moclips
Moclips River

Legend

Site Class

- > 135
- 115 to 134
- 90 to 114
- 65 to 89
- =< 64

North Boundary Conservation Easement Block

Rivers/Streams

Quinault Res. Boundary

Major Roads

Sections

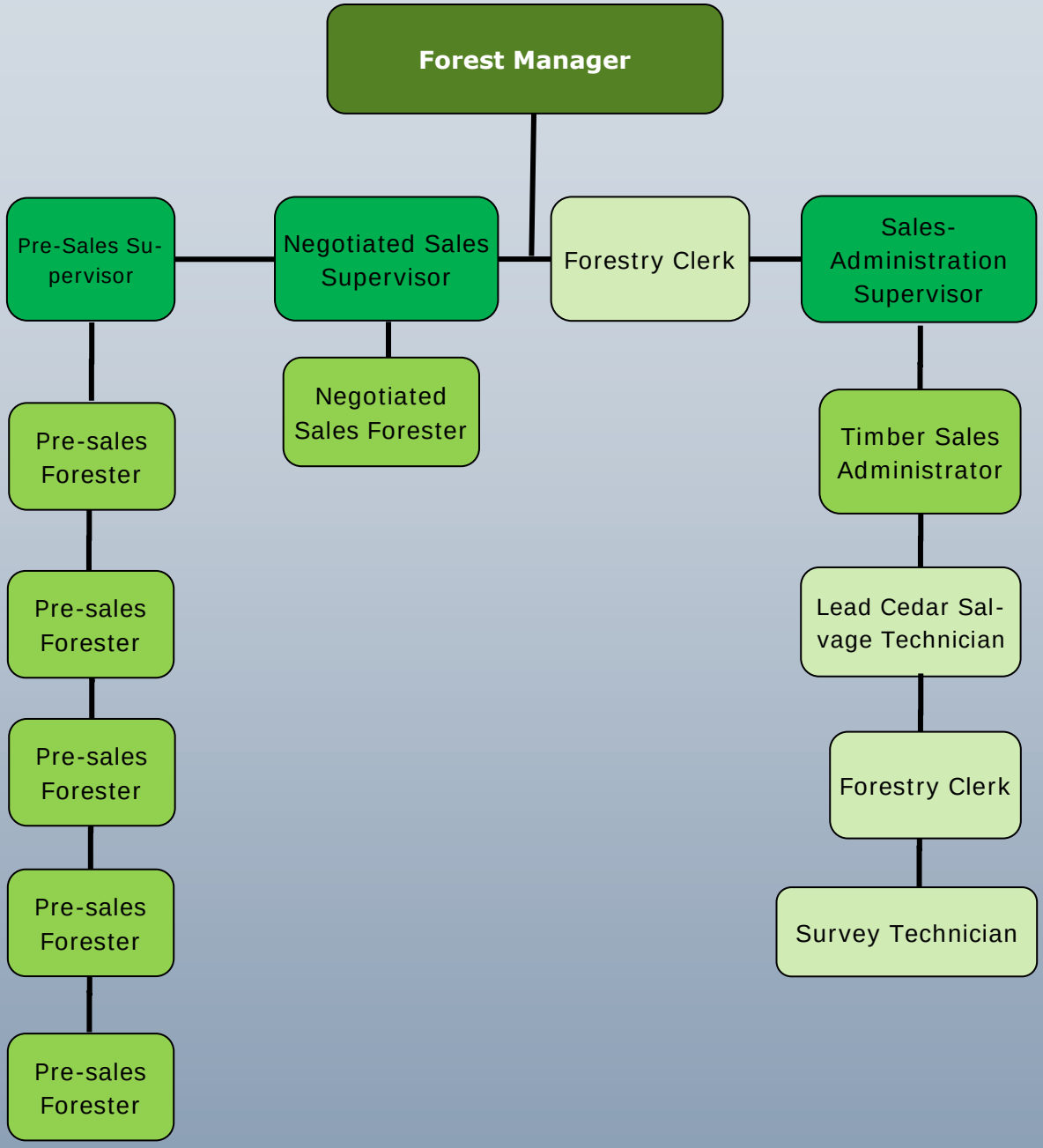
Township

Produced in support of the 2017 Quinault Reservation Forest Management Plan.
Produced by QDNR GIS Program.
Map Questions?: Contact: Tony Hartrich, thartrich@quinault.org; (360) 276-8211

