Idaho Department of Environmental Quality Ambient Air Quality Monitoring Network 5-Year Assessment

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EXECUTIVE SUMMARY

On October 17, 2006, the U.S. Environmental Protection Agency (EPA) amended its ambient air monitoring regulations. This amendment requires states to conduct detailed assessments of their air monitoring networks every five years. This document describes the Idaho State Department of Environmental Quality's (DEQ) 2010 Idaho State Ambient Air Monitoring Network Assessment. This is the first assessment of the Idaho network under the requirement.

Purpose of the Assessment

DEQ's air quality protection efforts are designed to assure compliance with federal and state health-based air quality standards and to inform public and local, state and federal decision-makers of air quality conditions in their areas**.** DEQ evaluated the effectiveness and efficiency of the Idaho State ambient air monitoring network in relation to this goal. DEQ's assessment provides decision-makers with information needed to maximize the effectiveness of Idaho's ambient air monitoring network. The assessment also ensures DEQ and its partners have the information needed to protect human health and the environment for current and future generations in Idaho.

Idaho's Ambient Air Monitoring Network

Most of Idaho's monitoring network is dedicated to characterizing levels of the two pollutants that have been shown to pose the greatest risk to public health — fine particulate matter ($PM_{2.5}$) and ozone (O_3). The remainder of the network is made up of monitors that measure larger particles (PM_{10}), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide and reactive oxides of nitrogen (NO_2/NO_Y), fine particle chemical composition, and meteorological parameters.

As of January 1, 2010, DEQ's air monitoring network consisted of 54 monitors at 30 distinct monitoring sites. Data from these monitors serve a variety of needs. The data are used to:

- Determine if air quality is meeting federal standards
- Provide near-real-time air quality information for the protection of public health
- Forecast air quality
- Make daily burn decisions and curtailment calls
- Assist with permitting activities
- Evaluate the effectiveness of air pollution control programs
- Evaluate the effects of air pollution on public health
- Determine air quality trends
- Identify and develop responsible and cost-effective pollution control strategies
- Evaluate air quality models

Assessment

To relate the value of its monitoring activities relevant to the policy goal, DEQ evaluated the state network on three separate scales: site-level, airshed-level and state-level on a pollutant-by-pollutant basis. DEQ generally conducted its assessment in accordance with EPA guidance, mostly with tools other than those provided by EPA.

Findings

- Overall, the Idaho State network is efficient and effective at meeting the monitoring objectives supporting DEQ's policy goal(s).
- Significant network changes are not needed.
- **Anticipated future ambient air monitoring requirements mandated by EPA will result in substantial cost(s) which may cause resource conflicts across programs supported by DEQ's network.**

Recommendations

Retain

Retain nearly all of the existing monitoring network as it is currently configured.

Relocate

1. Boise's ITD ozone station should be relocated to somewhere in Eagle which lies to the northwest.

Evaluate/modify

At the site-level, monitoring scales of representativeness for five monitoring sites need re-evaluation:

1. **Garden Valley** – change scale of representation from neighborhood to urban
2. **McCall** – change scale of representation from neighborhood to urban
3. **Moscow** – change scale of representation from neighborhood to urban
4. **Franklin** – change scale of representation from urban to neighborhood
5. **Soda Springs** and **Pocatello Sewage Treatment Plant** – normalize scale of representation to middle-scale for both sites

Monitoring objectives for one site need re-evaluation:

Middleton –

- Drop one objective for $PM_{2.5}$ (summer smoke management or winter AQI forecasting) because the site cannot fulfill both.
- Change the pollutant monitored to O_3 from $PM_{2.5}$ if the site type is to remain regional transport.

Add new monitors at prioritized locations

Should funds become available to acquire and deploy new monitors, locations frequently impacted by smoke that are currently lacking $PM_{2.5}$ monitors should be prioritized; these include Orofino, Priest River, Challis, and Shoshone.

Provide for technology needs:

- Convert to a robust network of FEM monitors for special purpose/AQI monitoring in order to support NAAQS compliance assessments.
- Purchase and deploy a trace-gas calibrator for St. Luke's Meridian NCore monitoring site to improve operational efficiency and the quality of measurements.
- Pursue monitoring of oxides of nitrogen (NOx) and real-time measurement of volatile organic compounds (VOC) at ozone monitoring sites.
- Continue expansion of the air quality workshop.

Conclusion

Overall, Idaho operates an efficient monitoring network with limited resources, so no sites are recommended for termination. If, in the future, Idaho needs to shut down a monitor(s) due to resource constraints, those sites assigned a Low value in the Site Ranking should be targeted first.

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A. INTRODUCTION

The U.S. Environmental Protection Agency (EPA) finalized an amendment to the ambient air monitoring regulations on October 17, 2006. As part of this amendment, EPA added a requirement for state monitoring agencies to conduct network assessments once every five years [40 CFR Part 58.10(e)]. At the core of this requirement is the need to assess the ability of existing and proposed monitoring sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or entities conducting health effects studies.

The goal of an air monitoring organization should be to optimize air monitoring networks to achieve, with available resources, the best possible scientific value and protection of public and environmental health and welfare. A network assessment includes (1) re-evaluation of the objectives and budget for air monitoring, (2) evaluation of a network's effectiveness and efficiency relative to its objectives and costs, and (3) development of recommendations for network reconfigurations and improvements. In some cases, network assessments consist only of answering one or more straightforward questions. In others, detailed analytical techniques are necessary. A thorough technical assessment will help support decisions about reconfiguring a network. These decisions might include eliminating redundant monitors, reducing or expanding the monitoring season, moving monitors to better locations, switching a monitor at one location to different technology (e.g., to provide finer temporal resolution), adding monitors to the network, or switching monitoring at a site to a different pollutant. In practice, a combination of several types of analyses might provide the most useful information.

Much of the ambient air monitoring network managed and operated by the Idaho Department of Environmental Quality (DEQ) is comprised of single-pollutant continuous monitoring equipment. This assessment will follow mostly site-by-site and bottom-up techniques for evaluating the overall effectiveness of DEQ's air monitoring network.

Site-by-site analyses are those that assign a ranking to each individual monitor based on a particular metric. These analyses are good for assessing which monitors might be candidates for modification or removal. In general, the metrics at each monitor are independent of the other monitors in the network. Sites and monitors will be evaluated according to respective importance and relevance in meeting the overall objectives of the ambient air monitoring network. Sites and monitors will also be evaluated according to their suitability in supporting their individual objectives (site location, technology, etc.)

The low-ranking monitors will be examined carefully on a case-by-case basis. There may be regulatory or political reasons to retain a specific monitor. Also, the site could be made potentially more useful by monitoring a different pollutant or using a different technology.

Bottom-up methods examine the phenomena that are thought to cause high pollutant concentrations and/or population exposure, such as emissions, meteorology, and population density. For example, emission inventory data can be used to predict the areas of maximum expected concentrations of pollutants directly emitted into the atmosphere (i.e., primary pollutants). Emission inventory data are less useful to understand pollutants formed in the atmosphere (i.e., secondarily formed pollutants). Multiple data sets can be combined using spatial analysis techniques to determine optimum site locations for various objectives. Those optimum locations can then be compared to the current network. In general, bottom-up analyses indicate where monitors are best located based on specific objectives and expected pollutant behavior. However, bottom-up techniques rely on a thorough understanding of the phenomena that cause air quality problems.

This assessment will also address future air monitoring needs in the State of Idaho, whether caused by on-going and future revisions of the National Ambient Air Quality Standards (NAAQS), or by projected changes in population, land use, and emissions levels within Idaho's borders, or nearby States.

B. AIR QUALITY MONITORING IN IDAHO

This section starts with some background information, then provides an overview of how monitoring data is used to determine compliance with NAAQS and with state implementation plans for areas that are or have been classified as nonattainment areas. An overview is also provided of Idaho's AQI and recent AQI history. These are followed by more detailed information about DEQ's ambient air monitoring program, including locations of monitors used in the program. The programs and tools that provide primary users with the program's monitoring data or information based on the data are identified.

B.1 Background

As ambient air monitoring objectives have shifted over time, air quality agencies have had to re-evaluate and reconfigure monitoring networks. A variety of factors contribute to these shifting monitoring objectives:

- Air quality has changed since the adoption of the federal Clean Air Act and NAAQS. For example, the problems of high ambient concentrations of lead and carbon monoxide have largely been solved.
- Populations and behaviors have changed. For example, the U.S. population has (on average) grown, aged, and shifted toward urban and suburban areas over the past four decades. In addition, rates of vehicle ownership and annual miles driven have increased.
- New air quality objectives have been established, including rules to reduce toxic air pollutants, fine particulate matter ($PM_{2.5}$), and regional haze.
- The understanding of air quality issues and the capability to monitor air quality have both improved. Together, the enhanced understanding and capabilities can be used to design more effective air monitoring networks.

Ambient air monitoring networks must be designed to meet three basic monitoring objectives. These basic objectives are listed below. The order of the objectives in this list is not based upon a prioritized scheme. Each objective is important and must be considered individually.

(a) Provide air pollution data to the general public in a timely manner. Data can be presented to the public in a number of attractive ways including air quality maps, newspapers, Internet sites, and as part of weather forecasts and public advisories.

(b) Support compliance with ambient air quality standards and emissions strategy development. Data from qualified monitors for NAAQS pollutants will be used for comparing an area's air pollution levels against the NAAQS. Data from monitors of various types can be used in the development of attainment and maintenance plans. Data from State and Local Air Monitoring Stations (SLAMS), and especially from National Core (NCore) stations, will be used to evaluate the regional air quality models used in developing emission strategies, to track trends in air pollution abatement control measures and assess their effectiveness on improving air quality. In monitoring locations near major air pollution sources, source-oriented monitoring data can provide insight into how well industrial sources are controlling their pollutant emissions.

(c) Support for air pollution research studies. Air pollution data from the NCore multi-pollutant monitoring network can be used to supplement data collected by researchers working on assessing health effects and understanding atmospheric processes or for work on developing monitoring methods .

B.2 Idaho's Air Quality – NAAQS Overview

To provide a quantifiable means of measuring air quality, EPA's Office of Air Quality Planning and Standards has established standards for six "criteria pollutants." For each criteria pollutant, the standard includes a threshold, which is maximum concentration above which adverse effects on human health may occur. These threshold concentrations are called National Ambient Air Quality Standards (NAAQS).

There are two types of standards: primary and secondary. Primary standards set limits to protect public health, including the health of "sensitive" populations, such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, vegetation, and buildings. Idaho has adopted the federal air quality standards in the Rules for the Control of Air Pollution in Idaho (IDAPA 58.01.01.575-587; *Table B-1*); the primary and secondary standards are shown in Table B-1.

Table B-1. Primary and Secondary Standards for the Six Criteria Pollutants

Pollutant		Primary Standards	Averaging Times	Secondary Standards
Carbon Monoxide		9 ppm [a]	8-hour	None
		35 ppm	1-hour	None
Lead		0.15 µg/m^3 [b]	Quarterly Average	Same as Primary
Nitrogen Dioxide		0.053 ppm	Annual (Arithmetic Mean)	Same as Primary
		0.100 ppm	1-hour	
Ozone		0.075 ppm	8-hour	Same as Primary
Particulate Matter	Particulate Matter (PM_{10})	150 µg/m^3	24-hour	Same as Primary
	Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual (Arithmetic Mean)	Same as Primary
		35 µg/m^3	24-hour	
Sulfur Oxides		0.075 ppm	1-hour	—
				—
		—	3-hour	0.5 ppm

a. ppm — parts per million
b. µg/m^3 —- micrograms per cubic meter

Based upon the level of air pollutants measured, geographic areas are classified by EPA as attainment or nonattainment areas. A geographic area that has pollutant levels at or below the NAAQS is called an **attainment area**. An area with persistent air quality problems is designated a **nonattainment area**. This means that the area has violated the federal health-based standards for outdoor air pollution. Each nonattainment area is declared for a specific pollutant. Nonattainment areas for different pollutants may overlap each other or share common boundaries.

In addition to areas classified as attainment and nonattainment, some areas are described as "maintenance areas." Maintenance areas are those geographic areas that were classified as nonattainment, but are now consistently meeting the NAAQS. Maintenance areas have been re-designated by the EPA from "nonattainment" to "attainment with a maintenance plan," commonly called "maintenance areas." Through monitoring and modeling, it has been demonstrated that these areas have sufficient controls in place to meet and maintain the NAAQS. These plans also establish contingency measures that would be implemented if these areas again begin to have pollutant levels that exceed the NAAQS.

Five geographical areas in Idaho are classified as nonattainment or maintenance areas. They are listed in *Table B-2* and shown in *Figure B-1*. The map in *Figure B-1* also identifies federal Class I areas, where regional haze levels must be addressed.

Table B-2. Nonattainment and Maintenance Areas in Idaho

Area	Description	Pollutant	Background
Sandpoint	Located in Bonner County, the area rests on the northwest corner of Lake Pend Oreille within the Panhandle National Forest	PM_{10}	The topography influences much of the PM buildup in the area. In 1997, the area was designated moderate PM_{10} nonattainment, and an emissions inventory identified the primary PM_{10} source as residential wood burning. Fugitive road dust and some industrial sources are also considered significant contributors. DEQ is presently developing a Limited Maintenance Plan.
Pinehurst	Located in Shoshone County, the area rests in the Silver Valley surrounded by the Coeur d'Alene and St. Joe National Forests	PM_{10}	The area's topography is a significant factor in the buildup of pollutants that result in poor air quality. The emission inventory identified residential wood burning as the primary PM_{10} source and fugitive road dust as a secondary source.
Portneuf Valley (Maintenance Area)	96.6 square miles of Pocatello, Chubbuck, and surrounding areas	PM_{10}	The Portneuf Valley is a Maintenance Area for PM_{10}. Formerly the Power/Bannock County PM_{10} area; it was split into the Portneuf Valley and federal Fort Hall PM_{10} areas. Includes federal land managed by the Bureau of Land Management and the Caribou National Forest, as well as privately owned land in the cities of Pocatello and Chubbuck. Link to maintenance plan.
Northern Ada County (Maintenance Area)	Southwestern Idaho	Carbon Monoxide (CO) and PM_{10}	At present, Northern Ada County is a Limited Maintenance Area for CO. Mobile and area source emissions are the two major sources of CO. Link to CO maintenance plan. Northern Ada County is also a Maintenance Area for PM_{10}. The main sources of PM_{10} are fugitive road dust and agriculture. Link to PM_{10} maintenance plan.
Part of Franklin County	Southeast Idaho, Cache Valley	$PM_{2.5}$	Franklin County shares this designation (2009) as the northern portion of the Logan UT- Franklin ID $PM_{2.5}$ nonattainment area. This designation was based on monitoring data measured in Logan UT.

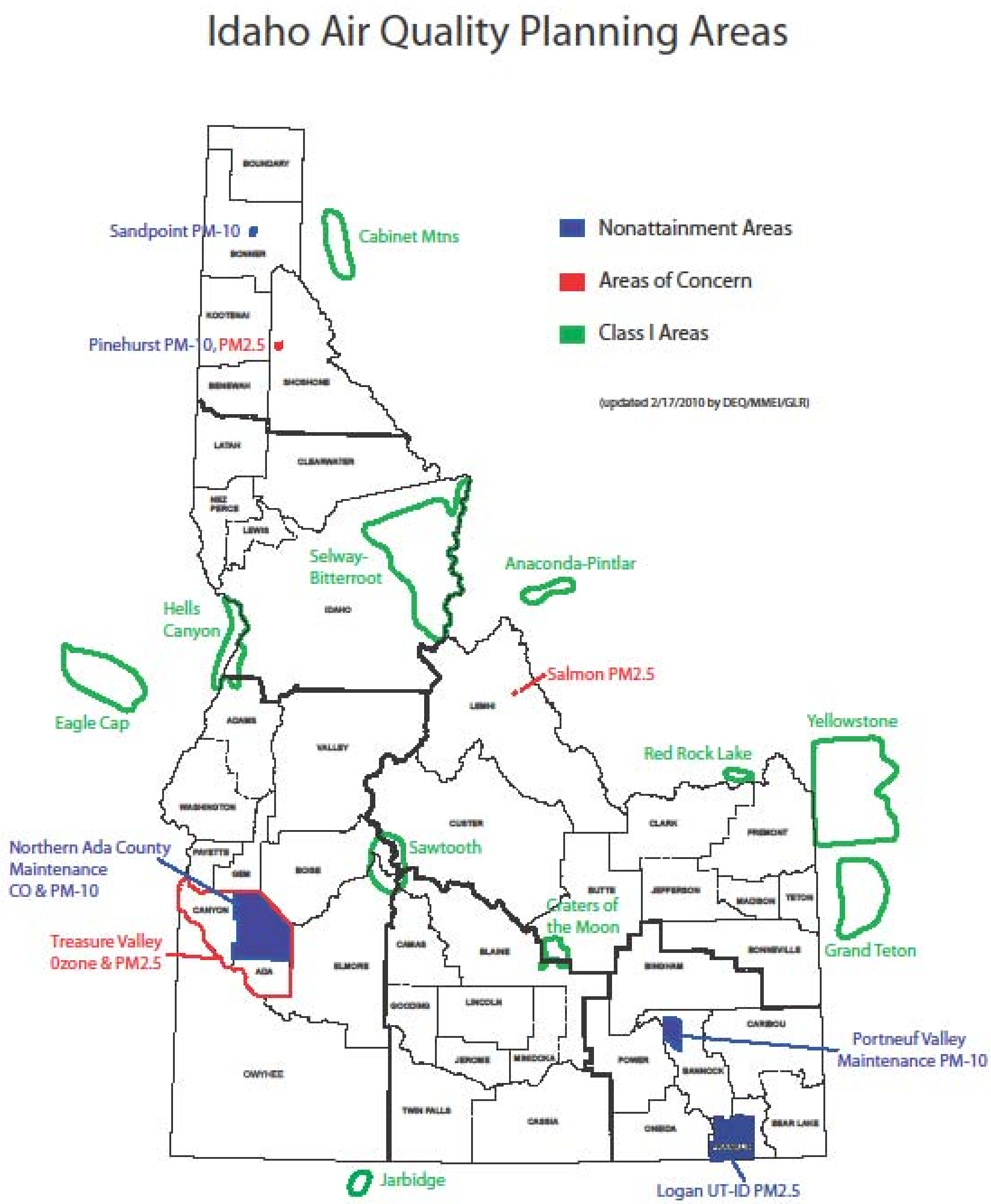


Figure B-1. Idaho Air Quality Planning Map

B.3 Idaho's Air Quality – Air Quality Index (AQI) Overview

The AQI is a guide for the daily reporting of air quality. It indicates how clean or polluted the air is in a particular area, identifies potential health impacts, and allows the levels of various pollutants to be evaluated using one common index. The AQI focuses on health effects that can happen within a few hours or days after breathing polluted air. DEQ uses the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide.

