

OPERATIONAL AND COST BENEFIT EVALUATION
OF A
RAPATTACK PEST MANAGEMENT PROGRAM

by

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ABSTRACT

The criteria for use, training requirements, and the organizational and operational requirements of a provincial Rapattack pest management program are reviewed. In addition, the volume of available and applicable work is assessed. All six forest regions and many of the 46 districts were contacted to identify possible projects. Results indicate that there is a tremendous amount of work in most of the locations.

The advantages of a Rapattack pest management program are also discussed. However, a proper comparison between the Rapattack approach and the conventional approach (i.e. ground access by road and/or trail) requires a detailed cost-benefit analysis. Critical data necessary for cost analysis are presently lacking and therefore the meaningful evaluation of a Rapattack pest management program is limited. Although no firm conclusions can be drawn at this time, there are indications suggesting that on certain projects a Rapattack pest management program would be very cost-effective and comparatively less expensive than the conventional alternatives.

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INTRODUCTION

Current forest pest populations in British Columbia are causing significant annual losses in merchantable timber throughout the province. At present, the greatest single-damage causing group are the bark beetles, in particular mountain pine beetle (Dendroctonus ponderosae) and spruce beetle (Dendroctonus rufipennis). Of these, mountain pine beetle continues to be the most significant problem of mature forests in British Columbia and since 1972 has killed more than 175 million lodgepole pine trees (Wood et al. 1984). Spruce beetle infestations declined slightly in 1984 destroying 1.7 million cubic metres of wood, down from 3.3 million cubic metres in 1983 (Wood et al. 1984). However, mountain pine beetle infestations continued to intensify and expand, destroying 12.1 million cubic metres of timber in 1984 (Wood et al. 1984). If no action is taken, beetle infestations are expected to continue to expand with no natural population collapse taking place until many of susceptible pine and spruce stands have been either destroyed by the insects or removed by logging. In addition to the bark beetle problem, other areas of concern include: decay in mature forests, dwarf mistletoes, root and butt rots, and defoliating insects.

As forest pest managers seek to find answers to these pest problems, alternative solutions must be considered. For example, many of the infested areas within the province are in inaccessible locations. The use of rappel crews (i.e. Rapattack) is currently being investigated as a means of overcoming the inaccessibility factor. An extensive field trip to all forest regions was completed in the winter of 1983-1984 to assess the scope of pest management field work that might be most efficiently handled by the Ministry's Rapattack crews. All regions contacted submitted extensive project proposals indicating large volumes of potential Rapattack pest management work.

This report will focus on, but will not be limited to:

- 1) evaluating the potential, in terms of cost-effectiveness, for the use of Rapattack crews for specific pest management activities;
- 2) establishing criteria for determining whether or not the specialty services of the Rapattack crews are appropriate for these activities;
- 3) identifying the specific activities where the Rapattack crews will provide the most benefit; and
- 4) determining whether or not such operations are feasible.

OPERATIONAL EVALUATION

Work Volume Assessment In order to evaluate the potential success of a Rapattack pest management program it was necessary to identify the volume of applicable work available. Initially a telex was sent to Protection staff at the regional offices requesting identification and delineation of any pest management work where rappel crews might be of assistance. This was followed up with an extensive field trip to these regions, designed in part to outline the capabilities, costs, and organization of the rappel crews. In addition, possible projects were discussed and work activities identified.

Results from the field trip indicate that there is a tremendous amount of pest management work for rappel crews in most of the regions. This work has been outlined in Appendix I of this report. Numerous work activities were also identified and include:

- 1) ground probes or other systematic surveys to adequately determine insect or disease distributions and impacts;
- 2) felling of trap trees to contain spruce beetle attack;
- 3) felling and burning of small infestations to destroy beetle broods;
- 4) ground-truthing of aerial surveys to validate previously established data concerning insect populations, green attack, red attack, grey attack, volume losses, and other impacts;
- 5) access development (helispots); and
- 6) access improvement.

Criteria For Use The decision to use rappel crews on specific pest management activities is a difficult one and there are many factors to consider. To justify the use of highly specialized rappel crews, pest management projects must be:

- 1) more cost-effectively implemented using rappel capabilities in comparison to alternative methods;
- 2) high priority pest management problems;
- 3) located in inaccessible areas necessitating the use of rappel crews; and
- 4) low intensity work projects (i.e. approximately one crew day/site).