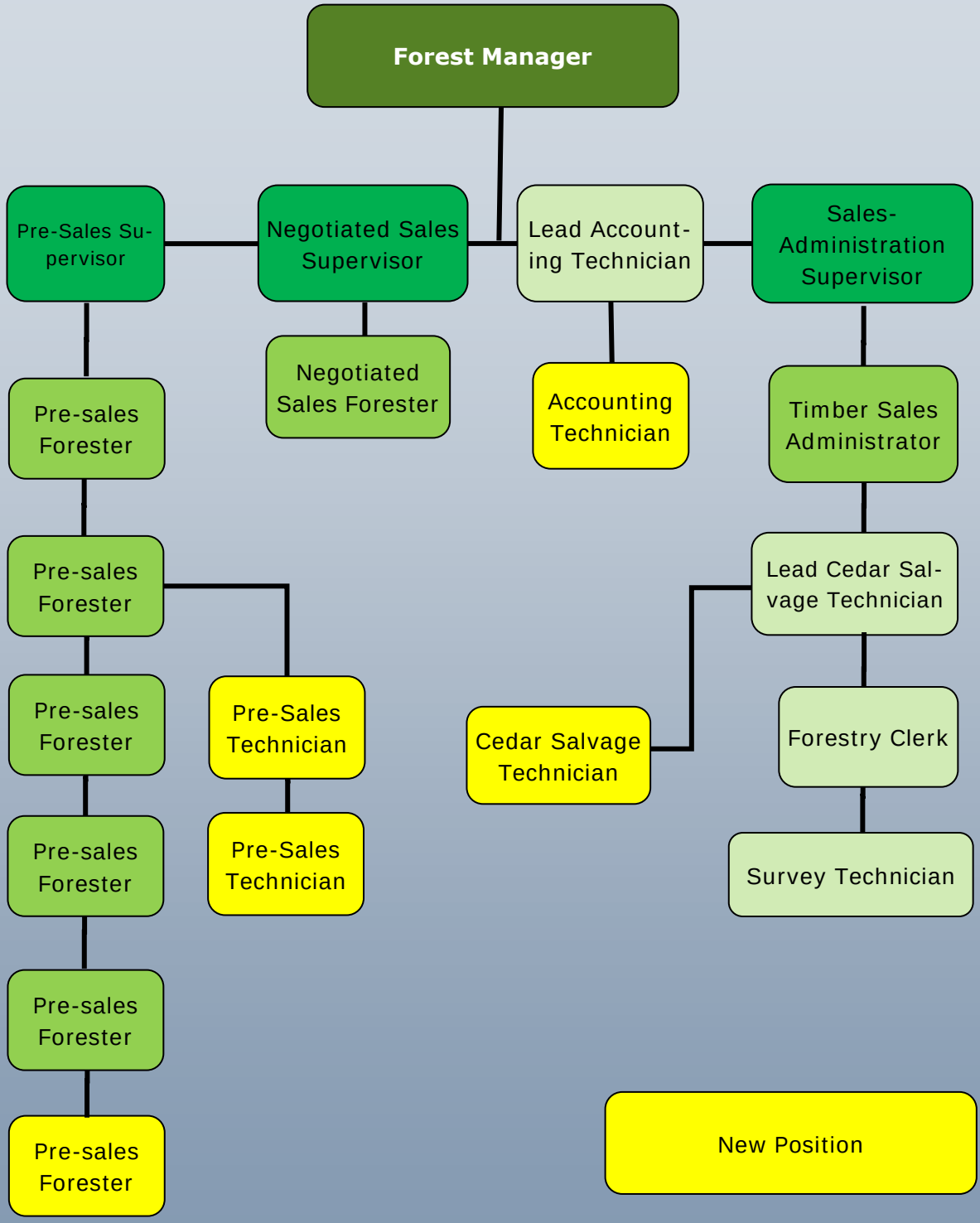
QDNR GIS: C:\Users\thartrich\Documents\ArcGIS\FMP2017maps\FMP2017_Map4_5.mxd --- 2/16/2017