The higher the AQI, the greater the potential for deleterious health effects. For example, an AQI value of 50 represents good air quality and little potential to affect public health, while an AQI value over 300 represents hazardous air quality with potentially serious health impacts. An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the threshold EPA has set to protect public health. So, AQI values below 100 are considered healthful. When AQI values are above 100, air quality is considered to be unhealthy— impacting certain sensitive segments of the population first, and then the more general population as the AQI values increase. AQI categories and health precautions are summarized in *Table B-3*.

DEQ is required to publish the AQI at least once per working day for areas with populations over 350,000 on working days and at least once per day. DEQ publishes this information for areas with lower populations as well, particularly in areas that may be impacted by wintertime wood smoke or smoke from various types of open burning (agricultural burning, prescribed fire, and wildfire).

When the AQI is above 100, DEQ also must report which groups (such as children, the elderly, and people with asthma or heart disease) may be sensitive to the specific pollutant. If two or more pollutants have AQI values above 100 on a given day, DEQ reports all the groups that are sensitive to those pollutants.

Tables B-4 through *B-6* provide Idaho summary AQI data by county for 2006-2008. The pollutant with the biggest effect on the AQI for Ada, Canyon, and Kootenai counties during the winter months is primarily $PM_{2.5}$ and during the summer, ozone has the biggest effect on the AQI in these three counties. Since DEQ does not monitor ozone in the remaining counties listed in the tables below, $PM_{2.5}$ concentrations have the biggest effect on the AQI all year in those counties. Elevated $PM_{2.5}$ concentrations can be due to localized residential wood combustion (RWC) during the winter. Smoke from various biomass burning (e.g. prescribed fire, wildland fire, agricultural burning) can impact $PM_{2.5}$ levels any time of the year, but primarily in the summer and fall.

Tables B-4 through *B-6* do not make the distinction between AQI levels and levels of the pollutant or pollutants responsible for the AQI levels. More detailed information can be found on EPA's AirData Web site: http://www.epa.gov/air/data/monaqi.html?st~ID~Idaho.

Table B-3. AQI Categories and Associated Health Precautions

Air Quality	Protect Your Health	AQI
Good	No precautions necessary. Breathe deeply and enjoy!	0 - 50
Moderate	Sensitive people* should plan strenuous outside activities when air quality is better.	51 - 100
Unhealthy for Sensitive Groups	Sensitive people* should cut back or reschedule strenuous outside activities. Everyone else should consider limiting strenuous outdoor activities.	101 - 150
Unhealthy	Sensitive people* should avoid strenuous outside activities. Everyone else should cut back or reschedule strenuous outside activities.	151 - 200
Very Unhealthy	Sensitive people* should avoid all outside physical activities. Everyone else should significantly cut back on outside physical activities.	201 - 300
Hazardous	Everyone should avoid all outside physical activities.	301 - 500

* Sensitive *people include children, the elderly, those with existing health conditions, and people who have high exposure (those who work, exercise, or spend extensive time outdoors).*

Table B-4. Idaho AQI Summary for 2006

2006		AQI Rating # Days				
County	# AQI Days	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Highest AQI
Ada	365	290	71	4		138
Bannock	365	358	7			66
Benewah	124	108	15	1		115
Boise	46	26	17	2	1	160
Bonner	359	345	14			78
Bonneville	224	222	2			57
Butte	365	365				40
Canyon	359	307	50	2		108
Caribou	272	272				49
Franklin	291	271	20			100
Gem	9	9				50
Idaho	233	214	17	2		132
Kootenai	272	248	24			91
Latah	250	235	13	2		123
Lemhi	208	180	25	1	2	171
Nez Perce	244	221	21	2		107
Power	230	218	11	1		146
Shoshone	350	300	49	1		113
Twin Falls	227	222	5			70
Valley	65	40	22	3	1	147

Table B-5. Idaho AQI Summary for 2007

2007		AQI Rating # Days				
County	# AQI Days	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Highest AQI
Ada	365	251	102	11	1	163
Bannock	359	353	6			90
Benewah	303	277	26			96
Bonner	305	305				49
Bonneville	276	264	12			73
Butte	222	207	15			87
Canyon	362	289	71	2		123
Caribou	347	346	1			76
Franklin	211	199	11	1		104
Idaho	340	322	17		1	163
Kootenai	357	303	54			90
Latah	353	347	6			73
Lemhi	316	272	35	6	3	223
Nez Perce	357	348	9			67
Power	339	313	26			81
Shoshone	361	237	114	10		133
Twin Falls	295	275	20			71
Valley	167	120	40	6	1	153

Table B-6. Idaho AQI Summary for 2008

2008		AQI Rating # Days				
County	# AQI Days	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Highest AQI
Ada	366	296	68	2		128
Bannock	363	349	14			99
Benewah	365	324	41			96
Bonner	365	335	30			92
Bonneville	321	301	20			77
Butte	364	334	30			87
Canyon	350	313	37			92
Caribou	317	317				19
Franklin	90	85	4	1		122
Idaho	297	295	2			55
Kootenai	364	333	31			100
Latah	340	337	3			60
Lemhi	350	334	16			76
Nez Perce	327	317	10			67
Shoshone	366	246	109	11		147
Twin Falls	335	322	13			71
Valley	190	180	10			62

B.4 Idaho DEQ's Ambient Air Monitoring Program

This section contains brief descriptions of the purposes of DEQ's air monitoring program and the tools DEQ uses to determine the program's adequacy, along with a map showing each monitor's location.

The ambient air quality and meteorological data collected from DEQ's air monitoring network is used for a variety of purposes:

- determining compliance with NAAQS,
- determining the location of maximum pollutant concentrations,
- forecasting air quality (Air Quality Index, or AQI),
- early detection of smoke impacts (or smoke management),
- determining the effectiveness of air pollution control programs,
- evaluating the effects of air pollution levels on public health,
- tracking the progress of State Implementation Plans (SIPs),
- supporting pollutant dispersion models,
- developing responsible, cost-effective control strategies, and
- analyzing air quality trends.
- analysis.

The adequacy of an ambient air monitoring network may be determined by using a variety of tools, including the following:

- federal monitoring requirements and network minimums,
- analyses of historical monitoring data,
- maps of pollutant emissions densities,
- dispersion modeling,
- special studies/saturation sampling,
- SIP requirements,
- revised monitoring strategies (e.g., new regulations, reengineering air monitoring network),
- network maps and network descriptions with site objectives defined, and
- best professional judgment.

The appropriate location of a monitor can only be determined on the basis of stated objectives. Maps, graphical overlays, and GIS-based information are extremely helpful in visualizing or assessing the adequacy of monitor locations. Plots of potential emissions and/or historical monitoring data versus monitor locations are especially useful. When questions arise about the adequacy of a particular location, modeling or special studies (including saturation monitoring studies) may be appropriate.

,For each of DEQ's air monitoring sites, this document has an assessment of the appropriateness of the site location, the monitor type (technology), and the sampling strategy. For each site, these assessments are reconciled with the site's stated monitoring objectives. Factors affecting ambient pollution concentrations such as population, emissions densities, and meteorology are evaluated. In addition, projections of population and emissions growth and impacts on future monitoring needs are addressed. Consideration is also given to changes in federal regulations that will have an impact on DEQ's monitoring priorities and needs during the next five years.

Figure B-2 is a 2010 map of air monitoring stations managed by DEQ and the pollutants monitored at each station.

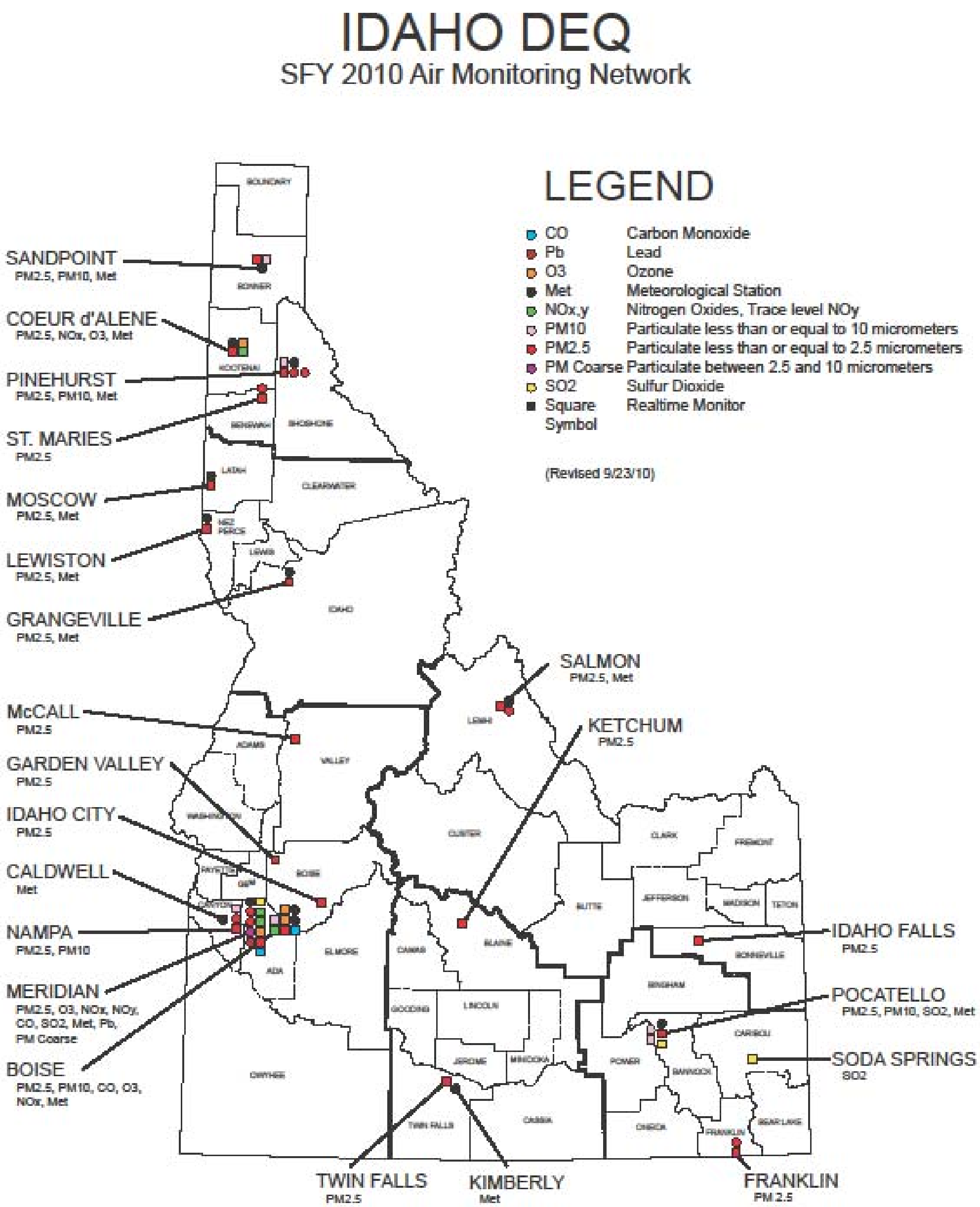


Figure B-2. 2010 Idaho DEQ Ambient Air Monitoring Network

B.5 Primary Users of DEQ's Ambient Air Monitoring Data

Ambient monitoring data is used to support a variety of programs and tools for which daily decisions are required. From personal activities to agricultural and forestry practices, a number of tools exist to inform individuals and local, state, and federal organizations. These tools support credible decisions for specific actions.

Local Ordinances

City and County ordinances related to air quality are described in the following sections.

Treasure Valley

A number of local governments in Idaho have ordinances that recommend or prohibit open burning when forecasted AQI levels reach a specific numerical value. *Table B-7* lists those ordinances in the Treasure Valley.

Outside the Treasure Valley

Outside the Treasure Valley, the following local ordinances apply. Local ambient monitoring data is the basis for implementing any of these local ordinances.

The City of Pocatello Ordinance 2726 states ". . .When the Idaho Department of Environmental Quality, or its successor division or agency, informs the City that it is declaring an "air quality alert" and notifies local print, radio and television news media that an air pollution alert is being declared the prohibitions set forth below shall apply."

The City of Chubbuck Ordinance 582 states the same conditions as Pocatello's ordinance.

The Coeur d'Alene Regional Office provides an Air Quality Advisory (AQA) for Sandpoint, Pinehurst and the Kootenai County areas. The advisory is for outdoor open burning and woodstove use curtailment. The advisory is issued from November 1 through March 31 each year.

Sandpoint adopted Ordinance 965, which was incorporated into the SIP (PM_{10} nonattainment), and requires wood stove curtailment during a "yellow" advisory (issued by DEQ). (The ordinance also requires EPA certified woodstoves).

Pinehurst adopted Resolution No. 68 (incorporated into the Pinehurst PM_{10} SIP) which requires curtailment of wood burning during times when poor air quality is forecast.

Under a 1995 Memorandum of Understanding (MOU) between EPA, DEQ and the Kootenai County Air Quality Advisory Committee, Kootenai County agreed to abide with a daily air quality advisory (AQA) program administered by DEQ. The AQA provides increasing types of burn restrictions with increasing deterioration of air quality and forecasted air stagnation.

Twin Falls County has adopted County Ordinance 196: Part 4-4-6 BURN PERMIT TERMINATED. The Fire Chief, Assistant Chief, Fire Officer or Fire Marshall has the authority to require that open burning be immediately discontinued (even if valid permit has been issued) if smoke from burning becomes a nuisance or creates a hazardous condition or a regional burn ban has been declared by a fire management agency or the Department of Environmental Quality.

Table B-7. Local Ordinances in the Treasure Valley

Burn Restrictions in Treasure Valley Cities and Counties				
Location	**AQI is**	**These Burn Restrictions Apply**		**Ordinance**
Ada County	≥ 60	No:	Open/outdoor burning.	577
		Okay:	Fireplaces and all wood stoves.	
	≥ 74	No:	Open/outdoor burning, fireplaces, and non-certified wood st□ves.	254
		Okay:	Certified wood stoves.	
Boise City	≥ 60	No:	Open/outdoor burning.	7-01-23
		Okay:	Fireplaces and all wood □t□ves.	
	≥ 74	No:	Open/outdoor burning, fireplaces, and all w□od □toves.	4-06-04
Eagle	≥ 60	No:	Open/out□oor□burning.	488
		Okay:	Fireplaces and all wood stoves.	
	≥ 74	No:	Open/outdoor□b□rning, fireplaces, and all wood stoves.	
Kuna	≥ 60	No:	Open/outdoor burning.	922
		Okay:	Fireplaces and all wood stoves.	
	≥□74 □	No:	Open/outdoor burning, fireplaces, and non-certified wood stoves.	
		Okay:	Certified wood stoves.	
Garden City	≥ 60	No:	Open/outdoor burning.	841-06
		Okay:	Fireplaces and all wood stoves.	
	≥ 74	No:	Open/outdoor burning,□f□replaces, and all wood stoves.	808
Meridian	≥ 60	No:	Open/outdoor burning.	06-1221
		Okay:	Fireplaces and all wood stoves.	
	≥ 74	No:	Open/outdoor burning, fireplaces, and all wood sto□e□.	
Star	≥ 60	No:	Open/outdoor burning.	74
		Okay:	□i□eplaces and all wood stoves.	
	≥ 74	No:	Open/outdoor burnin□, f□replaces, and all wood stoves.	85
Canyon County	≥ 60	No:	Open/outdoor burning.	05-011
		Okay:	Fireplaces and all wood stoves.	
	≥ 74	No:	Open/outdoor burning, fireplaces, and non-certified woo□ st□ves.	04-001
		Okay:	Certified wood stoves.	
Caldwell	≥ 60	No:□	Op□n/outdoor burning.	2335
		Okay:	Fireplaces and all wood stoves.	
Greenleaf	≥ 60	No:	Open/outdoor burning.	196
		Okay:	Fir□p□aces and all wood stoves.	
Middleton	≥ 60	No:	Open/outdoor burning.	390
		Okay:	Fireplaces and all wood stoves.	
	≥ 74	No:	Open/outdoo□ burning, fireplaces, and non-certified wood stoves.	
		Okay:	Certified wood stoves.	
Nampa	≥ 60	No:	Open/outdoor burning.	2910
		Okay:	Fireplaces and all wood stoves.	
Parma	≥ 60	No:	Open/outdoor burning.	478
		Okay:	Fireplaces and all wood stoves.	

State Rules and Programs

Emergency Episode Rule

Under Sections 550-562 of the Rules for the Control of Air Pollution in Idaho (http://adm.idaho.gov/adminrules/rules/idapa58/0101.pdf), known as the Air Pollution Emergency Rule, DEQ is authorized to manage and remedy pollution levels that may constitute a health emergency. The rule is designed to:

- define criteria for an air pollution emergency,
- formulate a plan for preventing or alleviating such an emergency, and
- specify procedures for carrying out the plan.