At present, critical data enabling thorough comparisons between the effectiveness of conventional crews and rappel crews on various pest management activities is lacking, and therefore the decision-making process is further complicated. However, this data will evolve from future projects and eventually help to expedite this process. In the interim, trial projects should be established and carried out to determine cost-effectiveness and to identify and correct any operational problems that may arise.

Each rappel pest management project must be assessed on an individual basis to determine the extent of activity required. The function of rappel crews on projects requiring repeated access or extensive work (more than one full day/site) should be limited to access development or improvement (helispot construction and/or upgrading). These situations arise in many of the pest management activities, including:

- 1) grid surveys where extensive ground work is required over a period of days;
- 2) lethal trap tree programs where establishment, treatment, and monitoring requires repeated access;
- 3) felling and burning operations; and
- 4) ground-truthing procedures.

However, there may be cases where local spot infestations might best be handled directly by small two-man rappel crews. Such would be the case when infestations are so small and isolated that multiple access from a single helispot would be impractical.

Other factors to consider include: weather, crew productivity, daylight hours, and travel time. Weather is an extremely important factor and is often limiting. No rappelling shall be undertaken where the ceiling above ground level is less than 500 feet or when the horizontal visibility is less than 1/2 mile. Winds (steady in excess of 20 mph and gusts of 8 mph or greater) and/or any form of precipitation are also limiting. Safety may also be compromised especially when working at high altitudes where the potential exists for being "weathered in" for weeks at a time. Crew productivity, daylight hours, and travel time between the main base and the project site all play an important role in determining the feasibility of scheduling and completing a given project. A final point to consider is that lack of conventional manpower does not justify the use of rappel crews for pest management activities which are in reality non-rappel projects.

Training Requirements To ensure the success of a Rapattack pest management program it is critical that selected Rapattack personnel receive extensive training in the biological aspects of pest management, including: entomology and pathology. In addition, all theoretical and procedural aspects of probes, surveys, and treatments should be reviewed in detail.

Rappel pest management projects may involve work in all of the six forest regions and many of the 46 forest districts. Procedures usually vary for specific activities from region to region and therefore, to avoid operational complications, Branch personnel should develop a standard set of procedures for each type of probe, survey, or treatment. The procedures selected should fulfill all regional and district requirements. Where special circumstances arise which require deviations from these procedures, it should be the responsibility of the districts and/or regions to brief the crews in this regard.

Training should be completed prior to the commencement of each operational season. Refresher courses should also be provided for those returning crew persons who have already taken the initial training. Branch pest management personnel should be responsible for providing the formal training with any additional site specific information supplied at the district level.

Organizational and Operational Requirements Rapattack crews have been used in the past (1981 - 1984 inclusive) on small pest management projects (Table 1).

TABLE 1 Summary - Rapattack Pest Management (Kemmler, 1983)
(Man Days)

YEAR	PROBES	# of Helipads	# of Trap Trees	# of Burned or Infested
1981	--	43	--	--
1982	50	49	583	210
1983	47	21	--	1
1984	--	--	62	--
Totals	97	113	645	211

To date, the most extensive work was undertaken during March and April of 1982 in the Kamloops, Penticton, and Princeton Forest Districts where almost 400 man hours of pest management work were completed (Ministry of Forests, 1982).

Experience from these projects identified some training needs, including:

- 1) proper treatment techniques (i.e. probes, surveys, etc.);
- 2) dendrology of relative species for non-tech grads;
- 3) entomological and pathological identification and recognition; and
- 4) familiarization with forest insect and disease survey sampling forms, etc.

A view of these needs clearly shows the major contributing factor to be insufficient and/or improper training. This is not a major fault of the Rapattack pest management program and can easily be corrected by implementing the recommendations from the previous section (i.e. training requirements).

Application of the Rapattack crew organization used during the fire season has been used on pest management projects in the past and has proven to be very successful. Therefore, it is recommended that identical crew organization be adopted for future Rapattack pest management projects. Rapattack crews are the responsibility of the Protection Branch office and are funded solely through Branch programs. However, as the Rapattack crews are providing a

service to regions and districts, it is the responsibility of those regions and districts to ensure the optimum utilization of both the crews and the Bell 205 multipurpose helitanker while they are working within local jurisdiction.

