

Findings and Decision of the Director  
of the Division of Oil and Gas

APPROVING THE  
HEMLOCK PARTICIPATING AREA  
WITHIN THE REDOUBT UNIT

Under a Delegation of Authority  
from the Commissioner of the State Of Alaska  
Department of Natural Resources

December 13, 2002

## **I. INTRODUCTION, BACKGROUND, AND DECISION SUMMARY**

Forest Oil Corporation (Forest), as Redoubt Unit Operator applied to create the Hemlock Participating Area (HPA) within the current boundary of the Redoubt Unit (RU). Forest's application, if approved, would result in the formation of the HPA, and would include approximately 6,520 acres. Forest submitted geologic and well data that justifies the formation of the HPA. The data indicate that the proposed acreage is capable of producing or contributing to the production of hydrocarbons in paying quantities.

The State of Alaska Department of Natural Resources, Division of Oil and Gas (Division) approves Forest's application to create the HPA. The HPA includes the area proposed by Forest because that area has been shown to be "reasonably known to be underlain by hydrocarbons and known or reasonably estimated...to be capable of producing or contributing to production of hydrocarbons in paying quantities." 11 AAC 83.351(a). The Division also approves the tract allocation schedule, Exhibit C to the RU Agreement, for the HPA. The tract allocation schedule "equitably allocates production and costs among the leases" in the HPA. The effective date of the HPA and the Exhibit C is December 1, 2002.

## **II. APPLICATION FOR THE FORMATION OF THE HEMLOCK PARTICIPATING AREA**

Forest submitted the application, dated October 24, 2002, under 11 AAC 83.351 and Article 9 of the RU Agreement. Forest applied to include portions of four state oil and gas leases, ADLs 378114, 374002, 381203, 381003, totaling approximately 6,520 acres. Forest is the only Working Interest Owner, but there are approximately 93 Overriding Royalty Owners.

The proposed HPA encompasses the Hemlock Reservoir within the Hemlock Formation, which is capable of producing or contributing to production of hydrocarbons in paying quantities. The legal description and initial tract participation schedule for the leases in the HPA (Exhibit C to the Unit Agreement) and a map depicting the HPA (Exhibit D to the Unit Agreement) are Attachments 1 and 2 to the application.

There is geologic and engineering evidence to support the formation of the HPA to develop the Hemlock Reservoir within the RU under a unified plan of development. Between June of 1967 and June of 1976, PanAm, Tenneco, and Unocal drilled five exploratory wells on the Redoubt Shoal in an attempt to delineate the original prospect. Since 2000, Forest has drilled an additional 5 wells on the structure and brought the first well on production on December 9, 2002.

Forest and the Division agree that the effective date for the proposed HPA and the tract participation schedule for the HPA, Exhibit C to the RU Agreement, is December 1, 2002.

## **III. DISCUSSION OF THE PARTICIPATING AREA DECISION CRITERIA**

I considered the criteria set out in 11 AAC 83.303(a) and (b) to evaluate Forest's application to form the HPA. 11 AAC 83.303(c)

Under 11 AAC 83.303(a), I considered whether the proposed PA will: (1) conserve natural resources; (2) prevent economic and physical waste; and (3) protect all parties of interest, including the state.

In evaluating these three criteria, I considered: (1) the environmental costs and benefits; (2) the geological and engineering characteristics of the potential hydrocarbon accumulation or reservoir proposed for inclusion in the PA; (3) prior exploration activities in the proposed area; (4) the applicant's plans for exploration or development of the proposed area; (5) the economic costs and benefits to the state; and (6) other relevant factors (including mitigation measures) the commissioner determines necessary or advisable to protect the public interest. 11 AAC 83.303(b).

A PA may include only land reasonably known to be underlain by hydrocarbons and known or reasonably estimated through use of geological, geophysical, or engineering data to be capable of producing or contributing to the production of hydrocarbons in paying quantities. 11 AAC 83.351(a). "Paying Quantities" means:

Quantities sufficient to yield a return in excess of operating, costs, even if drilling and equipment costs may never be repaid and the undertaking as a whole may ultimately result in a loss; quantities are sufficient to yield a return in excess of operating costs unless those quantities, not considering the costs of transportation and marketing, will produce sufficient revenue to induce a prudent operator to produce those quantities. 11 AAC 83.395(4)

## **A. 11 AAC 83.303(a) criteria discussion**

### **1) Conservation of Natural Resources**

The formation of oil and gas units, as well as the formation of PAs within units, generally conserves hydrocarbons; coordinated development of leases held by diverse parties maximizes total hydrocarbon recovery and minimizes waste. Formation of the HPA will provide for more efficient, integrated development of the Hemlock reservoir within the RU. A comprehensive operating agreement and plan of development governing the area will help avoid duplicative development efforts on and beneath the surface.