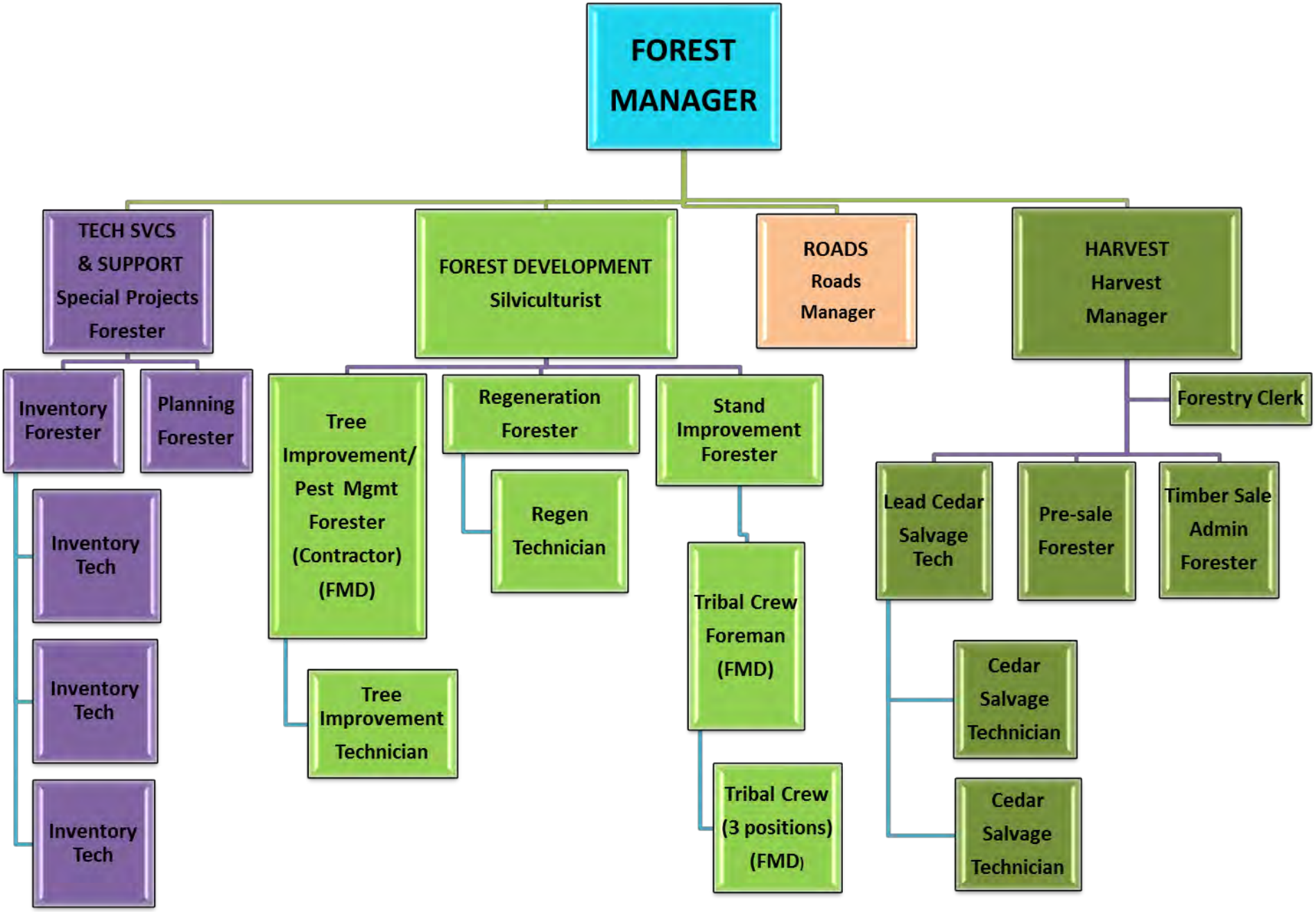
Appendix D: Organizational Charts

BIA—Forestry Organization Chart Current

