

**Final Report to the Washington State Legislature
On The Northwest Weather and Avalanche Center**

As Required by SSB 5219 (Chapter 141 Laws of 2007)

December 1, 2008



Washington State Parks and Recreation Commission

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(Regarding the Northwest Weather and Avalanche Center / 2007)**

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Appendices (available on the Internet at www.parks.wa.gov/winter/AvalancheCenter):

- Operations Consulting Report - by Knox Williams (Full Report)
- Economic Benefit Analysis - by Berk & Associates (Full Report)
- Economic Benefit Analysis - by Berk & Associates (Highlights)

This report may be found on the Internet at www.parks.wa.gov/winter/AvalancheCenter.

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Washington State Parks and Recreation Commission

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EXECUTIVE SUMMARY

The Northwest Weather and Avalanche Center (NWAC) is an integral part of the state's public-safety infrastructure for winter travel and recreation. It provides mountain weather and avalanche forecasts, special watches and warnings, hourly mountain weather data, awareness classes and related information to the general public and to avalanche safety personnel. These life-safety services also foster economic development by stimulating tourism, ensuring freight and passenger mobility through mountain passes, and leveraging the state's natural resources into a competitive advantage for corporate relocation and retention.

The Seattle-based center was founded in 1976, and is one of the oldest and most comprehensive of 22 such programs across North America. Its \$340,000 annual budget is funded by a consortium of public and private entities including the U.S. Forest Service, the National Park Service, the Washington State Department of Transportation, the Washington State Parks and Recreation Commission, the ski industry (Ski Washington and the Pacific Northwest Ski Areas Association), and the non-profit Friends of the Avalanche Center. In-kind support is provided by the National Weather Service and others.

After resolving a budget crisis that would have closed the center, the Washington State Legislature directed State Parks in 2007 to develop “an intergovernmental plan and recommendations that seek to ensure that the Northwest Weather and Avalanche Center program has the resources to continue operating at its current level of service into the future” (SSB 5219). This report provides the plan and recommendations requested for continuing the operation of the avalanche center.

Working collaboratively with funding cooperators, State Parks approached the study using the following strategy:

- It engaged an industry expert to review NWAC operations and make recommendations for internal process improvement;
- It led discussions and problem solving with public and private funding cooperators to identify ways for the network to improve its support;
- It worked with an independent research firm to assess the avalanche center's economic benefits and impacts on Washington State.

Key Results

- The internal review identified potential strategic realignments and process improvements that will initially lower operating costs by at least ten thousand dollars (\$10,000) per year. The most significant of these is a new relationship with the U.S. Forest Service's summer-based Fire Weather forecasting and Fire Research programs, creating synergies for the two counter-seasonal (winter/summer) programs. Other improvements are expected to produce savings and efficiencies in forecasting, outreach, instrumentation management, and other areas.
- Cooperators have agreed to stabilize funding commitments, provide for inflationary adjustments and diversify the funding model with market-based service enhancements. The new measures will lead to a more interactive relationship with customers who prefer added convenience, while keeping basic public-safety forecast information available to the general public at no charge.
- An independent research firm identified economic benefits and impacts that demonstrate the Center's value to the state's economy. The firm estimated that NWAC, by fostering safety in winter recreation and commercial transportation, produces a likely economic benefit for Washington estimated at a minimum of \$7.9 million per year. The Center also adds safety to winter recreation activity at ski areas and backcountry access points valued at more than \$110 million annually, which generates millions of dollars of tax revenue for the state and for distressed rural governments.

Conclusion and Recommendations

- NWAC and Cooperators agree to a Commitment of Efficiency: to operate with minimal expenses necessary to perform the work (initial savings identified: \$10,000 per year).
- Commitment to Customers: NWAC and Cooperators agree that, as a new source of revenue for support, the non-profit Friends of the Avalanche Center will take the lead in providing value-added product and services -- for example, donations & sponsorships from the private sector, NWAC content and banner advertising on the private Friends website, etc. -- in response to market demand from consumers.
- Cooperators presume that the Legislature's past Supplemental Budget Appropriations will not continue. Consequently, Cooperators will re-base their budgets accordingly or develop additional funding streams.

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Background

Outdoor recreation plays a significant role in the life of many residents of Washington State. Ready access to the grandeur of the state's abundant natural resources brings an intimate connection to the environment – and to friends and family – that contributes to the unparalleled quality of life in the Pacific Northwest.

In an average winter month in 2006, more than 1 in 6 Washington residents participated in activities such as snowshoeing, sledding, inner tubing, snowboarding, downhill ("Alpine") and cross-country skiing, snowmobiling, ATV riding, ice skating and related sports.¹

Winter recreation activity in Washington brings more than \$110 million of spending annually on equipment, supplies, travel, admissions and other consumables, and creates jobs and vital tax revenue in distressed rural economies.

Ski resorts are popular destinations for many winter recreationists, while others heed the call of the remote wilderness for a different experience. Some 200,000 to 400,000 recreational backcountry trips were made in Washington during the 2007-08 winter season.²

Occasionally, a trip to the mountains turns dangerous, and even deadly. The worst of these dangers is the avalanche. Named from the French word *aval*, meaning 'to swallow,' weather conditions can suddenly transform a placid playground into a deadly deluge of snow, rock and debris.³

In the winter of 2007-2008, there were 36 avalanche deaths recorded in the United States, including nine (9) deaths in Washington. The average number of avalanche

¹ Washington State Recreation and Conservation Office (2006 Outdoor Recreation Survey: Final Report, 2007)

² Benefit Assessment and Economic Impact Analysis for NWAC, Berk & Associates, 2008

³ A first-hand account of an avalanche survivor may be found at:
<http://goclimbarock.blogspot.com/2008/01/account-of-avalanche-survivor.html>

deaths in Washington over the past 20 years⁴ is approximately two (2) per year, a record that has held steady despite a 43% increase in the state's population and unprecedented access to the mountains for winter sports.

The Northwest Weather and Avalanche Center (NWAC) was founded in 1976 and is part of a network of 22 such centers across the United States and Canada. These centers save lives by providing mountain weather information and forecasts, avalanche advisories, and awareness classes to educate the public about safe and responsible travel in winter backcountry.

NWAC also plays an important role in fostering economic development by stimulating the tourism economy, ensuring the mobility of freight and passenger travel through mountain passes,⁵ and turning access to the state's natural resources into a competitive advantage for corporate relocation and retention.

Mission

The mission of the Northwest Weather and Avalanche Center is:

“To reduce the impacts of adverse mountain weather and avalanches on recreation, industry, and transportation in Washington and northern Oregon through data collection, forecasting and education. This promotion of public safety is accomplished by providing cooperating agencies and the public with mountain weather data, mountain weather forecasts, avalanche forecasts, education, and applied research and technology.”

The Northwest Weather and Avalanche Center is a public service success story. For 32 years, the center has provided high-quality, cost-effective services that save lives, improve freight and passenger mobility and foster economic development in Washington State.

This report identifies the need for inflation-adjusted public and private support to operate NWAC, and proposes market-based strategies for service enhancements that will diversify funding and enhance the center's viability.

Budget

NWAC is funded by a public-private partnership, identified below with respective direct funding contributions for the Federal Fiscal Year ending September 30, 2008:

⁴ Prior to the 1985-86 winter season, Washington and Oregon fatalities were reported together.

⁵ A four-day closure of I-90 near Snoqualmie Pass in 2008 had an economic impact of nearly \$38 million and 170 jobs, per: "Storm-Related Closures of I-5 and I-90: Freight Transportation Economic Impact Assessment Report," by the Washington State Department of Transportation, at www.wsdot.wa.gov/research/reports/fullreports/708.1.pdf

	<u>FY2008</u>
U.S. Forest Service (USFS)	\$ 90,000
Washington State Parks and Recreation Commission (State Parks)	\$ 89,500
Washington State – Special Supplemental Appropriation	\$ 58,000
Washington State Department of Transportation (WSDOT)	\$ 45,000
National Park Service (NPS)	\$ 17,000
Ski Washington (SkiWA)	\$ 20,000
Other Sources	\$ 10,000
County (Title II / Resource Advisory Committee)	\$ 8,000
Friends of the Avalanche Center (FOAC or Friends)	<u>\$ 5,000</u>
Total Direct Funding	\$342,500

NWAC is administered by the U.S. Forest Service and located in the offices of the National Weather Service (NWS) at the National Oceanic and Atmospheric Administration (NOAA) in Seattle, where it shares office space and hi-tech weather forecasting equipment, a contribution valued at \$66,000 annually. Total indirect support of the center is estimated at \$184,700 per year.

NWAC provides twice-daily forecasts of mountain weather conditions, avalanche conditions and danger ratings. It also operates a network of 42 Remote Automated Weather Stations (RAWS). These telemetry sites, located across the region, are the crucial 'eyes and ears' of a meteorology-based forecast program operating in a maritime snow climate like the Pacific Northwest. (Avalanches in maritime snow climates almost always result from immediate weather effects such as snowfall, rain, or thaw.) Data from the sites are accessed millions of times annually on the Center's website by the recreating public, by snow-safety personnel at WSDOT and ski areas, and by others.

Excluding indirect support, the FY08 budget is driven overwhelmingly by salaries (83%), followed by capital equipment (8%), website development (4%), communications (2%), travel (primarily for on-site equipment maintenance and snow-pack stability assessment) (2%), and medical & unemployment insurance (1%). Approximately \$10,000 is slated for carryover to FY 2009.

The center is staffed by three highly-experienced avalanche meteorologists and serves an area of approximately 25,000 square miles, from Hurricane Ridge in Olympic National Park to Washington's Cascade Range and south to Mt. Hood in the northern Oregon Cascades.

Excluding indirect support, NWAC's annual budget of \$340,000 computes to a cost of about 85¢ to \$1.70 per trip for each of the 200,000 to 400,000 recreational backcountry trips made during the 2007-08 season, or about 20¢ for each of the 1 in 6 Washington residents who participated in winter recreation activities in 2006. The state-funded portion of the Center's budget cost each Washington resident about three cents (3¢) in 2008.

Budget Problem and Interim Solution

The funding model experienced considerable stress in the mid-2000s. Inflationary pressures from cost-of-living and step increases built into the federal GS pay scale went unmatched by cooperators, setting the stage for a future crisis. Forest Service contributions declined due to federal budget priorities, and contributions from Title II RAC funds, generated from timber production on forest lands, declined dramatically in response to market conditions. The Washington State Department of Transportation redirected some funds toward highway-specific weather forecasting programs. These divergent budget trends triggered a collapse of the business model in 2007, when the Forest Service announced that it would cease administration and most, if not all, funding effective October 2009.

The Washington State Legislature rescued the NWAC budget with supplemental appropriations in FY 2008 and FY 2009. That support came with the caveat in 2007 legislation of a study to assess the Center's operation and future:

*"The state parks and recreation commission shall invite the United States forest service, the national weather service, and the national park service to cooperatively develop an intergovernmental plan and recommendations that seek to ensure that the Northwest weather and avalanche center program has the resources to continue operating at its current level of service into the future."
(SSB 5219)*

This report presents the results of that study and recommendations for the future of NWAC.

Methodology

Working collaboratively with funding cooperators, State Parks led the review of NWAC using a three-tiered strategy that looked first inward, then increasingly outward:

- First, an industry expert was retained to review the Center's operation and identify potential process improvements in internal operations. Mr. Knox Williams, former director of the Colorado Avalanche Information Center, conducted the study.
- Second, State Parks led discussions and problem solving with public and private funding cooperators to identify ways for the network to improve its support.
- Third, an independent research firm was engaged to identify the macro-economic benefits and impacts of the avalanche center on Washington State. Berk & Associates of Seattle performed that work.

Key results from each of the three strategies appear below, followed by the report's conclusion and recommendations.

1. Industry Expert: Key Findings for Internal Process Improvements

Knox Williams directed the Colorado Avalanche Information Center for 22 years, and has authored or co-authored three books and approximately 30 papers and articles. The Colorado center compares to NWAC in size and in scope, as they are the only two US avalanche centers whose mission includes forecasting for the general public, DOT personnel, and the ski industry. After retirement in Colorado, Mr. Williams served as an avalanche meteorologist at NWAC for one season. With extensive experience in Colorado and recent work at NWAC, Mr. Williams was uniquely qualified for analyzing the center's operations and prescribing recommendations for process improvement.

Mr. Williams' key findings include the following:

- **Staffing:** The expense driver in future budgets is inflation. Funding must keep pace with salary increases in order to maintain current service levels. The season's work load and deliverables must align with cooperator pledges, which may require reducing staff schedules, work hours, and the services provided to cooperators and the public. Adjustments like changing the release time of the daily avalanche forecast may help align workloads with available resources.
- **Strategic alliance:** A formal linkage should be made with the Fire Weather forecasting program of the USFS, which operates primarily in summer and is based at region headquarters in Portland. Such a linkage could be made that would keep NWAC and Fire Weather meteorologists employed year-round, reduce unemployment claims from seasonal discharge, share overhead and provide other synergies and economies of scale.
- **Revenue:** While basic forecasts must continue to be provided to the public at no charge, certain premium NWAC data assets could be packaged at a fee (or sponsored) to provide better access to data and to diversify funding support for the Center. For instance, subscription feeds to cell phones and other handheld electronic devices could be offered. The NWAC website receives millions of hits every season. Winter recreation equipment retailers, among others, might find banner advertising on the NWAC website to be an effective way of reaching their target market, creating new symbiotic relationships. Certain commercial entities that rely on data from the RAWS network for proprietary purposes, but which do not presently support the network, could be charged a fee for high-intensity (or enhanced) access.

Mr. Williams' full report appears in the Appendices.

2. State Parks' Discussion Groups: Key Findings for the Cooperators Network

Following receipt of the operational analysis by Knox Williams, State Parks met with each cooperator to review the report, gather reaction, and determine commitment to continued cooperation. There was unanimous agreement on the value of NWAC and commitment to continue (and often increase) support. Synergies that are not captured on financial statements -- such as in-kind contributions, extra equipment purchases and maintenance, information sharing, staff support for equipment repair and administrative tasks, etc. -- increase the center's value to taxpayers and underscore the benefit and urgency of maintaining this high performing public-private partnership.

The most significant results of the discussions with cooperators are as follows:

- The Forest Service agreed to continue to administer NWAC, providing continuity and expertise possessed by no other partner;
- Partners agreed to enter into a five-year Memorandum of Understanding (MOU) to continue the network relationship;
- Partners agreed to seek provisions for inflation in their respective funding support, subject to availability and legislative and executive approvals;
- Partners supported an enhanced entrepreneurial role for the non-profit Friends group, which has already begun to increase its financial and in-kind support of NWAC.

3. Consulting Firm: Key Findings on Economic Benefits and Impacts

Finally, State Parks asked an independent management consulting firm to assess the benefits and economic impacts of NWAC. These effects were considered to be important to informing a general understanding of the value of the Center, and to potentially identifying beneficiaries who could become contributors to its support.

Seattle-based Berk & Associates, founded in 1988, describes itself as "a multi-disciplinary consultancy integrating strategy and policy, financial and economic analysis, facilitation, design and communications."

Berk's major findings are as follows:

A. NWAC generates direct benefits that almost certainly have an annual value of more than \$7.5 million.

- **NWAC saves lives** by forecasting, tracking and reporting weather conditions and avalanche risks in the Cascade and Olympic Mountains. Comparisons of historical trends in avalanche deaths suggest that NWAC's services contribute to saving at least two, and probably six to nine or more lives each year.

- **NWAC makes the Cascade and Olympic backcountry more accessible and more enjoyable** by offering information and education to backcountry users.
- **NWAC improves the efficiency of enterprises that operate in the mountains** by developing and sharing mountain weather and avalanche forecasts and real-time conditions data that are unequalled in their accuracy. These enterprises include WSDOT, ski areas, counties and cities that clear and maintain roads, search and rescue operations, and U.S. Forest Service and National Park Service staff who work in the backcountry during winter months.

B. NWAC also has positive impacts on Washington State's patterns of commerce.

- **NWAC supports industries that bring economic activity and increased revenue streams to non-urban parts of the state.** Snow and ice recreation activities generate \$100 million or more in economic activity in rural areas, which generates close to \$5 million in state sales tax revenue, other B&O and leasehold tax, and nearly \$1 million in sales tax for cash-strapped rural counties.
- **NWAC fosters Washington's overall competitiveness.** Wintertime accessibility to the Cascade and Olympic backcountry is an important piece of what makes Washington State a vital center of the knowledge-based economy. Every day, Washington State competes on a national stage to attract and retain industries, entrepreneurs, and high-skill workers that have the luxury of establishing themselves in any number of high-amenity locales across the country. One of Washington's greatest competitive advantages is the immediate access residents have to the state's immense natural amenities.

The full report by Berk & Associates appears in the Appendices.

Conclusion and Recommendations

The Northwest Weather and Avalanche Center is one of the nation's premiere, comprehensive mountain weather and avalanche forecasting organizations. The Center is a cost-effective public service that saves lives and generates economic benefit.

NWAC and its cooperators -- U.S. Forest Service, WA State Parks, WA Department of Transportation, National Park Service, Ski Washington, Pacific Northwest Ski Areas Association, Friends of the Avalanche Center, and County Title II participants -- have agreed to adopt the following strategies for improving the performance and financial viability of the program.

1. **Commitment to Efficiency.** NWAC remains committed to achieving every potential operating efficiency. The new strategic alliance with the USFS Fire Weather and Fire Research programs, already underway, is an example of a paradigm-shifting synergy that is expected to reduce overhead by at least \$10,000 per year.

Other operating efficiencies include outsourcing educational efforts to qualified non-profits and volunteers, sharing in diagnostics and repairs of telemetry equipment with the most proximate partner, and optimizing the length of work days and the operating season, among others. NWAC will also develop a succession plan that provides for replacing through attrition at least one of the three staff meteorologists at a starting pay grade lower than GS 12.

2. Commitment to Customers. Although the need for additional financial support is real and urgent, cooperators agree that basic public-safety forecasts must remain free of charge on the website. While government will remain focused on providing services like forecasts for the general public, the non-profit Friends of the Avalanche Center will take the lead providing value-added products and services in response to market demand. Consumers (or proxies like advertisers) often find it desirable to pay for customized format, delivery or access, and this willingness to participate represents a new and significant source of revenue for supporting NWAC.

The NWAC Cooperators will seek donations, underwriting and sponsorships from private individuals and corporations. Promotional support will be sought through television weather broadcasts and websites. The NWAC Cooperators will bring other entities that benefit from its services and products into the funding partnership, and seek grants from public and private sources as appropriate.

Beginning in 2009, NWAC content will be hosted on the private Friends website, providing a platform for more interactive and entrepreneurial site management such as banner advertising (as already done by other avalanche centers). Fee-driven service delivery enhancements will also be offered, such as subscription downloads of premium content.

3. Commitment from Cooperators. The NWAC's primary need is for improved and stable funding. Support is needed from each cooperator at the executive and policy level to maintain current funding and to provide cost-of-living adjustments to sustain core funding for the Center's operations.

In addition to executive government efforts, new private funding initiatives are needed to augment the Center's budget and not simply supplant existing public support.

Cooperators presume that the Legislature's past Supplemental Budget Appropriations will not continue. In view of this, Cooperators will re-base their budgets accordingly or develop additional funding streams as possible.

Legislative Involvement. SSB 5219 (regarding the Northwest Weather and Avalanche Center) directed State Parks to respond with recommendations for two specific sets of issues.

With regard to the first set of issues -- "Administrative control over the Northwest weather and avalanche center program; the physical location of the Northwest weather and avalanche center program; administrative control over the employees, equipment, and facilities of the Northwest weather and avalanche center" -- **State Parks recommends to Cooperators** that NWAC continue to be administered by the U.S. Forest Service and housed at NWS/NOAA offices in Seattle. The Forest Service, National Weather Service, and other cooperators are amenable to that arrangement.

With regard to the second set of issues -- "...ensuring continued cooperative funding, with equitable contributions from federal, state, local, and private sources, to meet the long-term needs of the Northwest weather and avalanche center" -- **State Parks makes the following recommendations to the Legislature:**

1. Continue current appropriations through State Parks and WSDOT, and acknowledge that any Cost of Living Adjustments (COLAs) mandated by the federal government will be covered by parent agencies to the extent possible;
2. Petition, through NWAC, the State of Oregon to provide public support on behalf of its recreating public in the Mt. Hood portion of NWAC's service area;
3. Encourage the federal government, via Joint Memorial, to continue its role in administering NWAC through the U.S. Forest Service, to build programmatic linkages between NWAC and the Fire Weather and Fire Research programs, and to continue support at maintenance levels with COLAs required by federal agencies;
4. Propose to the Washington State Department of Licensing that it consider allowing snowmobile and trailer owners to voluntarily add a donation onto annual license registration forms to benefit NWAC, similar to the way donations to State Parks may now be made on vehicle registrations;
5. Propose to State Parks that it offer a donation option to benefit NWAC on all Sno-Park Permits available to the recreating public;
6. Propose to State Parks and WSDOT that they consider offering a website link to the NWAC website for on-line and other donation options to benefit NWAC; and
7. Provide legislative support to the Center's citizen stakeholders in their efforts to secure additional private funding for the Center.

The cooperators appreciate the state legislature's long support for NWAC's public safety services, and its authorization and funding through SSB 5219 of this important programmatic review.

APPENDICES

There are three (3) appendices to this report, which may be downloaded from the Internet at www.parks.wa.gov/winter/AvalancheCenter:

- Operations Consulting Report - by Knox Williams (Full Report -- 44 pages)
- Economic Benefit Analysis - by Berk & Associates (Full Report – 48 pages)
- Economic Benefit Analysis - by Berk & Associates (Highlights – 18 pages)

For additional information about the Northwest Weather and Avalanche Center, please visit the Center on-line at:

www.nwac.us

**Report on the
Northwest Weather and Avalanche Center**

**by
Knox Williams**

**Consultant to the
Washington State Parks and Recreation
Commission**

January 31, 2008

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Executive Summary

Mission: The Northwest Weather and Avalanche Center (NWAC) was founded in 1975 and is charged with promoting safety by reducing the impact of adverse mountain weather and avalanches on recreation, industry and transportation.

Administration and cost sharing: NWAC has been run through the Mt. Baker-Snoqualmie National Forest (MBS), with costs shared by the US Forest Service (USFS), Washington State Parks & Recreation Commission (Parks), Washington State Dept. of Transportation (WSDOT), National Parks Service (NPS), ski industry, and Friends association (FOAC).

Housing and staffing: NWAC is housed with the National Weather Service in Seattle. It has three permanent staff. All are professional meteorologists

Budget crisis: NWAC budgets have risen from \$240K to \$319K in the last eight years, while revenues have stayed mostly flat. This has created the current budget crisis that has forced the MBS to withdraw its administration and support at the end of federal FY 08-09.

Use, value, and support: There is abundant evidence of use and value of the program by the public, WSDOT and the ski industry. Annually, NWAC's website gets millions of hits for its remote weather station data and hundreds of thousands of hits for its weather and avalanche forecasts. WSDOT and the ski industry rely on NWAC forecasts, which aid those cooperators in their responsibilities of snow safety and avalanche control.

Peer programs: NWAC is most similar to the Utah (UAC) and Colorado (CAIC) avalanche centers in size and scope. NWAC and CAIC are the only two US avalanche centers whose mission includes forecasting for the public, highways, and ski industry.

New organizational model: This report looks at restructuring NWAC to make it a sustainable program, with the following important aspects:

- Administration either continued by the US Forest Service or moved to Washington State Parks and Recreation Commission
- Changes to some NWAC products and services including new website, less text and more visual content to forecasts, and changes in release times
- A business model that focuses on staying within a budget
- Ways to cut costs and to seek new revenues
- Sustainable partnerships

Recommendations: This report concludes with six options for the future of NWAC, with recommendations for each. The strongest recommendation goes to a program that stays in the administration of the US Forest Service, is not a financial burden on the USFS, has a lower cost structure, and has sustainable partners.

Introduction

Founded in 1975, the Northwest Weather and Avalanche Center (NWAC) (pronounced “N-wac”) has well served the citizens of Washington and northern Oregon with daily forecasts of weather and avalanche conditions in the Olympic and Cascade mountain ranges. (See **Appendix A** for a brief history of US avalanche centers.) The Center’s bulletins have aided winter backcountry recreationists (mountaineers, snowshoers, skiers, snowmobilers, and snowboarders) to make their outings safer, and aided motorists, truckers, and Washington State DOT maintenance personnel with forecasts of mountain storms that adversely affect driving conditions and avalanche potential through the mountain passes. As the chart below shows, there is a need for this service.