The Air Pollution Emergency Rule outlines the criteria that enable DEQ to take appropriate action when levels of regulated air pollutants cause or are predicted to cause a health emergency. The rule identifies four stages or levels of an emergency, with each successive stage addressing a progressively more serious air quality event.

Stage	Title	Description
1	Forecast/Caution	The National Weather Service issues an Atmospheric Stagnation Advisory, or an equivalent local forecast is issued, triggering an internal watch by DEQ.
2	Alert	Air quality has degraded, requiring industrial sources to begin air pollution control actions.
3	Warning	Air quality has further degraded, requiring control actions to maintain or improve air quality.
4	Emergency	Air quality has degraded to a level that will substantially endanger public health, requiring implementation of the most stringent control actions.

Levels of pollutants in the atmosphere are determined through analysis of meteorological data and ambient air quality monitoring data gathered by DEQ. Four criteria stages have been established for carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter with an aerodynamic diameter of 10 micrometers or less and of 2.5 micrometers or less (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2). The criteria apply to any situation or circumstance in which pollutants reach, or are predicted to reach and persist at, potentially unhealthful levels.

Vehicle Inspection and Maintenance

In April 2008, the Idaho Legislature enacted and the Governor signed into law Idaho Code Section 39-116B, entitled Vehicle Inspection and Maintenance Program. It required DEQ to enter into rulemaking to establish the minimum requirements for a vehicle inspection and maintenance program for airsheds located within a metropolitan statistical area (MSA) when ambient air quality design values are at or above 85% of a National Ambient Air Quality Standard (NAAQS) and motor vehicle emissions constitute one of the top two contributing sources to the concentrations.

Crop Residue Burning (CRB)

In 2008, DEQ was assigned responsibility by the Idaho Legislature to manage crop residue burning on lands other than the five Indian reservations in Idaho. The crop residue burning program is designed to be protective of public health while enabling growers to burn under specific conditions. Under the program, growers must obtain approval from DEQ before burning by registering for a Permit-by-Rule at least 30 days in advance of the proposed burn date.

An acceptable burn day occurs when air quality is good and is expected to continue to be good, as indicated by measured pollutant levels. Specifically, pollutant levels must not exceed 75% of any applicable federal air quality standard and must be projected to continue at no more than those levels during the subsequent 24 hours or must not exceed or be forecasted to reach and persist at 80% of the Stage-one Emergency Episode one-hour criteria for particulate matter (80 $\mu g/m^3$ for $PM_{2.5}$).

Burn approval decisions are based on air quality conditions; proximity to towns, schools, roads, hospitals, canyon rims, etc.; the order of burn requests received from applicants (first come, first reserved); and other relevant factors.

More information about the CRB program is found at: http://www.deq.idaho.gov/air/prog_issues/burning/crop_residue_burning.cfm.

Montana/Idaho Airshed Group

In Idaho, land managers who conduct a "major" amount of prescribed burning participate in a bi-state smoke management program with Montana. The program is managed by the Montana/Idaho State Airshed Group, which was formed to limit the impacts of smoke generated from necessary forest and rangeland burning.

Idaho Department of Lands

The Idaho Department of Lands (IDL) requires a permit for all open fires on any forest or rangeland during the closed fire season, which is generally May 10 through October 20. This requirement may be year-round in some areas. The Idaho Forest Practices Act, enforced by IDL, requires slash created by forest harvesting practices on state and private lands to be treated. The most common treatment technique involves burning the slash during periods of low fire danger. IDL may provide further information about fire management activities.

State Implementation, Attainment, and Maintenance Plans

Air Quality Improvement Plans and Air Quality Maintenance (in some cases Limited Maintenance) Plans typically provide a commitment to conduct ambient air monitoring, typically for 20 years from the approval date of the plan, to ensure compliance for the pollutant the plan is written for. In Idaho, there are currently five attainment/maintenance plans in effect that have ambient air monitoring commitments:

1. Portions of Power-Bannock Counties (Pocatello) in Idaho were designated a moderate nonattainment area for PM_{10} by operation of law upon enactment of the Clean Air Act Amendments of 1990. On November 5, 1998, EPA granted a request by the State to divide

the Power-Bannock counties nonattainment area, which included a portion of the Fort Hall Indian Reservation, into two nonattainment areas; one which included only Reservation lands (Fort Hall nonattainment area) and a second (Portneuf Valley area) under the regulatory jurisdiction of the State.

On June 30, 2004, the State of Idaho submitted a plan that meets the planning obligations for both the nonattainment and maintenance plans. In addition, the State requested redesignation of the Portneuf Valley to attainment for PM10.
On May 20, 2005, EPA proposed in the Federal Register to approve the plan and grant the redesignation request. On July 13, 2006, EPA approved the plan and granted the redesignation request. (See 71 FR 39574)

2. Northern Ada County (Boise), Idaho, was designated as a moderate PM10 nonattainment area upon enactment of the Clean Air Act Amendments of 1990. Idaho submitted a maintenance plan and redesignation request on September 27, 2002, and provided supplemental information on July 10, 2003, and July 21, 2003. EPA proposed the maintenance plan and redesignation request on July 30, 2003 (68 FR 44715). On October 27, 2003, EPA approved the Northern Ada County (Boise) PM10 maintenance plan and redesignation request (68 FR 61106).

3. Northern Ada County (Boise), Idaho, was designated nonattainment for carbon monoxide (CO) and classified as "not classified" upon enactment of the Clean Air Act Amendments in 1990. Idaho submitted a CO maintenance plan on January 17, 2002, and EPA approved the plan on October 28, 2002 (67 FR 65713).

4. The Sandpoint area in Bonner County, Idaho, was designated as a nonattainment area for PM10 and classified as moderate upon enactment of the Clean Air Act Amendments in 1990. Idaho submitted a PM10 attainment plan in May of 1993. On August 16, 1996, Idaho submitted a revised plan, and EPA approved the plan on June 26, 2002 (67 FR 43006).

5. The Shoshone County, Pinehurst, Idaho, area was designated nonattainment for particulate matter (PM10) and classified as moderate upon enactment of the Clean Air Act Amendments of 1990. Idaho submitted a PM10 attainment plan on April 14, 1992, and EPA approved the plan on August 25, 1994 (59 FR 43745). On April 14, 1992, Idaho also submitted a PM10 attainment plan revision for the portion of the Shoshone County, Idaho, nonattainment area just outside the city of Pinehurst. This area was designated nonattainment in January 1994. EPA approved the plan revision on May 26, 1995 (60 FR 27891).

"Sunset" dates, or end dates for monitoring requirements, are not specified in the air quality improvement or maintenance plans. DEQ presumes that the monitoring commitments for demonstrating attainment have a 20-year duration from the date the airshed is reclassified to attainment. DEQ would have to propose and EPA would have to approve alternate methods for demonstrating attainment of NAAQS in lieu of ambient air monitoring.

Public Information

DEQ provides updates on real-time or near real-time air quality conditions to the public in two ways. Using file transfer protocol (FTP), DEQ publishes continuous air monitoring data to both EPA's AirNow Web page and DEQ's real-time air quality map. Links to both of these tools are provided on DEQ's air quality Web page: http://www.deq.idaho.gov/air/aqindex.cfm. DEQ also provides daily AQI forecasts by 9 am each morning, allowing citizens and governments to plan their activities as early as practical.

DEQ has finalized a new real-time air quality map with current conditions on display. The map can be found at: http://airquality.deq.idaho.gov/. This tool will eventually allow public query of archived air quality data.

Databases

DEQ's monitoring data is submitted to EPA's Air Quality System (AQS) database in a timely manner as required by the Clean Air Act. Data from AQS is accessible through EPA's public Web sites: AirData http://www.epa.gov/air/data/ and Air Explorer http://www.epa.gov/airexplorer/.

Air Quality Modeling and Forecasting Tool

Monitoring data is also used by various institutions (e.g. University of Washington, Washington State University) for incorporation into tools that are used to forecast local meteorology and real-time air quality. These tools are discussed in section C-2.

C. AIR QUALITY AND IDAHO'S PHYSICAL ENVIRONMENT

This section provides detailed information about Idaho's topography and meteorology and how they affect air quality in Idaho's airsheds. It also provides information the sources of air pollutants in Idaho, including overviews of emissions inventories and a summary of recent air quality trends.

C.1 Topography and Meteorological Summary

Topography of the area and local meteorological conditions influence air quality significantly. Both are complex and vary seasonally in their influences on air quality. The same characteristic can be beneficial to air quality in one season but be detrimental in another. The same characteristic can also have opposite effects on air quality at two different times of day.

The following brief descriptions of Idaho's topographic and meteorological characteristics and their influences on air quality are paraphrased from more detailed discussions developed and published by the Western Regional Climate Center, Climate of Idaho narrative (http://www.wrcc.dri.edu/narratives/IDAHO.htm). More detailed descriptions of how climate and topography influence the specific airsheds in Idaho are in section C.3 Idaho's Airsheds.

Topographic Features

Topography provides a structure that directs or impedes air and pollutant flows in an area. The same structure can have a positive influence on air quality during some seasons and a negative influence during others. Seasonal variations in winds direct or trap pollutants in some seasons and provide a cleansing effect in others. Diurnal winds, caused by normal heating and cooling of the ground, can bring pollutants in from a source or trap them in an area during one part of the day and drain them out of the area during another time of day. Valleys enclosed by mountains on all sides are conducive to inversion conditions that can trap pollutants at ground level and result in poor air quality.

The elevation in Idaho varies dramatically from 738 feet at the confluence of the Clearwater and Snake rivers to as high as 12,655 feet at the peak of Mt. Borah. This vast variation in elevation provides for many barriers to the free flow of air. Additionally, despite being roughly 300 miles from the Pacific Ocean, Idaho's northern area is influenced by maritime air brought by the prevailing westerly winds.

Temperature

Temperature has both a direct and an indirect influence on pollutant concentrations. Most air quality impacts related to temperature are observed on each end of the spectrum – cold/winter or hot/summer. During times of the year when the temperature is mild, or in the median range (spring and fall), air quality is more favorable.

Ozone is typically known as a summertime pollutant because it is most easily formed in warm temperatures and under high sunlight conditions. The times of highest ozone concentrations in Idaho are during the hottest periods of the year (July and August). Particulates ($PM_{2.5}$ and PM_{10})

most commonly increase during wintertime inversions when pollutants are trapped in an area and accumulate. However, particulate concentrations can increase in both hot and cold conditions when extremely dry. In warmer temperatures some outdoor recreation activities that produce particulates are more common and in colder conditions dust from winter road sanding can become airborne.

Elevation plays an important role in the average annual temperatures as well as the amount of diurnal variation throughout the state. In general, it can be said that monthly means are 32° F or lower at stations above 5,000 feet from November through March; between 4,000 and 5,000 feet from November through February; between 3,000 and 4,000 feet from December through February; and between 2,000 and 3,000 feet, only one or two months. It can also be said that diurnal variation is lowest during winter months when cloud cover stabilizes temperatures.

Precipitation

Precipitation typically has a positive influence on air quality. Rain and snow both have a physical ability to absorb and remove pollutants from the air and they also create or coincide with turbulence that results in dilution of pollutants from the increased mixing that occurs.

The largest source of moisture is from the Pacific Ocean although some moisture is brought in from the Gulf of Mexico during certain weather patterns, which affects the eastern part of the state the most.

Average precipitation varies significantly across the state. In general, northern regions receive more precipitation due to fewer topographical barriers to the west and more storm activity. Higher elevations tend to have higher average precipitation with much of it received in the form of snowfall.

Humidity

Humidity impacts air quality in varying ways based on season. High humidity has a positive influence on air quality conditions in the summer when it reduces sunlight intensity and facilitates atmospheric chemical reactions that inhibit ozone formation. High humidity, however, can have a negative influence in the winter when it provides a media for small chemical species in the air to condense and react to form secondary particulates. However, when combined with very low temperatures, high humidity can result in rime ice or hoar frost that is very effective at removing pollutants from the air. Low humidity in the summer allows full sunlight intensity and does not compete in the ozone formation reaction. This can lead to higher ozone concentrations. Low humidity in the winter slows the formation of secondary particulates but also allows dust from road-sanding operations to dry out and be more likely to become airborne and be measured as particulates. Humidity can vary within each season but tends to be higher in the winter and lower in the summer.

Fog

Fog is typically only an influence in the colder months. Light fog provides the same influences on air quality as described for high humidity. However, heavy fog can work similarly to precipitation in that water droplets can become large and dense enough that they actually work to remove pollutants from the air. Similarly, hoar frost or rime ice forming ice crystals on trees, power lines, or other structures during times of heavy fog and cold conditions often scrub pollutants from the air.

Information on how frequently fog occurs is limited and information on hoar frost or rime ice is even more limited. However, the National Weather Service tracks fog in Boise, Lewiston, and Pocatello. Occurrence of heavy fog varies in these cities, on average, from 10 days to 17 days per year.

Storms

Windstorms are not uncommon in Idaho. While the state has no destructive storms such as hurricanes, and an extremely small incidence of tornadoes, windstorms of various types impact the area year-round. Cyclonic windstorms associated with low pressure or cold fronts may occur at any time from October into July, while during the summer months strong winds almost invariably come with thunderstorms. The incidence of summer thunderstorms is greatest in mountainous areas, where lightning often causes serious forest and range fires.

Storms can provide the winds needed to clean the air after a period of pollutant accumulation such as during an inversion. They can also provide a needed shift to direct pollutants away from an area such as a community impacted by wildfire smoke. However, winds can also be the cause of high particulate concentrations brought on by airborne dust or by directing pollution from its source to an airshed..

Sunshine (Solar Radiation)

Ozone (O_3) is a gas composed of three oxygen atoms. It is not usually emitted directly into the air, but at ground-level is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. The more sunlight and the warmer the air, generally the more efficient the reaction and the higher the ozone concentration.

Typically, winter months in Idaho have sunshine between 30 to 40 percent of the time. During summer months that rises to about 80 percent of the time, particularly in the southern part of the state. The increased amount of summertime sunshine, in combination with the warmer temperatures, makes Idaho’s climate very efficient in producing ozone.

Forested Lands

Forested lands provide fuels for a variety of biomass burning that leads directly to increased particulate levels. Trees are harvested to supply fuel for home heating. Lumber harvest produces waste products such as limbs and other slash. Forest management practices involve under-brush clearing through prescribed burning. And of course there are accidental wildfires. Additionally, various types of vegetation emit biogenic VOCs that contribute to ozone formation.

Approximately two million acres of forest lie within the eastern part of the state, mostly in the higher mountainous areas. Lumber harvest there is done only on a small scale. The southwestern portion of the state has a greater forested area, running into several million acres. Lumber harvest is a more important phase of the economy in southwestern Idaho than in eastern Idaho. The northern part of Idaho, because of its greater annual precipitation, is more heavily forested than the southern portion of the state, and lumber harvest has long occupied a prominent place in the economy of North Idaho. Lewiston, Potlatch, and Coeur d'Alene are among the sites of important forest product industries.

C.2 Meteorological Data and Tools Available for Air Quality Forecasting

This section explains how DEQ's program uses meteorological data and tools to support the data and information provided to primary users. Information is provided for the data and tools most commonly used by DEQ to forecast air quality and meteorological conditions, which are a CART ozone forecasting tool, the National Weather Service Air Quality Guidance Model, Unisys 500-millibar (mb) and 850-mb forecast models, the Unisys Skew-T diagrams of atmospheric conditions, the AIRPACT-3 air quality model, outputs from the MM5-WRF model at the University of Washington, and National Weather Service forecasts. As previously mentioned in Section B.5, certain regional modeling and air quality forecasting tools require real-time DEQ ambient monitoring data. This section will provide examples of those tools.

Boise City (Treasure Valley airshed) is Idaho's only Metropolitan Statistical Area (MSA) that meets the population criteria for determining and reporting a daily AQI, per the Code of Federal Regulations (CFR). However, in accordance with Clean Air Act planning requirements for areas that have violated the National Ambient Air Quality Standards (NAAQS), DEQ has implemented air quality advisory (AQA) programs in several designated (or formerly designated) nonattainment areas. Agricultural and other open burning, smoke from wildfire, strong winter inversions, and other sources of pollution have prompted DEQ to extend the AQI program to a number of different areas in the state.

Forecasting AQI for an AQA program requires informed decisions that take into consideration the most recent air quality conditions and the expected meteorological conditions over the forecast period. The various resources used by DEQ forecasters to determine changes in meteorological conditions and project impacts on local air quality are described below.

CART Ozone Forecasting Tool

Idaho DEQ has developed a classification and regression tree (CART) forecasting system as a tool for the Boise Regional Office of DEQ to use in developing their AQI forecast during the ozone season. Historical ozone monitoring data and meteorological parameters for the previous five years were analyzed using the CART module in the R Statistical software. This analysis helped DEQ to select meaningful predictive parameters and to generate a classification tree that uses the previous day 8-hour ozone concentration, temperature, wind speed, relative humidity, and 850-millibar (mb) temperature. AQI categories and control measure trigger points have been integrated into the tree so that it can be used to determine the probability of reaching each category or trigger point for the Treasure Valley airshed. The resulting tree is automated with forecast meteorological inputs from the University of Washington w**eather research and forecasting** WRF simulations (described below) and updated twice daily. The CART tool includes ozone and meteorological monitoring data from the DEQ monitoring network to aid interpretation of the forecast and is used along with the other available tools, as described below.

National Weather Service Air Quality Guidance Model

The National Weather Service provides a map that predicts ozone and smoke concentrations for use by the public and state and local air quality forecasters (located at http://www.weather.gov/aq/sectors/pacnorthwest.php?period=3#tabs).