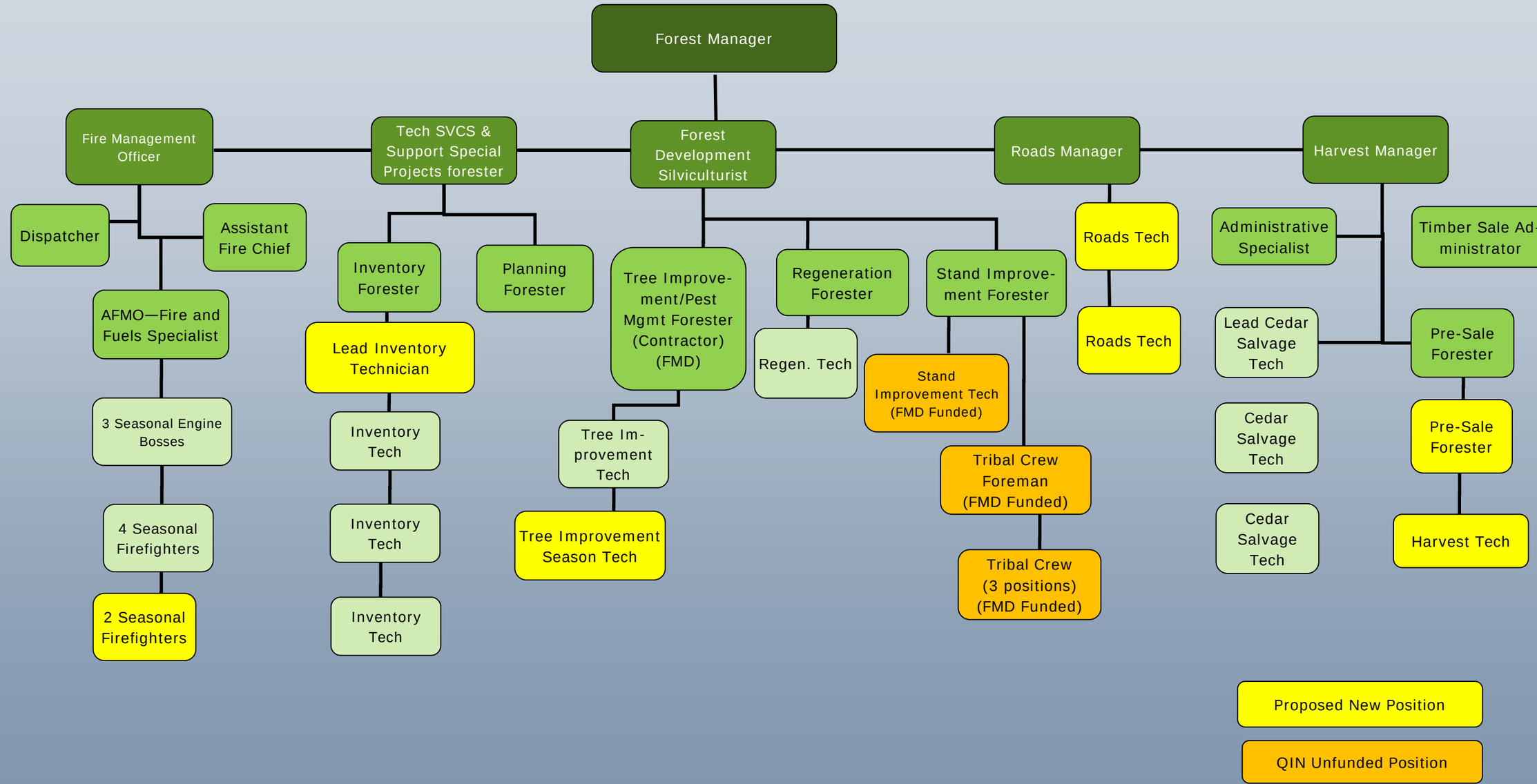


BIA—Forestry Organization Chart Current (Draft July 2015)