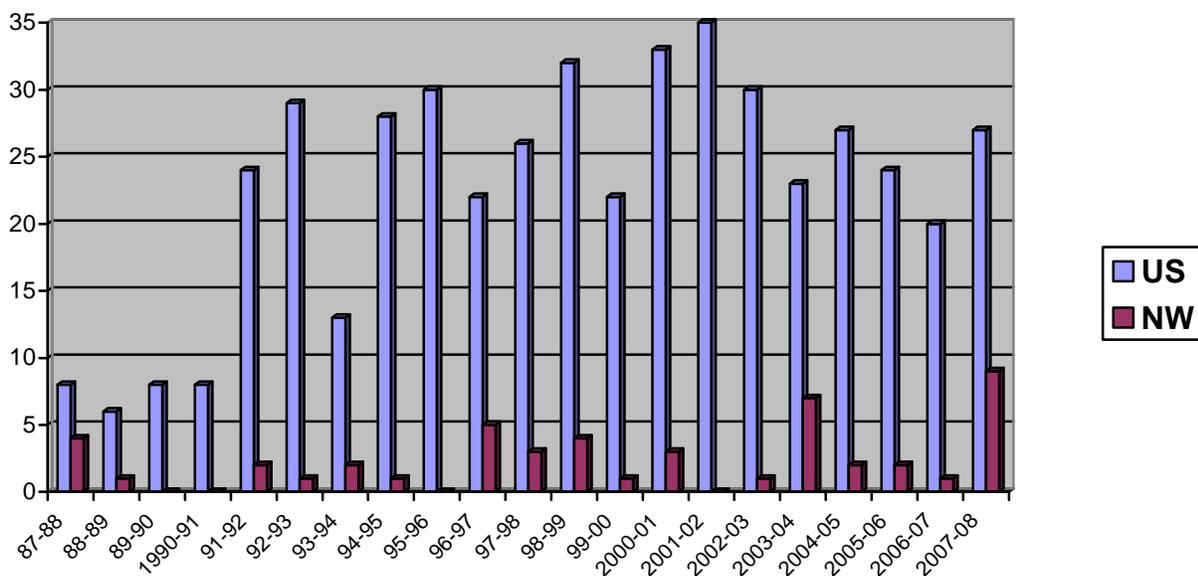


Figure 1: Annual avalanche deaths in the US and the Northwest

Except for its first year, NWAC has always been administered by the USDA Forest Service, but with significant funding provided by a consortium of federal, state, and private sources. For many years, adequate funding has been a problem, because of rising costs and little, if any, increase in revenues. Then in 2007 the Forest Service announced, because of budget constraints, its intention to cease its administrative role and cease most, if not all, of its funding for NWAC, effective October 1, 2009.

The prospect of NWAC actually closing triggered an emergency action by the Washington State Legislature -- the passage of Substitute Senate Bill 5219. That bill charged the Washington State Parks and Recreation Commission to develop a plan that would ensure NWAC had the resources to make it a sustainable program into the future. A key element of the plan would be “continued cooperative funding, with equitable contributions from federal, state, local, and private sources.”

To help carry out its assignment, Parks hired a qualified, independent consultant (see **Appendix E**) to:

- review NWAC operations, services, budget, cooperators, and staff;
- interview users to determine levels of satisfaction and support;
- compare NWAC with peer avalanche centers in the US;
- interview existing financial cooperators to determine future levels of support;
- identify potential new partners or new sources of revenue;
- and develop options for a restructured NWAC to provide the services that meet the needs of users and cooperators and at a cost that is sustainable.

I am that consultant and this is my report.

Scope of Work (with Author's Responses)

The following Scope of Work contains the specific items in the consultant's contract with Washington State Parks. Parks has targeted the information it deemed as necessary to understanding the operations of NWAC, its organization, administration, budgets, partnerships, comparison with other avalanche centers, and possibilities for change and improvement to make NWAC serviceable and sustainable for the long term. The author's responses follow each item.

“Visit the Northwest Weather and Avalanche Center (NWAC) to conduct interviews and investigate current operations and opportunities for improvement, including identification of potential efficiencies and revenue sources.

Report to State Parks by January 31, 2008, on the following issues:”

1) Gather and review the charter and mission of NWAC. Considering the charter and mission, what level of information produced by NWAC does the public require to be safe?

The NWAC mission statement reads: “To reduce the impacts of adverse mountain weather and avalanches on recreation, industry, and transportation in Washington and northern Oregon through data collection, forecasting and education. This promotion of public safety is accomplished by providing cooperating agencies and the public with mountain weather data, mountain weather forecasts, avalanche forecasts, education, and applied research and technology.”

NWAC achieves its mission with the following products and services:

- Daily weather forecast: This website product is read by users 450,000 to 600,000 times per winter. It provides a general weather discussion and specific weather forecasts for the next 48 hours, plus a 3-5 day outlook. This forecast provides (1) the public with information they can use for trip planning and safety from adverse weather, and (2) industry users with information useful for operations.
- Daily avalanche forecast: This product is available via website and hotlines, and generates 200,000 to 300,000 web hits and 8,000 calls per winter. It provides snowpack information and avalanche danger ratings for the next 48 hours, and is a valuable product for public safety.

However, in my opinion the usefulness of the avalanche forecast could be greatly improved by changing the release time. Currently it goes out about 9 am. This is too late for that day's users to make plans based on the avalanche conditions. This forecast should be posted by 6 am (which is almost impossible to do), or it should be posted by early afternoon (noon to 1 pm) and should be the last thing the forecaster does before leaving the office. The advantages of the afternoon posting are (1) it would contain the latest avalanche data from the field (observed earlier in the day), and (2) it would be available in a timely manner for anyone planning a trip for the next day.

- **Avalanche warnings:** An avalanche warning is posted whenever the avalanche danger is expected to reach HIGH or EXTREME over a significant portion of the forecast area. Warnings get wide media exposure via the National Weather Service's NOAA Weatherwire dissemination network and via radio, TV, and newspaper coverage. This is valuable product for public safety.
- **Daily weather and avalanche consultations to WSDOT, ski areas, and other cooperating agencies (e.g., National Park Service):** These phone calls are the most important part of NWAC's office routine in providing specific weather forecasts to agency and industry field personnel for planning purposes, and for receiving snowpack and avalanche observations from those field sites.
- **Education:** NWAC staff presents 30+ avalanche awareness talks to 1400-2000 people annually. Avalanche awareness training is key to saving lives, and NWAC is a strong community voice in providing this life-saving service.

2) Identify current NWAC work products and program outcomes.

The work products as described in 1) above are twice daily weather forecasts, once daily avalanche forecast, avalanche warning bulletins as needed, and multiple daily phone consultations. These are the core products that collectively contribute to three program outcomes – (1) improved public avalanche awareness and backcountry safety, (2) data exchange with ski-area snow safety personnel for the purpose of improving ski-area safety, and (3) data exchange with WSDOT avalanche personnel with the purpose of improving highway safety.

For each, further identify the:

- **degree of criticality for public safety**

The avalanche forecast and avalanche warnings are the two key NWAC products – combined with education -- that promote public safety and save lives. It is not possible to say that NWAC saves “x” number of lives, for we don't know how many people postpone or change their recreation plans because they heard the avalanche danger was on the rise. But we do know that annual avalanche deaths are rising only slowly while growth in winter sports – especially backcountry skiing, snowboarding, snowshoeing, and snowmobiling – has mushroomed. This is indirect, but pretty convincing, evidence that avalanche centers work.

NWAC's weather forecasts and phone consultations to WSDOT and ski-area personnel are invaluable. When DOT and ski-area avalanche professionals get timely and accurate forecasts from NWAC of storm intensity, snow/rain amounts, temperatures, and winds, they have the information they need to plan avalanche mitigation that makes highways and ski areas safer.

- **cost required for production**

The current year (FY 07-08) budget for NWAC is \$318,900. Of this total, \$287,000

goes to personal services (salaries and benefits) and \$32,000 to operational expenses. (See item 3 on page 10.) Compared to other avalanche centers, this is a high cost to sustain three employees – and a big reason NWAC has had trouble raising enough funding year after year. (See the following item for the reason for the high salaries.)

- **staff time and skill level required for production**

The current “tour” arrangement with the Forest Service guarantees 10 months of employment for the NWAC Director, and 9 months for each of the other two forecasters. (If funding falls short to complete the season at NWAC, the Forest Service is required to offer another position to complete the tour or pay unemployment.)

All three employees are GS-12 meteorologists with the Forest Service. Meteorologist is the key word here. When NWAC was founded in the 1970’s, it was known that forecasters must get the meteorology right in order to forecast the level of avalanche danger. Thus NWAC has always been staffed with meteorologists (as contrasted with avalanche specialists being hired at most other avalanche centers).

This raises the question, Are meteorologists necessary to the success of NWAC? I discuss this in detail in the section **Organizational Model, Staff Qualifications**, but the short answer is yes.

Finally, if the Forest Service does in fact remove itself and NWAC were relocated into the administration of another agency, there would be a significant cost savings that would result with a new salary structure. These savings would come with a shorter tour (fewer months of operation) and lower salaries. Details are provided in the section **Options and Recommendations**.

- **parties benefiting from the activity**

WSDOT, ski industry, Forest Service rangers, National Park Service, snowmobile clubs, mountaineering clubs, Search & Rescue teams, professional guides, and a million individual recreationists.

- **current fees or revenue derived**

None.

- **potential fees or revenue that could be derived**

There are at least three untapped sources of revenue that may generate a significant portion of the budget.

- **Sponsors logos on websites**

First is the display on the NWAC website of logos of companies who would like to advertise but otherwise do not provide funding. The Bridger-Teton Avalanche Center in Jackson, WY, is one that uses this sponsorship idea to generate about \$10,000 per year. Though some will complain that this is crass commercialism, its use is widespread in today’s world and an accepted way of generating revenue.

- **Access fee for RAWs data**

Second is to charge a small annual fee for access to that part of the NWAC website that displays the data from its remote automated weather stations (RAWs) sites (see **Appendix C**). Here's the justification for charging a fee: The public should get for free information that enhances public safety – in this case, personal avalanche safety – and this information is conveyed in the daily weather forecast, daily avalanche forecast, and avalanche warnings. But the public are accessing the RAWs data not for safety reasons but for recreational reasons. From October 2007 through January 2008, there have been more than 7 million hits for RAWs data. Probably 90% of these users are looking for the best place to ski; that is, the ski resort or backcountry area with the most new snow (and no rain), best weather, and least wind. Access to RAWs data is a value-added service.

A good analogy is a toll road. The road was built with public funds. Taxes paid for the road, but to use it you must pay a toll. The toll road represents added value. People who do not derive value from a shorter drive can choose to skip the toll road.

Similarly, NWAC users will have the option to access the data for a fee or to not have access. NWAC must explain that the free ride is over, that NWAC can no longer afford to give the data away for free (“it costs lots of money to keep these stations running”), and that a new financial scheme is needed to keep NWAC's doors open.

- **Expense reimbursement for education**

Colorado does not give free avalanche classes because it is such a drain on the budget for salaries and travel. Rather, it asks the course sponsor (e.g., REI, other retail stores, clubs, rescue teams, public schools, etc) to cover the expenses for traveling and teaching. Such a plan for NWAC could cover much of the cost of avalanche classes, and the sponsors should be understanding of the need to do this.

- **direct or indirect competition with the private sector**

There is no competition for avalanche forecast services. But there is competition for weather forecast services to WSDOT, and it comes from the NorthWest WeatherNet Inc., a private meteorology service. WSDOT contracts with NWWI for year-round, statewide forecasts, and these forecasts include the Snoqualmie Pass and Stevens Pass areas. These are the same areas for which NWAC provides detailed forecasts to WSDOT.

In comparing the satisfaction to WSDOT personnel of these competing services, DOT likes the simple and concise format of NWWI's forecast, likes having 24/7 access to a forecaster, but thinks NWWI over-forecasts snowfall for virtually every storm and therefore is not very accurate. Concerning NWAC's forecasts, they feel NWAC is more accurate more often, has more useful detail (gotten in the phone consultation, not in the written product), but they have no need whatsoever for NWAC's lengthy meteorological discussions.

This criticism of NWAC’s forecast can easily be solved. NWAC needs to write concise statements for Snoqualmie Pass and Stevens Pass that contain what WSDOT is asking for – onset of storm, intensity, type of precipitation (snow or rain), freezing levels, winds, and end of storm. This will take the NWAC forecaster a little longer to write and format, but it would be exactly what WSDOT wants, and therefore will improve the service provided by NWAC.

- **reliance by commercial entities such as private weather services, television stations, etc.**

Northwest Weathernet probably relies on NWAC’s remote weather stations to get current mountain weather conditions. (Northwest Weathernet has no remote stations of its own.) King TV (and perhaps other Northwest TV stations occasionally look at the RAWS data. All TV stations and newspapers have access to the National Weather Service Weatherwire, which disseminates NWAC avalanche warnings.

- 3) Review and analyze the current and recent past budgets, and provide a professional assessment on comparability with peer facilities. Explain the reason for any variances that seem materially out of line.**

Below is the expense budget for NWAC for the current year (FY 07-08)

<u>Expense</u>	<u>Amount</u>	<u>% of budget</u>
Salaries	\$272,728	85.5
Medical/ unemployment	14,172	4.4
Capital equipment	20,000	6.3
Travel	6,000	1.9
Communications	6,000	1.9
Total	\$318,900	

Figure 2 shows total budget for recent years, with each year showing the cost of personal services (blue bar) and operational costs (red bar). The increase in costs over 8 years totals about \$80,000, or about \$10,000 per year. That makes the year over year increase about 4.2%. This increase is due almost entirely to the mandated cost of living and step increases built into the GS pay scale, as shown by the steady rise in the blue bars and essentially no rise on the red bars (because operational costs have remained in check and steady).

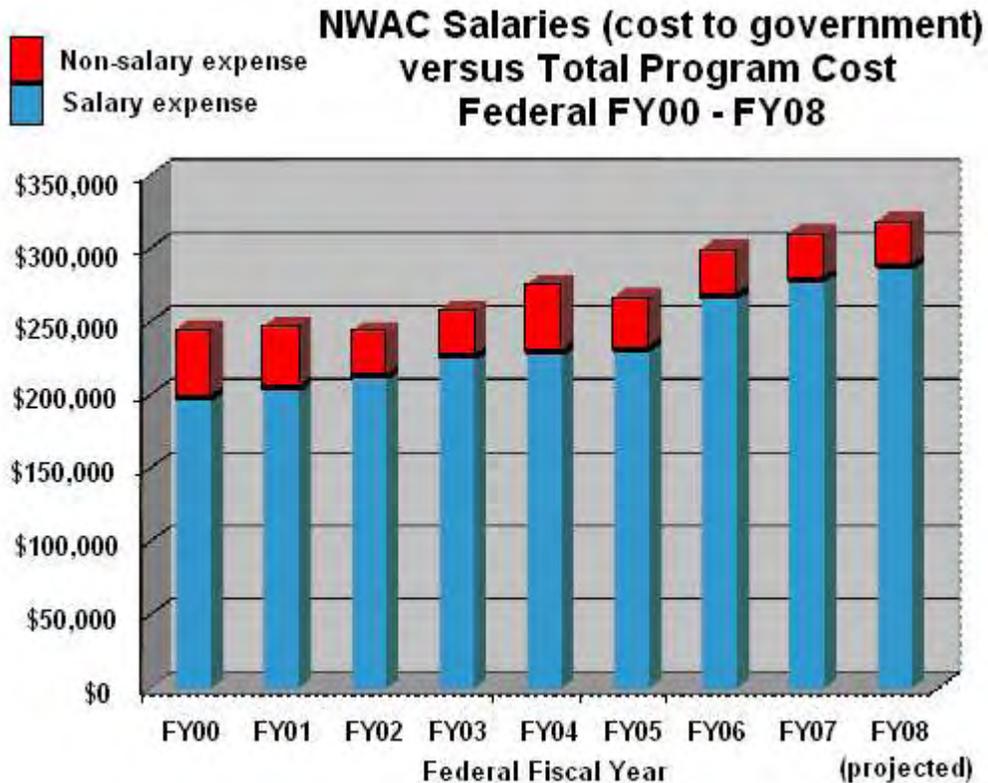


Figure 2: Personal services and operating expenses

The cost of salaries is a concern. In the segment on page 8 called **staff time and skill level required for production**, I stated the reason for the high salaries, and that is because the three forecasters are all GS-12 meteorologists. I discuss the pros (high skill) and cons (high cost) of staffing with professional meteorologists in detail in the section **Options and Recommendations**.

See the section **Peer Programs** for comparison to peer programs.

- 4) Identify changes in NWAC deliverables that may have evolved over time. What new/ additional services are being performed since its creation, what was the rationale behind each expansion, what funding was provided to originally support such expansion, and has the funding remained in place?**

There have been no new services or deliverables by NWAC in 20 years. The method of delivery has changed dramatically, from telephone hotline and fax delivery, to website and email delivery, but the content and style have not changed and remain 100% text products.

- 5) Identify the expense drivers of future budgets. What new expenses, including increases in current expense categories, can be expected over the next 10 years, and why? What is the source of the recurring \$50,000 +/- deficit?**

The expense driver is the cost-of-living salary increases. Future budgets must include built-in increases in revenues to match the salary cost.

The recurring \$50,000 +/- deficit is a product of the budget process that has been used. Budgets were set based on the costs for full operation, with the expectation that revenues would be found before year's end to meet expenses. That always required a last-minute bailout. (Note: One source of the shortfall between FY 06-07 and FY 07-08 was the end of RAC Grants [see page 15]).

A better budget process and better business plan would be to plan the season's work load and deliverables based on known revenues. This may require reducing staff schedule and work hours, resulting in reduced services to cooperators and the public, but then they get what they paid for.

- 6) Comment on the adequacy of the current telemetry network, its strengths, weaknesses, and opportunities for improvement. Identify equipment and sites advisable for enhancement or reduction.**

The network of remote automated weather stations (RAWS) is NWAC's second greatest strength – the first being the skills and experience of its staff of meteorologists. Over the years NWAC has bought, installed, and maintained 42 RAWS sites, meaning that ownership and operational responsibility lies with NWAC (though WSDOT will claim partial ownership for sites along highways because of costs of replacement parts and salaries spent in maintenance). The network of 42 sites is both a great resource and a unique opportunity. Consider the strengths:

- the sites are the eyes of NWAC, giving the forecasters 24/7 data needed for accurate nowcasts (meteorology speak for short-term forecasts). NWAC could not operate without most of these stations.
- for a meteorology-based forecast program in maritime snow climates, RAWS sites provide much of the necessary data for making both weather and avalanche forecasts. Avalanches in maritime snow climates are almost always “direct action”, resulting from immediate weather effects such as snowfall, rain, or thaw. (Contrast this to areas such as the Rocky Mountains where the snowpack is classified as continental, and therefore much more snowpack data is required for avalanche forecasts. The reason? Many

avalanches release because of snowpack weak layers, and these releases can come during fair weather. This kind of avalanche forecasting requires more manned observations, and less reliance on RAWS data.)

- the stations provide necessary data for snow-safety personnel at DOT and ski areas to do their jobs.
- data from the sites are displayed on NWAC's website and accessed multi-million times by the recreating public, thus offering a value-added product that could help fund NWAC.

There are no major weaknesses, but there is room for improvement:

- a few sites are redundant (e.g., Grace Lakes, Stevens Pass) and a few may be poorly located for forecasting (e.g., Mt. St. Helens), so there could be cost savings in removing some of these. Perhaps as many as 5-10 sites (10-25%) could be removed without a crippling loss of data, but the decision on which stations could be removed should be left to NWAC staff.
- RAWS stations require frequent maintenance, at a considerable cost in travel and salary, but a cost savings could be found in contracting out maintenance and repair.

7) Explain the rationale for the move into Oregon, and what funding sources were expected to be derived. What percentage of the NWAC budget goes to services that benefit primarily the state of Oregon?

The move to forecasting for the Mt. Hood area came decades ago and was logical extension into an area of heavy recreational use and great avalanche potential. Very little additional funding has come from the Mt. Hood ski areas, but this is an area where many residents of southern Washington go to ski. The NWAC forecaster spends perhaps half an hour per morning in creating the weather and avalanche forecasts for this area, and that is a small investment in additional safety for the residents of southern Washington and the Portland area.

Southern and central Oregon are another matter altogether. NWAC briefly forecasted for the Crater Lake and Bend areas, but when the funding for this ended, NWAC wisely ended its forecasts. These are mountains too far removed from the Seattle office and should not be in the forecast area.

8) Comment on the potential of leveraging the existing technical and administrative service platform for other weather applications such as forest fire suppression, climate change research, etc.

There is a distinct possibility of merging NWAC with the USFS Region 6 Wildland Fire Operations program, based in Portland. Several key Forest Service people have already met to discuss this possibility. These include Jim Furlong and Mike Heilman in the Regional Office in Portland and Rod Mace on the Mt. Baker-Snoqualmie National Forest in Everett.

The NWAC staff possesses two important skills valuable to fire weather: weather forecasting and RAWS operations. The idea is to employ the NWAC staff for managing the network of 114 RAWS sites that Wildland Fire Operations has created and/or for fire

weather forecasting in the summer fire season, while that staff would continue its wintertime avalanche forecasting.

The beauty of this plan is its logic and simplicity: no messy divorce from the Forest Service, holding onto the skills and expertise, and no additional cost to the Forest Service. Wintertime costs would be borne by the consortium of NWAC funders, and summertime costs by Wildland Fire Operations.

On the other hand, initial contacts with Atmospheric Science, University of Washington showed there was no interest in collaboration with NWAC – certainly not any partnership that would direct any funding toward NWAC. The Atmospheric Science Department uses NWAC data from its RAWS sites both for its climate change research and for Automated Road Weather Service, but UW has always gotten this data for free and expects that arrangement to continue.

However, NWAC should enter into a serious conversation with UW Atmospheric Science to explain that if NWAC closes, so does its RAWS network; and therefore, it would be in Atmospheric Science's (or the consortium that runs ARWS) best interest to help financially support NWAC.

9) Describe the state of the art of Avalanche Center funding across the country, and any obvious and/or innovative sources untapped by NWAC.

All US avalanche centers except Colorado are in the administration of the Forest Service, but all have built partnerships with state, local, and private entities to share the costs. Fundraising is an ongoing necessity, so most centers have created Friends groups to help with this.

There are some innovative sources of funding that should be explored. One involves an annual fee for public access to RAWS data on the NWAC website. This idea is discussed on page 9.

10) Describe trends in the financial relationship between NWAC and each of its strategic partners. Identify relationships where the economic benefit to the recipient empirically seems to exceed the value of the party's level of support to NWAC. Identify any potential new strategic partners and/or customers, both public and private.

Listed are the partners that help fund NWAC, current funding, and history or recent trends:

- **US Forest Service (\$75K in appropriated funds from Mt. Baker-Snoqualmie (MBS) NF, and \$15K in fee-demo funds from Okanogan-Wenatchee NF):** The USFS has always been the administrator of NWAC, and for many years was the principal funding agency, using recreation funds out of the Regional Office (RO). Around 2000, the RO decided to no longer fund NWAC, because it was considered an earmark (some Forests complained that they had no avalanche problems and should not be paying) and was thought to be too costly. The RO dispersed those recreation funds to the Forests in Region 6, but only the MBS

agreed to continue funding NWAC. Now the burden is too great for the MBS, and it is pulling out at the end of FY 08-09.

- **WSDOT (\$10K in maintenance funds and \$35K in general fund pass-thru):** DOT has also been a partner since NWAC was founded. DOT funding has diminished from \$85K in the late 1990's to \$10K today. No supporting agency is getting as advantageous a deal as DOT. When you consider the several hours per day the NWAC forecaster spends preparing the forecast and then the phone calls for weather consultation, \$10K doesn't come near to covering the cost. Additionally, DOT benefits from the RAWS sites on Snoqualmie, Stevens, Chinook, and North Cascades highways that NWAC has bought and maintains. This is highway safety we are talking about, and DOT should be supporting this for a minimum of \$45K, which is the sum of the direct and the pass-thru funding.
- **National Parks Service (\$17K):** Mt. Rainier and Olympic National Parks have contributed \$15-17,000 steadily for some years. But any cut in their own budgets would likely have a negative trickle-down effect. These parks post the daily avalanche danger rating from NWAC for the safety of visitors.
- **Washington State Parks and Recreation Commission (\$10K + \$79K pass thru):** Parks makes a \$10K contribution that comes from snowmobile registration fees and the Sno-Park program, and also serves as the agency for pass-thru general funds. Parks should remain a key strategic partner, with a chance that it could be the administering agency if the Forest Service withdraws.
- **Pacific Northwest Ski Areas Association (\$15K):** Scott Kaden is President of PNSAA, is a supporter of NWAC, and has doubled the contribution to NWAC since he took office. This level of funding is fairly secure, and could go up significantly: Duncan Howat, General Manager at Mt. Baker, has vowed to lobby all the ski areas to double the contribution. Certainly a significant increase is warranted because of (1) the value of NWAC to the snow safety and lifts departments at most ski areas and (2) the value of the free RAWS data that most ski areas take advantage of.
- **RAC Grants (\$0):** Resource Advisory Committee Grants is a line of federal funding routed through Counties when timber cutting was curtailed. NWAC used to get about \$30K, but the RAC program was discontinued. It is uncertain if the program will be reinstated.
- **FOAC (varies):** The Friends of the NWAC has made cash donations (\$5K to \$19K), usually to purchase equipment but also to cover budget shortfalls. FOAC has also kept the state legislature aware of budget issues with NWAC – which should be a strategy of last resort. FOAC will be an important resource in the future of FOAC, with a stronger role being likely.
- **National Weather Service (estimated \$65,000 in-kind services):** The NWS (Seattle) has been a fabulous partner since the inception of NWAC in 1975. NWS provides office space and full access to the NWS computer data network and work stations. Additionally, there is a strong interaction between NWS and NWAC staff in sharing information and discussing the daily forecast, so that NWAC provides value to NWS as well. This is a valuable partnership for both sides.