Producing hydrocarbon liquids from the area through the Kustatan facilities and the W. McArthur River Facilities reduces the incremental environmental impact of the production. Creating the HPA will help maximize oil and gas recovery, while minimizing negative impacts on all other natural resources.

### **2) Prevention of Economic and Physical Waste**

Generally, the formation of a PA facilitates the equitable division of costs and allocation of the hydrocarbon shares, and provides for a diligent development plan, which helps to maximize hydrocarbon recovery from a reservoir. Further, the formation of a PA, which enables both facility sharing opportunities and adoption of a unified reservoir management strategy, may allow economically marginal hydrocarbon accumulations to be developed.

Formation of a PA improves the likelihood of more complete development of a reservoir with variable productivity across adjoining leases.

### **3) Protection of All Parties**

Because hydrocarbon recovery will more likely be maximized, the state's economic interest is promoted. Diligent exploration and development under a single approved unit plan without the complications of competing leasehold interests promotes the state's interest. The formation of the HPA advances the efficient evaluation and development of the state's resources, while minimizing impacts to the area's cultural, biological, and environmental resources. Operating under the RU Agreement provides for accurate reporting and record keeping, royalty settlement, in-kind taking, and emergency storage of oil. These all protect the state's interest.

The proposed HPA protects the economic interests of all working interest owners and the royalty owner. Combining interests and operating under the terms of a unit agreement and unit operation agreement assures each individual working interest owner an equitable allocation of costs and revenues commensurate with the resources on and value of its lease(s).

## **B. 11 AAC 83.303(b) criteria discussion**

### **1) The Environmental Costs and Benefits**

The approval of the HPA itself has no environmental impact. Formation of the HPA is an administrative action and does not authorize any on-the-ground activity. Potential effects on the environment are analyzed when permits to conduct exploration or development in the unit area are reviewed. In fact, unitized development has less impact on the environment than development on a lease-by-lease basis. Approval of the HPA formation does not convey any authority to conduct any operations on the surface within the unit area. The DNR's approval of the Plan of Development is only one step in the process of obtaining permission to drill a well or wells or develop the known reservoirs within the unit area. The Unit Operator must still obtain approval of a Plan of Operations from the state, and other permits from various agencies before drilling a well or wells or initiating development activities to produce known reservoirs within the unit area.

### **2) The Geological and Engineering Characteristics of the Proposed PA area**

The geological, geophysical and engineering data submitted by Forest and Forest's interpretation of the data supports the formation of the HPA as proposed. Based on current interpretation, the area proposed in the application, either is known, or is reasonably estimated, to be capable of producing or contributing to the production of hydrocarbons in paying quantities as is required under 11 AAC 83.351(a).

The Redoubt structure is a fault bounded, plunging anticline. Its structural axis is on trend with the McArthur River field structure to the north. Forest has defined the limits of the reservoir by a three-way dip closure to the west, east and south and a northwest-southeast trending fault zone, currently interpreted as impermeable, on the north. No field-wide oil/water contact has been defined. No gas cap has been encountered during drilling and the reservoir is undersaturated. The oil averages 26.8°

API, and is slightly lower in gravity than average Cook Inlet crude oils. The interpreted down-dip limit of oil in the Redoubt structure is reasonable at this point in time based on the lowest known oil and highest known water as seen in the wells drilled to date.

### **3) Prior Exploration Activities in the Redoubt Unit-Hemlock Participating Area**

The HPA is located two miles southeast of West Foreland and 16 miles northwest of Kenai in Cook Inlet. Portions of the proposed HPA were included in three previous unit agreements prior to its formation in 1997. These unit agreements include: 1) the Redoubt Shoal Unit Agreement, approved on February 7, 1968, and terminated November, 1970; 2) the Redoubt Bay Unit Agreement, approved November, 1975, and terminated on June 1, 1977; and 3) the South McArthur River Unit, approved December 31, 1982, and terminated March 23, 1986.