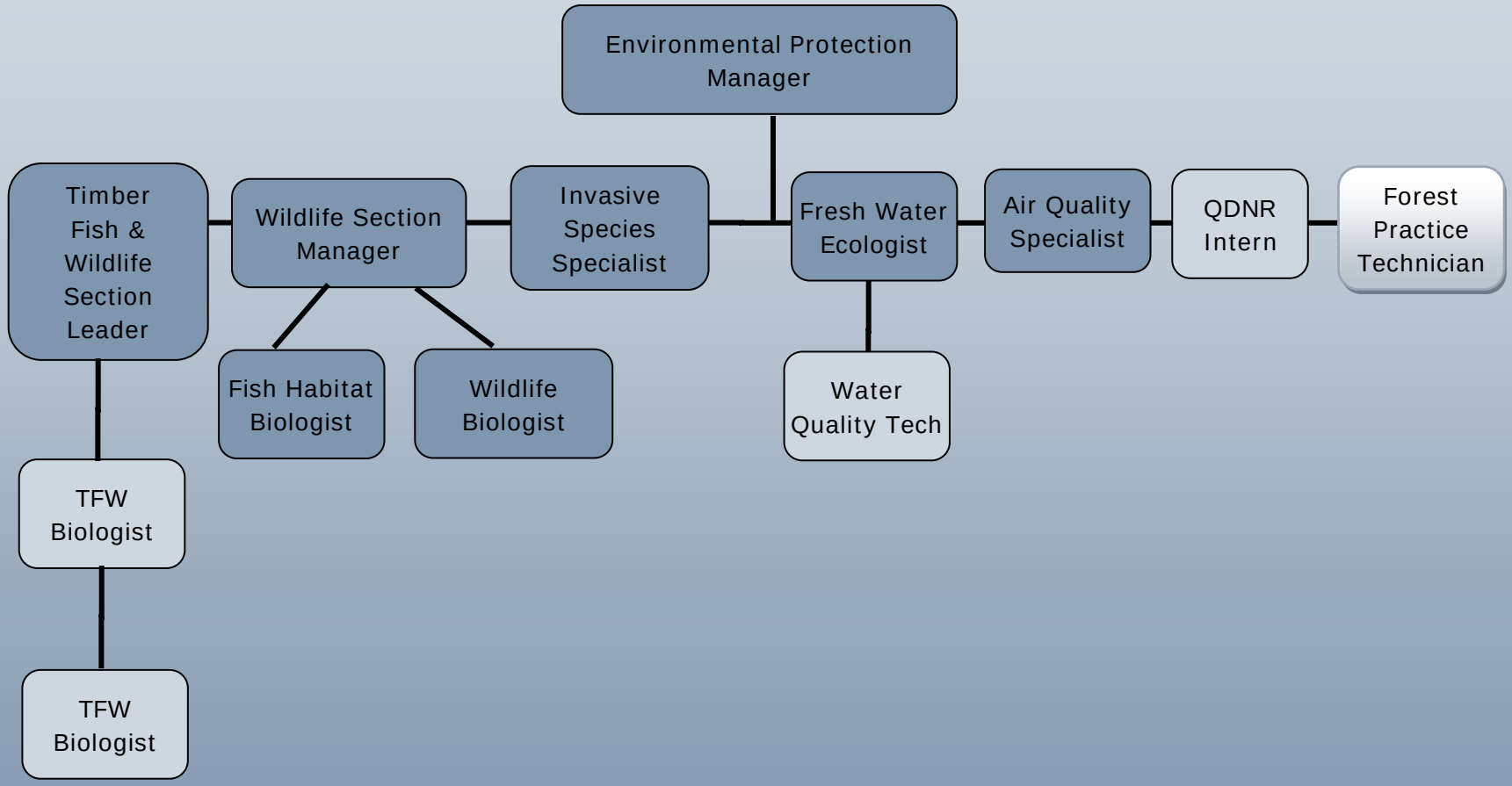



FOREST MANAGER
TECH SVCS & SUPPORT Special Projects Forester
FOREST DEVELOPMENT Silviculturist
ROADS Roads Manager
HARVEST Harvest Manager
Inventory Forester
Planning Forester
Inventory Tech
Inventory Tech
Inventory Tech
Tree Improvement/ Pest Mgmt Forester (Contractor) (FMD)
Tree Improvement Technician