11) Discuss existing and potential synergies and collaborative opportunities with the University of Washington, including Automated Road Weather Service, Climate Change research, etc.

Collaboration with the University of Washington is not a viable option. UW undertakes research to develop programs and services, but once operational, these programs and services are shifted outside the university (see further discussion in (8) above). An example is ARWS which is now run by a consortium of partners, which is now struggling for funding to sustain it.

A further note on and WSDOT and ARWS: WSDOT paid a substantial seven-figure sum for development of ARWS, and now finds that ARWS is not a useful operational tool for road maintenance. WSDOT now pays \$150,000 annually for use of ARWS, and does so only because ARWS is needed to support road-travel information on the WSDOT website.

12) Address and provide rationale for the ideal organizational model for NWAC in terms of:

- **organizational / administrative control;**
- **physical location of the program;**
- **administrative control over the employees, equipment, and facilities; and**
- **method of ensuring continued cooperative funding, with equitable contributions from federal, state, local, and private sources, to meet the long-term needs of NWAC.**

This is such an important topic that I have devoted a section of this report to it, the section titled **Organizational Model**.

13) Review Substitute Senate Bill 5219 passed in 2007 by the state legislature, and comment on any additional factors that Parks should consider in developing its report to the legislature.

www.leg.wa.gov/pub/billinfo/2007-08/Pdf/Bills/Session%20Law%202007/5219-S.SL.pdf

No additional factors found.

14) Turn your responses to the above questions and your other findings into a series of recommendations and a strategy for continuing the current funding of NWAC (1) at its current level of service and (2) for its long-term needs.

See section **Options and Recommendations**.

Peer Programs

Comparison to CAIC and UAC

There are three avalanche centers that forecast for all, or the large majority, of the mountain area of their state, and whose main office is located with the National Weather Service. They are the Colorado Avalanche Information Center (CAIC), Utah Avalanche Center (UAC), and NWAC. The table below compares some vital data from these three centers.

	Forecast Area (sq mi)	Mission B=back-country H=hwy S=ski area	Offices	Staff	Budget 2006-07	Cost per employee	Cost per 1000 sq. mi.	Avg deaths per year
NWAC	15,000	B,H,S	1	3	\$310,000	\$103,000	\$21,000	3.0
UAC	5,000	B	3	6	\$268,000	\$45,000	\$54,000	4.2
CAIC	23,000	B,H,S	7	12	\$640,000	\$53,000	\$28,000	5.4

Let's draw some conclusions from the information above:

- NWAC's mission – forecasting for backcountry, highways, and ski areas – and forecast area make it most similar to Colorado (CAIC).
- NWAC is the most expensive program per employee in the US. The reason is that NWAC sees its role in providing weather forecasts and data to its cooperators as being equal to providing avalanche information. This role requires that the staff be professional meteorologists. I agree this is the best role for NWAC, but it is not the only option (see **Options and Recommendations**). Also see the note about meteorologists and avalanche forecasters in **Options and Recommendations**.
- NWAC is the least expensive program per area of coverage. This is a fact never pointed out by critics who say NWAC is too costly.
- UAC is the least costly center per employee. This is accomplished by (1) classifying most employees at GS-8 and by (2) limiting their federal tour of employment to 6 months. It certainly makes UAC cost-effective and easier to sustain, but it is not an employment structure to be used as a model. Employees must have a good-paying job for the off-season. It's a structure that would not attract top avalanche professionals.
- UAC is the most costly per area of coverage, but this ignores an important fact. The Wasatch Mountains are the most heavily used recreation area in the US, with extensive avalanche terrain that results in numerous avalanche accidents. Therefore, the high cost per area is easily justified.
- CAIC's budget and number of employees is so large because of a contract with CDOT that places the responsibility for highway avalanche forecasting within CAIC, not CDOT. (Remember in Washington that WSDOT has teams of avalanche specialists based at Snoqualmie Pass and Stevens Pass, and these specialists make all avalanche decisions for their highway section. NWAC supplies the weather data for WSDOT to determine the avalanche danger.)

- CAIC is the only center in the US that is not administered by the Forest Service. It is run through the Colorado Dept of Natural Resources, Geological Survey.

Comparing Budgets and Sources of Funding

	NWAC (FY 06-07)	UAC (FY 06-07)	CAIC (FY 05-06)*
Forest Service	94,000	90,000	24,000
DOT	45,000	0	319,000
State Parks	89,000	82,000	2,000
Nat. Park Service	17,000	0	0
Local Government	31,500	25,000	3,600
Ski Areas	15,000	0	29,700
Friends	19,000	45,000	34,200
Utah Public Safety	0	25,000	0
State Severance Tax			151,500
Education Donations			16,500
Miscellaneous			31,200
Total	310,500	268,000	611,700

*FY 06-07 not available for CAIC

A few notes to the above table:

- For NWAC:
 - normal Forest Service funding is \$90K instead of \$94K (there was \$4K carryover from the previous year).
 - the DOT figure is made up of \$10K DOT funds and \$35K pass-thru.
 - the State Parks figure is made up of \$10K Parks fee income and \$79K pass-thru.
 - the Local Government figure is from RAC Grants, which have ended so this funding source has ended.
- For CAIC:
 - the large DOT figure comes from a contract that authorizes CAIC to perform all avalanche forecasting for highways, taking this responsibility out of CDOT's hands and allowing CDOT to concentrate on maintenance and avalanche mitigation.
 - the Friends funding of \$34,200 comes solely on 1000+ individual subscriptions to get forecasts via email. This is a line of funding that NWAC Friends could pursue harder.
 - Severance Tax is a line of State funding that is parallel to the General Fund. The Severance Tax fund comes from tax collections from the mining industry.
 - Education donations are reimbursements for expenses incurred in teaching avalanche classes and are paid by the course sponsor. Other avalanche centers ought to consider this reimbursement, because education expenses can be large.

Organizational Model

This section looks at the ideal organizational model for the new NWAC and explores changes and improvements to its operations that, in the author's opinion, would make its services and products more useful to customers, without substantial impact on staff or budget. My goal by the end of this section is to fill in the blanks in the following sentence:

“In the Northwest there is a need for an avalanche center with this administration ... with this staff ... that provides these services ... to these users and customers ... at this cost ... and with these sustainable partners and revenues.”

Administration

The first step in figuring out how to restructure NWAC is to determine its future administration. Once that most important component is determined, other components will follow. Though it remains likely the Forest Service will cease NWAC program administration, that outcome is not certain. Two things need to happen for the Forest Service to remain in charge: first, the financial burden must be taken off the Forest Service; and second, an alliance with the Forest Service Wildland Fire Operations must be forged. Failing this, the only other prospective parent agency is Washington State Parks. Let's look at these two options.

Option 1 – US Forest Service

The best possible administration for the future of NWAC would be the US Forest Service. That is where administration has resided since 1976 and currently is with the Mt. Baker-Snoqualmie NF. There appear to be three options of keeping NWAC within the Forest Service, listed in order of logic and preference:

- Mt. Baker-Snoqualmie (MBS): This is the most preferred and logical administration office because of its proximity to and history with NWAC, and it is without the financial burden that MBS has carried in the past. If an alliance with Fire (see below) can be arranged, the MBS could negotiate shorter tours of employment with NWAC staff.
- Regional Office (RO): If the MBS is unable to take on this role, then administration by the RO Recreation would be the second choice. This was the admin point many years ago, but it came to an end due to cost and the issue of earmarks. Today of course a consortium of funders would cover the costs.
- Wildland Fire Operations, Interagency Predictive Services Group: This does not seem to be a logical admin agency. However, an alliance with “Fire” is suggested as a synergy that benefits both NWAC and Fire (see **Alliance with USFS Wildland Fire Operations** below).

Advantages to remaining in the Forest Service are:

- No messy divorce of the NWAC staff out of federal service and reduction in force (RIF) or retirement. Current staff would maintain their federal positions at their current grade level (GS 12).

- The Forest Service would keep a program (at much less cost) that the public and numerous Forest Service employees at the Forest and District levels find valuable.
- No need to transfer ownership and negotiate special-use permits for 42 RAWs sites.
- State Parks would be willing to put the consortium of funders together.
- No need for another agency (e.g., State Parks) to get authorization for the program, create new positions in state government (there is no classification for meteorologist), and take on a new program that is not logically linked to Parks' mission.

All these options assume that a consortium of sponsoring partners can come together to take the financial burden off the Forest Service. Washington State Parks could, at the direction of the legislature, take on this role. Additionally, this new funding arrangement has to have legs; that is, there must be a strong commitment from partners for a known amount of funding for at least 5-year increments. Otherwise we would be back in the same situation of scrambling for funding every year, and facing layoffs and reduced services if the money does not appear.

Option 2 – Washington State Parks

The second best option would be administration by State Parks. Parks could take on the NWAC program, though it is not a logical fit. If Parks assumed administration, there are two scenarios for employment status of the NWAC staff.

In the first scenario, NWAC staff would maintain their federal positions at current pay grade (GS 12). Their positions and FTE would be either with the MBS or RO, but either of those entities would not have the financial burden of those employees. Rather they would become contractors to Parks to staff NWAC, and the funding to pay them would come from the consortium of sponsoring partners.

In the second scenario, NWAC staff would be RIF'ed, as their federal jobs would be abolished. Parks would create new jobs in the State system. (One down side to this scenario is the amount of work required. Parks would have to navigate through the State personnel system to find the FTE, create new positions, write job descriptions, grade the jobs, and go through the hiring process.) Current NWAC staff of course could apply for the new jobs.

Alliance with USFS Wildland Fire Operations

A possible alliance of the NWAC staff with the Forest Service Wildland Fire Operations has recently emerged. This could be a win-win situation for both agencies. It would work this way.

Fire Ops has an immediate need, and likely a long-term need as well, for experienced meteorologists to manage their network of 114 RAWs units. Fire Ops has a sizeable budget for RAWs maintenance, and that budget could support a maintenance manager as well. (There also may be a need for an additional fire weather meteorologist.) At NWAC there is a staff of three meteorologists who are skilled forecasters and skilled RAWs

experts. Since NWAC's core season is November-April, and Fire Ops core season is May-September, there would be a perfect fit to employ some of NWAC's staff for the fire season.

Physical Location

NWAC should remain in its office space with the National Weather Service Forecast Office in Seattle. NWS wants NWAC to remain because of a strong interaction between meteorologists of both agencies, and it's the logical place for the NWAC meteorologists to continue to provide the weather services expected by their cooperators. NWAC staff gets full use of the NWS state-of-the-art AWIPS workstations, which provide everything the forecaster could want – numerical forecast models, satellite and radar data, sounding data, NWS text discussions and forecasts, and dissemination of NWAC forecasts via the NOAA Weatherwire. These in-kind services by NWS are valued at \$65,000 annually.

Special note: An obvious question is, Why doesn't the National Weather Service take over avalanche centers and add avalanche forecasting to its responsibilities? There are three reasons why this will not and cannot happen:

- First, the mission of the NWS is to provide the infrastructure for gathering weather data, to make its own analysis and forecasts, to issue warnings for storms and severe weather, and to make all this available to radio, TV, private meteorology services, and avalanche centers so that these outlets can provide specific forecasts to the public and special user groups.
- Second, avalanche forecasting requires a thorough knowledge of snowpack conditions in addition to weather conditions. NWS staff does not have the snow and avalanche background to take on this added application of forecasting.
- Third, the NWS does not provide specific forecasts to special clients. That is the job of the media, private weather services, and avalanche centers (as mentioned above).

Staff Qualifications and Levels

NWAC should be staffed by meteorologists – for two important reasons. First, in a maritime snow climate such as the Northwest, avalanches are almost always “direct action”, meaning that they release because of immediate weather effects such as heavy snowfall, rain, or thaw. Thus the forecaster must be well trained in meteorology to make accurate avalanche forecasts. If you miss your weather forecast, you miss your avalanche forecast. You cannot rely on National Weather Service zone forecasts, because those do not have the necessary detail.

Second, NWAC's mission is more than forecasting avalanche danger in the backcountry for recreationalists. NWAC provides invaluable weather data to avalanche specialists at WSDOT and ski areas. That makes its mission broader than that at many other US avalanche centers, such as Utah, Sun Valley, Jackson Hole, etc. Those centers do outstanding jobs keeping backcountry users safer, but they are not required to provide detailed weather data to highways or the ski industry. Therefore they can operate their centers adequately and professionally by taking weather data provided by the National Weather Service.

Make no mistake about the value of the forecasts that NWAC gives to WSDOT and the ski industry. Without the daily weather forecasts and phone consultations provided by NWAC's meteorologists, DOT and ski areas would have little use for NWAC and would cease being cooperators.

Staff level: A minimum of three meteorologists should staff NWAC. If a time ever came when budget allowed a fourth forecaster, NWAC staff should discuss this option with their cooperators and sponsors.

Services and Products

For 30 years NWAC has produced a set of services and deliverables to specific customers and the public that have changed little over years. The daily weather and avalanche forecasts, available via telephone hotline and website are the staples for the public, in addition to avalanche awareness classes. For WSDOT and the ski industry, daily phone consultations are the preferred means of information exchange.

There is no reason to change these basic products and services; they are pretty standard for the larger avalanche centers. So the new NWAC should not need to make radical changes. However, this author has several recommendations for changes that might improve the content or timing of the products.

- **Upgrade the website:** The website is currently not appealing. This is NWAC's window to the world, so it must have a more stimulating appearance. It is far too dependent on full text forecasts and bulletins. Modern websites use more visual means to get their message across.
- **Use color maps and icons on website:** Icons should not be dismissed as a dumbing-down of a text product. The information can all be there, but the first layer a visitor would see is a visual icon that gets across the most important point the forecaster wants to say (for example, high avalanche danger, or heavy snowfall, or major meltdown). That can be followed by a mouse click to the second layer of information that would provide details of the condition made known by the icon. People want simplified presentations of information, and icons serve that purpose. If the forecaster does not simplify the message, the consumer will (perhaps introducing error to the result).
- **Less is more:** The current text-based weather and avalanche forecasts, while perhaps totally accurate, are much too long. Very few users like such a lengthy product (although some users like it exactly as it has always been done). Most users that I interviewed did not read the majority of the forecasts, but rather tried to pull out a few key points. It is difficult for most people to digest a 2, 3, or 4-page forecast, even if they choose to read it. So cut to the chase, shorten it, and tabulate data rather than write lines of text.
- **Weather forecast:** A release time of 7 am is fine for the public forecast. Keep doing it. But also consider issuing concise, separate, site-specific forecasts for WSDOT by 6 am. That will sooth criticism from WSDOT that they are not

getting what they need. Lastly, consider not producing an afternoon update. Instead issue only a statement of “changes in the morning forecast”.

- **Avalanche forecast:** Stop issuing a morning avalanche forecast at 9 to 10 am. That is too late to do anyone any good. Instead issue an afternoon forecast at 1 pm that includes the morning’s data. That will have the latest information and will serve everyone’s needs for the next day’s outing.

Business Model

The new NWAC needs to develop a business model in which personnel and operational costs can be covered by revenues. That plan would identify the major users of its products and services, identify the content and timing of those products and services that meets the users’ needs, and identify what revenues are required to make this happen. Thus, NWAC would be run like a business, not a government agency. That means no bailouts to cover shortfalls. Budgets would be made on expected revenues. NWAC would provide the services and products that available revenues can pay for. That is, you raise this much money, you do this much work.

This model should drive relationships with cooperators and users of NWAC’s services. Cooperators, and even the public, should expect to pay a fair price for a service that meets their needs. And there would be incentive for NWAC to be cost efficient and to provide services that suit the cooperators and public needs.

On the revenue side, there must be a realistic balance between public funding (federal, state, local) that reflects the public safety aspects of the program, and private-sector funding that reflects the concept of “user pays.”

This business concept leads to the following operational scenario: If at the start of a season revenues are strong, then the Director can plan for full staffing, full office hours, full field work, and full services and products. However, if at the start of a season, full funding is uncertain, then the Director must implement a contingency plan. Cost-cutting measures of reduced operational expenses and staff hours should be implemented. The contingency plan would then carry out a reduced level of service that does the most good for the most people (or cooperators) for the longest time.

Cost-Saving Measures

There is a consensus among some of NWAC’s cooperators that there are ways to cut costs without sacrificing any critical services and products. The author of this report agrees with that assessment. A leaner, meaner NWAC stands a better chance of surviving for the long-term. Below are some ideas that would cut costs and therefore require smaller budgets:

- **Shorter tours:** The current tours of employment for NWAC staff are (1) Director’s position, 10 months; and (2) two forecaster’s positions, 9 months each. These tours are certainly not inflated, but they could be shortened to 8 months, and still meet almost all users’ needs. This should be palatable to existing staff and palatable to new hires as well, especially if summer employment with Fire Ops materialized for some of NWAC staff. **Savings: \$50-60,000**

- **10-hour office day:** The work day at the NWAC can easily extend to 12 hours or more. NWAC staff should look at its work load and see if certain products or procedures could be shortened so that the day's work can be done in 10 hours. (NWAC is actually trying to do exactly this, but finding it hard with current work load.) However, this measure will save money only if it means a shorter work week (e.g., 36 hours instead of 40).
Additionally, a shorter office day would free up extra hours for field work, which is a necessary part of the job. Thus if budget allowed for fulltime work, each forecaster could have an extra 8 hours available every two weeks for an extra field day, all at no additional cost.
- **Lower pay scale:** If State Parks assumed administration and NWAC jobs went to the state personnel system, the new positions would grade out below the GS-12 federal level. If, for example, the new state classification graded out at the equivalent of a federal GS-9, there would be a \$20,000 savings in annual salary per employee. Even if the new grade were the equivalent of GS-11, there would be a \$10,000 savings in annual salary per employee. **Savings: \$30-60,000**

Possible sources of increased revenues

The author has identified four sources that could provide more, or new, revenue. A smart entrepreneur will undoubtedly find more. Some of these strategies are discussed in the section **Scope of Work, potential fees or revenue that could be derived** as well.

- **Ski industry:** Ski areas in the Cascades collectively contribute \$15,000 via the Pacific Northwest Ski Areas Association. And thanks goes to the President of PNSAA for getting that donation doubled since 2000. But almost every major ski area is getting tremendous value from the RAWs unit at its area, because they are a great weather resource for snow safety and lift operations. These units have been bought, installed, and maintained by NWAC, at little or no cost to the ski area. Contributions from ski areas should be higher than the current amount.
- **Reimbursement for education costs:** Avalanche education is key to saving lives, but the costs incurred by avalanche centers in teaching courses can be significant. It is reasonable to ask the sponsors of courses (rather than the individual students) to reimburse NWAC for travel and a reasonably hourly rate. Colorado receives about \$15,000 per year this way.
If this system were adopted, an additional benefit to NWAC would be the ability to hire an avalanche educator who would teach as many avalanche courses as new revenues allowed. This would have two advantages: it would take some of the burden of teaching off the forecast staff; and it would have a built-in cost savings, because the educator would be hired at a lower hourly rate than the forecasters.
- **Sponsors logos on websites:** Invite companies who would like to advertise but otherwise do not provide funding to display their logos on the NWAC website. The Bridger-Teton Avalanche Center (Jackson, WY) is one that uses this sponsorship idea to generate about \$10,000 per year. Though some will complain that this is crass commercialism, its use is widespread in today's world and an accepted way of generating revenue.

- **Access fee for RAWs data:** Charge a small annual fee for access to that part of the NWAC website that displays the data from its RAWs sites (see **Appendix C**). See page 9 for the justification for charging a fee.
- **Email subscription fee:** Colorado generates about \$34,000 per year by repackaging its daily weather and avalanche forecasts as an email that goes to subscribing “friends” (see bulleted item on page 18). The Friends of NWAC (FOAC) has recently begun to do this, and with a little more effort could increase its circulation of emailed forecasts and thereby increase revenues. Additionally, text messaging to cell-phone customers could be offered as well.

Partnerships for Sustainable Cooperative Funding

The current year’s budget (FY 07-08) for NWAC is \$318,900. That covers full operations, in the manner that NWAC has been operating for years. However, there are cost-savings measures as described above that would allow the new NWAC to operate on a smaller budget, without sacrificing any critical services and products. Cutting costs is an important step toward making NWAC sustainable for the long-term.

The table below lists cooperators and revenues for the current year (FY 07-08). You can see that there is a shortfall of \$53,900 compared to \$318,900 budget listed above. And chronic shortfalls have been the problem all along. With cost-cutting, NWAC should be able to operate on a smaller budget.

Also in the table is a projected budget for FY 09-10 that shows revenues similar to FY 07-08, but without a shortfall. These revenues appear within reach, and additional sources more than make up for the reduced Forest Service position.

Cooperator/Source	FY 07-08	FY 09-10
US Forest Service	94,000	30,000
WSDOT	45,000	45,000
State Parks	89,000	89,000
National Park Service	17,000	17,000
Ski industry	15,000	25,000
Friends association	5,000	10,000
Industry logos on website		5,000
Education reimbursement		10,000
Access fee to website data		30,000
Email/text message service		20,000
Total	265,000	281,000

There are two key elements to making partnerships sustainable and budgets adequate. First, partners need to commit to funding in 5-year increments, so that every year is not a scramble to get pledges from cooperators. Second, budgets must have a 3% or larger cost-of-living increase year over year, or we will revert to the same situation of shortfalls that we face today, caused by rising costs and flat revenues.

Summary Organizational Model

In the Northwest there is a need for an avalanche center:

- with administration by the US Forest Service, or if that is not attainable, by the Washington State Parks and Recreation Commission
- with a staff of at least three meteorologists (with training as avalanche specialists as well) housed at the National Weather Service Forecast Office in Seattle
- that provides daily weather and avalanche forecast services, as well as avalanche awareness training
- to the US Forest Service, WSDOT, State Parks, National Parks Service, ski industry, and hundreds of thousands of backcountry enthusiasts
- at a cost of \$250,000 to \$300,000 a year
- with a consortium of funding partners that includes – but is not limited to – the US Forest Service, State Parks, WSDOT, National Park Service, ski industry of Washington and northern Oregon, and the Friends of NWAC
- and with new funding generated from market-based fees for value-added services.

Options and Recommendations

In this study and assessment of the Northwest Weather and Avalanche Center, I have interviewed dozens of persons who are associated with, cooperate with, have first-hand knowledge of, and/or use the services of NWAC. My personal experience and resume (see **Appendix E**) allow me a broad perspective on NWAC and avalanche centers in general. Thus I have come down to six options for the future of NWAC and recommendations that would best serve the needs of the citizens of Washington and northern Oregon and the cooperators and agencies that have used its services.

Option 1 – NWAC closes and ceases operations

This is a distinct possibility, given the budget concerns that have frequented NWAC. If this option actually occurred, it would be shameful. Winter recreationists, motorists, and truckers would be worse off. Economists have studied the economic value of a human life in the US and have come up with a figure of about \$700,000. Similarly economists have determined that a one-day closure of Interstate 90 over Snoqualmie Pass due to avalanches costs about \$20 million. For a program like NWAC that costs so little (\$250,000 to \$300,000 in the future), it does not make sense to close it. It's just a matter of finding an administration and funding to keep NWAC in operation, and that can be done.

Not recommended

Option 2 – State Parks administration, mission reduced to recreation only

There are other avalanche programs in the US that forecast for recreational users only; that is, they have no responsibility for providing services to highways of the ski industry (see the discussion in section **Organizational Model, Staff Qualifications and Levels**). These are good programs, but they should not be the model for NWAC – for three reasons. First, these programs do not provide specific weather forecasts as a significant part of the value of their programs, as does NWAC. Second, the areas of coverage are far less than the area forecasted by NWAC. Third, it may not cost less to run such a program. For example, Utah has a budget of \$268,000, which is in the range of NWAC's future budget.

Not recommended

Option 3 – State Parks administration, state classified employees

This is possible and workable, though at considerable restructuring cost and angst. NWAC is not a logical fit into Parks' mission. Plus there would be considerable work required within the state personnel system. This option is discussed in a little more detail in the section **Organizational Model, Administration, Option 2**. The only advantage seen would be a possible cost savings because the new jobs would likely grade out lower than the current federal positions.

Recommended only as last resort

Option 4 – State Parks administration, federal employees

This option is possible, workable, and preferable to Option 2 above. It is discussed in a little more detail in the section **Organizational Model, Administration, Option 2**. Under this plan, the forecasters would remain federal employees but would become contractors to Parks to staff NWAC, and the funding to pay them would come from the consortium of sponsoring partners.