Ozone is shown as 1-hour and 8-hour concentrations (in parts per billion or ppb), updated twice daily. Surface and column-average concentrations of predicted smoke for large fires are displayed as 1-hour averages (in micrograms per cubic meter), updated each day. The model provides a visualization of how weather information and pollutant monitoring information come together to show a plausible prediction of air quality conditions. Figure C-1 is an example.

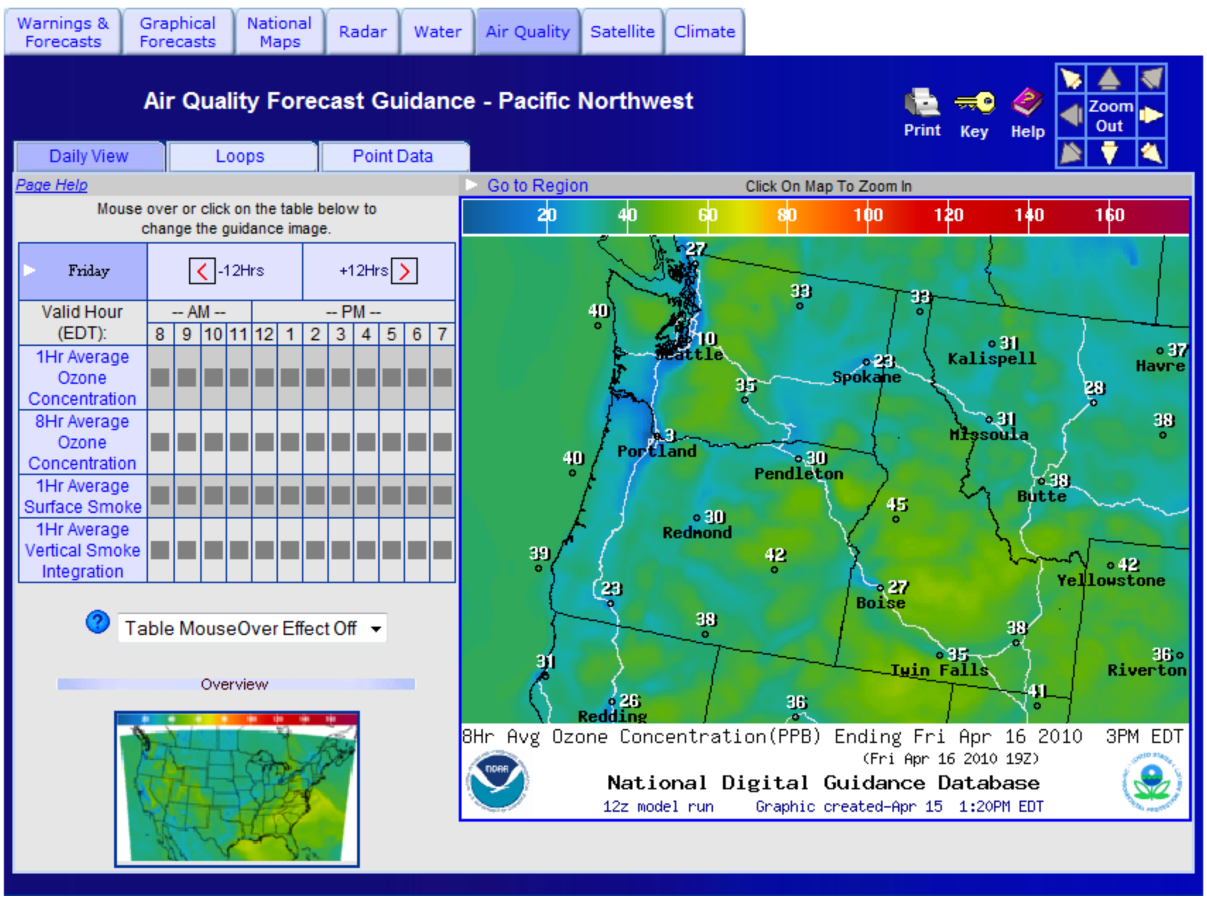


Figure C-1. National Weather Service Air Quality Guidance Model

UniSys 500-mb Forecast Model

The 500-mb level is approximately 17,000 feet above sea level. On the UniSys 500-mb charts (located at http://www.weather.unisys.com/mrf/9panel/mrf_500p_9panel.html), pressure at the 500-mb level is in color and the sea-level, or surface, pressure is represented by thin black lines. *Figure C-2* shows an example. The ridge in the center appears like a red and orange mountain while each of the troughs looks like a yellow and orange letter U. The ridge in the example (*Figure C-2*) is east of Idaho and marked with an angled line. The trough approaching Idaho from the northwest is marked with a dashed line. (When seen on the Web site, these maps do not includes lines such as these in *Figure C-2*—the angled and dashed lines indicating ridges and troughs.) When ridges are overhead, that provides the best opportunity for high-pressure, stagnant conditions at the surface. DEQ uses the 500-mb forecast model to understand predicted upper atmosphere conditions that can influence air quality for the forecast period.

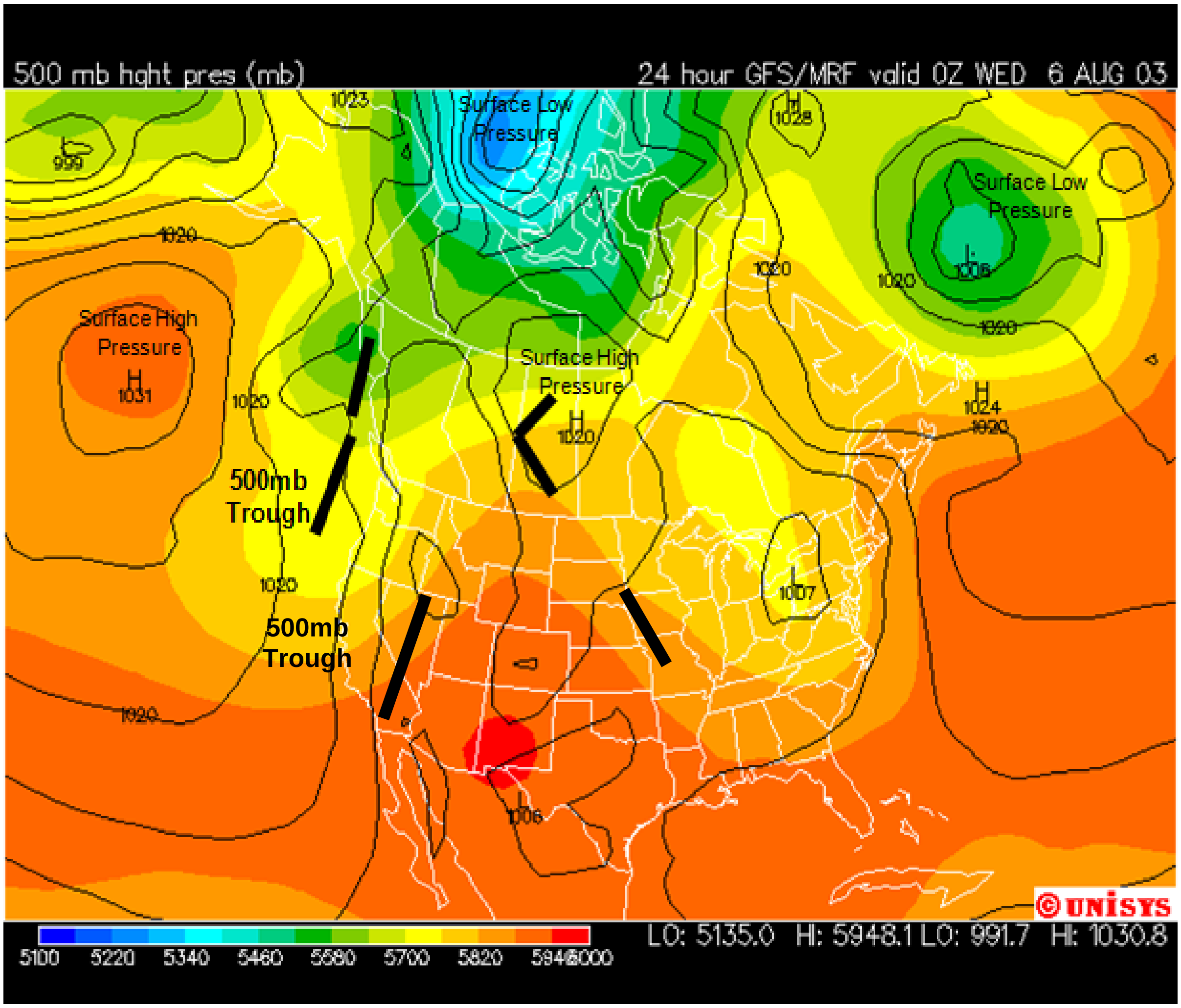


Figure C-2. UniSys 500-mb Forecast Model example

UniSys 850-mb Forecast Model

The 850-mb level is approximately 5,000 feet above sea level. On the UniSys 850-mb charts (located at http://www.weather.unisys.com/eta/4panel/eta_850_4panel.html), temperature is indicated by color scale. An 850-mb temperature chart gives a good indication of the expected advection of warm and warming air into the forecast region. In the example below (*Figure C-3*), the temperature over Boise is expected to be approximately 26-28°C. DEQ uses the 850-mb forecast model to understand predicted near-surface or surface conditions that can influence air quality for the forecast period.

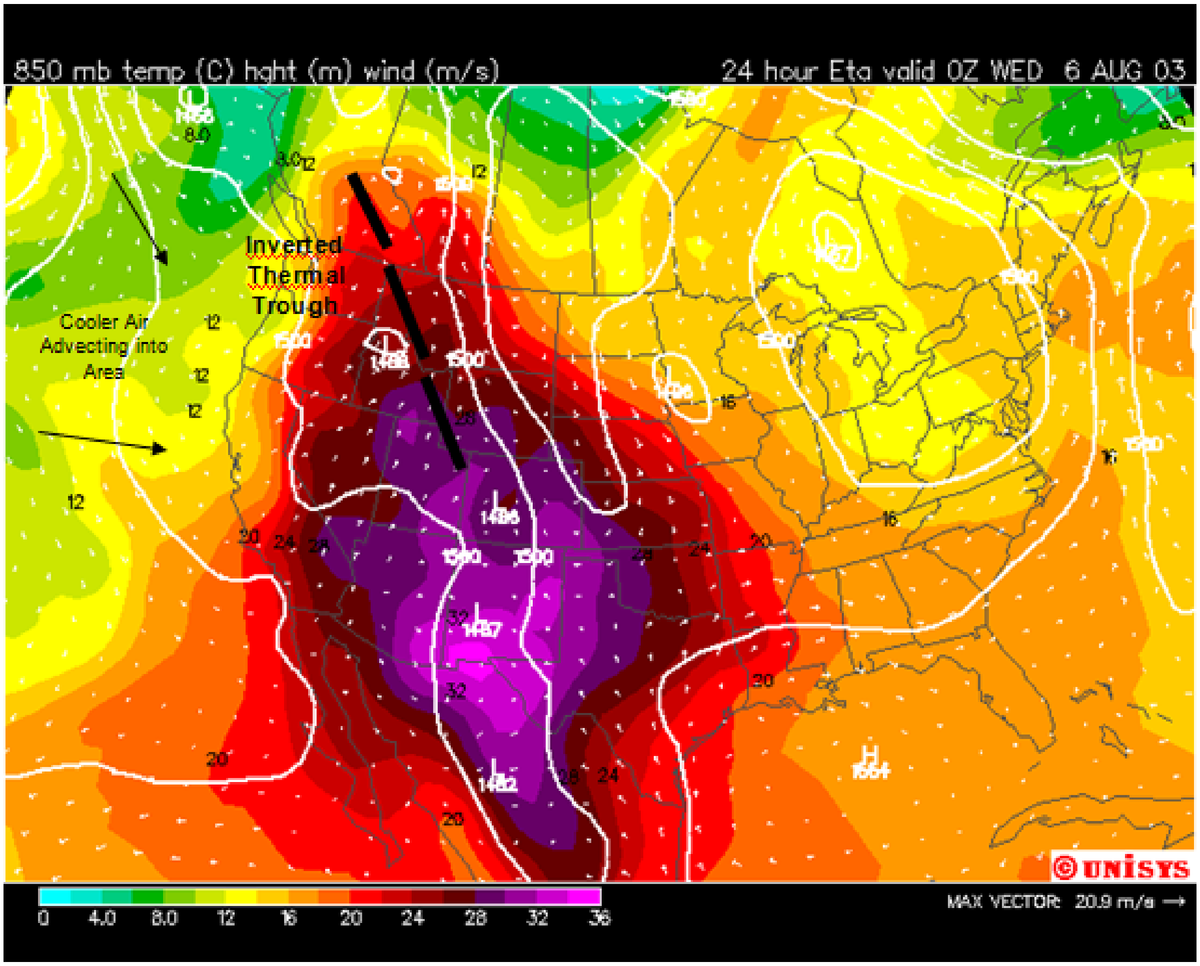


Figure C-3. UniSys 850-mb Forecast Model example

UniSys Skew-T Diagram

These Skew-T diagrams reflect atmospheric measurements that are obtained at regional airports at periodic intervals. These charts (located at http://weather.unisys.com/upper_air/skew/details.html) present many forms of information for a weather forecaster—winds, cloud formation, atmospheric stability, temperatures, etc. The example below (*Figure C-4*) indicates that clouds will likely form at about the 650 to 700–mb level.

DEQ uses these Skew-T diagrams to better understand the vertical profile of the atmosphere. This information gives guidance on whether forecasters can expect atmospheric instability; breaking of inversion conditions; formation of cloud cover, dew, or frost; and other conditions that could impact pollutant concentrations.

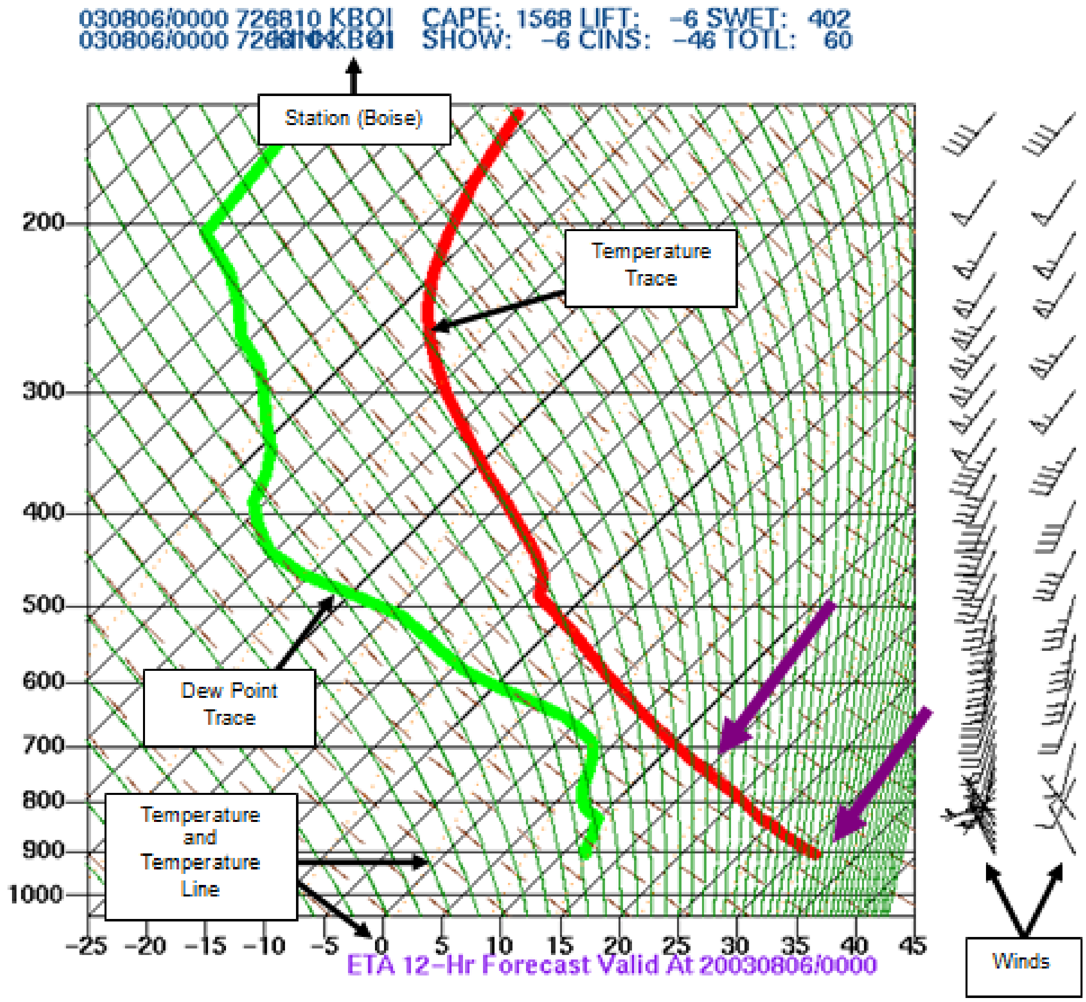


Figure C-4. Unisys Skew-T Diagram example

AIRPACT-3

AIRPACT-3 is a photochemical grid modeling system (accessible at http://www.lar.wsu.edu/airpact-3/) used for predicting air quality (AQ) for the immediate future of one to three days for ID, OR and WA. *Figure C-5* shows an example.

AIRPACT predicts air quality by calculating the chemistry and physics of air pollutants as determined by pollutant emissions within the context of the background, natural air chemistry, and predicted meteorology. Meteorology and pollutant emissions are used to provide a visualization of air quality conditions in the immediate future.

AIRPACT's project name, the Air Information Report for Public Access and Community Tracking, reflects the goal of bringing meaningful information on the quality of the air (or the level of air pollutants) to the public from a variety of sources, including both model results and monitoring stations.