Oil in the HPA was discovered in 1968, but after testing, all wells in the field were plugged and abandoned (P&A'd). Six exploration wells were drilled in or near the Hemlock PA during the early exploration phase prior to creation of the unit in 1997. In order, from first drilled to last drilled, they are: 1) Pan Am Redoubt Shoal State 22064 No. 1, API No. 507331002400, P&A'd June 4, 1967; 2) Tenneco State 36465 No. 1, API No. 507332003300, P&A'd November 15, 1967; 3) Pan Am Redoubt Shoal No. 1, API No. 507332004000, P&A'd December 13, 1967; 4) Pan Am Redoubt Shoal No. 2, API No. 507332004001, P&A'd September 27, 1968; 5) Unocal Redoubt Bay Unit No. 1, API No. 507332027000, P&A'd October 31, 1976; and 6) Mobil South McArthur River No. 1A, API No. 507332036100, P&A'd December 12, 1982.

The Pan Am Redoubt Shoal State 22064 No. 1, API No. 507331002400, was P&A'd June 4, 1967, as a dry hole at a total depth of 14,367 feet measured depth (MD) and was a straight hole. This well was the first well drilled on the Redoubt Shoal anticline structure. This well was drilled with very high mud weights and a 6-8% diesel mud to prevent hole problems. No DSTs or RFTs were run, no cores were cut, and no mud log gas chromatography is available to determine hydrocarbon shows. Thus, this well did not provide enough data to adequately evaluate the prospect.

The Tenneco State 36465 No. 1, API No. 507332003300, was P&A'd November 15, 1967, at a total depth of 13,963 feet MD (straight hole) despite minor amounts of oil recovered during several tests of the Hemlock Formation and one test of the West Foreland Formation. No cores were cut. DST #1 recovered 91 barrels of 23.5° API gravity oil over 22 hours from 12,778-12,894 feet MD in the Hemlock Formation. DST #2 flowed 65 barrels oil and swabbed 93 barrels oil, for a total of 158 barrels, over a 28.5 hour test period from 12,778-12,894 feet MD. DST #3 recovered 69 barrels oil over 17 hours from 12,778-12,894 feet MD, after acidizing the formation. DST #4 recovered 2 barrels of 28.4° API gravity oil from 13,287-13,545 feet MD in the West Foreland Formation.

The Pan Am Redoubt Shoal No. 1, API No. 507332004000, was P&A'd December 13, 1967, at a total depth of 13,950 feet MD (12,770 feet TVD), despite minor amounts of oil recovered during several tests of the Hemlock Formation. In this well, one conventional core was cut from the Hemlock Formation and five open hole DSTs were run. DST #1 recovered 10 barrels of water-cut mud with oil stain and 122 barrels of water from 13,540-13,716 feet MD. DST #2 recovered 110 barrels of 27.1° API gravity oil and 85 barrels oil-cut mud from 13,245-13,540 feet MD. DST #3 reversed 105 barrels 26.7° API gravity oil from 12,965-13,540 feet MD. DST #4 flowed 15 barrels

of oil and died, then reversed 60 barrels diesel, 65 barrels gas-cut oil, and 70 barrels gas-cut mud from 13,965-13,540 feet MD. DST #5 recovered 125 barrels of 26.8° API gravity oil and 10 barrels gassy mud from 12,980-13,083 feet MD.

The Pan Am Redoubt Shoal No. 2, API No. 507332004001, was P&A'd September 27, 1968, at a total depth of 14,060 feet MD (12,410 feet TVD). This well is considered the discovery well of the Redoubt field, with successful tests in the Hemlock Formation. DST #1 recovered 72 barrels of 24.4° API gravity oil and 20 barrels muddy water from 13,485-13,845 feet MD. DST #2 flowed 28.6° API gravity oil to surface at a maximum rate of 480 barrels oil per day (BOPD) from 13,260-13,845 feet MD. DST #3 flowed 28.2° API gravity oil to surface at a rate of 1,291 BOPD over a 3.5 hour test from 13,260-13,845 feet MD.

The Unocal Redoubt Bay Unit No. 1, API No. 507332027000, was P&A'd October 31, 1976, at a total depth of 13,950 feet MD (12,770 feet TVD), despite oil shows in several tests. Two conventional cores were cut from 13,033-13,080 and 13,502-13,525 feet MD. Three DSTs were run, one in the West Foreland Formation and two in the Hemlock Formation. Only minor amounts of hydrocarbons were recovered in the two Hemlock Formation tests.

The Mobil South McArthur River No. 1A, API No. 507332036100, was P&A'd December 12, 1982, at a total depth of 12,857 ft MD (12,247 feet TVD). Several tests were run, but recovered no significant hydrocarbons. This well is located north of what is interpreted as the Hemlock reservoir-bounding fault at the north end of the Redoubt structure.