Recommended if Options 5 or 6 are unattainable

Option 5 – US Forest Service, Region 6, administration

This is a good option and one made possible by removing the financial burden on the USFS and by a possible alliance with Fire Weather. (See the section **Organizational Model, Administration, Option 1**.)

Recommended if administration by MBS is unattainable (Option 6)

Option 6 – US Forest Service, Mt. Baker-Snoqualmie NF, administration

This is the best option, for reasons discussed in the section **Organizational Model, Administration, Option 1**. There is everything to be liked about this plan:

- MBS has the history and experience with NWAC, and proximity to NWAC.
- MBS would maintain admin control over a program that it valued but eventually could not afford.
- With the financial burden mostly transferred to a strong consortium of partners, MBS would have no concern with funding.
- If an alliance with Fire Weather at the Regional level could be forged to give NWAC staff summer employment, MBS could negotiate a shorter tour of employment for wintertime NWAC duties, which would further alleviate financial responsibility.

Recommended

Appendix A: A Brief History of US Avalanche Centers (and the Role of the Forest Service)

For more than 50 years the US Forest Service has played a significant, central role in all matters relating to snow avalanches in the US. An important evolution in winter sports led to founding of avalanche forecast centers, and that was the growth of backcountry skiing (later to encompass other recreationists such as snowmobilers, snowshoers, and snowboarders) that began in the 1970s and has continued through today. The Forest Service refers to this as dispersed winter recreation, a term that distinguished it as different from developed winter recreation (ski resorts) and includes not only individuals pursuing their sport but also guided recreation such as snow-cat and helicopter skiing.

Avalanche deaths in the US were rising steadily year after year (see chart), and the cause was directly related to more people in the backcountry. The deaths were occurring almost exclusively on lands managed by the FS: the backcountry, ski areas, and highway rights-of-way. Many of the victims had little knowledge of avalanches and therefore little ability to make themselves safe.

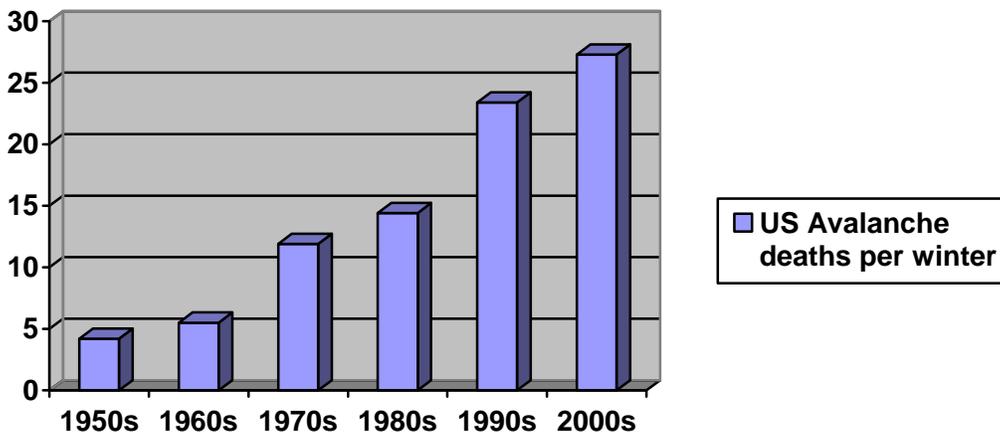


Figure 3: US avalanche deaths per winter by decade

In response, the first avalanche forecast center was founded in Colorado in 1973. It was a Forest Service program. The second program came in 1975 in Washington and the third in Utah in 1981 ... both Forest Service programs. Thus three regional avalanche centers, each covering the mountain areas of three states highly prone to avalanches, existed within the Forest Service. Other smaller centers, some regional and some local, were founded later in the states of Alaska, Montana, Idaho, Wyoming, California, and New Hampshire in the last 20 years.

All the programs have been successful in terms of public acceptance and use. The people liked the weather and avalanche bulletins that came out of the centers, and also took advantage of the avalanche awareness classes taught by the centers. So avalanche centers have always been viewed as valuable social programs. The problem has been, Who pays for them?

At one time in the 1980s, the Forest Service found itself the lead agency in everything to do with avalanches: research, mitigation (control), education, forecasting (avalanche centers), and land-use permit management. But this dominance was short lived, because the role of the Forest Service in administering programs was in transition, as was the federal funding for these avalanche programs. One by one the Forest Service abandoned its commitment to most of its avalanche programs. It was a reversal driven by a change in agency philosophy to “user pays” and by budget cuts. The result was a mission change for the Forest Service and the abolishment or privatization of many programs.

Consider these changes that took place:

- The USFS Alta avalanche research program was closed in the 1970’s.
- The USFS Fort Collins avalanche research program was closed in 1985.
- The USFS Colorado avalanche warning program was closed in 1983 and relocated to the State of Colorado.
- The USFS National Avalanche School was privatized and transferred to the National Ski Patrol.
- The role of avalanche mitigation at ski areas was privatized and was transferred from the USFS Snow Ranger position to ski-area employees, essentially removing avalanche expertise from the District level of the Forest Service.
- Funding for all avalanche forecast centers was cut to the point that they could not exist without extensive partnerships with States or the private sector.

This trend will almost certainly continue. The Forest Service simply cannot provide the service it once did because of budget slashing. And there is nothing in federal statute or the Forest Service Manual that mandates avalanche centers or any sort of warning service. So while the Forest Service remains the parent agency for avalanche centers, it encourages them to create partnerships for cost sharing. But there seems to be a Catch 22 built into the partnerships: The more successful you are at raising money through partnerships, the more likely it is that the Forest Service will reduce its share of the cost.

The avalanche centers that are sustainable will have these traits:

- A budget spread over many committed partners for stable funding
- Strong community awareness, use, and support of the service
- A staff of respected and well-spoken professionals
- Products and services that timely, accurate, clear, concise, and user-friendly so that users get what they need
- A strong brand name, earned via reputation, advertising, and word of mouth
- A good business/operations plan
- An innovative entrepreneurial strategy
- An exciting website

Appendix B: List of Contacts (Persons contacted in December 2007 and January 2008 in meetings, interviews, phone, or email)

<u>Name/Title</u>	<u>Organization</u>
Bruce Tremper, Director	Utah Avalanche Center
Ethan Greene, Director	Colorado Avalanche Information Center
Colleen Maguire Tom Oliva Rita Cooper	Washington State Parks & Rec. Commission
Mark Moore Kenny Kramer Garth Ferber	NWAC
Brad Coleman, MIC Ted Buehner	National Weather Service
Benj Wadsworth	Friends of the Avalanche Center
Rich Marriott	King TV, Channel 5, Seattle
Marty Schmoker Mike Stanford	WSDOT, Stevens Pass
Craig Wilbour	WSDOT, Snoqualmie Pass
Tom Root, Asst Maintenance Engineer Monty Mills, Maint & Ops Branch Mgr	WSDOT, Olympia
Rob Iwamoto, Supervisor Sean Wetterberg, Winter Sports Specialist	USFS Mt Baker Snoqualmie NF
Larry Donovan, retired	USFS MBS NF
Linda Goodman, Regional Forester Kimberly Bown, Dir of Recreation Mike Heilman, Special Use Coordinator Jim Furlong, Asst Dir Wildland Fire Ops	USFS R6, Portland
Mick Steinman	Washington State Snowmobile Assn

<u>Name/Title</u>	<u>Organization</u>
Scott Kaden, President	Pacific Northwest Ski Areas Assn
Patty Morrison, Snow Safety Jon Andrews, Snow Safety John Meriweather Chester Marler, Dir. of Planning	Stevens Pass Ski Area
Rob Gibson, Patrol Director	Alpental & Snoqualmie Ski Areas
Paul Baugher, Patrol Director Chet Mowbray, Snow Safety Ben Wright, Snow Safety	Crystal Mountain Ski Area
Duncan Howat, General Manager	Mt. Baker Ski Area
Tom Paulson, Reporter	Seattle PI
Doug Abromeit Karl Birkeland	USFS National Avalanche Center
Prof. Cliff Mass	Dept. of Atmospheric Science, University of Washington

Appendix C: Remote Automated Weather Stations

NWAC has installed and maintains a network of 42 remote automated weather stations (see map). This network is one of the great strengths of NWAC. It is the largest network of RAWS sites of any avalanche center in the US. Avalanche forecasting in the Northwest is driven by meteorology, meaning that weather dictates avalanche danger far more than weak layers in the snowpack. (In contrast, avalanche danger in the higher, colder Rocky Mountains is usually driven equally by the weather and snowpack weaknesses.) Thus, a strong network of weather stations is required by NWAC.

The data are used by NWAC, WSDOT, ski areas, and NPS for local conditions, forecast input, forecast verification, and building a climatology database. The data displayed on NWAC's website are also used by the public, to the tune of 4-8 million hits per winter.



Figure 4: Map of NWAC's RAWS sites

RAWS sites require constant maintenance because of the harsh weather where they are positioned. For many years NWAC has run an exceptionally cost-effective maintenance program for its RAWS sites. Their annual maintenance budget is \$30,000, which is about \$700 per station. For comparison, the USFS Wildland Fire program maintains 114 stations with an annual budget of \$300,000, or about \$2600 per station.



Figure 5: Typical ridgetop RAWS site for wind, temperature, and humidity data

Appendix D: User & Cooperator Emails of Support

1. Received from Jon Andrews, Stevens Pass Ski Area

Survey Questions about NWAC

1. What departments of your ski resort use the services of the Northwest Avalanche Center? (For example, lifts, snow safety, plowing, etc)
Response-All our departments use the NWAC forecast to help determine staffing levels. This includes all listed, lift maintenance for winds and icing and marketing.
2. If you use NWAC's weather forecast:
 - a. Do you find its format user friendly? (Any specific comments would be helpful.)
Response-As far as the snow safety department I am used to the format. I look through it relatively quickly. There are some portions that I do not look at- fairly lengthy. I would rather see a shorter forecast and be able to talk to a forecaster over the phone.
 - b. Are certain portions of the forecast product more valuable?
Response-I think the discussion/synopsis is fairly lengthy. Most folks tend to skip through to information they are looking for. For Operational forecasting I appreciate the break down for areas. I do not have a lot of time to make decisions. I need a short, concise format and the ability to talk to a forecaster on the phone for a quick explanation/interpretation.
 - c. Which bulletin do you most often use: morning, afternoon, or both?
Response-Both. The afternoon bulletin helps us to decide start times for the next day, staffing levels and future snow pack conditions. The afternoon update is important because of the rapid weather and snow pack changes in the cascades.
 - d. Are there any changes that would make the forecast more valuable?
Response-Maybe some what shorter and the ability to talk to someone for interpretation/trade information. More public friendly.
3. Do you use the daily avalanche forecast? How would you rate its value to your operations, compared to the weather forecast?
Response-Not so much for Operational Forecasting. We do recommend the Avalanche Forecast to backcountry users. We do see a lot of similarities between the Backcountry Avalanche Forecast and inbounds of the ski area. We talk with the NWAC almost daily comparing profiles with forecast.
4. US Forest Service administration and funding for NWAC will end by the summer of 2009. If NWAC closed, how would it affect your operations?
Response-If the NWAC where to close it would initially cost the ski area quit a bit to rebuild a weather station program and to find a forecast that is applicable to the mountain and snow pack environment.
5. If you have an NWAC remote weather station, would its removal affect your operations?

Response-Yes, The programs that run the remote weather stations were developed by the NWAC and is maintained with the cooperation of the ski area.

6. If NWAC were restructured and relocated to another agency, would your area become a partner to help with the financial support to make NWAC sustainable?

Response-I believe that a partnership between ski area, DOT and what ever agency runs the program would in the long run cost all of us less. It seems now days there are more people that are learning to maintain these remote weather stations.

Comments-I think the NWAC is a needed resource for the Cascades. I think it is a very underutilized program. The question is how do you get better cooperation from people using this site? How do you get the public backcountry user the information that they need. This snow pack condition throughout the Cascades now is not unusual, it is very common. The problem I feel is the explosion of the snow user over the past several years in the cascades. For the most part all groups do not learn first about the environment they are going to be in but rather learn through the school of hard knocks. The marketing of products and activities far exceeds the learning curve on consequences of misuse.

The NWAC is a needed source but maybe in a different way. Avalanche education only works for a few of the very small percentage of snow users that seek it. The answer may be in some sort of a better information gathering and public warning system and defiantly more interaction with public and private agencies and businesses.

2. Received from Mick Steinman, Safety Chairman, Wash. State Snowmobile Assn

Dear Knox Williams,

Last week you sent me some survey questions. I passed the survey questions to several inside the WSSA Snowmobile Community. I have tempered many comments with my thoughts.

I have personally lost 2 Very Dear to Me to avalanches. One was an immediate family member and the other a freinds son. These are avoidable deaths given the proper training and use of the NWAC. The forecasts are very important as the average person cannot gauge the danger level.

Mick

Survey Questions about NWAC

1. Are the services of the Northwest Avalanche Center valuable to your organization? If yes, does it help most in trail grooming, trip planning, education, or safety? **Yes –All of the above are very important.**
2. If you use NWAC's weather forecast:

- a. Do you find its format user friendly? (Any specific comments would be helpful.) – **Yes it is clear – It may operate differently than some other sites, but once you are familiar with it, its fine.**
 - b. Are certain portions of the forecast product more valuable? Primarily the level of hazard. **Sometimes hard to pin down the exact locations, but when one understands the hazard level changes within short distance and within a short period of time – the exact location isn't all that important – It is the general information about the hazard that one needs to consider.**
 - c. Which bulletin do you most often use: morning, afternoon, or both? **Both**
 - d. Are there any changes that would make the forecast more valuable? **No changes that immediately come to mind.**
3. Do you use the daily avalanche forecast? **YES** How would you rate its value to your operations or members, compared to the weather forecast? **Good....** Is it easy to understand? **It is fairly technical and more than some may want to know, but has good detail for those interested. A good balance.**
 4. US Forest Service administration and funding for NWAC will end by the summer of 2009. If NWAC closed, how would it affect your operations or members? **The NWAC is very important to snowmobilers and all back country users. The closure would be devastating and would result in many more fatalities. These fatalities cannot be measured in Dollars. We must keep NWAC running at its current levels of service.**
 5. If NWAC were restructured and relocated to another agency, would your group become a partner to help with the financial support to make NWAC sustainable? **WSSA – through contributions from the Snowmobile Account (via WA state Parks and Recreation Commission), organization, and individuals is already a “partner”. WSSA is a volunteer organization and certainly doesn't have the resources to replace the funds that the FS currently provides. It is inappropriate that FS withdraw its funds from this user group – i.e. winter recreation. FS seems to be able to better provide services to summer recreation without charge directly to the users.**
 6. Are there changes that would make NWAC better in the future? **NO The Forest Service should continue funding the NWAC. It already has suitable management. Moving to another agency will only cause disruption in services and if it is transferred to State Parks the administration cost will likely go up considerably. Is there anything that shows State Parks would be a more efficient agency to manage the NWAC? Would they provide any program management or leadership? The change would be that USFS acknowledges its responsibility and provides funding at a meaningful level. Many other National forests are still running the avalanche centers. The FS is probably best at the operation/management, since they have done it for so long. The personnel at the NWAC are very knowledgeable and have provided awareness training at many WSSA events over the years. There would be a higher cost for these services if provided via a private entity.**

3. Received from Mt. Hood Meadows

Survey Questions about NWAC

1. What departments of your ski resort use the services of the Northwest Avalanche Center? (For example, lifts, snow safety, plowing, etc)

Lifts, parking, grooming, Patrol, Marketing, Concierge. nearly every department within Mt. Hood Meadows and Cooper Spur Mountain Resort.

2. If you use NWAC's weather forecast:

a. Do you find its format user friendly? (Any specific comments would be helpful.)

Maps should be larger. Narrative could be clearer. For the most part, our staff and guests have become quite familiar with the current format. Changing it significantly would be confusing to many users.

b. Are certain portions of the forecast product more valuable?

Forecasting of the freezing level and participation probabilities and amounts at the base area elevation of MHM are the most valuable to us. Wind speed and direction forecasts at the top of Mt. Hood Express are also very important.

c. Which bulletin do you most often use: morning, afternoon, or both?

Both

d. Are there any changes that would make the forecast more valuable?

Additional telemetry reading points within the MHM permit area and at the top of Super Bowl.

3. Do you use the daily avalanche forecast? How would you rate its value to your operations, compared to the weather forecast?

Yes, weather more useful to all users

4. US Forest Service administration and funding for NWAC will end by the summer of 2009. If NWAC closed, how would it affect your operations?

Significant loss of valuable info. Risks to our daily operations and guests will go up significantly.

5. If you have an NWAC remote weather station, would its removal affect your operations?

We depend on the two stations for accurate, timely data. Linked to web site for guest information - wind and snow depth. Impact to our operations will be significant, including reduced guest participation in alpine recreation and increased risk to guests, MHM and the USFS.

6. If NWAC were restructured and relocated to another agency, would your area become a partner to help with the financial support to make NWAC sustainable?

Yes, but, we would need to know the details to make a business decision. If cost were too high we have ability to manage telemetry, would need to evaluate other options for weather forecasts.

Steve Warila
Executive Director of Mountain Operations and Planning
Mt Hood Meadows Ski Resort
503 337 2222 ext 206
541 991 1157 cell

4.

From: Tim Towell
Sent: Wednesday, December 12, 2007 3:13 PM
To: Maguire, Colleen (PARKS)
Subject: RE: North West Avalanche Center

I use the site on a personal basis, when there is some question of avalanche in a backcountry area, but I don't believe any of NW Snowgrooming's Operators use it on either a regular or occasional basis. We ride mostly in the Oregon and Washington Cascades, and mostly off-trail and use this site and others to determine the snow-depth, weather forecasts, and avalanche forecasts, however in back-country riding with rapid changes in elevation and terrain the information on the website is at best a high-level overview and gives a little more direction on where extra caution should be given. I can't remember ever using the phone service.

Probably not the answer that you are looking for, but the grooming routes that we have within the South Cascades don't have any history of avalanche danger for the most part, and it is more the areas that are served by the grooming routes like the backcountry mountain riding on Mt. St. Helens and Mt. Adams that have high avalanche danger.

Tim and Mary Towell
Sherwood, Oregon

5.

From: Todd Stiles [mailto:tstiles01@fs.fed.us]
Sent: Thursday, December 13, 2007 8:46 AM
To: Pam Novitzky; Maguire, Colleen (PARKS)
Cc: John Morrow/Home
Subject: Re: Fw: North West Avalanche Center

Our winter snow ranger crew uses the Northwest Avalanche Center website extensively throughout the 5 months or so of winter. We check the website daily to look at both the avalanche and weather forecast. This is a useful tool for planning where we patrol for our own employee safety, and it is also useful to help us with our educational message for the public. We routinely refer the public both motorized, and non-motorized users to the NWAC website and phone line. Avalanche and weather awareness are at the core of the message we try to spread. The website is also useful for its historic weather data, and its avalanche incident profiles. We also refer the public to the site as a general area to

grandfather information from, as we constantly get questions about where can I take an avalanche class?

How do I learn about avalanche terrain? Given that our crew is simply educators, and not avalanche professionals, I really believe it is critical for us to have an easy, user friendly resource to point the public to. Winter gear including snowmobiles, skis, and snowshoes are all getting better and more accessible. Many more people are getting into avalanche terrain that were not before due to the better gear, often times their skill and gear far surpass their experience with avalanche education/familiarity. If the public and its educators did not have this resource, I think it is likely that more people will make poor decisions without accurate forecasts. Given that we have a large population center in our neck of the woods, and that our maritime snowpack can be very volatile, I think the avalanche center is very important.

Hope this describes our use of the site.

Todd M Stiles
Wenatchee National Forest
Cle Elum Ranger District
Cle Elum, Washington
509.852.1077
tstiles01@fs.fed.us

6.

From: Jennifer M Beauvais [mailto:jbeauvais@fs.fed.us]
Sent: Monday, December 17, 2007 8:57 AM
To: Maguire, Colleen (PARKS)
Subject: Re: Fw: North West Avalanche Center

Colleen--

As a Winter Snow Ranger for the Forest Service, I check the avalanche forecast daily, not only to see what I might be getting myself into in the field, but in order to educate the public. We contact hundreds of snowmobile users, sometimes in one day! They don't always check out the website, and we like to be able to tell them what the avalanche danger is. The same with BC skiers and snowshoers.

Come my days off, I am a back country skier. I telemark and tour off piste, and the avalanche report is a huge component in researching snow safety. The information provided in it is invaluable to every user, and I honestly cannot imagine this information not being available. I am sure that if we didn't have this info, much of our winter travel for work, let alone play, would be dragged to a halt. You simply can't go out in the woods without this information in the winter.

I check the avalanche danger for the day, the telemetry in order to figure out what kind of precip is happening where, and the weather forecasts and histories, which all indicate

what the snow pack is doing. The weather forecast is the most detailed I have found, and it is incredibly relevant, since it relates to mountain conditions on the ground.

The Northwest Avalanche Center is THE number one component in helping to judge, widespread, what is happening in our snow pack and in the weather. It helps us to judge wind direction, deposition sites, snow composition and layering, compression, future behavior, avalanche potential at elevation and above, unsafe directional aspects, all which lead us to determine which are the safest routes and terrain on which to travel.

The public reaps benefits from us, if they don't check the sites themselves. We are hoping to spread awareness of the NWAC site, as the amount of knowledge contained on its pages is enormous. So many people do not understand the shear danger of the backcountry, and while we are educational resources, as rangers, in this department, we can't be everywhere. Knowing before going is the responsibility of the public, and the information needs to be available for them.

Thanks for asking!

Jennifer Beauvais
Snow Ranger
Cle Elum District
Okanagan-Wenatchee National Forest
(509) 852-1077 (via Todd Stiles)

7.

From: Kimberly A Larned [mailto:klarned@fs.fed.us]
Sent: Wednesday, December 26, 2007 1:01 PM
To: Maguire, Colleen (PARKS)
Subject: Re: Fw: North West Avalanche Center

Hi Colleen,

I work at the Snoqualmie Pass Visitor Information Center for the Forest Service leading interpretive snowshoe walks throughout the winter. We use NWAC daily for avalanche forecasts and weather forecasts. We provide information to backcountry users and Sno-park users. NWAC is critical to our operations to alert the public to the hazards in the backcountry and then if necessary, offer a safer alternative.

We also rely on the avalanche information to assess the safety of our own snowshoe routes. We have a beginner level 90 minute program and a longer 1/2 day route into Commonwealth Basin. We check the forecast every morning of our walks to see if our intended destination is attainable or if we should use an alternate route. We use the avalanche forecast to determine our avalanche danger rating in our field notebooks (as recommended by the American Institute for Avalanche Research and Education). I am especially sensitive to the safety of our program since we are taking members of the public out into potential avalanche terrain. Public safety is our utmost concern.

We do not have web access at the Snoqualmie Pass Visitor Center so we use the phone line regularly for the morning update. We will continue to use the phone line; internet capabilities at the Visitor Center are not likely to happen any time soon.

We incorporate the NWAC in our presentations so that people will start to use the information found in the avalanche and weather forecasts. That's about 800 people every winter we talk to about avalanche safety and the resources available to them, most importantly the NWAC.

If the NWAC were not available we would likely not be able to run our trips into Commonwealth Basin. Without accurate avalanche danger levels we could not make an accurate assessment of the safety of the area we would be traveling in. We would also be severely lacking information to pass on to the general public. We could provide maps and locations of snoparks etc. but with no ability to share information about the snow pack and avalanche potential. As a public agency managing that land, it is imperative that we provide as much information as possible, especially when safety is a concern.

Thank you.

Kimberly Larned
Public Affairs, Information & Education
Cle Elum and Naches Ranger Districts
Cle Elum - 509.852.1062
Naches - 509.653-1417

8.

Dear Sir,

I found out recently that you are in charge of determining the feasibility of the Northwest Weather and Avalanche Center. Lives have been lost already this winter in avalanches, but NWAC has saved many more lives. Mt Baker looked to NWAC when avalanche conditions were the worst in anyone's memory and their big event, the Legendary Banked Slalom, was on the line. This is just one scenario where situations have become clearer with help from the NWAC. With the numbers I've seen, the NWAC is worth every penny. What price can you put on all of the lives saved?

