

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



Washington State Parks



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120 Lakeside Avenue
Suite 200
Seattle, Washington 98122
P (206) 324-8760

www.berkandassociates.com

Principals:	Bonnie Berk and Michael Hodgins
Project Director:	Brett Sheckler
Project Manager:	Julia Bosch
Strategic Advisor:	Morgan Shook
Analysts:	Emily Heatherington, Erica Natali, Julia Warth

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.

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- **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

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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 unsupportable. 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**

Measure	WA Backcountry Trip Estimates	
	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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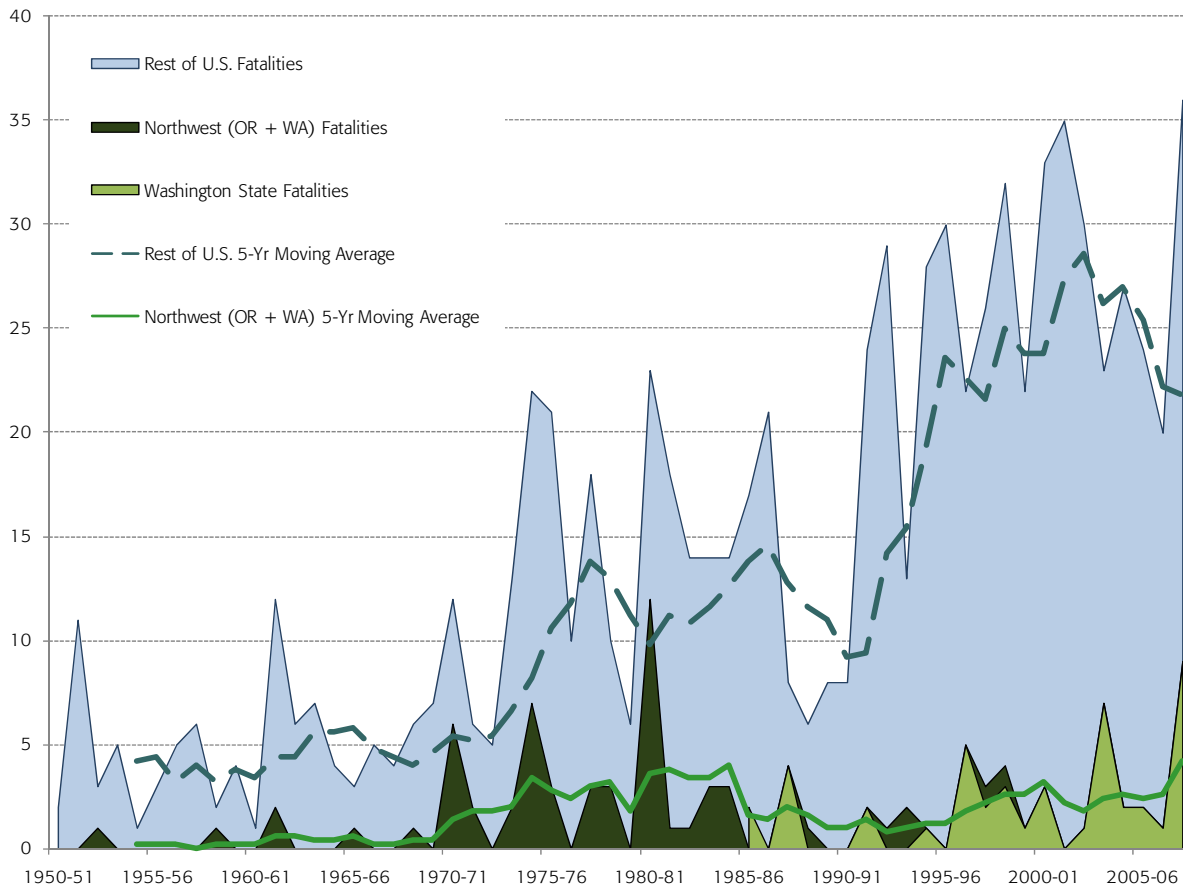
Exhibit 3 presents the number of avalanche deaths over time for Washington, the Northwest (Washington and Oregon), and the remainder of the U.S. Not surprisingly there is significant fluctuation from year-to-year. The U.S. five-year moving average trend line indicates an increasing number of avalanche 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%.

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.

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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