Since formation of the Redoubt Unit, six additional exploration wells have been drilled: 1) Forest Redoubt Unit No. 1, API No. 507332049700, completed February 21, 2001; 2) Forest Redoubt Unit No. 2, API No. 507332050100, completed June 27, 2001; 3) Forest Redoubt Unit No. 3, API No. 507332050400, completed November 22, 2001; 4) Forest Redoubt Unit No. 4, API No. 507332050600, completed April 13, 2002; 5) Forest Redoubt Unit No. 5, API No. 507332051300, P&A'd August 13, 2002; and 6) Forest Redoubt Unit No. 5A, API No. 507332051301, still currently active. Results from all of these wells are currently confidential.

The geologic and engineering data submitted with the application along with the expected incremental contribution to production after water injection startup reasonably demonstrates that the proposed HPA area is capable of producing or contributing to the production of hydrocarbons in paying quantities.

#### **4) The Applicant's Plan for Development of the Participating Area**

Included in the application is the RU Second Plan of Development (2<sup>nd</sup> POD). This plan is effective for the period from August 15, 2002 – August 14, 2003.

Forest plans to continue to develop the Redoubt Unit on nominal 80-Acre well spacing within the HPA. A number of issues affecting the long-term implementation of this plan are under evaluation. Some of these issues include the use of high-angle completions through the productive interval, multi-lateral completions, and water injection well placement to maximize waterflood efficiencies.

The Osprey platform has 27 slots, all of which will most likely be used as production or injection wells to develop the reservoir in the HPA. Forest is currently engaged in the installation of platform facilities to support field startup in December 2002 and is planning to produce limited volumes through existing West McArthur River Unit facilities, prior to completion and startup of the Kustatan Production Facilities.

The 2<sup>nd</sup> POD consists of seven tasks:

- 1) continue development drilling, including further delineation of the areal extent of the Hemlock oil accumulation in the main fault blocks;
- 2) prepare for Redoubt Hemlock water injection pressure maintenance;
- 3) determine productive potential of northern accumulations;
- 4) continue seismic interpretation, geologic modeling, and develop a reservoir model of the Redoubt Hemlock reservoir;
- 5) complete installation of pipelines and surface production facilities;
- 6) obtain approval of the initial Redoubt Hemlock Participating Area and pool rules;
- 7) continue to meet local hire commitments.

In addition to the 2<sup>nd</sup> POD, Forest's long term planning includes effectively managing water injection, further evaluating shallow gas reserves, evaluating oil potential below the Hemlock Reservoir, and evaluating acreage outside the proposed HPA. Water injection is expected to begin 18-24 months after the field reaches design oil production rates. Evaluation of the shallow gas reserves will continue alongside the Hemlock development drilling. A deep test is likely to occur in the 2005 to 2006 timeframe. Exploratory drilling outside the previously discussed areas will only occur when it is determined that well slots will be available, probably in the 2008-2010 timeframe.

## **5) The Economic Costs and Benefits to the State**

Approval of the formation of the proposed HPA will provide economic benefits to the state in association with the tasks outlined in the 2<sup>nd</sup> POD. The long-term goal is to maximize the physical and economic recovery of hydrocarbons from the Hemlock reservoir. Maximum hydrocarbon recovery will enhance the state's long-term royalty and tax revenues.

Any additional administrative burdens associated with the proposed HPA are far outweighed by the additional royalty and tax benefits derived from the area production.

## **6) Other Relevant Factors**

Under 11 AAC 83.351 and 11 AAC 83.371, Forest submitted with the application an allocation of cost for the leases in the proposed HPA (Attachment 3 to the Findings and Decision and Exhibit E to the RU Agreement). The proposed tract allocation schedule distributes working interest equity and over-riding royalties among the leases according to recoverable reserves. The Division finds Forest's tract allocation schedule acceptable for allocating production and costs among the leases in the HPA.

Forest and the Division agree that the effective date of the HPA and the Exhibit C to the RU Agreement will be December 1, 2002.