Graham Mueller
Portland, OR

Appendix E: Credentials and Resume of Consultant

PROFESSIONAL RESUME

Career Positions and Experience

- 1970-2006: Avalanche researcher, forecaster, educator, and program director
- 1970-1983: Avalanche Scientist, US Forest Service Avalanche Research Project; and Avalanche Forecaster, Colorado Avalanche Warning Program, Fort Collins, CO
- 1983-2005: Director, Colorado Avalanche Information Center, Denver and Boulder
 - Helped found the CAIC and relocate from a federal program (US Forest Service) to a State program (Colorado Department of Natural Resources, Geological Survey)
 - Grew the CAIC from 3 employees 1 office, and \$75K annual budget in 1983 ... to 13 employees, 6 offices, and \$581K budget in 2005
 - Retired from CAIC in 2005
- 2005-06: Forecaster, Northwest Avalanche Center, Seattle
- National Avalanche School
 - Instructor, 1971-2007
 - Chairman of Steering Committee, 1986-1999
 - Member of Steering Committee, 1999-2007
- Avalanche educator
 - Taught 5-10 avalanche courses per year for 30 years
 - Qualified to teach Introductory, Level 1, and Level 2 Courses

Publications (Author or co-author)

- 3 avalanche books
- approx 30 avalanche papers and articles
- 1 avalanche safety booklet
- 1 avalanche video script

Professional Societies

- American Avalanche Association
 - Founding Member, 1986
 - Governing Council Member, 1986-1999
 - President, 1994-98

Education

- M.S., Atmospheric Science, Colorado State University, Fort Collins, 1970
- B.A., Math, University of Texas, Austin, 1965

Related skills, knowledge, and experience

- Experienced weather forecaster, working as an avalanche hazard forecaster and based in National Weather Service Forecast Offices in Denver, Boulder, and Seattle
- Thorough knowledge of snow and avalanche science
- Knowledge of weather instrumentation
- Program development and management

PRIOR EXPERIENCE IN THE SUBJECT PROGRAM AREA

Several key points, some of which are listed in the resume:

- I was working under Art Judson in 1973 when he founded the USFS Colorado Avalanche Warning Program (CAWP), the first avalanche center in the US.
- I assumed management of the CAWP in 1976.
- In 1983 the USFS abandoned the CAWP. I was instrumental in relocating the program to the Colorado Department of Natural Resources, where it was renamed the Colorado Avalanche Information Center.
- I was Director of the CAIC from 1983 until 2005, when I retired.
- I worked the winter of 2005-06 at the NWAC at the request of Director Mark Moore. This gave me a new insight into the operations of the NWAC.
- I am in close contact with the directors of the CAIC and the Utah Avalanche Forecast Center, two very successful programs that are similar in size and scope of the NWAC.

FINAL REPORT
December 1, 2008

Benefit Assessment and Economic Impact Analysis for the Northwest Weather and Avalanche Center



Washington State Parks



BERK & ASSOCIATES



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Founded in 1988, we are an interdisciplinary strategy and analysis firm providing integrated, creative and analytically rigorous approaches to complex policy and planning decisions. Our team of strategic planners, policy and financial analysts, economists, cartographers, information designers and facilitators work together to bring new ideas, clarity, and robust frameworks to the development of analytically-based and action-oriented plans.

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ONE-PAGE SUMMARY OF FINDINGS

In its 2007 legislative session, the Washington State Legislature directed the Washington State Parks and Recreation Commission to develop a plan to ensure that the Northwest Weather and Avalanche Center (NWAC) has the resources to make it a sustainable program for years to come. To inform the development of this plan, Berk & Associates conducted an economic assessment of NWAC.

What Does NWAC Do?

With a 2008 budget of approximately \$340,000, NWAC provides five key services to public and private organizations and individuals: (1) mountain weather forecasts, (2) avalanche forecasts, (3) current conditions data, (4) phone consultations with entities that operate in the Cascade and Olympic Mountains, and (5) educational services regarding the nature and risk of avalanches.

What Value Do Users Derive From NWAC's Services?

Even very conservative estimates suggest that NWAC's services generate annual benefits of more than \$7.5 million. More realistic estimates suggest that NWAC's services result in economic benefits ranging from \$20 million to more than \$79 million per year. Even if one uses the most conservative estimate of \$7.5 million, this translates into an annual return on investment of more than two-thousand percent. These figures reflect two categories of direct benefits:

- **Lives saved:** Comparisons of historical trends in avalanche deaths suggest that NWAC's services may save between six and nine lives each year. Even if one were to be very conservative and assume that the range extends from two to nine lives saved, annual benefits from lives saved range from \$6.4 million to more than \$75 million.
- **Increased accessibility and enjoyment for backcountry users:** Annual benefits range from \$1.1 million to \$4.2 million, based on a range of 220,000 to 417,000 annual trips to Washington's backcountry.

Benefits that are real and tangible, but that are not included in the above figures include:

- **Increased efficiencies for enterprises operating in the backcountry:** Many federal, state, local, and private organizations derive direct benefits from NWAC's services. These organizations rely on NWAC for day-to-day planning; for streamlining operations; for maintaining the safety of staff; and in the case of search and rescue operations, for reducing the demand for services.

NWAC's services also play a positive role in influencing the patterns and level of commerce in Washington State.

In broad terms, **NWAC helps to support the state's overall competitiveness.** Every day, Washington State competes on a national stage to attract and retain industries, entrepreneurs, and highest of high-skill workers. By facilitating access to wintertime recreational activities, NWAC allows the state to leverage its greatest competitive advantage—its immense natural amenities.

In terms of commercial patterns within the state, **NWAC offers key support for snow and ice activities. These industries represent economic engines for many non-urban parts of Washington State.** Snow and ice activities generate \$100 million or more in economic activity in rural areas, and they generate nearly \$1 million in revenues for local jurisdictions, with most of these revenues going to cash-strapped county governments.

WASHINGTON STATE PARKS AND RECREATION COMMISSION

Benefit Assessment and Economic Impact Analysis for the Northwest Weather and Avalanche Center

EXECUTIVE SUMMARY

INTRODUCTION

Context

The Washington State Parks and Recreation Commission contracted with Berk & Associates to conduct an economic assessment of the value the Northwest Weather and Avalanche Center (NWAC) provides Washington State and the state's constituent communities. This economic assessment is in response to funding challenges faced by NWAC and is part of a larger legislatively-mandated project. The overarching goal of this report is to inform discussions about how NWAC can achieve a sustainable business model.

This assessment informs that discussion by addressing the following two fundamental issues:

- 1. What is the *value* of NWAC's products and services?**
- 2. What *impacts* do NWAC's products and services have on the level and pattern of commerce in Washington State?**

In addition, this report also offers a brief overview of an economic perspective on funding. The goal of this funding discussion is to inform the broader process of examining potential methods for NWAC to generate revenues in the future.

Approach

To answer the two questions above, this assessment presents analysis and findings based on two analytic frameworks:

- **A benefit/cost analysis** that examines the *value* of NWAC's services using the well-established frameworks of user-benefit assessment. This analysis examines a set of unambiguous benefits derived by direct and indirect users of NWAC's services. In this context, the term *benefit* is defined as the inherent *value* derived by users, and is measured in terms of willingness-to-pay. Ultimately, the goal of such analyses is to determine how much users of NWAC's services value those services and to balance that value against the costs of providing those services.
- **A discussion of economic impacts** that examines the effects that NWAC's services have on the state's level and patterns of commerce. This discussion focuses in large part on the economic impacts of snow-sports activities and industries, examining the economic and fiscal impacts that these industries have on rural and small-town economies in the Cascade and Olympic regions of the state.

OVERVIEW OF NWAC

NWAC Products and Services

Since its founding in 1975, NWAC has been charged with promoting safety by reducing the impact of adverse mountain weather and avalanches. NWAC pursues this charge by providing five key services:

- **Mountain Weather Forecasts.** NWAC provides detailed and area-specific forecasts of weather conditions in the mountains. Its weather forecasts include a general weather discussion, specific weather forecasts for the next 48 hours, a three to five day outlook, and such details as expected cloud cover, precipitation levels, freezing and snow levels, and wind speeds.
- **Avalanche Forecasts.** NWAC provides information about avalanche conditions and releases and distributes avalanche warnings as warranted. The avalanche forecasts include snowpack information, analysis of and reasons for snowpack structure, two to three day forecasts of expected changes in snow stability, and avalanche danger ratings.
- **Collection and Distribution of Current Conditions Data from RAWs.** NWAC uses its network of Remote Automated Weather Stations (RAWs) sites to maintain hourly weather conditions on its website for 42 locations throughout Washington and Northern Oregon. The data collected include the past 24 hourly readings of temperature, wind speed, wind direction, precipitation, snow fall, and snow levels.
- **Phone Consultations.** NWAC provides personal phone consultations for planning purposes to the Washington State Department of Transportation (WSDOT), ski-area personnel, the media, and other cooperating agencies.
- **Educational Services.** NWAC provides avalanche educational resources to recreationists, industry users, and its primary cooperators through presentations conducted by staff and Friends of the Avalanche Center (FOAC) volunteers, and its website.

NWAC Users

A direct user is an entity or person that accesses NWAC's products and services through the NWAC website or through contact with the NWAC staff. There are two main categories of direct users:

- **Industry.** These are public and private entities that primarily use NWAC products and services to inform their operations, including government agencies such as WSDOT; the U.S. Forest Service; the National Park Service (NPS); the Washington State Parks and Recreation Commission; the National Weather Service (NWS); county search and rescue organizations; sheriff's departments; and private entities such as private weather companies, broadcast media outlets, academic researchers, ski areas, and ski schools.
- **Consumers.** These are ski area and backcountry recreationists such as skiers, snowboarders, hikers, snowshoers, snowmobilers, highway travelers, and climbing groups that primarily use NWAC products and services to inform their travel and recreation plans, and avoid adverse weather and safety conditions.

MEASURING THE DIRECT ECONOMIC BENEFITS OF NWAC

NWAC's services generate value for residents and visitors to Washington State in a wide variety of ways. While most of the benefits that are generated through NWAC's services are impossible to establish with certainty, a review of existing data suggests that **the value of NWAC services ranges from a low of more than \$7.5 million to a high of well over \$79 million annually**. These figures reflect the following categories of direct benefits:

- **Lives Saved.** By forecasting, tracking, and reporting weather conditions and avalanche risks in the Cascade and Olympic Mountains, NWAC saves lives. Based on historical avalanche fatality data, a conservative estimate would suggest that NWAC saves between two and nine lives in an average year. The issue of how one puts a dollar value on a life saved is tricky. Everyone agrees that lives have value. When faced with investments that save lives, however, a vague agreement that human lives have *some* value is quickly put to the test: How much should we be willing to invest to save a life? After considering the question from many different angles, economists at the U.S. Department of Transportation (U.S. DOT) suggest that investment decisions should be made using an assumption that the value of saving a life (the so-called value of a statistical life [VSL]) could range from a low of \$3.2 million to a high of \$8.4 million. Using the U.S. DOT's guidelines, the above estimate of lives saved translates to **annual benefits ranging from \$6.4 million to more than \$75 million**.
- **Increased Accessibility and Enjoyment for Backcountry Users.** A conservative estimate, based on research and analysis conducted for this report, suggests that between 220,000 and 417,000 recreational backcountry trips were made during the 2007-08 season in NWAC's Washington service area. Oregon's Mount Hood area, not included in those estimates but within NWAC's service area, also sees substantial backcountry activity (backcountry ski estimates alone would result in an addition 32,000 to 64,000 trips). For recreationists who made these trips, the enjoyment of the trips was greater due to the services of NWAC because (1) they knew where to find the best possible conditions, (2) they felt confident that they understood the nature of avalanche risks in general and the level of risk on a given day, and (3) they set out with the best possible information about expected weather conditions. While, again, it is not possible to know the precise value users derived from this knowledge and sense of well-being, one could plausibly assume a modest per-trip value of \$5 to \$10, based on existing spending and stated-value willingness-to-pay preferences. Given the vast number of backcountry trips, even these modest values translate to **annual economic benefits ranging from \$1.1 million to \$4.2 million in Washington**.

The figures cited above do *not* include a long list of other benefits that clearly redound from NWAC's services. These other benefits include:

- **Operations of WSDOT.** WSDOT Avalanche Technicians use the NWAC mountain weather forecast and NWAC instrumentation and phone consultation to assist in making informed decisions as to the necessity and timing of avalanche control missions. These missions are an integral part of keeping the passes open for traffic and freight movement, and for ensuring the safety of the traveling public.
- **Operations of Ski Areas.** The volume of ski area visits depends on current snow and weather conditions. Daily management choices regarding ski lift operations, avalanche control, and service-related staff both on and off the slope are influenced by NWAC data, forecasts, and consultations.

Washington State Parks and Recreation Commission
Benefit Assessment and Economic Impact Analysis for NWAC: *Executive Summary*

- **Operations of the U.S. Forest Service and National Park Service.** Both agencies use NWAC to help ensure the safety of their personnel and the public in the backcountry. Decisions regarding patrol area boundaries, trail work locations, road maintenance and closures, and the opening and closure of backcountry access points are affected by NWAC forecasts, data, and consultations.
- **Operations of Search and Rescue.** Current conditions data and forecasts inform where, when, and how search and rescue missions are planned and implemented to help ensure a quick response time and the safety of all involved. Well-informed travelers also result in fewer search and rescue missions being undertaken each year.
- **Operation of Local Governments' Road Clearing.** Using NWAC's RAWs data and forecasts, local governments can modify road clearing operations to adjust to real-time conditions throughout the backcountry.
- **Operations of the National Weather Service.** The accuracy and reliability of NWS mountain weather forecasts are increased significantly through use of the data provided by NWAC, as well as through direct consultation with NWAC staff.

Again, even conservative estimates of the value of NWAC's services suggest that these benefits far exceed the costs of the program. Current program costs fall at around \$340,000 per year; and with this investment, NWAC generates benefits that almost certainly have an annual value of more than \$7.5 million. In fact, a realistic range of benefits derived from NWAC services is likely to fall between \$20 million and \$79 million. Even if one uses the conservative \$7.5 million value, however, this translates to **a benefit/cost ratio of 22—an annual return-on-investment of more than two-thousand percent.**

ECONOMIC AND FISCAL IMPACTS — MEASURING NWAC'S EFFECT ON THE STATE ECONOMY

Beyond the economic benefits that NWAC generates by providing its services, NWAC also plays a role in influencing the level and pattern of commerce in Washington State.

Increased Revenue to Non-Urban Counties. By helping to support skiing, snowboarding, and backcountry snow and ice activities, NWAC supports industries that bring economic activity and increased revenue streams to non-urban parts of the state. In particular, cash-strapped rural counties derive significant fiscal benefits. It would be incorrect to say that NWAC's services are a lynchpin to the success of ski areas, or to the existence of snow and ice recreation in the backcountry. However, NWAC does play an important role in allowing these activities to thrive.

Across Washington State, ski areas generated gross business revenues of nearly \$76 million in 2007, supporting nearly 3,800 direct jobs in the state. From the perspective of state government, these activities generate \$4.3 million in retail sales tax, and more than \$300,000 in business and occupation taxes. Ski areas also generate substantial leasehold excise tax revenues.

From the perspective of local governments, economic activity at ski areas generated between \$700,000 and \$800,000 in sales tax dollars for local jurisdictions—with the majority of these dollars flowing to cash-strapped counties in the Cascade and Olympic regions.¹

¹ These figures assume average local sales taxes between 1.1% and 1.2%, reflecting base 1% sales taxes in most Washington counties and an additional 0.1% to 0.2% to fund criminal justice service/public safety

Washington State Parks and Recreation Commission
Benefit Assessment and Economic Impact Analysis for NWAC: *Executive Summary*

If one looks at the relationships between ski-area revenues and overall impacts to local economies, economic input/output models suggest that non-urban communities see multiplier effects equal to an additional 51 cents of economic activity for every \$1 of direct activity in ski areas. This reflects (1) ski-area purchases of services and supplies, and (2) the ripple effects of ski area employees and supplier employees spending their wages. These so-called multiplier effects suggest that roughly \$39 million of additional economic activity in non-urban areas was associated with ski-area activity in 2007. This activity supported more than 1,000 additional jobs, and generated yet more tax revenues for counties and other local jurisdictions.

In addition to the dollars that were spent directly *at* ski areas, millions of dollars were spent by skiers and other recreationists who made trips to the mountain backcountry. With roughly 220,000 to 417,000 trips, if trip-makers spent an average of \$10 to \$20 on goods and services outside the ski areas, these outside expenditures would equal an additional \$2.2 million to \$8.3 million. These expenditures and their associated multiplier effects generate additional tax revenues for counties and other local jurisdictions.

Overall, one can safely say that local expenditures on skiing, snowboarding, and backcountry snow and ice activities can be tied to more than \$1 million in tax revenues to non-urban communities in Washington State.

A Broader Perspective: State Competitiveness. From a state perspective, perhaps the most important impact of NWAC's services revolves around the program's effect on Washington's overall competitiveness. Wintertime accessibility to the Cascade and Olympic backcountry is an important piece of what makes Washington State a vital center of the knowledge-based economy. Every day, Washington State competes on a national stage to attract and retain industries, entrepreneurs, and high-skill workers that have the luxury of establishing themselves in any number of high-amenity locales across the country. One of Washington's greatest competitive advantages stems from the state's immense natural amenities and the ready access residents have to them. From a perspective of economic competitiveness, perhaps nothing the state can do is as important as protecting its natural gifts and facilitating access to the state's recreational opportunities.

AN ECONOMIC PERSPECTIVE ON FUNDING

Public vs. Private Goods

The characteristics of NWAC's goods and services can influence decisions regarding funding sources. When economists talk about goods and services, they often distinguish between public and private goods, based on two considerations:

- 1. Are they rivalrous in their consumption?** Does one person's consumption of the good diminish the value derived by another consumer?
- 2. Is consumption of the good excludable?** Is it possible or practical to exclude a group of potential users from consuming the good or service?

A pure private good is both rivalrous and excludable. Economic theory suggests pure private goods are most efficiently produced through private enterprise and distributed through the competitive

delivery. The level of criminal justice/public safety sales taxes vary by county, but typically range from 0.1% to as much as 0.4%.

marketplace. A pure public good, on the other hand, is neither rivalrous nor excludable. These goods and services are most efficiently provided by a government.

Application to NWAC Products and Services

One can argue that some of NWAC's services are private goods, and others are public. None of NWAC's services is rivalrous, but some services could be excludable. When determining the exclusivity of these products, we must consider not only *if* the product could be excludable, but also the broader public welfare implications of excluding users.

- **Excludable NWAC Product Example.** Perhaps the clearest example of an excludable service is the sharing of detailed, current-conditions data from RAWS locations. NWAC could technically restrict access to these data. If decision makers chose to pursue such an option, they might seek to generate revenues by offering RAWS data to premium service subscribers.

Another option for generating revenues might be to take an advertising approach, taking advantage of NWAC's millions of website page views each year to generate revenues through banner advertisements/sponsorships.

- **Non-Excludable NWAC Product Example.** In contrast to the RAWS data distribution, one might argue that NWAC avalanche and weather forecasts are non-excludable. While excluding users from receiving these services is possible from a *practical* perspective, the increased public risk associated with such an action would almost certainly make such an action unsupported. As a service that has the potential to save lives, and as a service that generates extraordinary levels of public benefits, it seems clear that the welfare maximizing stance should be to develop every possible avenue for disseminating NWAC's avalanche information. In other words, NWAC's avalanche risk information should be viewed as a public good.

WAY-FINDING

The remainder of this report provides more detailed discussion and analyses regarding the topics outlined above. In particular, the report includes discrete sections discussing economic benefits, economic impacts, and an economic perspective on funding.

Attachments to the report include Substitute Senate Bill 5219 (SSB 5219) and a list of stakeholders interviewed.

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1.0 INTRODUCTION

1.1 Context

The Washington State Parks and Recreation Commission contracted with Berk & Associates to conduct an economic assessment of the value the Northwest Weather and Avalanche Center (NWAC) provides Washington State and the state's constituent communities. This economic assessment is in response to funding challenges faced by NWAC and is part of a larger legislatively mandated project.

NWAC has a Fiscal Year (FY) 2008 projected budget of roughly \$340,000. Since its founding in 1975, NWAC has been run and administered by the U.S. Forest Service, primarily through the Mount Baker-Snoqualmie National Forest. It has been funded by a consortium of federal and state agencies, the ski industry, and a nonprofit Friends of the Avalanche Center association (FOAC). Given increasing costs, flat revenues, and continued fiscal pressures at the U.S. Forest Service, NWAC's funding and future is now uncertain.

Recognizing the importance of NWAC's services, in 2007 the Washington State Legislature directed the Washington State Parks and Recreation Commission to develop a plan to ensure NWAC has the resources to make it a sustainable program for years to come. According to Substitute Senate Bill 5219 (SSB 5219), the intent is to "develop an intergovernmental plan and recommendations that seek to ensure that the Northwest Weather and Avalanche Center program has the resources to continue operating at its current level of service into the future" (See **Attachment A**).

The purpose of this economic assessment is to address two fundamental issues:

1. **What is the value of NWAC's products and services? Given the current cost of \$340,000 to operate NWAC in a given year, what is the region's return on investment?** In economic terms, this assessment is often couched in terms of the ratio of benefits to costs, where any investment with a benefit/cost ratio greater than 1.0 can be considered a good investment.
2. **Acknowledging the above economic value, what *impacts* do NWAC's products and services have on the level and pattern of commerce in Washington State? In particular, what role do snow and ice activities have on the fiscal and economic health of non-urban communities around the Cascade and Olympic Mountains?**

By addressing these two issues, the overarching goal of the study is to inform discussions about how to achieve a sustainable business model for NWAC going forward.

A final piece of the puzzle revolves around potential methods for NWAC to generate revenues. While these opportunities and challenges are more directly addressed in NWAC's broader strategic plan, the discipline of economics does have some things to say about the nature of services and welfare-maximizing funding mechanisms. The final section of this report offers a brief overview of this economic perspective on funding.

1.2 Approach and Methodology

Given the two central issues that are on the table, this assessment presents analysis and findings following two distinct and discrete analytic frameworks:

- **A benefit/cost analysis** that examines the *value* of NWAC's services using the well-established frameworks of user-benefit assessment. This analysis examines a set of unambiguous benefits that direct and indirect users of NWAC's services derive. In this context, the term *benefit* is defined as the inherent *value* derived by users and is measured in terms of willingness-to-pay. Ultimately, the goal of such analyses is to determine how much users of NWAC's services value those services and to balance that value against the costs of providing those services.
- **A discussion of economic impacts** that examines the effects that NWAC's services have on patterns of commerce, focusing on snow-sports activities and industries, and examines the economic and fiscal impacts that these industries have on rural and small-town economies in the Cascade and Olympic regions of the state.

Approach to Benefit Assessment

Quantifying the value derived specifically from NWAC's service is challenging, given the nature of the benefits and availability of data and measurement tools. Luckily, in instances such as NWAC's services, it is possible to gather enough information about what we *do* know to answer the question at hand.

Consistent with established benefit/cost frameworks, this analysis is geared towards informing a decision:

Is it worth spending a few hundred thousand dollars to provide the services offered by NWAC?

Or put another way:

From a perspective of societal well-being, do the benefits generated exceed the costs of NWAC's operation?

The most efficient way to answer these questions is (1) to identify plausible ranges of outcomes, and (2) to estimate the value of those ranges to see how they compare with the cost of the investment.

Section 3.0 summarizes Berk & Associates' assessment of user benefits to examine whether funding NWAC should be considered prudent.

Approach to Economic and Fiscal Impact Assessment

In section 4.0, the report moves on to discussions of the role NWAC's services play on patterns of commerce, and in local governments' costs of services and their ability to generate tax revenues (respectively, NWAC's economic and fiscal impacts).

This assessment focuses (1) on the impact of snow and ice activities on local, rural, and small town economies, (2) on the impacts that the economic ramifications have on rural local governments' ability to generate revenue, and (3) on the ways in which NWAC's services directly affect the costs of local governmental services.

Methodology

To address the issues discussed above, Berk & Associates collected and synthesized information and data from a variety of sources and stakeholders.

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- **Stakeholder Interviews.** In consultation with the Washington State Parks and Recreation Commission, we identified a list of stakeholders to inform the description of NWAC, its products and services, and its users. Interviews were conducted by phone and in person with 13 stakeholders, including NWAC staff and representatives from major user groups around the state. NWAC staff provided detailed descriptions of NWAC's daily operations, major users, and products and services. Members of user groups provided information on operational impacts to their industry, as well as foreseeable impacts of operating without access to NWAC products and services. Stakeholders were also given the opportunity to review and comment on the draft report. For a list of stakeholders interviewed, see **Attachment B**.
- **Document Review.** To further inform our understanding of NWAC, its products and services, and the details of its operation, we reviewed a set of documents relevant to NWAC's operations. These documents included NWAC Annual Reports, a previous impact report written by former Colorado Avalanche Center Director Knox Williams, related economic impact studies, and articles and studies done about avalanche hazards, impacts, and mitigation throughout the United States.
- **Data Collection.** To measure the benefits and impacts of NWAC on the state and the public, we collected data regarding financial impacts and user benefits. Market information about NWAC's service area was obtained from the Department of Revenue, and NWAC revenue and expenditure information was obtained from NWAC's 2007-08 Annual Report. NWAC also provided data on avalanche fatalities over time and on visitor hits to its website. To inform the estimates of the number of people entering the backcountry, Berk & Associates received snowmobile license data from the Washington State Department of Licensing (DOL), Sno-Park permit data from the Washington State Parks and Recreation Commission, and Washington ski area visitation numbers from the Pacific Northwest Ski Areas Association (PNSAA). A user survey provided by FOAC showed which NWAC products and services were used most often, and how they were regularly accessed.