Regeneration Forester
Regen Technician
Stand Improvement Forester
Tribal Crew Foreman (FMD)
Tribal Crew (3 positions) (FMD)
Forestry Clerk
Lead Cedar Salvage Tech
Pre-sale Forester
Timber Sale Admin Forester
Cedar Salvage Technician
Cedar Salvage Technician

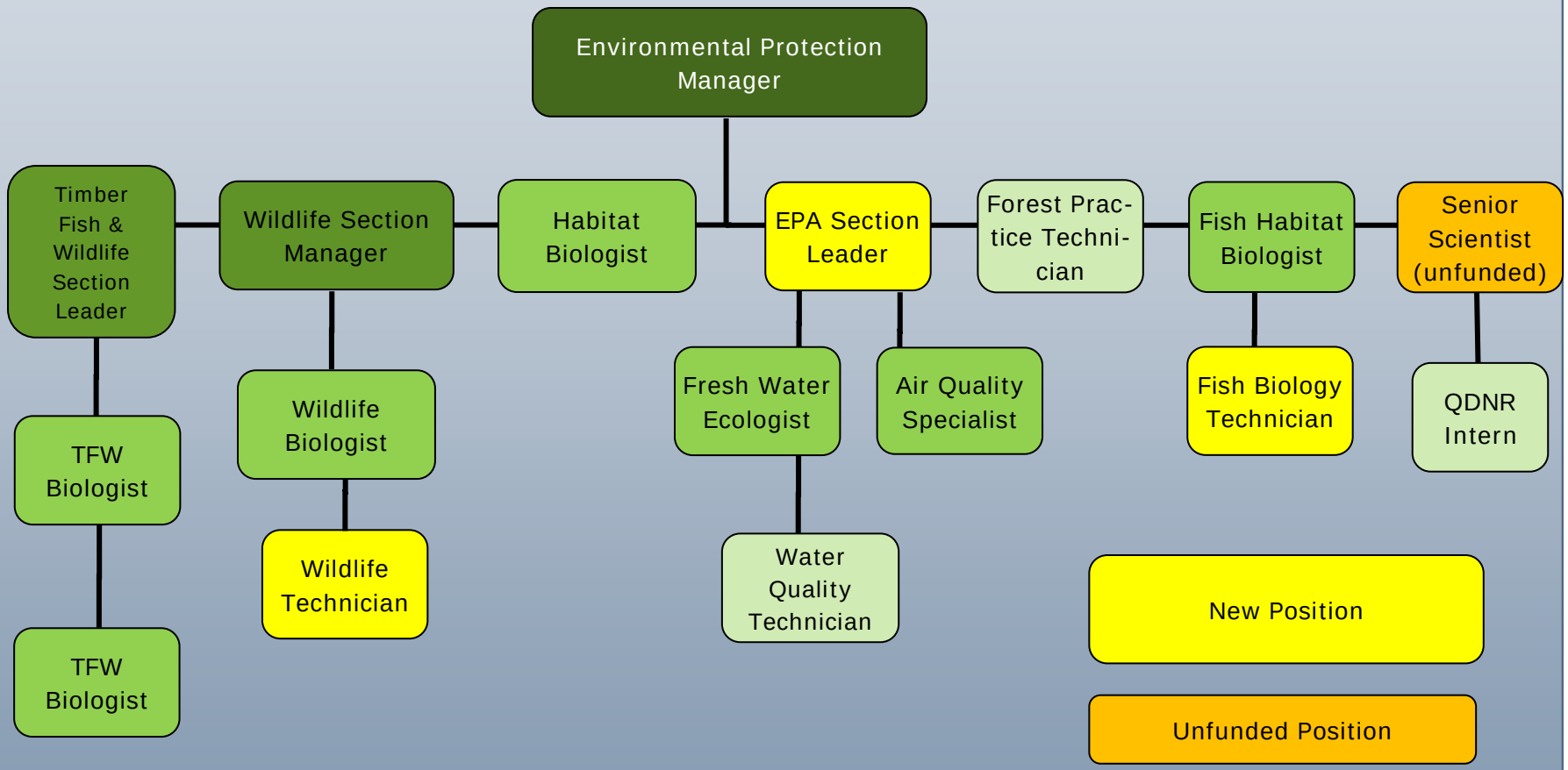
QIN Forestry Organization Chart Proposed