AIRPACT is one tool that may be used by air quality forecasters in Idaho to judge expected changes in air quality levels predicted for the next day or two.

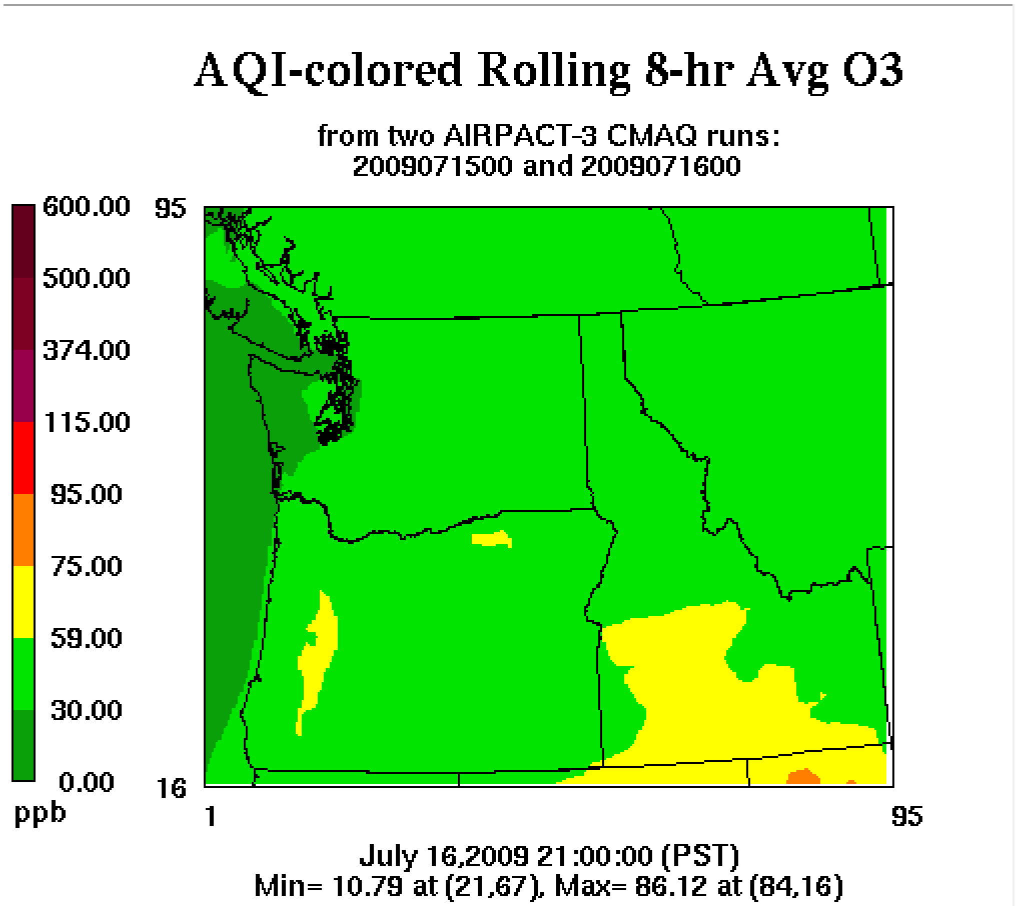


Figure C-5. AIRPACT-3 model output example

MM5-WRF

DEQ uses outputs from the weather prediction models MM5(fifth generation mesoscale model) and WRF(Weather Research and Forecasting) at the University of Washington. Certain outputs from the MM5-WRF models are sponsored by the Northwest Regional Modeling Consortium (available at http://www.atmos.washington.edu/mm5rt/). *Figure C-6* shows an example. The activities of the consortium include:

- The creation of one of the highest- resolution operational weather prediction systems in the U.S. at the University of Washington built around the Penn State/**National Center for Atmospheric Research** (NCAR) mesoscale model. (This model was initially called MM5 and after improvments is now called WRF, but the MM5 model is still used).
- The purchase and maintenance of a 915- megahertz (MHz) radar wind profiler with radio acoustic sounding system (RASS) temperature-sounding capability that is located at the National Oceanic and Atmospheric Administration (NOAA) Sand Point facility in Seattle.

- The gathering of real-time observational data from operational networks in the Northwest to create a detailed description of atmospheric conditions over the region.
- The running of regional air quality and distributed hydrological forecast models coupled with the MM5.
- The production of smoke, ventilation, and fire control guidance driven by MM5 output.
- The running of a regional ensemble prediction system.

Idaho DEQ utilizes WRF model predictions to understand forecasted weather parameters to better develop daily air quality forecasts. In addition, Idaho DEQ downloads and archives the WRF outputs for use in driving our regional and airshed modeling efforts.

By combining observed pollutant levels at specific sites with modeling results, we are able to create the best possible depiction of air quality at locations throughout the state that are not near a monitoring site.

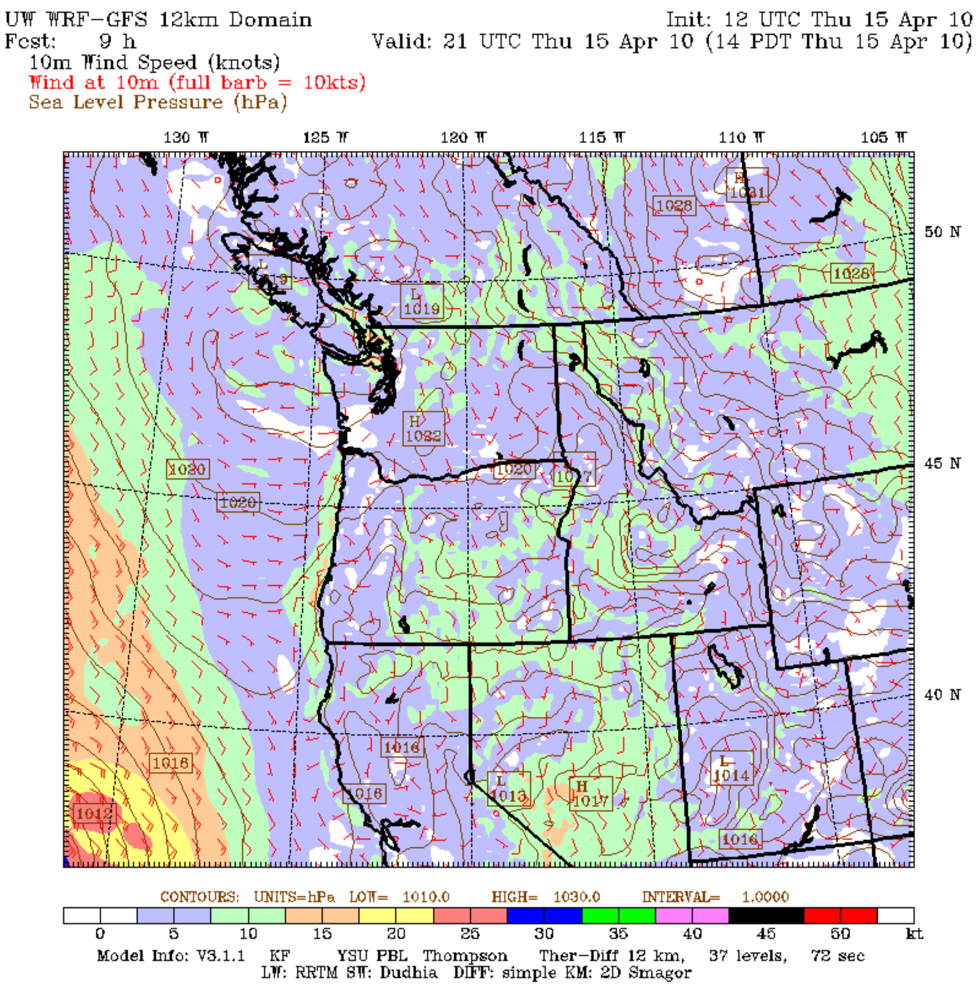


Figure C-6. MM5-WRF model output example

National Weather Service Forecasts

The National Weather Service provides detailed forecast information for several cities in Idaho. Seven day forecasts, forecast discussion, Hazardous Weather Outlook (when applicable), and Stagnation Warnings (when applicable) are provided to further assist forecasters in understanding the immediate weather conditions.

C.3 Idaho's Airsheds

Idaho's delineated airsheds, and some non-delineated areas, are described in this section. The first six are delineated to roughly correspond with DEQ's six regions (the Treasure Valley Airshed corresponds with DEQ's Boise Regional Office), the remaining (five) delineated airsheds have been established to correspond with certain air quality concerns. In addition, air quality is described for certain non-delineated airsheds.

Treasure Valley Airshed

Idaho's Treasure Valley occupies the western end of the broad Snake River Valley where the Payette, Boise Weiser, Malheur and Owyhee rivers drain into the Snake River. It includes the valley areas from Vale and Ontario, Oregon in the west to Mountain Home, Idaho in the east. The Boise City – Nampa Metropolitan Statistical Area accounts for the greatest population density in the Valley, with approximately 600,000 estimated in 2008, compared to Caldwell, Idaho (42,000) and Ontario, Oregon (11,000) in the western end of the airshed. Note all population estimates in section C.3 are 2008 estimates from the U.S. Census Bureau (2009).

Synoptic (regional) winds arrive at the Treasure Valley from the west and southwest; however, terrain-driven valley flows largely determine the surface wind patterns. The Boise Range Mountains to the northeast and the Owyhee Mountains to the southwest channel valley drainage winds into a very consistent southeasterly direction in the night and morning while upslope winds from the northwest predominate during the afternoon and early evening. The mountains and foothills immediately to the north and east of Boise appear to provide a blocking action when stagnant air persists in the wintertime, causing a Deep Stable Layer condition (Wolyn and McKee, 1989) and a trapped cold air pool with extremely stable, stagnant air in the Valley. When these conditions persist, pollutants are not advected out of the area and begin to build from day to day. In the most severe cases, the buildup of pollutants blocks incoming solar radiation causing the surface to cool further and the inversion to strengthen. Since this occurs during cold and often foggy conditions, secondary aerosols ammonium nitrate and ammonium sulfate dominate the $PM_{2.5}$ aerosol composition, often reaching 60 to 70% of the total.

In the past, carbon monoxide from cars and particulate matter from residential wood combustion were problem pollutants; however, new car standards and a reduction in residential wood burning have reduced these problems. PM_{10} concentrations have remained well below the NAAQS for over 10 years. The secondary aerosol formed during wintertime inversions continues to contribute to air quality in the *unhealthy for sensitive groups* category at times, but the 3-year average 98th percentile $PM_{2.5}$ remained below 30 $\mu g/m^3$ for all Treasure Valley sites through 2007 and 2008. Automotive traffic is the largest source of nitrogen oxides, which contribute to both nitrate aerosol formation in the winter and ozone formation in the summer;

however, limited NO_2 monitoring data indicates compliance with the new 1-hour NO_2 standard is not threatened. Industrial boilers in Caldwell/Nampa are the largest sources of sulfur dioxide in the area, contributing to secondary aerosol formation during winter inversions, although to a lesser extent than nitrates. The region is ammonia-rich so that secondary aerosol formation is limited only by the availability of NO_x and SO_2. Biogenic emissions and automotive exhaust and fuels contribute the majority of the volatile organic compounds (VOCs) in the airshed. Ozone formation has been shown (Kavouras, et al., 2008) to be lowest at the western edge of the airshed, and to increase toward Boise with the 2008 design value of 0.075 ppm remaining just below the NAAQS at the Whitney School site. The White Pine site (which replaced Whitney when the Whitney School closed), appears to trend a few ppb higher, due to less morning ozone scavenging by nitric oxide on the lower-traffic, upwind side of Boise during morning drainage conditions.

Coeur d'Alene – Rathdrum Prairie Airshed

The Coeur d'Alene –Rathdrum Prairie Airshed is delineated largely by the southwest-northeast trending Rathdrum Prairie with Lake Coeur d'Alene and the City of Coeur d'Alene, population 43,000, on the southeastern end and the City of Spokane, Washington, population 202,000, on the western end. The Rathdrum Prairie slopes gently from the northeast toward the Spokane River to the south, and turns into the Spokane Valley to the west.

Synoptic winds arrive at this airshed from the west and the south. The valley terrain imposes a prominent northeasterly drainage flow during the night and early morning hours and a westerly or southwesterly flow during the afternoon, bringing ozone precursors to the Coeur d'Alene area from the Spokane, Washington and Post Falls, Idaho urban areas.

Major sources of pollutants in this airshed appear to be motor vehicle traffic exhaust and fuels, and agricultural burning on the Rathdrum Prairie and on the agricultural lands south of Coeur d'Alene. The only major industry in the airshed is an aluminum plant located in the Spokane Valley of Washington.

PM_{10} and $PM_{2.5}$ concentrations remain well below their respective NAAQS, even though agricultural burning does increase levels to the *unhealthy for sensitive groups* level on a small number of days each year. Ozone levels at the Lancaster site on the Rathdrum Prairie reached a maximum design value of 0.067 ppm in 2007, with the 3-year design value in 2008 being lower at only 0.64 ppm.

Lewiston Airshed

Lewiston, Idaho, population 31,760, sits at the confluence of the Clearwater and Snake River canyons at 238 meters in elevation, the lowest point in Idaho, sharing the valley with the City of Clarkston, Washington, population 7,260. River canyons and mountains are found to the west, south and east of Lewiston, including Nez Perce Tribal lands, while the rolling hills of the Palouse agricultural area lies at 780 meters in elevation at the top of the canyon to the north. While the canyon walls are steep to the west and north, the terrain south of Lewiston slopes gently toward the southeast.

The only major industrial facilities in the Lewiston area are a large pulp and paper mill located on the south side of the river, just east of the City, and an ammunition manufacturing facility, however, agricultural burning can influence $PM_{2.5}$ conditions near the urban-rural interface southeast of Lewiston.

Synoptic winds approach Lewiston generally from the northwest during the summer and from the south during the winter; however, the steep Snake River and Clearwater River canyons that lead into the Lewiston Valley dominate the surface flow patterns with a predominant down-valley drainage flow from the east, along the Clearwater River, supplemented by a southeasterly drainage component flowing down the gently sloping land to the southeast of Lewiston. Both PM_{10} and carbon monoxide were found to be well below their respective NAAQS levels back in 2002 when monitoring for these two pollutants was suspended. In addition, current and historical $PM_{2.5}$ monitoring data has shown that the fine particulate level is also below its corresponding NAAQS.

Idaho Falls Airshed

The Upper Snake River Plain extends from American Falls in the south to St. Anthony to the north, and Idaho Falls, population 54, 300, lies on the eastern edge of this broad plain. Synoptic flows are channeled from the southwest toward the northeast in this portion of the plain resulting in afternoon winds largely from the southwest. At a smaller terrain scale, the Snake River meanders through Idaho Falls from the north toward the south, resulting in prominent northerly nighttime drainage winds. An absence of any significant terrain results in a well ventilated airshed which has historically exhibited no major air pollution problems. A number of food processing facilities are located along the Snake River Valley from Rexburg to American Falls, and a major phosphate fertilizer manufacturing facility is located near Pocatello, but no other significant industry influences the Idaho Falls airshed.

Pocatello Airshed

Pocatello, population 54,900, and the nearby cities of Inkom (725) and Chubbuck (11,830) lie along the Portneuf River Valley, just upstream from the area where it joins the Snake River Plain and flows into American Falls Reservoir. As a result, the s*outhwesterly* synoptic winds, best represented by the Pocatello Airport wind rose, are channeled across the northern edge of the airshed by the broad Snake River Plain, while the downtown Pocatello surface winds, best represented by the DEQ station at the Garrett and Gould (G&G) site, are dominated by the *southeasterly* drainage flows along the Portneuf River Valley.

The Pocatello airshed has long been dominated by two industrial phosphate manufacturing facilities located to the northeast of the city, resulting in primary particulate and ammonium sulfate secondary aerosol (IDEQ, 2004); however, the FMC/Astaris elemental phosphorous plant closed in December 2001 and maximum PM_{10} concentrations have since declined to less than 50% of the NAAQS while $PM_{2.5}$ concentrations remain below 30 $\mu g/m^3$. SO_2 monitoring in Pocatello indicates that levels are consistently about 20% or less of the NAAQS for the annual, 24-hour and 3-hour standards every year since 2002, and have remained 5 – 15 ppb below the new 1-hour SO_2 standard of 75 ppb from 2007 through 2008.

Twin Falls Airshed

Twin Falls, population 42,000, is the largest city in the Central Snake River Plain, also known as the Magic Valley of Idaho. The Magic Valley is dominated by agricultural production, including sugar beets, wheat, corn, dairy, and potatoes. Some dairy/cheese processing occurs in this area, in addition to two sugar beet processing facilities near the cities of Twin Falls and Paul.

The larger-scale winds in this area arrive from both the broad Snake River Plain to the west and from the Salmon Falls Creek drainage to the south. Thanks to these well-ventilated valley flows, an absence of any blocking terrain and any significant emissions source activity, the Twin Falls area has traditionally been an area of low air pollutant levels for all pollutants and continues to be so today.

Franklin County/Cache Valley Airshed

The Cache Valley straddles Idaho's southeastern border with Utah and has been designated as *nonattainment* for $PM_{2.5.}$ The major portion of the valley is in Utah and Utah is the lead state in developing a SIP for the area, with Idaho's participation involving the northern Franklin County portion of the valley. The $PM_{2.5}$ problem in the Cache Valley largely results from secondary ammonium sulfate and ammonium nitrate aerosol, primarily from transportation-related nitrogen oxides and agriculture-related ammonia.

The Cache Valley is a close-ended, north-south trending valley that develops severe winter inversions due to cold air pooling, especially when a snow floor exists during the onset of a high pressure system over the valley. Extremely stable air during these winter inversion episodes results in a day to day buildup of pollutants and conditions that are highly conducive to secondary aerosol production. No other air pollutant problems have been identified for the Franklin County portion of the Cache Valley.