1.3 Overview of the Report

This report is comprised of the following sections:

- **Section 2.0** presents an overview of NWAC's organization and funding, describes in detail its products and services it offers, and identifies NWAC's direct users.
- **Section 3.0** measures the direct economic benefits accrued to NWAC users.
- **Section 4.0** identifies economic and fiscal impacts that result from NWAC's operations.
- **Section 5.0** applies an economic characterization of NWAC's services and products to inform future funding decisions.
- **Section 6.0** summarizes the key takeaways from this report.

2.0 OVERVIEW OF NWAC

Since its founding in 1975, NWAC has been charged with promoting safety by reducing the impact of adverse mountain weather and avalanches. NWAC carries out this charge through a staff of three GS-12 meteorologists, one of whom also acts as director. The NWAC staff works nine to ten months out of the year, using its expertise in the field and a system of telemetry sites, Remote Automated Weather Stations (RAWS), to create accurate and specific mountain and weather information for government, public, and private users throughout Washington and Northern Oregon. NWAC operates from mid-September to mid-June, and provides its complete range of services during the winter season, mid-November to mid-April.

NWAC's projected budget for federal FY 2008 is approximately \$340,000. The majority of the budget, about 90%, goes towards salary and benefits for its three employees, while the other 10% is spent on operations. Operational expenses include equipment, travel, and communications.

The costs to run NWAC are currently shared by the state and federal governments, with contributions from private supporters. NWAC's highest expected funding sources for FY 2008 are the U.S. Forest Service (\$75,000), the National Park Service (NPS) (\$17,000), the Washington State Parks and Recreation Commission (\$89,000), the Washington State Department of Transportation (WSDOT) (\$45,000), the Washington State Supplemental Budget (\$58,000), Ski Washington (\$20,000), and the PNSAA (\$5,000). Sizable, private donations are also expected to come from individual ski area operators in Washington and Oregon.

NWAC has traditionally been run by the U.S. Forest Service at Mt. Baker-Snoqualmie National Forest. Due to budget constraints, its continued administration and level of support past FY 2008 has been uncertain. The Washington State Parks and Recreation Commission, charged by the State Legislature, is in the process of identifying a sustainable business model, a model in which the U.S. Forest Service will likely continue to play a significant role.

2.1 NWAC Products and Services

NWAC promotes public safety by providing a selection of products and services through media outlets, online, by phone, and in person. These services include information and resources that inform its users' decisions about recreation and business operations. Users say NWAC provides these services in specific areas and at a level of detail that are not available in products from the National Weather Service (NWS) or NorthWest Weathernet, two other entities that operate in the region.

A common way for users to access NWAC services is through the NWAC website. The website received over 414,000 unique visitors, or an average of almost 13,000 visitors per week in the 2006-07 season.

NWAC's five key services are:

- **Mountain Weather Forecasts.** NWAC provides very detailed and area-specific forecasts of weather conditions in the mountains. Through interviews with consumers of NWAC's weather forecasts, Berk & Associates has found virtually unanimous agreement that NWAC's forecasts provide, by far, the most accurate picture of coming weather conditions in the Cascade and Olympic Mountains. Its weather forecasts include a general weather discussion, specific weather forecasts for the next 48 hours, and a three to five day outlook. The forecasts go into such details as expected cloud cover, precipitation levels, freezing and snow levels, and wind

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speeds. Forecasts are released on the website and as hard copies starting each morning during the season at 7 am.

These forecasts are supplied at no charge, and are used by the general public for trip planning purposes and to avoid dangers from adverse weather. They also provide user groups that operate in the mountains with useful data for guiding those operations. NWAC creates these weather forecasts using personal observations, quantitative forecast models, and its extensive RAWS network. They are more location-specific than the broad forecasts released by the NWS or NorthWest Weather.net.

These forecasts were accessed on the website about 665,000 times, or an average of over 20,700 per week in the 2006-07 season, according to NWAC website usage data.

- **Avalanche Forecasts.** NWAC provides information about avalanche conditions and releases avalanche warnings when avalanche danger reaches High or Extreme. Its avalanche information is released on the website, a phone hotline, and by hard copy each morning during the season at 9 am. The avalanche forecasts include snowpack information, analysis of and reasons for snowpack structure, two to three day forecasts of expected changes in snow stability, and avalanche danger ratings according to the U.S. Avalanche Danger Scale.

An avalanche warning is posted whenever the avalanche danger is expected to reach High or Extreme over a significant portion of the forecast area. These warnings are distributed via the NWS's National Oceanic and Atmospheric Association (NOAA) Weatherwire dissemination network, radio, TV, and newspaper.

- **Collection and Distribution of Current Conditions Data from RAWS.** NWAC is responsible for operating and maintaining its network of RAWS sites throughout Washington and Northern Oregon. These sites are important not only to NWAC's creation of mountain weather information, but are also used by WSDOT and NWS, as well as university researchers at the University of Washington and the University of Utah, which uses RAWS data on its widely viewed Mesowest Data Network website.

NWAC uses its network of RAWS sites to maintain hourly weather conditions on its website for 42 locations throughout Washington and Northern Oregon. These data include the past 24 hourly readings of temperature, wind speed, wind direction, precipitation, snow fall, and snow levels. They are archived for ten days.

This information was accessed on the website via roughly 2.7 million page-views in the 2006-07 season, or an average of 86,000 page-views per week.

- **Phone Consultations.** NWAC provides personal phone consultations to WSDOT, ski-area personnel, the media, and other cooperating agencies. These phone calls are provided for planning purposes and include timely and accurate forecasts and discussion of any data and forecasts that NWAC creates. They speak to agencies and ski areas two to four times per day, depending on conditions and weather events. This creates an active line of communication that promotes information trading.
- **Educational Services.** NWAC provides both active and passive educational resources to recreationists, industry, and its primary cooperators. Each year, the NWAC staff presents about 30 one to two hour avalanche awareness talks to a variety of different groups, including mountaineering groups, skiers, and climbers. In the 2007-08 season, 1,362 people attended

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a session conducted by either NWAC staff or FOAC volunteers. NWAC gives its primary cooperators, which includes NPS and the U.S. Forest Service, more detailed trainings five to ten times per year.

NWAC also provides an educational section on its website that includes such information as an explanation of the U.S. Avalanche Danger Scale, common themes in avalanche accidents, links to other avalanche education and safety resources online, and statistical information. Over the years, NWAC's educational resources have directly or indirectly informed tens of thousands of backcountry users.

2.2 NWAC Users

Direct Users

A direct user is an entity or person that accesses NWAC's products and services through the NWAC website or through contact with NWAC staff. There are two main categories of direct users:

- **Industry.** These are public and private entities that primarily use NWAC products and services to inform their operations. These include government agencies such as WSDOT, the U.S. Forest Service, NWS, NPS, Washington State Parks and Recreation Commission, search and rescue organizations, and sheriff's departments, along with private entities such as private weather companies, ski areas, and ski schools.
- **Consumers.** These are ski area and backcountry recreationists such as skiers, snowboarders, hikers, snowshoers, snowmobilers, highway travelers, and climbing groups. They primarily use NWAC products and services to inform their travel and recreation plans, and avoid adverse weather and safety conditions. The most commonly accessed NWAC products, according to a survey of NWAC users, are weather forecasts, avalanche forecasts, and RAWs data.

Strategic Alliances

NWAC has recently established more formal linkages with the U.S. Forest Service's Fire Weather program. The two counter-seasonal programs create synergies for reduced overhead and other cost savings, as well as year-round employment opportunities for professional meteorologists.

Disseminators and Indirect Users

There are also indirect users who access NWAC data through a number of other actors that disseminate data generated by NWAC to a broader audience. These disseminators include: NPS, the U.S. Forest Service, NWS, ski areas, private weather companies, media outlets (TV, radio, internet), academic researchers, and other intermediaries that may be aggregating weather/backcountry data (especially on the internet). These are not defined as users for the purposes of this report because of the limited marginal value they derive from NWAC information.

3.0 MEASURING THE DIRECT ECONOMIC BENEFITS OF NWAC

NWAC's services generate value for residents and visitors to Washington State in a wide variety of ways. There are, however, a handful of key direct benefits:

- **NWAC saves lives** by forecasting, tracking, and reporting weather conditions and avalanche risks in the Cascade and Olympic Mountains.
- **NWAC makes the Cascade and Olympic Mountain backcountry more accessible and more enjoyable** by offering information and education to backcountry users.
- **NWAC improves the efficiency of enterprises that operate in the mountains** by developing and sharing mountain weather and avalanche forecasts and real-time conditions data that are unequalled in their accuracy. These enterprises include WSDOT, ski areas, counties and cities that clear and maintain roads, search and rescue operations, and U.S. Forest Service and NPS staff who work in the backcountry during winter months.

All of the benefits highlighted above are real, tangible, and of clear value. However, due to the nature of each, it is very difficult to assign a precise value to them with a high degree of certainty. What we *do* know appears to be more than sufficient to answer our key questions:

1. *Is the funding of NWAC a good investment?*
2. *Does the value of NWAC's services exceed the program's cost?*

The answer to both of these questions is: yes. Even implausibly conservative estimates of the value of NWAC's services suggest that these benefits far exceed the costs of the program by a margin of at least 22:1. Current program costs fall at around \$340,000 per year; and with this investment, NWAC generates benefits that almost certainly have an annual value of more than \$7.5 million. In fact, given the nature of the services provided, one could comfortably argue that the value of NWAC's services ranges from a low of more than \$20 million to a high of well over \$79 million each year.

These figures reflect the following categories of benefits:

- **Lives Saved:** Avalanches continue to remain a real threat. In 2007-08, nine lives were lost in Washington from avalanches. Historical data on avalanche deaths in the U.S. and the Pacific Northwest suggest that it would be plausible to estimate that NWAC's services save between six and nine lives in an average year. If one wanted to generate an extraordinarily conservative estimate, one might expand the estimated range to between two and nine lives saved.

The issue of how one puts a dollar on a life saved is complex. The U.S. Department of Transportation (U.S. DOT) suggests that investment decisions should be made using an assumption that the value of a statistical life ranges from a low of \$3.2 million to a high of \$8.4 million. Using this guidance, the above estimate of lives saved translates to **annual benefits ranging from \$6.4 million to more than \$75 million.**

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- **Increased Accessibility and Enjoyment for Backcountry Users:** A conservative estimate suggests that between 220,000 and 417,000 recreational backcountry trips were made during the 2007-08 season in the NWAC service area in Washington. (Oregon's Mount Hood area, not included in those estimates but within NWAC's service area, also sees substantial backcountry activity [backcountry ski estimates alone would increase the above figures for annual trips by 15%]). For recreationists who made these trips, the enjoyment of the trips was greater due to the services of NWAC. The users were able to:
 - Know where to find the best possible conditions thanks to NWAC's RAWs data;
 - Venture into the backcountry with the confidence that they understand the nature of avalanche risks in general, and knowledge of the degree of risk on a given day; and
 - Set out with the best possible information about what weather conditions they could expect in the hours and days ahead.

While it is not possible to know the precise value users derived from this knowledge and sense of well-being, one would probably be safe in assuming a modest per-trip value of \$5 to \$10.

Given the vast number of backcountry trips, even these modest values translate to economic **annual benefits ranging from \$1.1 million to \$4.2 million.**

The figures cited above do *not* include a long list of other benefits that clearly redound from NWAC's services. These other benefits include:

- **Operations of WSDOT.** WSDOT Avalanche Technicians use the NWAC mountain weather forecast and NWAC instrumentation and phone consultation to assist in making informed decisions as to the necessity and timing of avalanche control missions. These missions are an integral part of keeping the passes open for traffic and freight movement, and for ensuring the safety of the traveling public.
- **Operations of Ski Areas.** The volume of ski area visits depends on current snow and weather conditions. Daily management choices regarding ski lift operations, avalanche control, and service-related staff both on and off the slope are influenced by NWAC data, forecasts, and consultations.
- **Operations of the U.S. Forest Service and National Park Service.** Both agencies use NWAC to help ensure the safety of their personnel and the public in backcountry. Decisions regarding patrol area boundaries, trail work locations, road maintenance and closures, and the opening and closure of backcountry access points are affected by NWAC forecasts, data, and consultations.
- **Operations of Search and Rescue.** Current conditions data and forecasts inform where, when, and how search and rescue missions are planned and implemented to help ensure a quick response time and the safety of all involved. Well-informed travelers also result in fewer search and rescue missions being undertaken each year.
- **Operation of Local Governments' Road Clearing.** Using NWAC's RAWs data and forecasts, local governments can modify road clearing operations to adjust to real-time conditions throughout the backcountry.
- **Operations of the National Weather Service.** The accuracy and reliability of NWS mountain weather forecasts are increased significantly through use of the data provided by NWAC, as well as through direct consultation with NWAC staff.

The following discussion provides detailed data and analysis to inform the findings presented above.

3.1 Foundation to Benefit Analysis: Estimating Backcountry Recreation Trips

Backcountry recreationists derive significant benefits from NWAC services. A cornerstone of the benefit analysis which follows is an understanding of the scope of such recreation activity. In particular, we are interested in estimating the number of backcountry trips which occur annually within NWAC's Washington State service area.

It is challenging to estimate the number of trips taken in the backcountry per season because of data limitations. To estimate a range of backcountry trips taken by recreationists, we employed a multi-tiered approach. First, to get a high-level overview of snow and ice recreational activity by Washington residents, we present results of the Recreation and Conservation Office's (RCO) 2006 Outdoor Recreation Survey. Second, to estimate more specific backcountry usage by snowmobilers, skiers, snowshoers, hikers, and others within the NWAC service area, we analyze snowmobile licensing data from the DOL, Sno-Park permit data from the Washington State Parks and Recreation Commission, and annual ski visitation numbers from PNSAA. Third, in addition to estimating the current number of users, we outline the exponentially increasing trend in backcountry trips through summaries of historical data and descriptions of anecdotal reports from stakeholders.

Survey of Snow and Ice Activity in Washington State. In an average month in 2006, approximately 17.5% of Washington residents participated in snow and ice activity such as snowshoeing, sledding/inner tubing/other snow play, snowboarding, skiing, snowmobiling, ATV riding, and ice skating, according to the RCO (*2006 Outdoor Recreation Survey: Final Report*, 2007). The Survey Report estimated annual frequencies for each snow and ice activity, based on survey questions asking if a respondent participated in the activity in the past 30 days. These frequencies can be seen in **Exhibit 1**.

**Exhibit 1
Estimated Annual Frequency of Snow/Ice Activity
by Washington Residents, 2006**

Activity	Estimated Annual Frequency	
	N	95% C.I. (+/-) *
Snowshoeing	133,080	72,189
Sledding, inner tubing, other snow play	1,209,028	272,209
Snowboarding	435,061	223,547
Skiing	904,529	302,236
Snowmobiling	183,997	104,763
ATV riding	884,970	516,666
Ice skating	418,258	190,477

Source: Washington State Recreation and Conservation Office, 2007.

* Note: The 2006 Outdoor Recreation Survey reports the 95% confidence interval, which is included in column three.

In addition, lower bounds of the number and percentage of Washington residents participating in snow/ice activities were estimated in the Survey Report based on peak month data. Approximately 14.1% of Washington's population (or roughly at least 886,129 people) participated in skiing; a small number of these skiers (at least 192,319 people) engaged in cross-country or back-country skiing.

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Approximately 3.7% of the population (at least 230,916 people), participated in snowshoeing; 4.8% (at least 301,876 residents) snowmobile.

Estimates of Backcountry Trips. To estimate backcountry usage within the NWAC service area in Washington, we assumed that recreationists accessed the backcountry through three major gateways: (1) Sno-Parks, (2) ski facilities, and (3) informal entries. No proxies were used to estimate informal entries. Using the data and methodology described below, the estimated number of annual trips to the Washington backcountry serviced by NWAC for 2007-08 season ranges between 221,500 and 416,900.

**Exhibit 2
Estimated Number of Trips in NWAC's Washington Service Area,
2007-08**

WA Backcountry Trip Estimates		
Measure	Low	High
Snowmobile Licenses	86,900	173,800
Sno-Park Winter Permits	86,500	146,800
Ski Areas	48,200	96,300
Total *	221,500	416,900

Low = 3 trips per season permit & snowmobile; 2.5% backcountry skiers from ski areas High = 6 trips per season permit & snowmobile; 5% backcountry skiers from ski areas

Source: Washington Department of Licensing, 2008; Washington State Parks and Recreation Commission, 2008; PNSAA, 2008; Berk & Associates, 2008

* Note: Total does not equal the sum of the three measures, due to rounding.

- Washington State Sno-Parks provide cleared parking areas for winter recreationists in close proximity to groomed and/or backcountry trails. There are snowmobile and non-motorized Sno-Parks, of which approximately 79% are located within NWAC's service area. To estimate annual visits, Berk & Associates used two data sources: (1) Snowmobile registrations from the DOL, and (2) Sno-Park permit sales from the Washington State Parks and Recreation Commission. A snowmobile license is valid for a season and also comes with access to Sno-Parks. One-day and seasonal Sno-Park permits were used to estimate the number of non-motorized trips.

Most recreationists do not go into the backcountry alone. To account for this in our estimates, we assumed that two trips resulted from every one Sno-Park winter permit (one-day and seasonal). Or, put another way, two people traveled in each vehicle with a Sno-Park winter permit. With snowmobile registrations, however, we did not include an additional factor to account for group visits because the unit of measure is the snowmobile, not the parked vehicle.

The number of trips per snowmobile license and season pass was varied, from a low of three trips per season (which is the breakeven point between purchasing individual one-day passes at \$10 and a season pass at \$30) to a high of six trips per season, to obtain the range of total backcountry trips presented.

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- In the 2007-08 winter season, the PNSAA reports that there were approximately 1.9 million ski area visits to the 10 ski areas within NWAC's Washington service area.² According to ski area operators, the percentage of those ski visits that result in backcountry visits is small, estimated at less than 5%. For the purposes of this analysis, we estimated that the share of backcountry visits ranged from 2.5% at the low end to 5% at the high end. This range should be seen as conservative, especially given the growing number of "side country" skiers, who pass through ski area boundary gates and access the backcountry before returning to the ski area lift. This trend of "lift-accessed backcountry" has become a recent focus in avalanche education efforts.

It is important to note that the focus of this report is to develop an assessment of the benefits that NWAC's services generate in Washington State. Backcountry trips in Oregon's Mount Hood area, which is in NWAC's service area, are not included in this analysis. Clearly, however, many Washington residents from the Vancouver area do much of their winter recreation in and around the Mount Hood area—an area that directly benefits from NWAC's services and an area that supports substantial backcountry activity. Based on PNSAA reports, there were approximately 1.3 million ski area visits within the Mount Hood National Forest area in the 2007-08 season. Again assuming that between 2.5% and 5% of ski area visits result in backcountry visits, Mount Hood area ski visits alone would account for an additional 32,200 to 64,400 annual backcountry visits in the NWAC service area. These Oregon ski visits would increase the total backcountry visits by approximately 15%. Therefore, the range presented above is a very conservative estimate of the number of backcountry trips within NWAC's entire service area.

Increasing Trend of Backcountry Usage. The popularity of winter backcountry recreation has increased over the past several decades. Washington State user data, along with anecdotal evidence, industry trends and articles all support a picture of overall increasing use of the backcountry. For example, snowmobile registrations totaled 3,735 in 1971. In the 2001-02 season, Washington reached a record high of 38,241 registrations, a percent change of over 900%. In the 2007-08 season, registrations equaled 29,391, a percent change from 1971 of 687%. Ski area visits in Washington State increased approximately 21% between the 1998-99 and 2007-08 winter seasons. Lastly, Sno-Park permits sold increased 37% between 2002-03 and 2007-08.

3.2 NWAC Saves Lives

By forecasting and tracking weather conditions and avalanche risk in the Cascade Mountains, and by educating those who frequent the high backcountry, NWAC helps to decrease the number of users who are killed and injured by avalanches. Public safety and, specifically, the reduction of avalanche accidents are at the core of NWAC's mission.

Avalanche Fatalities over Time

In the 2007-08, there were 36 avalanche deaths recorded outside of Washington State in the U.S. There were nine deaths in Washington, the highest annual total, according to state data that dates back to 1985-86. The average annual number of deaths, however, equals approximately two per year in Washington between 1985-86 and 2007-08. Excluding last year's unusually high number of deaths, the average drops to 1.6 deaths a year.

² Crystal, Hurricane Ridge, Leavenworth, Loup Loup, Mission Ridge, Mount Baker, North Cascade (helicopter), Stevens Pass, The Summit at Snoqualmie, White Pass

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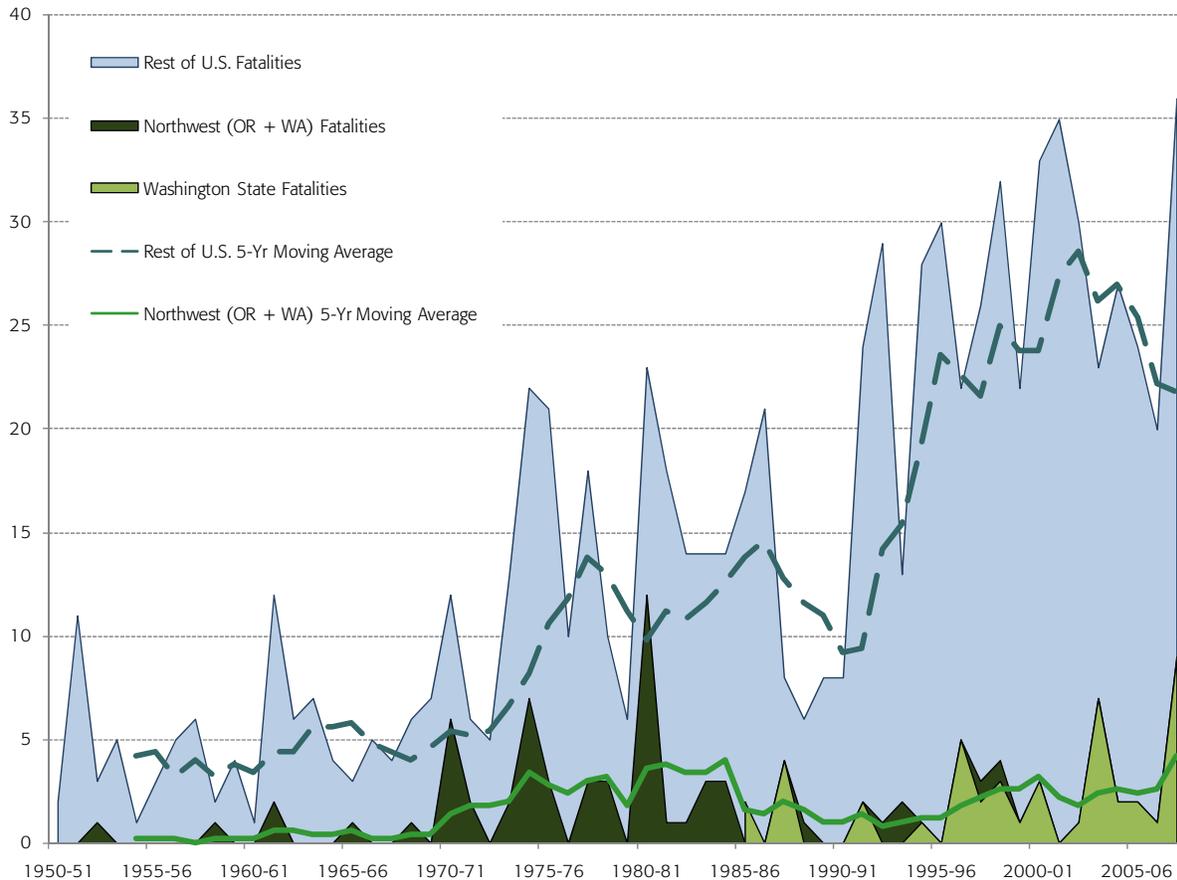
Exhibit 3 presents the number of avalanche deaths over time for Washington, the Northwest (Washington and Oregon), and the remainder of the U.S. Not surprisingly there is significant fluctuation from year-to-year. The U.S. five-year moving average trend line indicates an increasing number of avalanche fatalities over time. The Northwest five-year moving average does not, however, show a similar increasing trend. After an increase in fatalities after 1970, the five-year Northwest average fluctuates between 0.4 and 4.2 fatalities per year.

After examining the data in **Exhibit 3**, one could make a strong argument that NWAC's forecasting and education services might result in saving as many as 6 to 9 lives each year.

In the years from 1950 to 1975, the moving average of deaths in the Northwest (Washington and Oregon) tended to parallel the moving average for the remainder of the nation. After 1975 (the time of NWAC's founding), however, the two moving averages diverged sharply. In 1975, the moving average of annual deaths for the remainder of the nation stood at about 8, while the moving average for the Northwest stood at about 3. Since 1975, deaths in the remainder of the nation increased between three- and four-fold, while deaths in the Northwest have remained virtually unchanged (at a time where the Northwest states' share of the nation's total population increased by more than 40%).