#### **IV. FINDINGS AND DECISION**

Based on the facts discussed in this document and the administrative record, I make the following findings and decision:

- 1) The proposed acreage is underlain by hydrocarbons and known and reasonably estimated to be capable of production or contributing to production in sufficient quantities to justify the formation of the HPA within the RU.
- 2) The geological and engineering data justify the inclusion of the proposed acreage within the HPA under the terms of the applicable regulations governing formation and operation of oil and gas units (11 AAC 83.301 – 11 AAC 83.395) and the terms and conditions under which these lands were leased from the state.
- 3) The formation of the HPA provides for the equitable division of costs and an equitable allocation of produced hydrocarbons under a development plan designed to maximize physical and economic recovery from the reservoirs within the approved participating area. The allocations of production and costs for the tracts within the HPA (Exhibits C and E), Attachments 1 and 3 to this Findings and Decision, are approved.
- 4) The production of HPA hydrocarbon liquids through the existing production and processing facilities at W. McArthur River Field and at the new facilities at the Kustatan Facility reduces the environmental impact of the additional production. Using existing facilities will avoid unnecessary duplication of development efforts on and beneath the surface.
- 5) The RU Owners are committed to a continuous drilling program to develop the HPA reservoirs, as field conditions permit. This is demonstrated by their diligence to date and the confidential drilling program that has been submitted as part of this application.
- 6) The RU Owners have agreed to an automatic contraction and interim redetermination of the HPA after 30 months (June 1, 2005) to 160 acres around the development wells and 160 acres around proposed development wells. The RU owners have also agreed to a final redetermination after six years (December 1, 2008) to 160 acres around the development wells at that date.
- 7) The RU Owners plan sufficiently diligent exploration and delineation of the reservoirs outside of the HPA under the approved plan of development and operation.
- 8) Approval of the formation of the HPA and the attached Exhibits to the RU Agreement are effective December 1, 2002.

For these reasons I hereby approve the formation of the Hemlock Participating Area within the Redoubt Unit.

A person adversely affected by this decision may appeal this decision, in accordance with 11 AAC



02, to Marty Rutherford, Acting Commissioner, Department of Natural Resources, 550 W. 7<sup>th</sup> Avenue, Suite 1400, Anchorage, Alaska 99501-3561. Any appeal must be received at the above address, or by fax to 1-907-269-8918, within 30 calendar days after the date of “delivery” of this decision, as defined in 11 AAC 02.040. A copy of 11 AAC 02 may be obtained from any regional information office of the Department of Natural Resources.

Signed on 12/16/2002 by Mark Myers

\_\_\_\_\_  
Mark D Myers  
Division of Oil and Gas

\_\_\_\_\_  
Date

Attachments:

- 1) Exhibit C to the RU Agreement (HPA Tract Production Allocation Schedule)
- 2) Exhibit D to the RU Agreement (Map of HPA Tracts)
- 3) Exhibit E to the RU Agreement (HPA Tract Expense Allocation Schedule)