Pinehurst Airshed

The small mountain town of Pinehurst, in Shoshone County, Idaho lies in a somewhat close-ended, north-south mountain valley located on Pine Creek, a minor tributary of the Coeur d'Alene River. Although historically the nearby Silver Valley was the site of a major mining/smelting complex, little industry is currently present to impact the ambient air quality. However, Pinehurst has suffered from excessive levels of residential wood combustion (RWC) and was designated nonattainment for PM_{10} in 1990. RWC is the predominant source of primary fine particulate in Pinehurst, although slash burning in adjacent valleys to the west and north recently caused elevated $PM_{2.5}$ concentrations in Pinehurst when the smoke became trapped overnight, causing an exceedance of the 24-hour $PM_{2.5}$ standard.

The Pine Creek Valley widens into the town of Pinehurst, population 1,600, just before it empties into the broader Silver Valley. Due to its blocking terrain in a north-south configuration, the Pine Creek Valley is subject to cold air pooling during the wintertime inversions. While the synoptic winds typically approach the area from the south and west, and the main Silver Valley exhibits east-west valley flows, drainage winds from the Pine Creek drainage generally follow a south-southwesterly flow direction through the center of Pinehurst.

Salmon Airshed

Salmon, Idaho sits at the confluence of the northward flowing Salmon River and the northwesterly trending Lemhi River valley. As a result, surface wind patterns are dominated by drainage flows in these directions. Salmon has a population of only 3,000, and little industry, however, its location predominantly downwind of the largest contiguous area of forested land in the lower 48 states frequently causes it to be impacted by wildfire smoke. Smoke impacts may be directly advected over Salmon, or may be trapped by the night-time surface inversion in the Salmon or Lemhi River valleys upstream from Salmon, only to drain down-valley into the Salmon area during the stable night-time period. The frequent wildfire impacts at Salmon can be seen in the smoke frequency map (*Figure D-45*).

Sandpoint Airshed

The City of Sandpoint, population 8,337, sits just north of the Rathdrum Prairie, on the northeastern, outlet end of Lake Pend Oreille in Bonner County. Sandpoint was designated in 1990 as a moderate nonattainment area for PM_{10} and is currently a limited maintenance area, the regulatory term for a former nonattainment area that continues to maintain acceptable air quality under mandatory control measures implemented during the SIP process. While Sandpoint is a winter and summer vacation destination with some residential wood combustion impacts in the winter, it also had some light industry that contributed to the PM_{10} problem in the 1990s; however, much of that industry is no longer present in the city.

Due to its position north of the Rathdrum Prairie, Sandpoint experiences predominant northeast to southwest valley drainage flows similar to those in the upper Rathdrum Prairie. However, since Sandpoint is also located between mountains to the northwest and the 148-square mile Lake Pend Oreille to the east, it also experiences northwesterly morning drainage flows in the wintertime and easterly lake-breeze flows in the summertime.

Soda Springs Airshed

Soda Springs, population 3,100, lies in the Bear River Valley at the southern end of Caribou County. A large electric arc-elemental phosphorous plant is located near the northern edge of the City and significant phosphate mining and fertilizer production is located in the Aspen range 5–10 miles away to the northeast. Soda Springs has historically been affected by industrial SO_2 impacts, and SO_2 has been monitored here for over 10 years. However, a major flue gas desulfurization project was implemented in 2001 and SO_2 emissions dropped to well below the annual, 24-hour, and 3-hour NAAQS. In 2002, the SO_2 monitor at the Soda Springs High School was shut down. The site located near the Monsanto facility became the primary monitoring location for SO_2. The monitoring objective changed from population-based to a hot spot determined by dispersion modeling and from 2007 through 2009 the short-term SO_2 concentrations remained well below the level of both the old SO_2 NAAQS (3-hour, 24-hour, and annual) and the new 1-hour SO_2 NAAQS of 75 ppb.

Other Mountain Airsheds

In addition to Salmon, a number of other mountain airsheds throughout Idaho have become sites for $PM_{2.5}$ monitors, including McCall in Valley County with a population of 2,600, Garden Valley (unincorporated) in Boise County and Idaho City, also in Boise County with a population of 500, and Ketchum in Blaine County with a population of 3,300. The McCall, Garden Valley, and Ketchum airsheds are all in mountain valley terrain with little or no industry; however, they all experience frequent wildfire smoke impacts (*Figure D-45*). In these valleys the winds follow the traditional up-valley/down-valley flow patterns expected in a mountain valley.

Other Airsheds

Finally, a number of airsheds in Idaho are monitored for $PM_{2.5}$ largely to address crop residue burning in agricultural areas. While some monitors are deployed seasonally, the sites described below are operated throughout the year. These airsheds are frequently impacted by both wildfire and agricultural smoke, as indicated by the Smoke Frequency map (*Figure D-46*).
Grangeville, population 3,100, which often experiences both wildfire and agricultural burning smoke, sits at the upper end of the Camas Prairie plateau in Idaho County and is well ventilated by synoptic winds from the south and west, or by afternoon, up-slope winds coming up the plateau from the northwest.

Moscow, Idaho is a college town of 22,800 surrounded by the rich wheat-producing area of the Palouse, just north of Lewiston. Synoptic winds approach Moscow from the west and southwest. Moscow has no significant industry, but may at times be influenced by crop residue burning in both Whitman County, in Washington and Latah County, Idaho. There hasn't been any threat to compliance with either the short-term or annual $PM_{2.5}$ standard in either Grangeville or Moscow, Idaho.

St. Maries, population 2,600, lies along the St. Joe River near its inlet to Coeur d'Alene Lake. While there is no meteorological station in St. Maries, its location at the confluence of the St. Joe River Valley and the St. Maries River is believed to result in easterly and southerly drainage flows which are replaced by synoptic flows in the afternoon, often bringing agricultural burning smoke from a westerly or southwesterly direction.

C.4 Emissions Inventory – Sources Affecting Air Quality in Idaho

This section generally describes air pollutant sources in each of four categories. The pollutants are included in the emissions inventories that help determine the air monitoring network requirements and configuration.

Emissions inventories identify the types and quantities of air pollutants that influence air quality. The quantities and locations of greatest air pollutant emissions are often the locations where the air quality impacts are the greatest, although terrain, wind patterns, and other factors may also influence the actual air quality levels observed in any area. As a result, the needs and locations for any air monitoring network are largely determined by the emissions inventory and its spatial distribution throughout the state.

Emissions iventories are developed periodically by each state for submittal to the EPA. Periodic annual emissions inventories have been developed by DEQ in 2002, 2005 and most recently, in 2008. Emissions inventories for previous years are available as part of the EPA's National Emissions Inventory (USEPA, 2010). The most recent Periodic Emission Inventory for Idaho, for the year 2008, is just being completed and is available from DEQ upon request. Each inventory includes all known significant sources of the criteria pollutants and their precursors (CO, Pb, NO/NO_2, O_3, PM_{10}/$PM_{2.5}$, SO_2, VOCs, and ammonia [NH_3]). The emissions are categorized into four broad categories: point sources, nonpoint sources, on-road sources, and non-road sources.

Point Sources

Point sources are stationary industrial facilities which are required to obtain an air quality permit for their construction and operation, and which have a potential to release or emit pollutants of more than 10 tons per year of any of the criteria air pollutants. Pollutants from point sources traditionally are those that pass through a stack or vent; however, fugitive emissions that may be released without passing through a stack or vent are also included in the emissions inventory. Point sources often involve combustion processes which are the source of significant levels of CO, NO/NO_2, and SO_2; however, lesser quantities of PM_{10}/$PM_{2.5}$, VOCs and NH_3 are also typically released in combustion sources. Fugitive emissions usually involve particulate matter from materials handling and processing, usually in the PM_{10} size range rather than $PM_{2.5}$, or VOCs from organic materials processing or from industrial uses of cleaners, degreasers, paints, adhesives, or other surface coatings.

Due to its remoteness and terrain, Idaho does not have as much heavy industry as many other states. Thus, in the overall Idaho emissions inventory, point sources are a relatively minor source of most of the criteria pollutants except for SO_2 which is released in significant quantities in any process that involves combustion of coal, coke or any other sulfur-containing fuel or raw material. Nevertheless, in the immediate vicinity of a major point source, pollutant levels may rise to the level that requires a source-oriented monitor. In Idaho, such situations are typically restricted to PM_{10} or SO_2.

Nonpoint Sources

The nonpoint source category is a very broad category with a number of subcategories including:

Area Sources. Area sources represent a broad category of sources that cannot typically be specifically located and which generally should not release enough pollutant at any one location to significantly influence a specific monitor. Only when the density of area sources clustered in an area cumulatively contribute to increasing air quality levels (decreasing air quality) does this category of sources cause a significant impact at an air quality monitor. Important area source pollutants that affect air quality in Idaho include residential wood combustion (RWC), which produces $PM_{2.5}$ that accumulates during winter stagnation episodes in mountain valleys (e.g., Pinehurst) and ozone-forming VOCs from fuel storage and distribution and consumer and commercial solvent and paint uses.

The largest area sources of CO, PM_{10}/$PM_{2.5}$, VOCs, and NO_x that affect air quality levels in Idaho are wildfires and prescribed fires, a result of the huge area of forested lands in the State, greater than any other in the lower 48 states. Agricultural crop residue burning also contributes significant quantities of these pollutants. A number of Idaho monitoring sites were selected due to wildfire impacts and a number of others support the Crop Residue Burning program in the

State. The frequency of smoky days in populated areas resulting from both forest and agricultural fires can be seen in *Figure D-45*.

Biogenic Sources. Biogenic sources include non-anthropogenic emissions of VOCs and nitric oxide (NO) from trees, plants, and soils. These pollutants are primarily precursors to ozone formation and act only in a very broad pattern to elevate the regional background ozone levels, or on an airshed scale, when they combine with urban NO_x emissions to produce excess ozone that may exceed the NAAQS in larger urban areas.

Onroad Sources

Onroad sources include motor vehicles that are licensed to operate on the roadways, including light duty gas and diesel vehicles, heavy duty diesel vehicles, buses, and motorcycles. The primary emissions from on-road sources include VOCs from fuel evaporation, on-road fugitive dust (largely PM_{10}) from material present on the roadway and from brake and tire wear, and significant quantities of CO, NO_x, VOCs and fine particulate matter ($PM_{2.5}$) from the exhaust systems. In addition, smaller quantities of SO_2 emissions and NH_3 are included in the exhaust gas as a result of trace quantities of sulfur and nitrogen in the fuel.

Onroad sources typically influence air quality levels cumulatively on an urban scale or neighborhood scale and monitors should not be located close enough to any one roadway to be influenced by it (with the possible exception of the new near-roadway NO_2 monitors required under the 1-hour NAAQS recently promulgated by EPA. As a result of new-car emission standards implemented over the last 15 years, and the vehicle inspection and maintenance program in Ada County, on-road CO impacts have trended steadily downward and CO is no longer a problem in Idaho. Particulate emissions from on-road motor vehicles are believed to contribute somewhat to elevated wintertime $PM_{2.5}$ episodes in urban areas. However, VOC and NO_x emissions from on-road mobile are the most important emissions as precursors to ozone formation which is becoming one of the most critical ambient air quality problems in urban areas, particularly the Treasure Valley airshed.

Non-road sources

Nonroad refers to all moving vehicles or equipment that do not normally operate on a roadway, including agricultural, logging, and construction heavy equipment, aircraft and railroad equipment, and recreational equipment such as boats, snowmobiles and off-road, all-terrain vehicles not licensed for highway operation. These types of sources are usually widely dispersed and occur mostly where farming or new real estate development or recreation are taking place, rather than near urban centers. Non-road pollutants are primarily CO, NO/NO_2, and SO_2 associated with internal combustion of gas and diesel fuels, diesel particulate matter, a carbonaceous form of $PM_{2.5}$ associated with diesel combustion, and VOCs associated with fuel evaporation and combustion.

C.5 Summary of Recent Air Quality Trends

This section includes general descriptions of recent air quality trends for the criteria pollutants.

While Idaho generally enjoys good air quality, in many ways our airsheds are faced with new challenges. Some of these challenges are related to long-term economic and population growth, particularly in terms of the numbers of vehicles on roadways and growth in new construction. Additionally, weather plays a key role in determining air quality. Prolonged periods of any sort of weather pattern can have either a positive or negative impact on local air quality conditions. The following describe the various pollutants and trends in some areas of special interest.

Carbon Monoxide (CO)

Carbon monoxide (CO) is an odorless, colorless gas that can enter the bloodstream through the lungs and reduce the amount of oxygen that reaches organs and tissues. Carbon monoxide forms when the carbon in fuels doesn't burn completely. The majority of CO comes from vehicle exhaust. In cities, 85-95% of all CO emissions may come from motor vehicle exhaust.

Elevated levels of CO in the ambient air can occur in urban canyon areas with heavy traffic congestion. The highest levels of CO in the outside air typically occur during the colder months of the year when temperature inversions are more frequent. People with cardiovascular disease or respiratory problems might experience chest pain and increased cardiovascular symptoms, particularly while exercising, if CO levels are high. High levels of CO can affect alertness and vision even in healthy individuals.

Idaho currently monitors CO in Boise as a condition of the EPA-approved Northern Ada County CO Maintenance Plan. Beginning in 2009, trace CO monitoring began at the NCore site in Meridian. Trace monitoring provides the ability to determine whether variations in observed concentrations below 1.0 ppm are due to actual changes in atmospheric concentration or due to poor sensitivity of older instruments at those low levels.

The chart below (*Figure C-7*) shows the second highest eight-hour concentrations at Idaho's monitoring sites in relation to the NAAQS from 2001 through 2008. The second-highest concentration is displayed on these graphs because, under the federal rule, the 8-hour standard can not be exceeded more than once per year. Thus, if the second highest concentration does not exceed the NAAQS then the standard has been met.

These graphs confirm the general downward trend for ambient CO concentrations from the early 1990s to present. There were no 8-hour concentrations measured at any sites that exceeded the NAAQS of 9.4 ppm. The maximum 8-hour concentration for CO in 2008 was 2.9 ppm, well below the 8-hour standard.

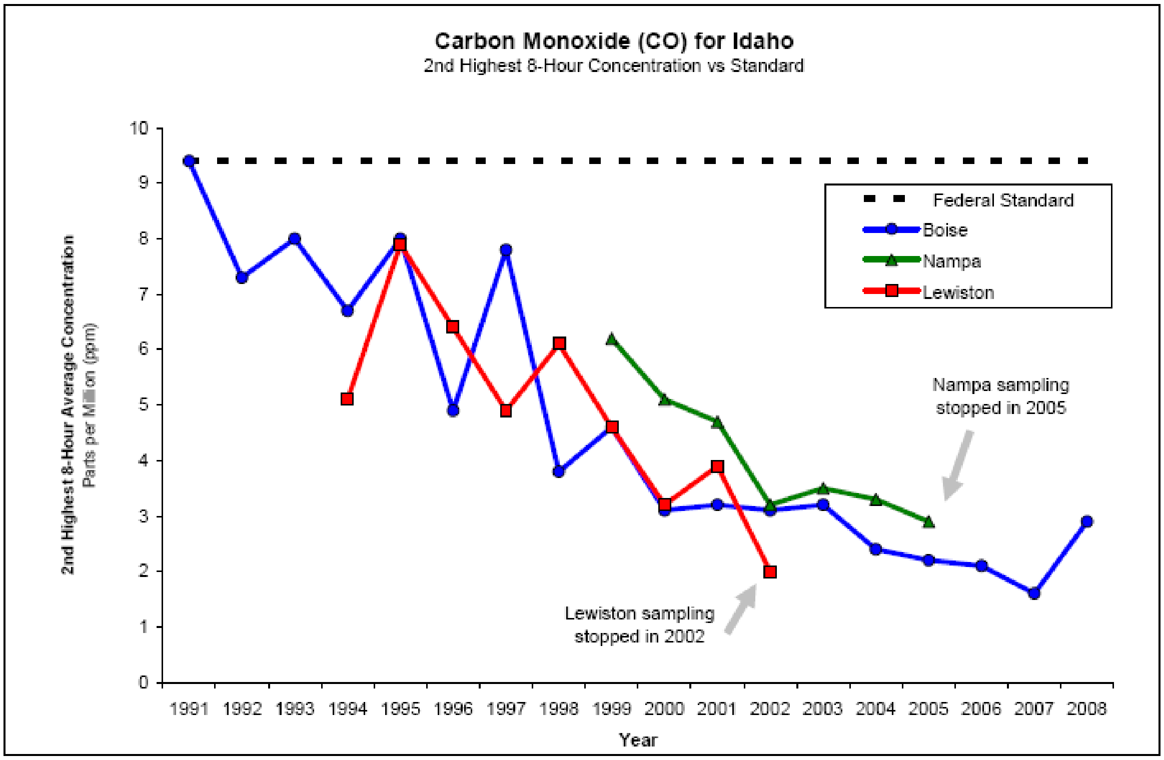


Figure C-7. Carbon Monoxide Measured by Idaho's CO Network

Lead (Pb)

Lead is a highly toxic metal that was used for many years in household products, automobile fuel, and industrial chemicals. Airborne lead was associated primarily with automobile exhaust and lead smelters. The large reductions in lead emissions from motor vehicles have resulted in great reductions of ambient lead levels across the United States. Industrial processes, particularly primary and secondary lead smelters and battery manufacturers, are now responsible for most of the lead emissions.

Lead has not been monitored in Idaho since 2002. With the phase-out of lead in fuel and the closure of the Bunker Hill lead smelter in Kellogg, airborne lead measurements were so far below the NAAQS, DEQ terminated monitoring at its only Pb site.