The Rapattack fire control program is designed to provide a useful service to regions and districts without further complicating or increasing regional and/or district administrative responsibilities. This should also be the case for a Rapattack pest management program. Rapattack crews can be operationally self-sufficient in terms of arranging and paying for any accommodation, meals, equipment, and miscellaneous supplies. This would limit regional and district office responsibilities to:

- 1) arranging and prioritizing Rapattack pest management activities (where critical, exact locations of helipads and other activities must be specified);
- 2) supplying any specialized equipment necessary to complete projects;
- 3) providing any site-specific training over and above the initial training necessary to complete the activities to standard; and
- 4) monitoring all of the projects to completion and carrying out the normal administrative requirements.

In order to improve efficiency in the future, regional and district staff should also be ready to review and provide constructive criticism of Rapattack pest management projects. Further, regions should accept and prioritize district pest management proposals before sending them along to the Protection Branch office. Final approval and allocation of Rapattack man hours and helicopter time should take place at the Protection Branch level. Absolute organization and operational preparation are critical to an efficient and viable (cost-effective) Rapattack pest management program.

COSTS AND BENEFITS

Costs

To date, the only isolated Rapattack pest management program occurred in 1982 over the period from March 1 to April 22. The work completed during this period is listed in Table 2 and the total costs for this program are reported in Table 3.

TABLE 2 Rapattack Pest Management (1982: March 1 - April 22) (Westby, 1982)

Helipads Built	Red Tops Felled	Green Infested Burned (# of Trees)	Probes	Spruce Trap Trees Felled
44	94	97.5	22	583

TABLE 3 Rapattack Pest Management Costs (1982: MARCH 1 - April 22) (Kemmler, 1983)

		cost	total cost*
Wages		15,814.00	
Support		15,620.00	
Helicopter: Basing Fee**	171,305.00		
Flight Time & Fuel	<u>35,784.00</u>	<u>207,089.00</u>	<u>238,523.00</u>

* All values recorded and expressed in terms of 1984 dollars using the '84 suggested inflation factor of 2.924.

** The basing fee for a six month period has been prorated for the period under discussion.

These costs are substantial, however, due to their non-specific nature it is difficult - if not impossible, to make any valid cost comparisons with conventional projects. As a result, the cost-effectiveness of this particular program has not been established. Therefore, it is critical that for future programs, representative projects be selected and monitored closely to show efficacy and cost comparisons to alternative methods.

Benefits

Of the forest insect pests in British Columbia, the bark beetles are recognized as the most devastating. It is with the control and monitoring of these pests that the benefits of a Rapattack pest management program might best be realized. However, the meaningful evaluation of such a program requires detailed cost-benefit analyses and in-depth cost comparisons with alternative control and monitoring measures. At present, critical costing data is limited and makes this evaluation difficult.

In absolute terms, rappel crews are more costly to operate on an hourly basis than conventional crews. The extra costs involved are due to:

- 1) training expenses;
- 2) specialized equipment expenses (rappel gear, etc.);
- 3) accommodation and living expenses;
- 4) base change (project change) transportation costs; and
- 5) helicopter costs (availability and flight time charges).

Of these, helicopter costs are by far the single most significant inflating factor. However, with the capability for seven two-man crews, there is potential for work at a maximum of seven project sites per day and by amortizing these costs over the total number of projects completed, it is expected that this additional expense will be more than offset. In addition, there will be periods within any given day where the helicopter may be available for other district flying. This will also help to reduce the overall helicopter costs attributable to a Rapattack pest management program and thereby increase cost-effectiveness. Therefore, when planning these projects, districts should consider and use this option whenever and wherever possible.

Although detailed costing is limited, there are indications that the use of rappel crews on remote inaccessible pest management projects will be more cost-effective than using conventional crews. Appendix II provides an

extensive and detailed cost analysis and cost comparison between the two approaches and clearly indicates that there is a substantial cost savings to be realized in opting for the Rapattack approach. On this one small project alone an estimated savings of approximately \$3,000.00 was realized. The bulk of this savings can be attributed to the reduction in travel time and the resulting effect on the project completion time (i.e. one day vs. 15 days). Review of the project in Appendix II indicated that the project time could have been reduced by two hours. This would have cut the project wage cost by 20% and further reduced the overall costs significantly (Lacey, 1984).