# Attachment 1 – Redoubt HPA Findings and Decision

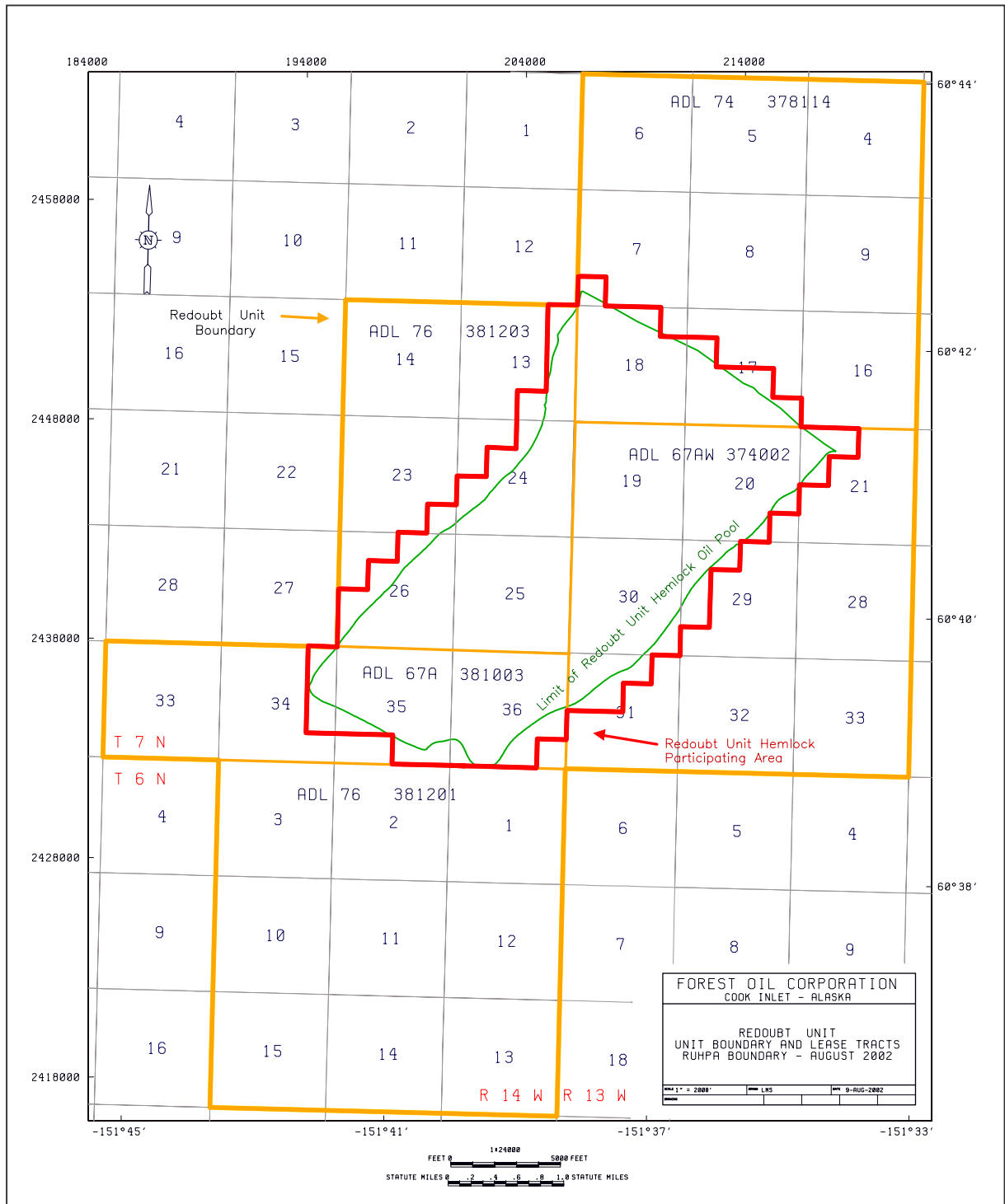
Redoubt Unit Agreement					
Exhibit C					
Table of Acreage Included in Initial Redoubt Unit Hemlock Participating Area and Initial Tract Participations					
Tract & ADL Number	Initial Tract Participation	Township, Range & Section	Portions of Section Included in Participating Area	Tract Acreage Within RUHPA	
1 (ADL 378114)	26.9%	T.7N., R.13W., S.M Sec. 7 Sec. 17 Sec. 18	SW/4 of SW/4 SW/4; SW/4 of NW/4; W/2 of SE/4; SE/4 of SE/4 W/2; SE/4; W/2 of NE/4; SE/4 of NE/4	960	
2 (ADL 374002)	45.6%	Sec. 19 Sec. 20 Sec. 21 Sec. 29 Sec. 30 Sec. 31	All W/2; NE/4; W/2 of SE/4; NE/4 of SE/4 W/2 of NW/4; NE/4 of NW/4 W/2 of NW/4; NE/4 of NW/4; NE/4 of SW/4 All NW/4; NW/4 of NE/4	2360	
3 (ADL 381203)	22.3%	T.7N., R.14W., S.M Sec. 13 Sec. 23 Sec. 24 Sec. 25 Sec. 26	E/2 of NE/4; E/2 of SE/4; SW/4 of SE/4 SE/4 of SE/4 E/2; SW/4; SE/4 of NW/4 All E/2; SW/4; SE/4 of NW/4	1920	
4 (ADL 381003)	5.2%	Sec. 34 Sec. 35 Sec. 36	E/2 of NE/4; NE/4 of SE/4 N/2; SE/4; N/2 of SW/4 N/2; SW/4; N/2 of SE/4; SW/4 of SE/4	1280	
5 (ADL 381201)	0%	—	—	0	
	100%			6,520	

# Attachment 2 – Redoubt HPA Findings and Decision

## Redoubt Unit Agreement

### Exhibit D

### Map of Unit Area, Proposed Redoubt Unit Hemlock Participating Area, and Tracts



## **Attachment 3**

### Redoubt Unit Agreement

#### Exhibit E

#### Allocation of Redoubt Unit Hemlock Participating Area Expense

- RUHPA expenses will be allocated to each tract using the Initial Tract Participation decimals contained in the Exhibit C of the Redoubt Unit Agreement.
- Future RUHPA expense allocations will reflect revisions to the Tract Participation decimals and the RUHPA as depicted in the revised Exhibit C of the Redoubt Unit Agreement, and including any realignment of historical Tract production or expense.