On November 12, 2008 EPA revised the level of the primary (health-based) standard from 1.5 µg/m3 to 0.15 µg/m3 and revised the secondary (welfare-based) standard to be identical in all respects to the primary standard. As required in this new standard, Idaho will begin monitoring for lead at the St. Luke's NCore site beginning January 1, 2011.

Figure C-8 shows the lead levels previously measured in North Idaho, in relation to the 2008 NAAQS.

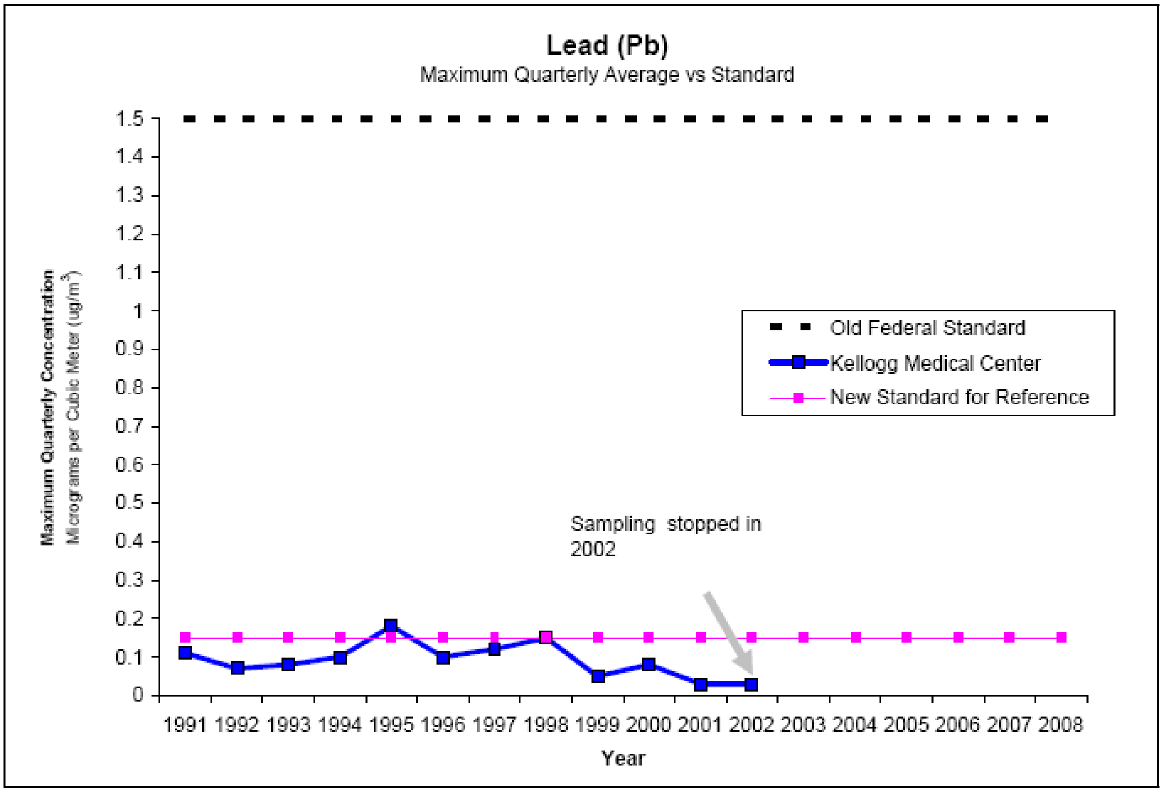


Figure C-8. Lead Monitoring Data in Idaho in Relation to the 2008 NAAQS

Nitrogen Dioxide (NO_2)

Nitrogen dioxide (NO2) is a reddish brown, highly reactive gas that forms from the reaction of nitrogen oxide (NO) and oxygen in the atmosphere. The term NO_x, which is frequently used, refers to both NO and NO2. NO2 will react with VOCs and can result in the formation of ozone. Onroad vehicles like trucks and automobiles are the major sources of NO_x in many airsheds. Industrial boilers and processes, home heaters, and gas stoves can also produce NO_x. NO_2 pollution is greatest during the cold weather seasons.

Motor vehicle manufacturers have been required to reduce NO_x emissions from cars and trucks since the 1970s. NO_x is not considered a significant pollution problem in Idaho.

On January 22, 2010 EPA established a new 1-hour NO2 NAAQS at the level of 100 parts per billion (ppb). This level defines the maximum allowable concentration anywhere in an area. EPA also is retaining the current annual average NO_2 standard of 53 ppb.

EPA also set a new "form" for the standard. The form is the air quality statistic used to determine if an area meets the standard. The form for the 1-hour NO_2 standard is the 3-year average of the 98th percentile of the annual distribution of daily maximum 1-hour average concentrations.

Idaho DEQ previously was not required to monitor NO_2 and therefore NO_2 data in Idaho is not very robust. *Figure C-9* shows the risk of violating the annual standard is very low.

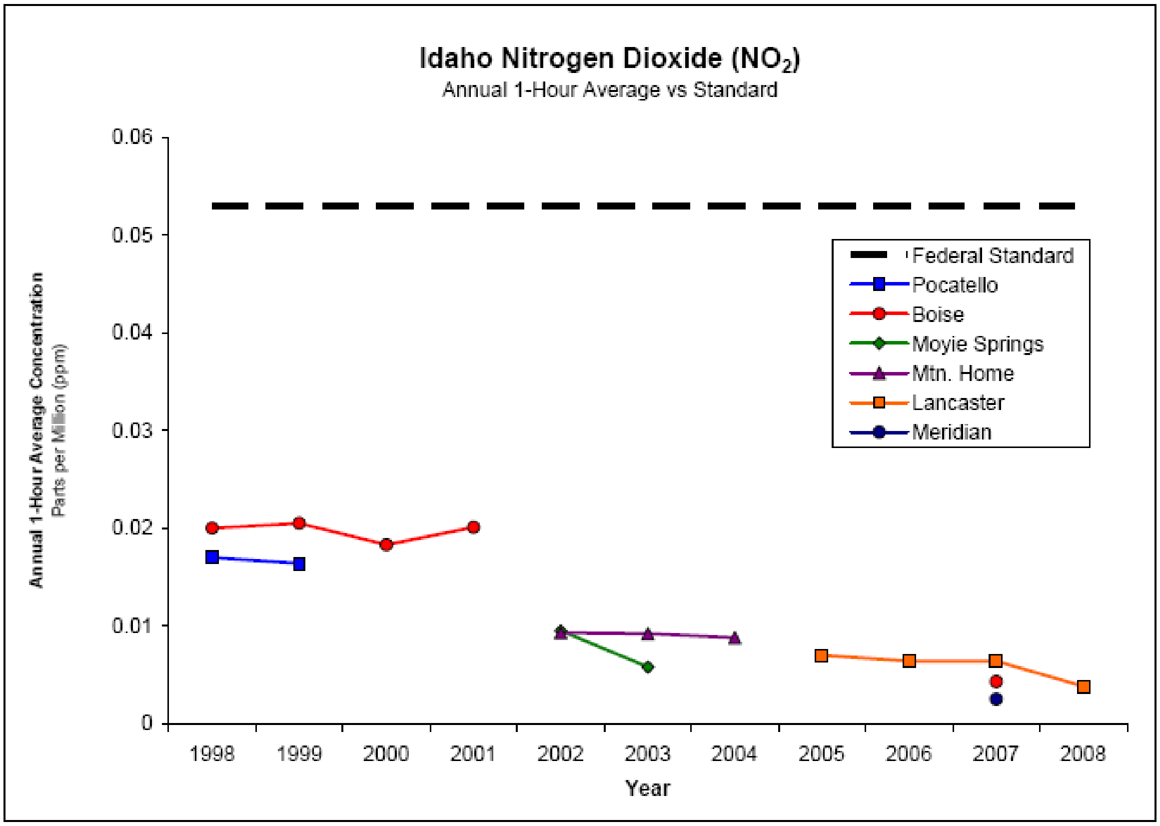


Figure C-9. NO_2 Annual Average of All Available Data

Beginning in January 2013, at least one new NO_2 monitor must be located near a major road in any urban area with a population greater than or equal to 500,000 people. This will be required in the Boise City–Nampa MSA (the 2007 estimated population was 584,000 as provided by the US Census Bureau). These NO_2 monitors must be placed near those road segments ranked with the highest traffic levels by annual average daily traffic (AADT). Consideration must be given to fleet mix, congestion patterns, terrain, geographic location, and meteorology in identifying locations where the peak concentrations of NO_2 are expected to occur. Monitors must be placed no more than 50 meters (about 164 feet) away from the edge of the nearest traffic lane. *Figure C-10* is a map of the highest AADT road segments in the Treasure Valley (I-84 and I-184).

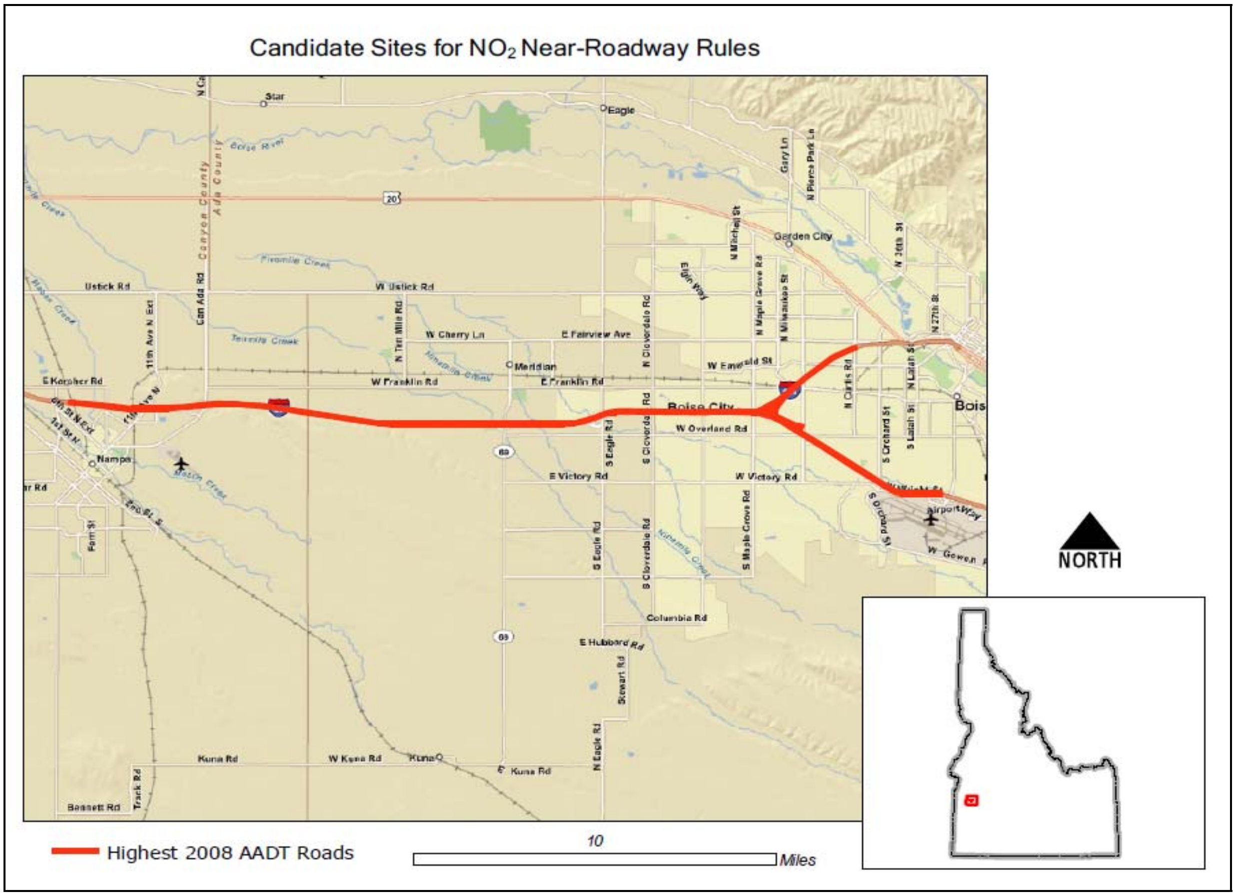


Figure C-10. Roadway Segments with Candidate Sites for NO_2 Near-Roadway Rules

Ozone (O_3)

Ozone is typically a summertime air pollution problem that primarily forms when pollutants from internal combustion engines and industrial sources (paints, solvents, gas vapors) react with sunlight. It can also be formed by materials that are released into the air from wildfires. Generally speaking, the hotter and drier the summer, the higher the ozone concentrations will be because the ozone-forming reaction occurs faster, and because additional precursor materials are often present from wildfires throughout the western United States.

The ozone standard is defined such that the three highest daily maximum 8-hour average ozone concentrations in any particular year can exceed the level of the standard while the area still maintains an attainment classification. However, if the three-year averages of the fourth-highest concentrations exceed the level of the standard, then the area is classified as nonattainment. Starting in 2008, the three-year average (2006-2008) of the fourth-highest eight-hour concentration will violate the NAAQS if it exceeds 0.075 ppm (0.076 ppm or higher). On January 6, 2010, EPA proposed revisions to the standard and plans to issue final standards by August 31, 2010.

The following charts demonstrate the ozone concentrations measured over time at the Whitney and Lancaster/Coeur d'Alene monitoring sites. Whitney has been the site in the Treasure Valley that has been used to determine compliance with the ozone NAAQS. Lancaster was established to monitor ozone concentrations downwind from the Spokane, Washington area.

The bars represent the four highest 8-hour average concentrations measured for each monitoring season starting in 2002. The number in the white box indicates the three-year average used to compare to the NAAQS. The black dashed line represents the old NAAQS of 0.08 ppm (allowing for rounding rules specified by EPA) while the red dashed line represents the current NAAQS of 0.075 ppm. The new ozone standard to be finalized in August of 2010 is expected to be lower than 0.075 ppm.

As can be determined from the Whitney (Treasure Valley) chart (*Figure C-11*), the 2008 ozone design value is at the NAAQS concentration. Any lowering of the ozone standard will increase the risk for the Treasure Valley going into nonattainment for ozone. The Lancaster (Coeur d'Alene) chart (*Figure C-12*) shows ozone levels in the airshed are about 85% of the NAAQS. A substantial lowering of the ozone NAAQS and/or an increase in ozone levels will result in the area being a concern for ozone.

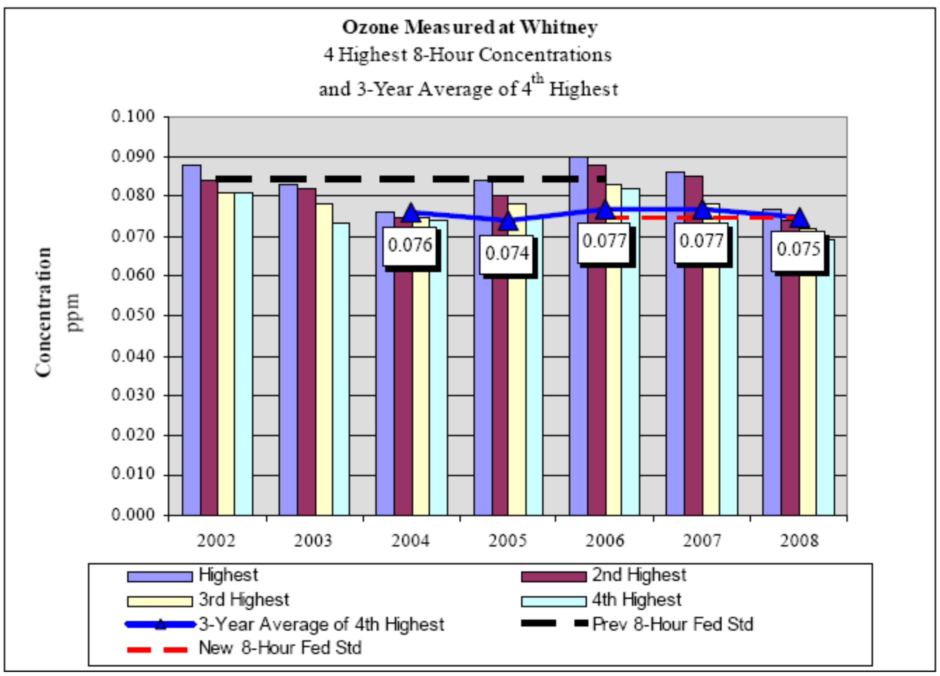


Figure C-11. Treasure Valley Ozone Design Values

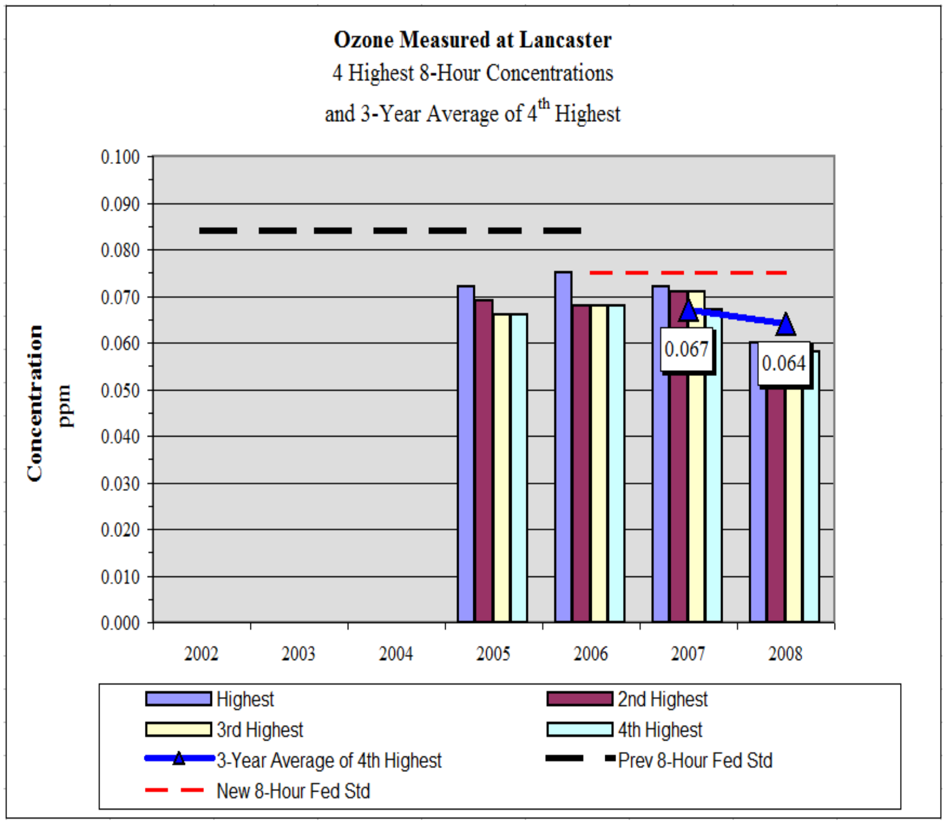


Figure C-12. Coeur d'Alene Airshed Ozone Design Values

Particulate Matter (PM_{10})

Particulate matter (PM) includes both solid matter and liquid droplets suspended in the air. Particles smaller than 2.5 micrometers in diameter are called fine particles, or $PM_{2.5}$. Particles between 2.5 and 10 micrometers in diameter are called coarse particles. PM_{10} includes both fine and coarse particles. Coarse particles typically come from crushing or grinding operations and dust from roads. PM_{10} can aggravate respiratory conditions such as asthma. People with respiratory conditions should avoid outdoor exertion if PM_{10} levels are high.