If the relationship between deaths in the Northwest and deaths in the remainder of the nation had remained constant, one would have expected to see a three- or four-fold increase in Northwest deaths, putting the Northwest's moving average between 9 and 12 deaths per year.

Exhibit 3
Number of Annual Avalanche Deaths in U.S., Northwest, and Washington,
1950/51-2007/08



Source: NWAC, 2008 and Berk & Associates, 2008

Note: Data regarding avalanche deaths for only Washington State was not available prior to the 1985-86 winter season. Prior to then, deaths were recorded with Oregon for the "Northwest" region.

Clearly, there have been numerous technical advances over the years that have almost certainly led to increased avalanche safety. Most of these advances, however, have been shared by all regions of the country. Beyond the creation of NWAC, it is difficult to identify why avalanche deaths in the Northwest have not increased during a period when participation in snow and ice activities has skyrocketed.

Quantifying the Benefits: Value of a Statistical Life

Today, with the benefit of NWAC services, avalanches have taken, on average, two lives per year since 1985. By disseminating information regarding avalanche risk, NWAC enables individual recreationists and operators to make better choices about when and where to go in the backcountry. Stakeholders interviewed expressed a conviction that such information does, in fact, alter individual behavior.

To quantify the benefits of reductions in mortality risks (i.e. to estimate how much society should invest to reduce the risk of death), economists employ a measure referred to as the *value of a statistical life* (VSL). Specifically, VSL measures a stated or revealed marginal value for a small change

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in risk, standardized for a risk change of 1.0. After considering the question from many different angles, economists at U.S. DOT suggest that investment decisions should be made using an assumption that the value of saving a life (the so-called value of a statistical life [VSL]) could range from a low of \$3.2 million to a high of \$8.4 million.

Employing very conservative estimates of the number of lives saved yields a significant amount of benefit. For example, if one assumes that NWAC's information and avalanche warning system prevents only two deaths per year, the economic benefit derived equals between \$6.4 million and \$16.8 million. **Exhibit 4** presents three number-of-lives-saved scenarios (referencing the plausible range of six to nine lives saved discussed above and examining a highly conservative assumption that only two lives are saved) and their corresponding economic value, using U.S. DOT's recommended VSL range. **These estimates translate into economic benefits ranging from a very conservative \$6.4 million to more than \$75 million derived from NWAC services.**

**Exhibit 4
Range of Estimated Benefits from Lives Saved**

Lives Saved per Year	Value of a Statistical Life (VSL)		
	\$3.2 M	\$5.8 M	\$8.4 M
2	\$6.4 M	\$11.6 M	\$16.8 M
6	\$19.2 M	\$34.8 M	\$50.4 M
9	\$28.8 M	\$52.2 M	\$75.6 M

Source: U.S. Department of Transportation, 2008 and Berk & Associates, 2008

3.3 NWAC Makes the Cascade and Olympic Mountain Backcountry More Accessible and More Enjoyable

By offering education about avalanche risks and by offering reliable information about current and expected mountain weather and avalanche conditions, tens of thousands of snowmobilers, skiers, snowboarders, snowshoers, and cross-country skiers make thousands of visits to the Cascade and Olympic backcountry each year armed with knowledge and timely information. This knowledge and information allows them to derive greater enjoyment from their trip. By tapping NWAC resources:

- Users know where to find the best conditions;
- Users can venture into the backcountry with the confidence that they understand the nature of avalanche risks in general, and they know the degree of risk on the given day; and
- Users can set out with the best possible knowledge about what weather conditions they can expect in the hours and days ahead.

This combination of knowledge and accurate information (1) allows users to seek out the most enjoyable conditions, and (2) offers users a real and valuable sense of well-being—a sense of well-being that allows them to more fully enjoy the trips they make, and leads them to make more trips to the backcountry in a given year.

Estimating Value to Users (Willingness-to-Pay)

Recreation, in general, has many intrinsic physical, mental, and social benefits, as a significant body of research has established. Quantifiable benefits derived include: increased life spans, improved health, decreased risk of certain diseases (such as coronary heart disease, stroke, diabetes, and some cancers), and improved mental health and overall quality of life. These benefits have broader impacts

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on healthcare systems and worker productivity. Outdoor recreation can also create a general sense of well-being and a greater connection and concern for the environment. Anyone can observe the capitalized value of these benefits by observing increases in property values in locations adjacent to recreation areas and open space.

One can assert with certainty that those who use NWAC's services place some value on those services and, if the truth were known and if a toll-collecting system were feasible, each user would be willing to pay *something* in return for these services. In fact, some users would probably be willing to pay a great deal for the full slate of NWAC's services, and at the other end of the spectrum, a few users would be willing to pay only a very small amount.

A few doorways exist that offer a glimpse of what such a willingness-to-pay might be. These include:

1. A direct survey of NWAC data users;
2. Consideration of the expenditures back-country recreationists *do* make; and
3. Other estimates of willingness-to-pay for enhanced recreational opportunities.

The three means listed above provide a context from which one can create plausible estimates of the marginal benefit derived from NWAC's services.

NWAC User Survey

The most direct way to measure willingness-to-pay is through a stated preference model, in which a surveyor asks users what they would be willing to pay for a given service. While no such stated preference survey has been conducted in regard to NWAC's full slate of services, a survey *was* recently completed in which users of NWAC's services were asked a related question. When asked, more than 70% of survey participants volunteered that they would be willing to pay some amount "...for more in-depth information or more enhanced web-site features..." from NWAC. A bit more than half of these participants reported that they would be willing to pay between \$10 and \$20 for enhanced features, while the remainder reported a greater willingness to pay (ranging from \$25 to more than \$100 per year).

This information does not offer direct information on how much value users derive from NWAC's full slate of services, but it does offer a glimpse of the magnitude of potential benefits.

Existing Spending

Another glimpse is offered by examining recreationists' actual spending. Recreationists reveal to some degree how they value backcountry trips by their spending choices along the way. For example, suppose a backcountry skier chooses to wake up early on Saturday and drive to the Sno-Park. Through these actions, the skier reveals that the value derived from skiing in the backcountry is greater than the cost of equipment (skis, boots, poles, warm clothing), the gasoline used in the drive, and the sleep lost. There are a number of other expenses that may have been paid during the trip, such as stopping for food or drinks during the trip. The key question, here, is: Beyond the expenditures that the skier *did* make, how much additional value did the person in question derive from the trip?

One can usually get a sense of the order-of-magnitude of the additional value by tracking the scale of expenditures that the users *did* make. If a recreationist spends substantial sums (hundreds, or even thousands of dollars) each year on gear and other expenditures, it is a safe bet that, on average, the "excess" value derived by the average user is substantial as well.

Stated Value of Recreation Activities

A database of more than 700 surveys conducted across the U.S. between 1967 and 1998 reveals that the national average stated value derived from outdoor recreational activities³ ranged from \$19.95 to \$92.46 per visit (adjusted to 2007 dollars). In particular, the national averages for winter (and often backcountry) activities included the following: downhill skiing equaled a value of \$36.89; cross country skiing equaled \$34.56; and snowmobiling equaled \$92.46, the highest in the range.

Quantifying Benefits: Economic Value of NWAC Services per Backcountry Trip in Washington State

From willingness-to-pay estimates, it is apparent that backcountry trips are highly valued by recreationists. While it is not possible to determine *exactly* how much of this total value is derived as a result of NWAC's information and education services, survey responses and existing spending habits suggest that the willingness to pay is not insignificant. Moreover, given the high number of backcountry trips estimated earlier in this section (between 220,000 and 417,000 in the 2007-08 winter season in Washington), even a small dollar value per trip generates a significant benefit. Taking into account the NWAC User Survey, existing spending, and other estimates of willingness-to-pay for outdoor recreation, we believe that a range of benefits between \$5 and \$10 derived directly from NWAC services per trip represents a plausible and conservative estimate. Using this average of \$5 to \$10 of marginal benefit derived from NWAC services per trip **results in an annual benefit between \$1.1 and \$4.2 million.**

3.4 NWAC Improves the Efficiency of Enterprises that Operate in the Mountains

By developing and sharing mountain weather forecasts that are unequalled in their accuracy, and by collecting and disseminating data on real-time conditions at sites throughout the Cascade and Olympic Mountains, NWAC enhances the ability of operators in the mountains to do what they need to do. These operators include ski areas, WSDOT, the U.S. Forest Service, NPS, and jurisdictions that perform search and rescue operations.

Benefits that are enjoyed by these operators have the potential to accrue (1) to the operators themselves (i.e. they are able to use accurate weather and avalanche condition information to make best use of their individual resources), and (2) to consumers of their services.

The following entities ("operators") have been identified as direct users of NWAC products and services. They use the mountain weather and avalanche information they receive to inform daily operating decisions, manage crisis situations, and keep employees and backcountry recreationists safe.

Ski Areas. Ski areas use the information they receive from NWAC each day to inform management decisions that have financial implications for the ski area. At the most basic level, they use NWAC's weather forecasts to anticipate the number of visitors their ski area will receive the next day. This estimate has impacts on setting up service levels with regards to food, rentals, and other volume-

³ Recreation activities included: camping, picnicking, swimming, sightseeing, off-road driving, motor boating, float boating, hiking/backpacking, biking, downhill skiing, cross country skiing, snowmobiling, big game hunting, small game hunting, waterfowl hunting, fishing, wildlife viewing, horseback riding, rock climbing, general recreation, others, and wilderness recreation.

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dependent staffing decisions. They can also use NWAC's data to help influence the number of visitors they receive by sending out email alerts to subscribers about upcoming "excellent powder days."

Numerous departments within a ski facility use NWAC data and forecasts: lift operations and maintenance, snow safety, avalanche control, parking, and grooming. NWAC's wind forecasts are a component in determining what lifts can be run, down to specific times of the day. The ski areas stay in contact with NWAC by phone throughout the day and can make decisions about closing or reopening lifts in real time.

Snow safety and avalanche control departments use NWAC's forecasts and snowpack data to decide whether or not to set up avalanche crews for the next day, or to complete avalanche control, grooming measures, or parking lot clearing before opening. The forecasts tell them what time to start, how many people to have, and how much work they will have to do.

The ski areas interviewed said they talked to NWAC staff about two to four times per day during the season, and the active, working relationship they had allowed them to make important decisions on the most up-to-date mountain weather and avalanche information possible. This continual contact was cited as especially critical during times of crisis management and storm cycles.

U.S. Forest Service. The U.S. Forest Service is a user and a disseminator of NWAC information. U.S. Forest Service employees use NWAC to inform their daily operations and to educate the public. They receive NWAC's daily weather and avalanche forecasts and from these forecasts make several decisions including: the boundaries of the day's patrol areas, what areas they can access by snowmobile, where they can do trail work, which trails to groom, and whether or not it is safe to lead climbing groups or snowshoe walks that day. Instructors of these walks also use NWAC materials to teach their students how to read and understand avalanche forecasts and other basic backcountry skills.

The U.S. Forest Service disseminates NWAC information through postings at backcountry access points, as appropriate. They make their decisions about where to inform the public, such as which ski areas or Sno-Parks to go to, based on NWAC's location-specific forecasts.

Washington State Department of Transportation. WSDOT Avalanche Technicians use the NWAC mountain weather forecasts and NWAC instrumentation and phone consultation to assist in making informed decisions as to the necessity and timing of avalanche control missions. NWAC's hourly weather updates from its many telemetry stations can alert WSDOT to storms moving into range. WSDOT also uses forecast details, such as hourly precipitation and water equivalency forecasts, to create in-house avalanche forecasts for specific areas of interest. Having such detailed information at multiple elevation levels allows WSDOT to set up staff and equipment in advance to mitigate impacts, such as road closures and structural damage. During winter months when inclement weather and avalanches create frequent road hazards, WSDOT personnel call and consult with NWAC staff two to four times per day.

WSDOT operates substantial resources to actively manage and maintain highways on mountain passes. Data, forecasts, and real-time, daily communication provided by NWAC should be viewed as parts of a system. Clearly, however, given that NWAC provides the most accurate forecasts, and the real-time RAWs data it provides, the services provided by NWAC contribute to WSDOT's successful operation of the highway passes.

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To get a sense of the importance of this task, one need only consider the costs associated with closure of Snoqualmie Pass for a handful of hours due to avalanches.

According to WSDOT's *2007 Annual Traffic Report*, the daily average traffic volume at Snoqualmie Pass⁴ in 2006 and 2007 equaled 33,000 vehicles, 21% of which are trucks. This is equal to an average of 1,375 vehicles per hour (289 trucks and 1,086 passenger vehicles). In 2007, on average, a two-hour closure of Snoqualmie Pass due to avalanches translated to 2,750 vehicle hours of delay, which in turn translates to more than \$62,000 in travel time losses to highway users.⁵

In addition to the direct costs of the pass closures, there are significant ripple effects to local economies and private enterprises dependent on those passes for access to consumers. For example, several ski area operators filed business interruption claims due to the Snoqualmie Pass closures between January and February 2008.

Search and Rescue Organizations. NWAC forecasts help backcountry recreationists be more well-informed, allowing them to choose to postpone trips or change destinations due to anticipated adverse weather or avalanche conditions. This reduces the overall number of search and rescue missions that need to be undertaken each year. Current conditions data and forecasts inform where, when, and how search and rescue missions are planned and implemented. This knowledge reduces the cost of search and rescue missions, as well as reduces the danger to search and rescue members.

Other Direct Industry Users. Other entities that fall into the direct industry user category include local roads maintenance operations, sheriff's departments, NPS, NWS, Washington State Parks and Recreation Commission, and private ski schools. NPS uses forecasts to help plan for road maintenance and closures during significant storm activity and high avalanche danger situations, NWS uses RAWS data and NWAC consultations to create reliable and accurate weather watches, and all entities that operate in the backcountry have a need to understand the nature of avalanche risks and a need to know current weather conditions and current levels of avalanche risks in order to inform their decisions. Having accurate, current mountain weather and avalanche information from NWAC allows these users to know when, where, and how they can operate safely and efficiently in the backcountry.

⁴ Average daily volume for State Route 90, Milepost 33.56, Location at ADC Location R039.

⁵ A two-hour pass closure translates to an average of one hour of delay for 2,750 vehicles (two hours worth of traffic volume with an average delay time of one hour each). If one uses values of time estimates based on guidance offered by the American Association of State Highway and Transportation Officials *2003 User Benefit Analysis for Highways* (otherwise known as AASHTO's *Redbook*) these lost hours translate to lost value to highway users equal to \$22.20 per hour of delay for private vehicles (\$18.50 per hour per person [70% of average wage rate] multiplied by an assumed average occupancy of 1.2 persons per vehicle) and \$24.35 per hour for trucks (reflecting the full cost of compensation for U.S. truck drivers translated to 2007 dollars).

4.0 ECONOMIC AND FISCAL IMPACTS – MEASURING NWAC’S EFFECT ON THE STATE ECONOMY

Beyond the economic benefits that NWAC generates with its services, NWAC also plays a role in influencing the patterns of commerce in Washington State. Snow and ice activities play an important role in the state’s economy, particularly in driving economic activity to rural parts of the state. While NWAC’s services are not a lynchpin that allows these activities to take place, NWAC *is* an important piece of the puzzle that allows Cascade and Olympic snow and ice activity industries to prosper.

Ski Area and Backcountry Trip Revenue. Across Washington State, ski areas generated gross business revenues of nearly \$76 million in 2007, supporting nearly 3,800 direct jobs in the state. From the perspective of state government, these activities generate \$4.3 million in retail sales tax, and more than \$300,000 in business and occupation taxes. Ski areas also generate substantial leasehold excise tax revenues.

From the perspective of local governments, economic activity at ski areas generated between \$700,000 and \$800,000 in sales tax dollars for local jurisdictions—with the majority of these dollars flowing to cash-strapped counties in the Cascade and Olympic regions.⁶

If one looks at the relationships between ski-area revenues and overall impacts to local economies, economic input/output models suggest that non-urban communities see multiplier effects equal to an additional 51 cents of economic activity for every \$1 of direct activity in ski areas (reflecting [1] ski-area purchases of services and supplies, and [2] the ripple effects of ski area employees and supplier employees spending their wages). This suggests that roughly \$39 million of additional economic activity in non-urban areas was associated with ski-area activity in 2007, supporting roughly 1,000 additional jobs, and generating yet more tax revenues for counties and other local jurisdictions.

In addition to the dollars that were spent directly *at* ski areas, millions of dollars were spent by skiers and other recreationists who made trips to the mountain backcountry. With roughly 220,000 to 417,000 trips, if trip-makers spent an average of \$10 to \$20 on goods and services outside the ski areas, these outside expenditures would equal an additional \$2.2 million to \$8.3 million. These expenditures and their associated multiplier effects generate additional tax revenues for counties and other local jurisdictions.

Overall, one can safely say that local expenditures on skiing, snowboarding, and backcountry snow and ice activities can be tied to more than \$1 million in tax revenues to non-urban communities in Washington State.

Statewide Perspective. From a Washington State perspective, it is clear that much of the economic activity associated with snow and ice activities does not reflect “new” economic activity to the state. If recreationists did not spend disposable income at ski areas and on trips to the backcountry, many of them would put their disposable income to work in the economy in other ways. There are reasons to believe, however, that robust levels of snow and ice recreation and safe access to the backcountry are extremely beneficial to the state.

⁶ These figures assume average local sales taxes between 1.1% and 1.2%, reflecting base 1% sales taxes in most Washington counties and an additional 0.1% to 0.2% to fund criminal justice service/public safety delivery. The level of criminal justice/public safety sales taxes vary by county, but typically range from 0.1% to as much as 0.4%.

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Perhaps the most important of these arguments revolves around the issue of the state's competitiveness. Wintertime accessibility to the Cascade and Olympic backcountry is an important piece of what makes Washington State a vital center of the knowledge-based economy. Every day, Washington State competes on a national stage to attract and retain industries and high-skill workers that have the luxury of establishing themselves in any number of high-amenity locales across the country. One of Washington's greatest competitive advantages is the immediate access residents have to the state's immense natural amenities. From a perspective of economic competitiveness, perhaps nothing the state can do is as important as protecting its natural gifts and facilitating access to recreational opportunities.

Way-Finding

The discussion that follows examines more deeply the role of snow and ice activities in Washington State's economy and, more particularly, in the economic and fiscal health of rural communities in many parts of the state.

4.1 Economic Impacts

Economic Impact Defined

Within the discipline of economics, a development or an action that has an *economic impact* is a development that shifts the demand for a region's resources. A prime example of an event that has a large economic impact is when a company like Boeing wins a major new contract to build 737 jets. In this example, Boeing taps into an international market and introduces new demands for Washington State resources that go into the production of 737 jets. This so-called "direct economic impact" then creates ripple effects: first, when Boeing purchases goods and services from its suppliers (a phenomenon described as the "indirect economic impact"); and, second, when employees of Boeing and its suppliers go out and spend the income they earn from production of the jets and the dollars continue to circulate in the state economy (the "induced impact"). Combined, the indirect and induced economic impacts are described as multiplier effects associated with the new demand that was introduced by the initial sale.

Snow and Ice Activity Impacts: Revenue Distribution in the State

When considering economic impacts associated with snow and ice activities, the first thing one recognizes is that, from a Washington State perspective, expenditures at ski areas or expenditures associated with backcountry recreation do not generate significant direct impacts on the broader state economy. To the extent that recreationists live in Washington State, one can safely assume that much of what recreationists spend while they pursue snow and ice activities would be spent within the state even if those activities were not available. Certainly, if Washington did not have such opportunities, some larger portion of residents' disposable income would be spent on trips to ski resorts and mountainous areas in other states, but in the grand scheme of things, there are other, more important reasons why Washington would want to nurture its opportunities for winter recreation.

From an economic impact perspective, the important point about the economic impacts of snow and ice activities revolves around the issue of distribution. In a state where a great deal of economic activity is focused in major urban centers, snow and ice recreation activities are an important way to share the economic and fiscal wealth with more rural, and typically, cash-strapped counties. Snow and ice activities, and particularly activities that occur in the high mountains, are an important driver that brings revenues to rural areas of the state. Again, while NWAC's services are not a lynchpin that allows

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these activities to take place, NWAC *is* an important piece of the puzzle that allows Cascade and Olympic snow and ice activity industries to prosper.

Ski Area and Backcountry Trip Revenue and Multiplier Effect Estimates

Data provided by Washington State's Department of Revenue suggest that, across Washington State, ski areas generated nearly \$76 million in gross revenues in 2007, revenues that translated to \$4.3 million in state sales taxes and more than \$300,000 in state business and occupation taxes. The Washington State Employment Security Department reports that, at the peak of the winter season, the ski industry employed nearly 3,800 people in the same year. Of this total, data provided by the Department of Revenue suggest that nearly 95% of revenues were generated in the Cascade and Olympic regions of the state, which are within the NWAC service area.

Within the Cascade and Olympic region, taxable retail sales at ski areas generated an estimated \$690,000 to \$750,000 in sales tax revenues for local jurisdictions, with the vast majority going to cash-strapped counties.⁷

In addition to economic activity located at ski areas, economic activity in rural areas of the Cascades and Olympics was driven by off-site expenditures by skiers and snowboarders, and by other visitors to the backcountry. With a conservatively-estimated 220,000 to 417,000 backcountry trips in the 2007-2008 season, if trip-makers spent an average of \$10 to \$20 on goods and services outside the ski areas, these outside expenditures would equal an additional \$2.2 million to \$8.3 million of sales activity. These expenditures and their associated multiplier effects generate additional tax revenues for counties and other local jurisdictions.⁸

Survey data from a 2001 study of *Economic Impacts of Downhill Skiers and Snowboarders* in Michigan suggest that off-site expenditures by skiers and snowboarders are roughly equally distributed among four categories: (1) restaurants, (2) lodging, (3) fuel, and (4) other retail expenditures.⁹ If one assumes an equal split of expenditure levels posited above, then these off-site expenditures generated an additional \$20,000 to \$67,000 in sales tax revenues to local governments in rural areas of the state.

If one combines the on-site and off-site expenditures discussed above, and if one takes into consideration the economic multiplier effects, the overall economic activity associated with skiing, snowboarding, and backcountry snow and ice activities might equal \$110 million to \$115 million per year in the rural areas of the Cascade and Olympic regions of the state. These levels of economic activity would likely generate close to \$5 million in states sales tax and \$800,000 in local sales tax revenues for counties and rural cities that rely on ski/snowboarding and backcountry snow activities.¹⁰

^{7,8} These figures assume average local sales taxes between 1.1% and 1.2%, reflecting base 1% sales taxes in most Washington counties and an additional 0.1% to 0.2% to fund criminal justice service/public safety delivery. The level of criminal justice/public safety sales taxes vary by county, but typically range from 0.1% to as much as 0.4%.

⁹ See *Economic Impacts of Michigan Downhill Skiers and Snowboarders, 2000-01* by authors at Michigan State University.

¹⁰ This figure reflects the combination of sales tax dollars collected directly at ski areas (based on Department of Revenue data and an assumed local retail tax rate of 1.1% to 1.2%), sales tax dollars collected from assumed off-site expenditures, and a rough estimate of sales tax dollars generated by indirect and induced expenditures.

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Methodology: IMPLAN. To generate the above estimates of multiplier effects, Berk & Associates relied on IMPLAN Pro software for input/output modeling. IMPLAN (short for Impact Analysis for PLANning) is an input/output model that uses county-level data to trace the ripple effects of an expenditure that occurs within the economy. The model is used to track how an economic action, such as money captured by a manufacturer of a basic good, will ripple through a regional economy creating different levels of revenue, jobs, and income in many different economic sectors. To estimate the *total* economic impact of an expenditure, IMPLAN sums the direct impacts (the original economic action) with the indirect and induced effects, accounting for the multiplier effect in full.

To estimate the impact that ski-area activity and related expenditures have on rural parts of the state, Berk & Associates created an IMPLAN model for an Eastern Cascade region of the state, a region that consists of Okanogan, Chelan, Kittitas, Yakima, and Skamania Counties. The goal in examining the economic relationships in this region was to focus on less urban economies, to capture the economic relationships that exist in areas with relatively modest urban components.

Using this Eastern Cascades region, Berk calculated multiplier effects of 1.51 for ski area activities (i.e. for every one dollar spent at a ski area, the broader economy of the region saw a total level of activity equal to \$1.51). This multiplier is lower than one would expect to see if one examined Washington State as a whole (where the multiplier could be expected to fall between 1.8 and 2.1). What that really says is that some of the economic ripple effects generated by activities in ski areas redound to the urban centers, presumably for things like financial services or other services like advertising or major equipment purchases.

We applied the 1.51 multiplier to estimated activity throughout Washington's entire Cascade and Olympic Mountain region. Some of the affected counties, particularly King and Pierce Counties, are home to major urban centers, and the economic impacts would certainly be larger due to ripple effects that reach into the urban centers. However, the goal of this exercise was to identify impacts that one would expect to see in *non-urban* communities within the state.