In addition to the cost savings mentioned above, there are numerous other benefits which may accrue from implementing a Rapattack pest management program. These include financial, industrial and social benefits. Although these benefits are not necessarily unique to a Rapattack program, they may not otherwise be realized to their greatest potential.

The financial implications are widespread, but difficult to define in dollar values. Areas where positive impacts may be realized include the amelioration of:

- 1) income loss from forest and allied industrial employment;
- 2) stumpage loss and reduction of other sources of revenues to the provincial and federal governments; and
- 3) increased fire protection costs resulting from the higher fire hazard of beetle-killed forests.

In addition, millions of dollars in timber values may be saved which might not have otherwise been preserved. The industrial implications and social impacts are as equally obscure, but nevertheless deserving of strong considerations. These include:

- 1) reductions in losses to the available wood supply and the corresponding effect on the viability and stability of numerous interior communities;

- 2) lessening the detrimental implications of lower grade products and foreign quarantine regulations on some export and domestic markets;
- 3) reductions in disruptions of normal forest and milling operations, including long-term closures and shutdowns;
- 4) abatements in forest fire hazards which jeopardize the safety of both townspeople and vacationers whose dollars contribute significantly to the provincial economy; and
- 5) reductions in losses to the amenity values: scenic, social and historical.

CONCLUSIONS

It is the firm commitment and official policy of this Ministry to protect and/or enhance the forest and range resources by preventing or reducing losses from pests. In order to meet the objectives of this policy statement, various pest control and monitoring measures have been considered and implemented. The expansion of the Rapattack program to include pest management activities is one such measure which is still in the developmental stage. The intent or design of implementing a Rapattack pest management program in British Columbia is to provide an effective tool to aid in combating the growing forest pest problems in our province; specifically in high priority, inaccessible areas.

The operational costs for a Rapattack pest management program are quite substantial. However, the values at risk have been clearly stated and are astronomical in comparison. Although detailed cost analyses are limited, there is evidence that a Rapattack pest management program would be very cost-effective when applied to specified projects (i.e. high priority, inaccessible, etc.) In addition, there are numerous other financial, industrial, and social benefits that would accrue from such a program.

As mentioned, the Rapattack pest management program is still developmental and therefore, great potential for improvement and innovation still exists. With time, improvements in organization and operational techniques will help to optimize the efficiency of the Rapattack pest management program and further reduce costs in the future.

Finally, on the basis of the information available at this time, the use of rappel crews (Rapattack) for pest management activities on high priority, inaccessible projects appear to be a potentially cost-effective alternative. However, no firm conclusions can be drawn as to whether or not it is truly viable. Before we will be able to draw definitive conclusions, representative projects must be established and monitored closely to show efficacy and cost comparison to other methods.

RECOMMENDATIONS

1. Rapattack has the potential to be a cost-effective pest management tool and therefore, a trial program of approximately two months in duration should be initiated as soon as possible and scheduled for September and October.
2. Representative trial projects should be established and closely monitored by Protection Branch staff for essential cost and operational evaluation.
3. Rapattack pest management projects must be:
 - 1) high priority pest management problems;
 - 2) located in inaccessible areas; and
 - 3) low intensity work projects (i.e. approximately one crew day/site).
4. Selected Rapattack personnel should receive extensive training in all of the biological aspects of pest management. Further, all theoretical and procedural aspects of probes, surveys, and treatments should be reviewed in detail.
5. The formal training should be the responsibility of Protection Branch pest management personnel and be carried out prior to each operational period.
6. Regional and district responsibilities should include:

- 1) arranging and prioritizing pest management activities within their jurisdiction;
 - 2) supplying specialized equipment necessary to complete projects;
 - 3) scheduling any additional district flying that is required around the rapattack operations to ensure optimum helicopter utilization; and
 - 4) monitoring all technical and procedural aspects of any projects and carrying out the normal administrative requirements.
-
7. Scheduling of Rapattack pest management projects requires vital consideration of: climatic conditions, daylight hours, crew productivity, and travel time.
 8. Regions should prioritize district pest management proposals and then submit them to the Branch.
 9. Final approval of projects and allocation of Rapattack man hours and helicopter time should take place at the Branch level.
 10. To avoid operational complications, Branch personnel should develop a standard set of procedures for each type of probe, survey or treatment. Site-specific anomalies should be explained by the districts, including any procedural deviations necessary.
 11. Rapattack crew organization used during the fire season has been successfully employed on past pest management projects and therefore should be adopted for future projects.
 12. Rapattack crews are the responsibility of the Branch and should be funded solely through Branch programs.

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APPENDIX I - POTENTIAL PROJECTS BY REGION

REGION	PROJECT	WORK VOLUME (Man days)*		
			Subtotal	Total
Vancouver	Helispot Construction	30		
	Single tree disposal (Fall & Burn)	10		
	Probes & Surveys	60	100	100
Kamloops	Helispot Construction			
	Single Tree Disposal	732		
	Probes & Surveys		732	832
Nelson	Helispot Construction			
	Single Tree Disposal	Not		
	Probes and Surveys	Available -		832
Cariboo	Probes and Surveys	150	150	982
Prince George	Helispot Construction			
	Lethal Trap Tree Establishment	450		
	Probes and Surveys		450	1432
Prince Rupert	Pheromone Bating			
	Single Tree Disposal (Fall & Burn)			
	Broadcast Burn	Not		
	Probes and Surveys	Available		
		-		1432

*All man day estimates were taken from project proposals submitted by regional staff.

APPENDIX II - TRIAL PROJECT COST ANALYSIS

Background:

Project - Similkameen Falls - S.F.U. Spray Control Trial
for mountain pine beetle - 1984.