QDNR Environmental Protection Organization Chart Current (Draft May 2015)



QDNR Environmental Protection Organization Chart Proposed (Draft May 2015)



Appendix E: Cultural Resources Legislation

Cultural Resource Regulations (http://www.npi.org/nepa)

- *NEPA itself, and the CEQ regulations*, require that agencies consider the effects of their actions on all aspects of the "**human environment**." Humans relate to their environment through their culture, so the cultural aspects of the environment — for example, cultural uses of the natural environment, the built environment, and human social institutions — obviously must be considered in NEPA analyses.
- *The National Historic Preservation Act (NHPA)* sets forth government policy and procedures regarding "historic properties" — that is, districts, sites, buildings, structures, and objects included in or eligible for the National Register of Historic Places. Section 106 of NHPA requires that Federal agencies consider the effects of their actions on such properties, following regulations issued by the Advisory Council on Historic Preservation (36 CFR 800).
- *The Native American Graves Protection and Repatriation Act (NAGPRA)* requires Federal agencies and federally assisted museums to return "Native American cultural items" to the Federally recognized Indian tribes or Native Hawaiian groups with which they are associated. Regulations, by the National Park Service (NPS) are at 43 CFR 10.
- *The American Indian Religious Freedom Act (AIRFA)* says that the U.S. Government will respect and protect the rights of Indian tribes to the free exercise of their traditional religions; the courts have interpreted this as requiring agencies to consider the effects of their actions on traditional religious practices.
- *The Archaeological Resources Protection Act (ARPA)* prohibits the excavation of archeological resources (anything of archeological interest) on Federal or Indian lands without a permit from the land manager.
- *The Archeological Data Preservation Act (ADPA)* or Archeological and Historic Preservation Act (AHPA) requires agencies to report any perceived impacts that their projects and programs may have on archeological, historical, and scientific data, and requires them to recover such data or assist the Secretary of the Interior in recovering them.
- *The Federal Records Act (FRA)* requires that agencies manage documents in such a way as to protect their historical value.
- *The Abandoned Shipwrecks Act (ASA)* asserts U.S. title to abandoned shipwrecks and transfers title to the states.
- *Executive Order 12898* requires that agencies try to avoid disproportionate and adverse environmental impacts on low-income and minority populations. Impacts may be cultural — for example, impacts on a culturally important religious, subsistence, or social practice.
- *Executive Order 13006* requires that agencies give priority to using historic buildings in historic districts in central business areas to meet their mission requirements.
- *Executive Order 13007* requires that agencies try not to damage "Indian sacred sites" on Federal land and avoid blocking access to such sites by traditional religious practitioners.