4.2 Operating and Other Fiscal Impacts on Local Governments

In addition to supporting skiing, snowboarding, and backcountry recreationists, which in turn generate tax revenues for counties and other local jurisdictions, NWAC's services generate *direct* fiscal and service benefits to these jurisdictions.

By generating the most accurate forecasts of mountain weather conditions, NWAC's services allow local governments to be more efficient in their snow clearing activities. In the event of major weather crises or storm cycles, NWAC also provides local jurisdictions with extremely accurate forecasts to inform public safety decisions. Finally, to the extent that NWAC helps to prevent recreationists or other backcountry users from being caught in avalanches, its services relieve a potential burden on county sheriff's offices, the U.S. Army (helicopter rescues), and others for underwriting search and rescue operations.

5.0 AN ECONOMIC PERSPECTIVE ON FUNDING

While the main thrust of this study is an examination of the economic benefits of NWAC's services and the economic impacts that snow and ice activities have on rural areas of the state, a final piece of NWAC's puzzle revolves around the question of funding models.

This section is designed to help inform the development of the business plan by providing an economic framework in which to approach future NWAC funding options. In particular, how the characteristics of the goods and services provided can influence decisions regarding funding sources is examined. After introducing the concepts of public and private goods, the framework is applied to two products and services provided by NWAC.

5.1 Public and Private Goods

When economists talk about the production of goods and services, one useful distinction they bring to the table is the distinction between public and private goods. When thinking about public and private goods, there are two key considerations:

- 1. Are they rivalrous in their consumption?** Does one person's consumption of the good diminish the value derived by another consumer?
- 2. Is consumption of the good excludable?** Is it possible or practical to exclude a group of potential users from consuming the good or service?

The answers to questions one and two carry implications regarding whom should provide and pay for the goods to achieve the "optimal amount" of those goods in the marketplace.

A pure private good is both rivalrous and excludable. According to economic theory, the efficient level of provision of a private good is reached when the marginal cost to the producer is equal to the marginal benefit to the consumer. Given the nature of private goods, economic theory suggests that pure private goods (exclusive and rival) are most efficiently produced through private enterprise and the competitive marketplace.

On the other hand, a pure public good is neither rivalrous nor excludable. A classic example of a public good is mosquito control. The benefits you derive from mosquito control are not diminished by the fact that your neighbor benefits as well, and the marginal cost of provision to an additional consumer within a given geographic area is zero. There is also no easy way to exclude your neighbor from benefiting from mosquito control even if he did not pay for it.

Given the non-exclusive nature of public goods, people can free ride—that is, they can enjoy the benefits without paying a portion of the cost of provision. This makes it difficult, if not impossible for the free market to efficiently produce public goods. Therefore, mosquito control, like other non-rivalrous and non-excludable goods, is a service that is most efficiently provided by a government.

5.2 Application to NWAC Products and Services

When one considers the services provided by NWAC, one can argue that some of NWAC's services might be categorized as private goods and others as public. None of NWAC's services is rivalrous (no consumer's enjoyment of the service is diminished by another user's consumption), but some services are more excludable than others. When determining the exclusivity of NWAC's products, we considered not only if the product *could* be excludable, but also the broader public welfare implications of doing so.

"Excludable" Product Example

Perhaps the clearest example of an excludable service is the sharing of detailed, current-conditions data from its 42 RAWs sites located throughout Washington and Northern Oregon. NWAC could technically restrict access to these data and charge so-called "premium" users for access to the information. According to NWAC website data, the RAWs data products accounted for approximately 80% of the 3.4 million data and forecasts hits to its website during the 2006-07 season. The number of hits varies substantially by location; for example, current conditions data for Mount Baker were most popular, with approximately 445,000 hits. However, there are potential legal and political issues surrounding the restriction of this information.

Access Fees and Memberships. Direct users who value having detailed information about current conditions could pay a fee for access to that information. This could be implemented in a number of ways. For example, direct users could be segmented into operators and consumers (as defined in section 2.0) and be assessed a fee accordingly. Fees could also be assigned to a particular subsection of the RAWs data products, such as only the most popular location data. The results of the FOAC survey, distributed to recreational users and operators, indicate that the introduction of some fee-based products is feasible. When asked if they were willing to pay for more in-depth or enhanced web features, approximately 44% of the 328 respondents said "yes," in addition to another 37% who said "maybe." An order-of-magnitude amount of the fee can also be gleaned from survey findings. When given a range of an annual fee, 54% of 265 respondents said \$10 to \$20 would be "an okay amount."

Depending on the number of potential premium users, revenue generation from premium subscribers could be substantial. If one were to perform a truly random survey of RAWs data users, one could estimate (1) a range of subscribers NWAC could expect to attract to a premium user program, and (2) likely price sensitivities of those potential subscribers.

Absent a detailed, random survey, the discussion must be more focused on conjecture. However, given the number of unique visitors who access RAWs data each season, and given the value that users can derive from knowing where they will find the best skiing and backcountry conditions, it is not implausible to envision a subscription pool of 5,000 premium users who might be willing to pay \$20 to \$30 per year for the benefit of having real-time data about conditions.

Sponsors and Advertisements. Sponsorship or advertising is an alternative to the implementation of a user fee for NWAC's current conditions data. Given the number of times current conditions data are accessed, there is an incentive for private enterprises, especially those in the winter recreation industry, to gain access to this niche market of individual users.

If one simply counted the number of page views, and if one viewed the site traffic as simply an opportunity to derive revenues from banner advertisements, then the annual revenues that might be

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generated could range from a low of \$10,000 to \$15,000 per banner to a high of perhaps \$50,000 or \$60,000. These figures reflect very rough estimates, based on rules of thumb that say that banner ads are valued at between \$0.50 and \$2.00 per thousand page views (depending on the characteristics of the viewers and the ability of target advertisers that are positioned to take advantage of the niche in question).

In regard to banner advertising, there is a tension between transaction costs associated with securing advertisers and the ability of a given advertiser to take fullest advantage of the demographics of the website's users. There exist low-cost, online advertising brokers who pursue a more scattershot approach to placing ads. Using these brokers reduces the transaction costs of securing advertisers, but they typically do so by placing ads that cannot extract the greatest value, which, in turn, means that the advertisers are willing to pay less for the banner.

At the other end of the advertising spectrum, NWAC might want to consider attracting a small pool of sponsors—entities that, presumably, would be seeking to reach precisely the niche of users that frequent the NWAC website. Presumably, these sponsors would be willing to pay top-of-market rates for recognition on the NWAC website.

“Non-Excludable” Product Examples

In contrast to the example of RAWs data as a private good, one could argue that NWAC's avalanche forecasts (and perhaps its weather forecasts) are examples of public, non-excludable goods. From a practical perspective, NWAC could potentially restrict access to information. However, the implications that such an action would have on public safety probably makes restriction unsupportable. As a service that has the potential to save lives, it is NWAC's responsibility to develop every financially feasible avenue for disseminating its avalanche information, a notion highlighted and supported in stakeholder interviews. This suggests that NWAC's avalanche risk information should be viewed as a public good, with an emphasis on, and commitment to, the broadest possible dissemination.

Given the extraordinary level of public benefits that are achieved through NWAC's avalanche and weather forecasting efforts (and through its efforts to educate backcountry users about avalanche risks), a powerful argument exists that the public sector should do everything in its power to ensure support for the program's continued operation. This basis for public support probably also extends to developing supporting mechanisms to expand and streamline dissemination of avalanche education and warnings of avalanche risks.

6.0 CONCLUSION

Examining the economic value that is generated as a result of NWAC's services, it is clear that the return on investment for the program is extraordinarily high. Even if one looks at only a subset of the benefits, and even if one chooses the most conservative estimates of NWAC's effects, NWAC's services generate annual economic benefits in excess of \$7.5 million. With a current program cost of \$340,000, this translates to an annual return on investment of at least two-thousand percent. In fact, one can make a realistic case that NWAC's services generate public benefits ranging between \$20 million and \$79 million. Benefits of this magnitude reflect an astounding return on investment.

NWAC's services result in real, tangible benefits in the form of lives saved, making the Cascade and Olympic Mountain backcountry more accessible and more enjoyable for recreationists, and improving the efficiency of enterprises that operate in the mountains during the winter months.

Beyond these economic benefits, NWAC has positive impacts on Washington State's patterns of commerce. By helping to support skiing, snowboarding, and backcountry snow and ice activities, NWAC supports industries that bring economic activity and increased revenue streams to non-urban parts of the state. In particular, cash-strapped rural counties derive significant fiscal benefits.

From a state perspective, perhaps the most important impact of NWAC's services revolves around their effect on Washington's overall competitiveness. Wintertime accessibility to the Cascade and Olympic backcountry is an important piece of what makes Washington State a vital center of the knowledge-based economy. Every day, Washington State competes on a national stage to attract and retain industries, entrepreneurs, and high-skill workers that have the luxury of establishing themselves in any number of high-amenity locales across the country. One of Washington's greatest competitive advantages is the immediate access residents have to the state's immense natural amenities. From a perspective of economic competitiveness, perhaps nothing the state can do is as important as protecting its natural gifts and facilitating access to recreational opportunities.

Given the nature of NWAC's mission and services, it is clear that many of its services should be viewed as public goods—services that would be provided at a less-than-optimal level if left to the private sector. Some entrepreneurial opportunities may be available, such as premium access, advertising, and/or sponsorships for NWAC's more detailed RAWs products. However, given the nature and extent of public benefits achieved through NWAC's avalanche and weather forecasting, clearly, there is a compelling case for public sector support for the program's operation.

ATTACHMENT A
Substitute Senate Bill 5219

CERTIFICATION OF ENROLLMENT
SUBSTITUTE SENATE BILL 5219

60th Legislature
2007 Regular Session

Passed by the Senate March 13, 2007
YEAS 46 NAYS 0

President of the Senate

Passed by the House April 9, 2007
YEAS 98 NAYS 0

Speaker of the House of Representatives

Approved

Governor of the State of Washington

CERTIFICATE

I, Thomas Hoemann, Secretary of the Senate of the State of Washington, do hereby certify that the attached is **SUBSTITUTE SENATE BILL 5219** as passed by the Senate and the House of Representatives on the dates hereon set forth.

Secretary

FILED

**Secretary of State
State of Washington**

SUBSTITUTE SENATE BILL 5219

Passed Legislature - 2007 Regular Session

State of Washington 60th Legislature 2007 Regular Session

By Senate Committee on Natural Resources, Ocean & Recreation
(originally sponsored by Senator Jacobsen)

READ FIRST TIME 02/14/07.

1 AN ACT Relating to the Northwest weather and avalanche center;
2 creating new sections; and providing an expiration date.

3 BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

4 NEW SECTION. **Sec. 1.** The legislature finds that the Northwest
5 weather and avalanche center (NWAC) provides valuable forecasting and
6 education services, provides valuable information to the public, and
7 reduces the impacts of adverse mountain weather and avalanches on
8 recreation, industry, and transportation in Washington state. To
9 conduct its forecasts, the NWAC receives information from the forty-two
10 weather stations it maintains or helps to maintain, consults sources of
11 on-the-ground weather observations, and utilizes information from the
12 national weather service. The NWAC provides mountain weather and
13 avalanche information through a public hotline recording and over the
14 internet.

15 The NWAC program, which was initiated in 1975, has been
16 administered by the United States forest service since 1976.
17 Throughout its history, the NWAC has been an interagency funded
18 program, receiving significant funds from state, federal, and private
19 sources. However, the NWAC faces funding shortfalls beginning in 2007

1 and for the foreseeable future, creating the possibility that the NWAC
2 will have to reduce its services or close. It is the intent of the
3 legislature to ensure, in continued cooperation with federal and
4 private sources, that the NWAC receives the resources necessary to
5 continue providing weather and avalanche forecasts for the benefit of
6 Washington state.

7 NEW SECTION. **Sec. 2.** (1) The state parks and recreation
8 commission shall invite the United States forest service, the national
9 weather service, and the national park service to cooperatively develop
10 an intergovernmental plan and recommendations that seek to ensure that
11 the Northwest weather and avalanche center program has the resources to
12 continue operating at its current level of service into the future.

13 (2) In developing the plan and recommendations, the state parks and
14 recreation commission shall seek to address issues to include:
15 Administrative control over the Northwest weather and avalanche center
16 program; the physical location of the Northwest weather and avalanche
17 center program; administrative control over the employees, equipment,
18 and facilities of the Northwest weather and avalanche center; and
19 ensuring continued cooperative funding, with equitable contributions
20 from federal, state, local, and private sources, to meet the long-term
21 needs of the Northwest weather and avalanche center.

22 (3) In addition to the government agencies listed in subsection (1)
23 of this section, the state parks and recreation commission and
24 participating agencies may invite the department of transportation, the
25 interagency committee for outdoor recreation, the United States
26 department of transportation, other relevant state and federal
27 entities, and relevant local governments, including counties along the
28 Cascade mountain range, and private organizations to participate in the
29 development of the plan and recommendations.

30 (4) The state parks and recreation commission shall, by December 1,
31 2007, provide an update on the development of the plan and
32 recommendations to the appropriate policy and fiscal committees of the
33 senate and house of representatives. The state parks and recreation
34 commission shall, by December 1, 2008, provide the final plan and
35 recommendations to the appropriate policy and fiscal committees of the
36 senate and house of representatives. The state parks and recreation

1 commission shall also provide a copy of the final plan and
2 recommendations to participating public and private entities.

3 (5) The state parks and recreation commission, or any other state
4 agency, may not assume administrative control over the Northwest
5 weather and avalanche center program, its employees, its equipment, or
6 its facilities without specific legislative authorization.

7 (6) This section expires June 30, 2009.

--- END ---

ATTACHMENT B

List of Stakeholders Interviewed

Northwest Weather and Avalanche Center Staff

Garth Ferber, Avalanche Meteorologist
Kenny Kramer, Avalanche Meteorologist
Mark Moore, Director/Avalanche Meteorologist

Friends of the Avalanche Center

Benj Wadsworth, Director

Ski Areas

Jon Andrews, Avalanche Forecaster, Stevens Pass Ski Area
Duncan Howat, Mt. Baker Ski Area
Scott Kaden, President, Pacific Northwest Ski Areas Association

Washington State Department of Transportation

Mike Stanford, Avalanche Forecaster/Control Specialist, North Central Region
John Stimberis, Avalanche Forecaster

Washington Parks and Recreation Commission

Colleen Maguire, Special Assistant to the Budget Director and Deputy Director
Tom Oliva, Enterprise Coordinator

U.S. Forest Service

Mike Heilman, Regional Special Use Coordinator, U.S. Forest Service
John Morrow, U.S. Forest Service

Benefit Assessment and Economic Impact Analysis for the Northwest Weather and Avalanche Center



December 1, 2008

 BERK & ASSOCIATES

PROJECT OVERVIEW



- Washington State Parks & Recreation Commission hired Berk & Associates to conduct an economic assessment of the Northwest Weather and Avalanche Center (NWAC), as part of a larger legislatively mandated project.
- This assessment addresses the following two fundamental issues:
 1. What is the value of NWAC's products and services?
 2. What impacts do NWAC's products and services have on the level and pattern of commerce in Washington State?

PROJECT APPROACH



This assessment presents analysis and findings based on two analytic frameworks:

1. **A benefit/cost analysis:** a comparison between how much users value NWAC's services and the cost of providing those services; and
1. **A discussion of economic impacts:** an examination of the economic and fiscal impacts that the snow and ice activity industry has on economies in the Cascade and Olympic Mountain regions.

BUDGET AND FUNDING



- NWAC has an estimated FY 2008 operating budget of \$340,000.
- Main sources of NWAC funding are:
 - Washington State Parks & Recreation Commission;
 - U.S. Forest Service;
 - Washington State Supplemental Budget; and
 - Washington State Department of Transportation.
- Other financial supporters of NWAC are:
 - Ski Washington;
 - Pacific Northwest Ski Areas Association; and
 - Ski area operators in Washington and Northern Oregon.

PRODUCTS AND SERVICES



NWAC provides five key services to public and private organizations and individuals:

1. Mountain weather forecasts;
2. Avalanche forecasts;
3. Current conditions data;
4. Phone consultations; and
5. Educational services.

INDUSTRY USERS



Industry users are public and private entities that use NWAC products and services to inform their operations:

- Government agencies, including:
 - WSDOT;
 - U.S. Forest Service;
 - National Park Service;
 - National Weather Service; and
 - Search and rescue organizations.
- Private entities, including:
 - Private weather companies;
 - Broadcast media outlets;
 - Academic researchers;
 - Ski areas; and
 - Ski schools.

CONSUMERS



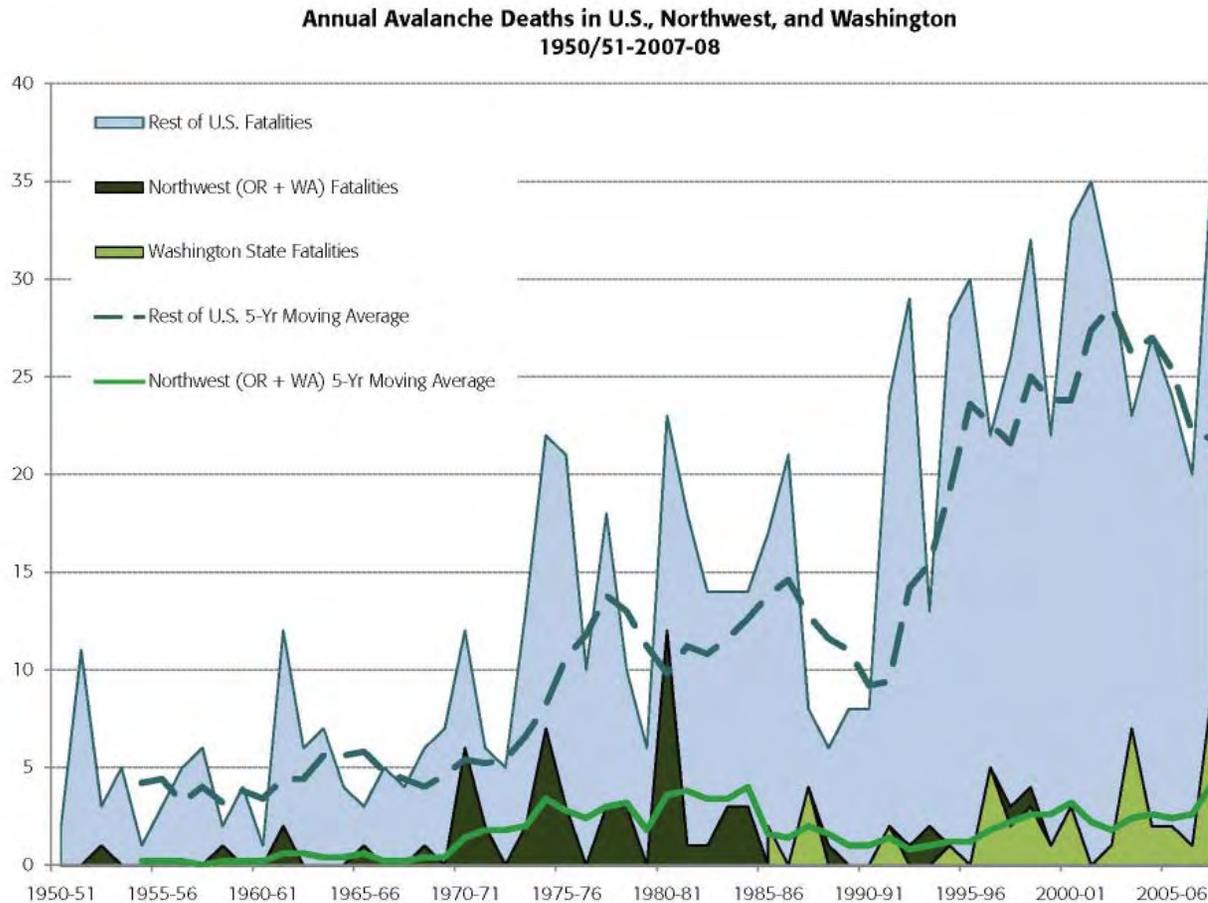
Consumers are ski area and backcountry recreationists who use NWAC products and services to inform travel and recreation plans, and to avoid adverse weather and safety conditions.

- This group includes:
 - Skiers;
 - Snowboarders;
 - Hikers;
 - Snowshoers;
 - Snowmobilers;
 - Highway travelers;
 - Climbing groups; and
 - Others.

BENEFITS OF NWAC SERVICES: LIVES SAVED



- NWAC saves lives by forecasting, tracking, and reporting weather and avalanche conditions.
- Historical avalanche fatality data suggest NWAC saves between two and nine lives per year.



VALUE OF LIVES SAVED



- How much should be invested to save a life? The U.S. Department of Transportation pegs the value of a statistical life between \$3.2 million to \$8.4 million.
- Using U.S. DOT guidelines, lives saved by NWAC translate to **annual economic benefits ranging from \$6.4 million to more than \$75 million.**

BENEFITS OF NWAC SERVICES: INCREASED ACCESSIBILITY



- NWAC provides increased accessibility and enjoyment for backcountry users
- Estimates suggest that between 220,000 and 417,000 recreational backcountry trips were made during the 2007-08 season in NWAC's Washington service area.
- For these recreationists, their enjoyment was greater due to NWAC because:
 1. They knew where to find the best possible conditions;
 2. They felt confident they understood the nature of avalanche risk; and
 3. They had the best possible information about expected weather conditions.

VALUE OF INCREASED ACCESSIBILITY & ENJOYMENT



- Based on existing spending and stated-value willingness-to-pay preferences, one could assume a modest per-trip value to backcountry recreationists of \$5 to \$10.
- Given the number of backcountry trips, this results in **annual economic benefits between \$1.1 million and \$4.2 million.**

BENEFITS OF NWAC SERVICES: OPERATIONAL EFFICIENCIES



- NWAC allows for increased efficiency of mountain and backcountry operations
- Many federal, state, local, and private organizations derive direct benefits from NWAC.
- These organizations rely on NWAC for day-to-day planning, streamlining operations, maintaining safety of staff, and reducing the demand for search and rescue services.

VALUE OF OPERATIONAL EFFICIENCIES



- The value of this benefit differs for each operator.
- The following organizations use NWAC services to inform their operating decisions:
 1. WSDOT makes decisions regarding avalanche control and road clearing;
 2. Ski areas make decisions regarding operations, avalanche control, and staffing levels;
 3. U.S. Forest Service and National Park Service make decisions regarding staff and public safety;
 4. Search and rescue organizations make decisions affecting response time and personal safety;
 5. Local governments make decisions regarding road clearing operations; and
 6. National Weather Service uses NWAC data to increase the accuracy and reliability of its forecasts.

ECONOMIC AND FISCAL IMPACTS: INCREASED REVENUE



- By supporting snow and ice activities, NWAC supports industries that bring economic activity and revenue streams to non-urban parts of the state.
- Snow and ice activities generate \$100 million or more in annual economic activity outside the urban centers of the Puget Sound region.
- Snow and ice activities generate nearly \$1 million in annual revenues for local jurisdictions, with most revenues going to cash-strapped counties.

ECONOMIC AND FISCAL IMPACTS: STATE COMPETITIVENESS



- Immense natural amenities are one of Washington's greatest competitive advantages.
- NWAC leverages these amenities by facilitating wintertime recreational activities.
- This helps Washington State attract and retain industries, entrepreneurs, and high-skill workers.

ECONOMIC PERSPECTIVE: PUBLIC VS PRIVATE GOODS



An economic framework to inform the development of future funding considerations:

- Goods can be public or private, based on two considerations:
 1. Are they rivalrous in their consumption?
 2. Is consumption of the good excludable?
- Private goods are rivalrous and excludable; they are efficiently provided by private enterprise. Public goods are neither rivalrous nor excludable; they are best provided by government.

NWAC FUTURE FUNDING OPTIONS



Some NWAC services could be categorized as more of a private good, while others are more like a public good.

- **Excludable Product Example:** Current conditions data.
 - Restricting access to data is technically feasible, but possible legal and political ramifications exist.
 - Potential revenue generating options include: access fees and memberships; sponsors and advertisements.
- **Non-Excludable Product Example:** Avalanche forecasts.
 - Technically feasible to limit access to information, but increased public risk from restriction makes this action unsupportable.

CONCLUSIONS



Important Tangible Benefits

- NWAC saves between two and nine lives per year.
- NWAC makes the backcountry more accessible and enjoyable.
- NWAC improves the efficiency of enterprises that operate in the backcountry.

Conservative estimates of **NWAC's benefits are at least \$7.5 million annually**. More likely benefits range from **\$20 million to \$79 million annually**. Given an annual budget of \$340,000, this translates to an **annual return on investment of at least two thousand percent**.

Broader Fiscal and Economic Impacts

- NWAC brings revenue streams and economic activity to rural areas of Washington State.
- NWAC increases the overall competitiveness of Washington State.