Date - July 10, 1984

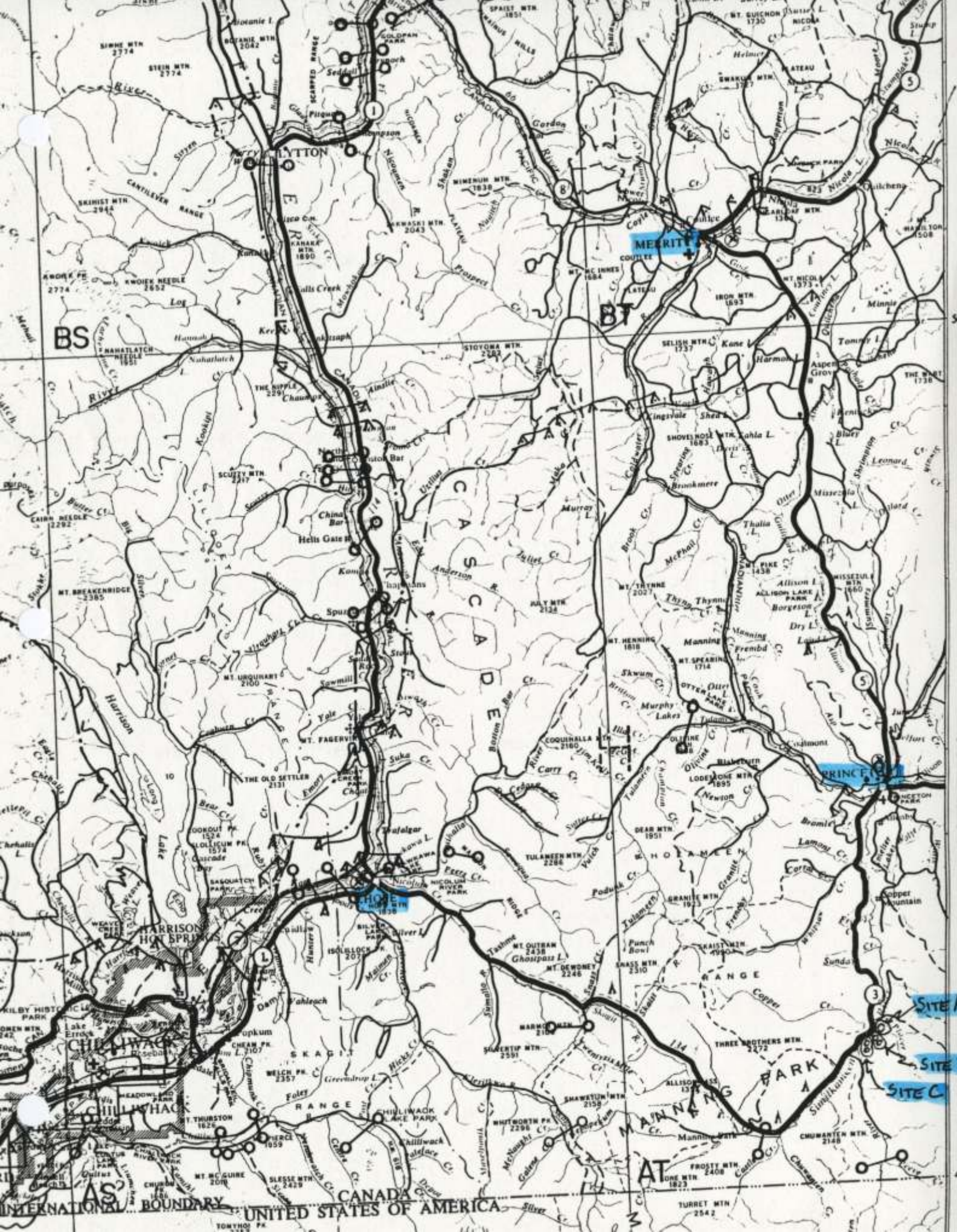
Rapattack crew and equipment -

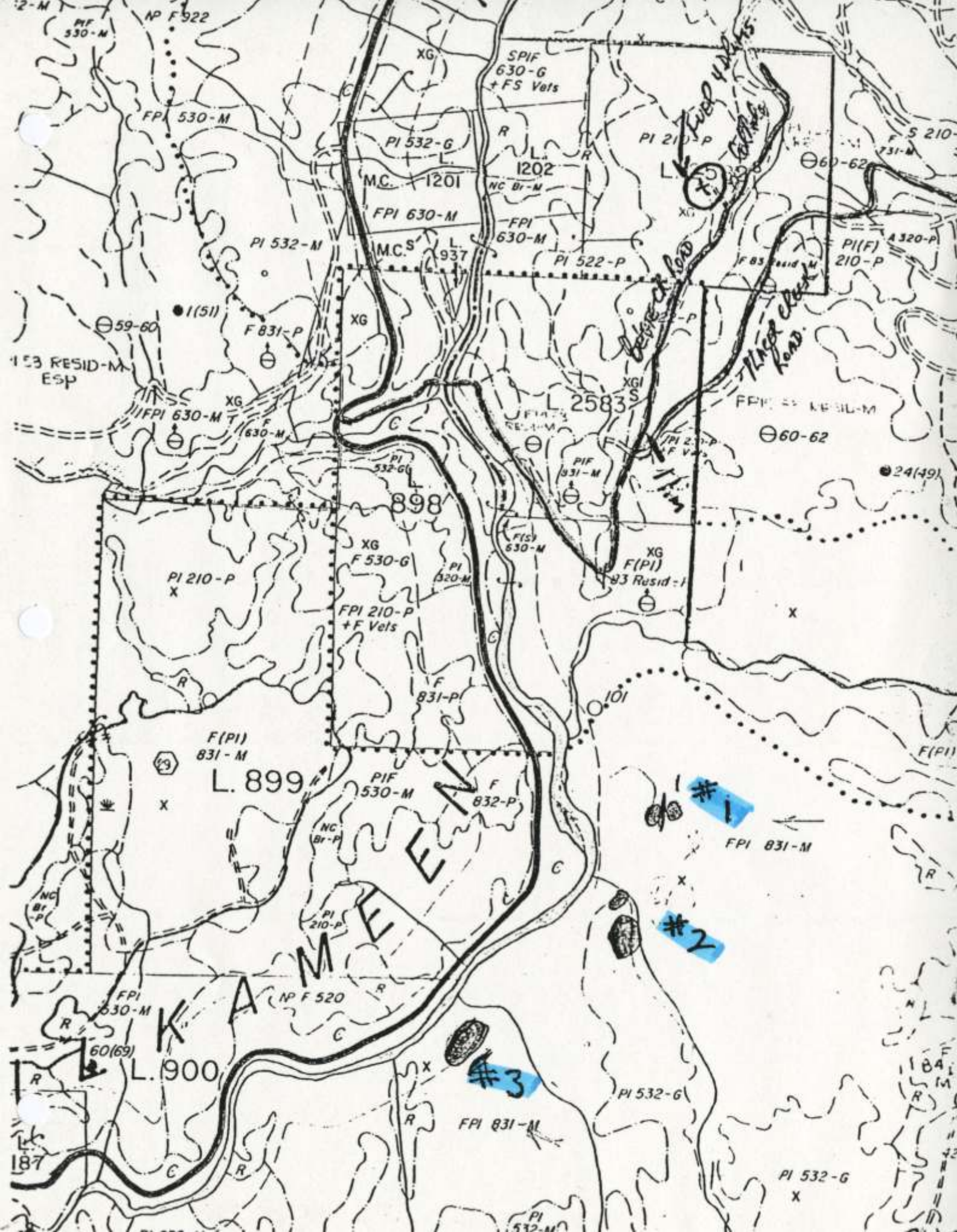
- one spotter
- three two-man crews
- three falling bags (i.e. two chain saws, gas, oil, etc.)
- two canflex bags
- three 205 cargo bags for pesticide and spraying equipment

Procedure -

Merritt District staff walked into the three sites from the nearest road. Two-man crews were rappelled into each of three sites (see included maps) with their falling equipment. The canflex water bags and spraying equipment were delivered immediately following the crew deployment. The Bell 205 off-load procedure was used to deliver 150 gallons of water to each of the Canflex tanks. This water was needed by district staff for mixing the pesticide (Sevin) to be used for application on the felled attacked trees and for clean-up purposes.

Upon direction from the district staff (i.e. marking of the attacked trees) the Rapattack crews felled the attacked trees across the slope and where necessary limbed them to the point on the bole where any visible signs of attack were no longer evident. Immediately following the felling operation, district staff applied the pesticide to the boles of the attacked trees. In total 62 trees were treated in approximately ten hours. An additional 28.55 man hours were required at a later date for MSMA insecticide translocation treatment.





Appendix II (Continued)

Costing:

Actual project costs* (Lacey, 1984)

	Cost	Subtotal	Total Cost
Initial work (Falling & Sevin Application - 62 trees)			
Wages:			
Helicopter: flight time	1,104.00	\$ 966.00	
fuel	<u>544.00</u>	\$1,648.00	
Equipment Rental: Sprayers (2)	40.00		
Chain saws (3)	<u>63.75</u>	103.75	
Chemical (Sevin):		<u>50.00</u>	
		<u>2,767.75</u>	
Follow-up work (MSMA Translocation - 46 trees)			
Wages:	370.50		
Vehicle rental:	40.00		
Chemical (MSMA):	<u>20.00</u>	<u>430.50</u>	<u>3,208.25</u>

*All costs are reported in 1984 Dollars.

Estimated conventional pile and burn project costs (Lacey, 1984)

The reported costing is based on a 10 hour day using a three man crew with the following classifications and corresponding rates of pay:

F.T. 2-4 : 11.72
F.T. 2-1 : 10.99
F.T. 1-1 : 10.16

All of the following costs are estimates provided by Tom Lacey (Protection R.O. - Merritt District).

Appendix II (Continued)

				Cost per Day	Total Cost Per Day	Total*** Project Cost
Wages:				318.70		
Equipment Rental: Vehicle**				50.00		
Chain saw				<u>21.00</u>	71.00	
Miscellaneous				10.00	399.70	6,195.39

* All costs are reported in 1984 dollars.

** Vehicle rental includes the cost of fuel.

*** Total project cost was determined based on a 15.5 day completion estimate determined as follows:

Travel time return 1.5 hours.

Walking time to site return 2.5 hours

Work time on site (maximum) 6.0 hours

Based on 1.5 hours/tree to fall, pile, burn, and control any fire escapes - 1.5 hours/tree X 62 trees - 93 work hours.

93 work hours/6 work hours/day = 15.5 days