The chart below (*Figure C-13*) shows the maximum daily concentration (24-hour averages) observed for PM_{10} from 1998 through 2008. Maximum daily values confirm that Idaho has generally shown a decrease since 1998, although the Boise, Nampa, and Pinehurst sites are showing an increase over the last few years. Although the maximum PM_{10} measured at the Nampa monitor in 2005 (172 $\mu g/m^3$) and 2007 (175 $\mu g/m^3$) exceeded the 24-hour NAAQS, the NAAQS is only considered violated if there are more than three total exceedances over three consecutive years. For example, Idaho could experience two exceedances in year 1, none in year 2, and one in year 3 and not violate the NAAQS.

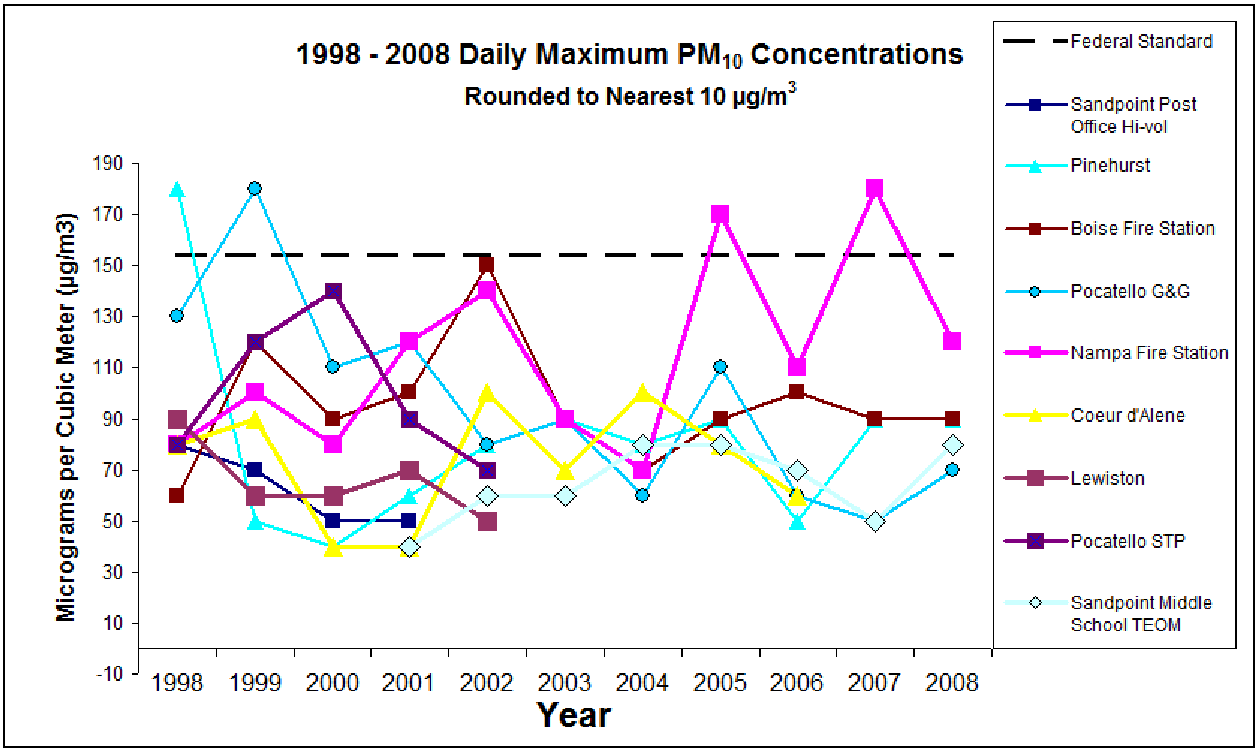


Figure C-13. PM_{10} Trends in Idaho

Particulate Matter ($PM_{2.5}$)

As noted, particles 2.5 micrometers in diameter or less are called fine particles, or $PM_{2.5}$. DEQ considers $PM_{2.5}$ to be one of the major air pollution concerns affecting a number of airsheds in Idaho. $PM_{2.5}$ generally comes from wood burning, agricultural burning, and other area sources, as well as industrial boilers, and exhaust from vehicles including cars, diesel trucks, and buses. Fine particulate can also be formed secondarily in the atmosphere by chemical reactions of pollutant gases.

In 1997, EPA adopted two primary or health-based standards for $PM_{2.5}$. The daily (or 24-hour) NAAQS was established at 65 micrograms per cubic meter (µg/m^3), while the annual standard was established at 15µg/m^3. In 2006, EPA revised the daily standard (35µg/m^3) while retaining the 1997 annual standard. An area is in violation of the daily NAAQS when in three consecutive years the average of each year's 98th percentile 24-hour average $PM_{2.5}$ concentration is greater than 35µg/m^3. The annual standard is violated when in any one year the average of all 24-hour concentrations is greater than 15µg/m^3. Meeting the annual standard has not been a concern in Idaho. However, the daily standard has been a concern.

The chart below (*Figure C-14*) shows the three-year average of the 98th percentile 24-hour averages (or design values) at Idaho's monitoring stations, in relation to the federal standard(s). The design values for 2001-2006 all fell well below the 1997 24-hour NAAQS of 65 micrograms per cubic meter (µg/m3).

As shown in *Figure C-14*, the 2007 (2005-2007) design value for Pinehurst (37µg/m^3) was above the 2006 NAAQS of 35 µg/m3. However, after the 2008 monitoring season the 2008 design value (34 µg/m^3) fell below the standard, and Pinehurst is presently in attainment of the $PM_{2.5}$ standards.

The Franklin monitor also recorded two exceedances of the 2006 24-hr NAAQS in 2007. Part of Franklin County has been designated nonattainment for the 24-hr NAAQS, along with Logan, Utah (together known as the Cache Valley) because they share the same airshed and Metropolitan Statistical Area (MSA).

Design values from the Salmon monitor are not included in the chart in *Figure C-14* because in 2008 there were not three consecutive years of data.

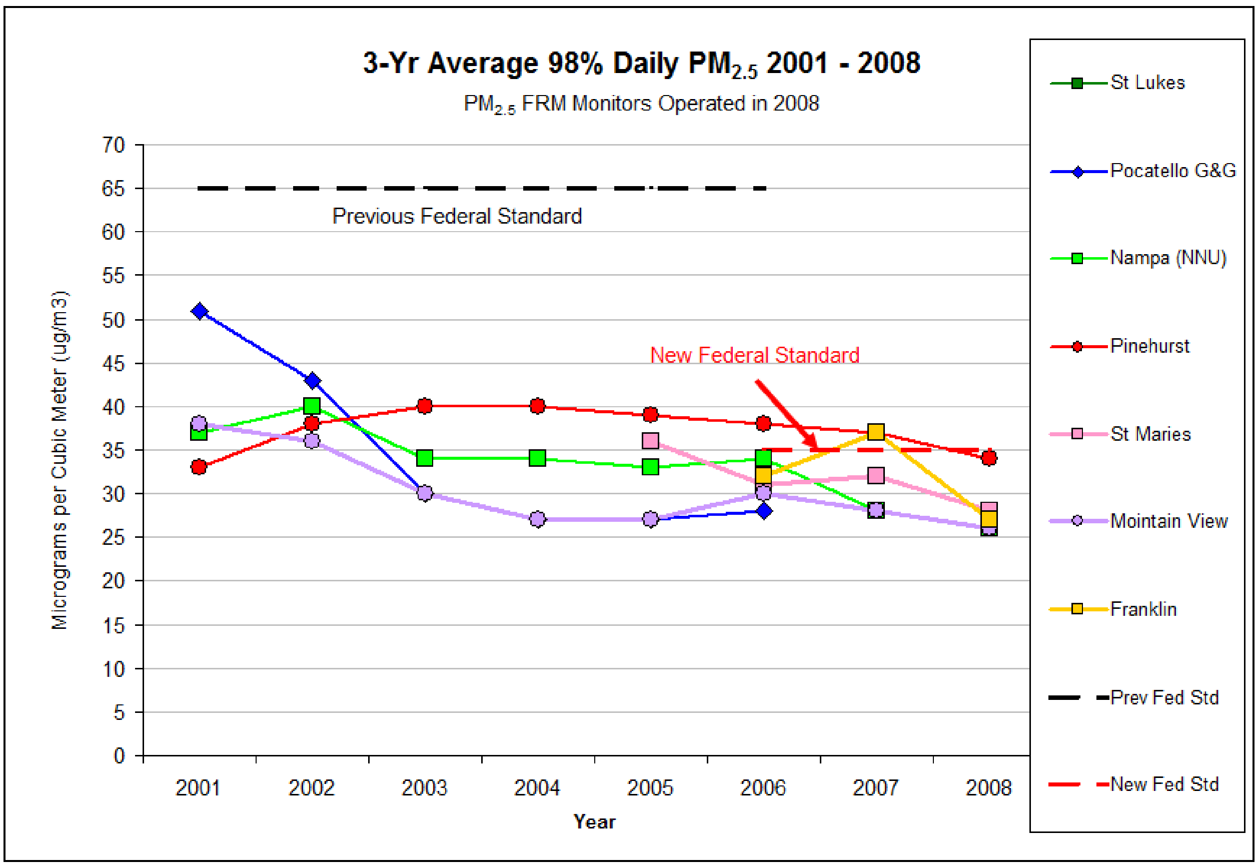


Figure C-14. 3-year Design Values for IDEQ's $PM_{2.5}$ Compliance Network

Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) is a colorless, reactive gas produced by burning fuels containing sulfur, such as coal and oil, and by industrial processes. Historically, the greatest sources of SO_2 were industrial facilities that derived their products from raw materials like metallic ore, coal, and crude oil, or that burned coal or oil to produce process heat (petroleum refineries, cement manufacturing, and metal processing facilities).

On June 2, 2010, EPA signed the final rule creating a new primary standard for SO_2. EPA established a 1-hour level of 75 ppb, and concurrently revoked the previously established 24-ourr and annual standards. The secondary 3-hour standard of 500 ppb remains in effect while it is currently under review. The 1-hour NAAQS is violated when the 3-year average of the annual fourth-highest daily-maximum 1-hour average is greater than 75 ppb. Additionally, EPA is developing an approach for implementing the new 1-hour standard that includes refined dispersion modeling of SO_2 sources to determine compliance.

Prior to June 2, 2010, the primary NAAQS for SO_2 included both an annual standard of 30 ppb and a maximum 24-hour standard of 140 ppb. *Figures C-15, C-16,* and *C-17* show Idaho's SO_2 levels well below the annual, the 24-hour, and the secondary 3-hour NAAQS during the past five years.

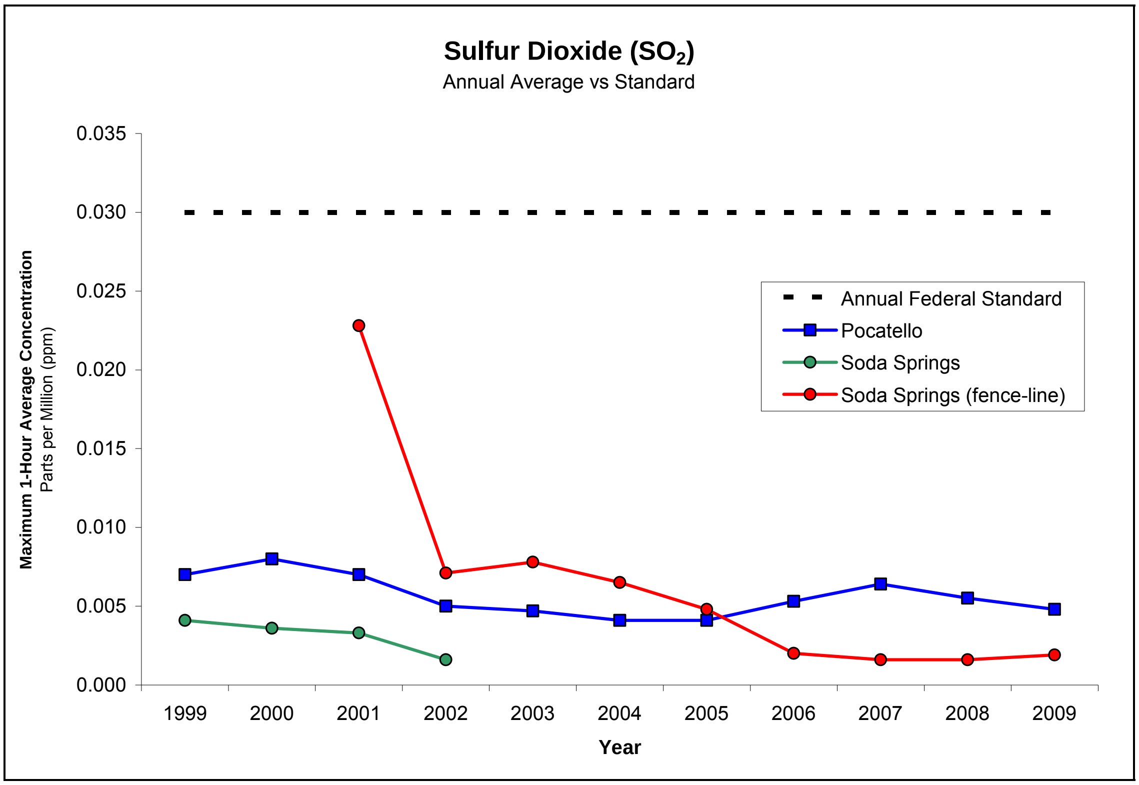


Figure C-15. Annual SO_2 Levels in Idaho

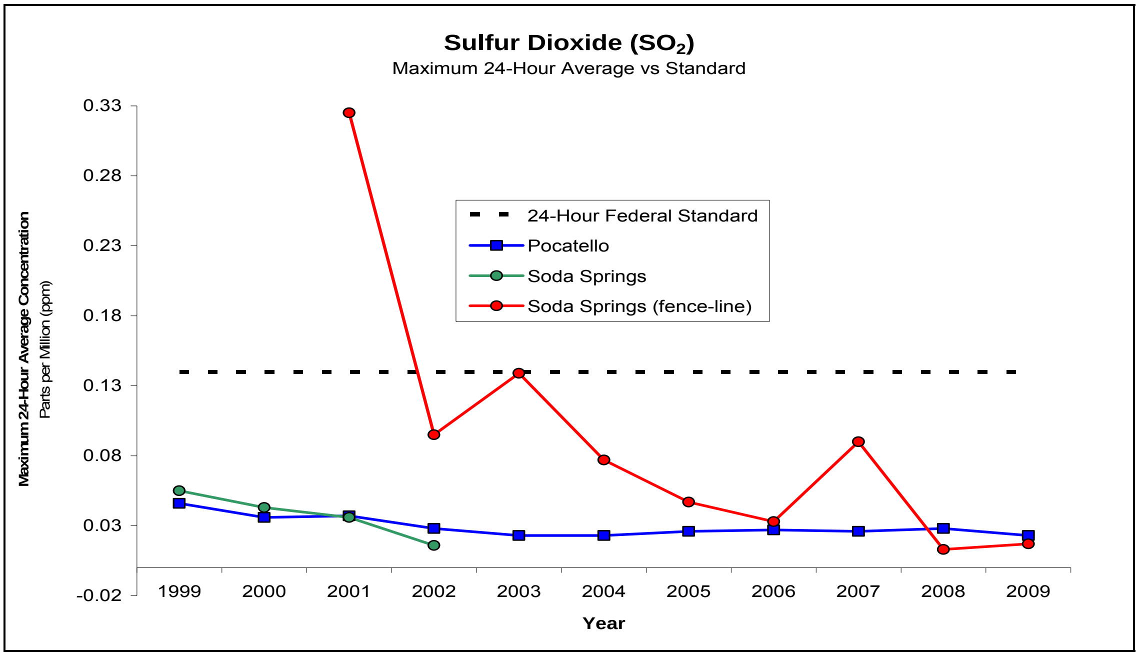


Figure C-16. Maximum Daily (24-hour) SO_2 Levels in Idaho

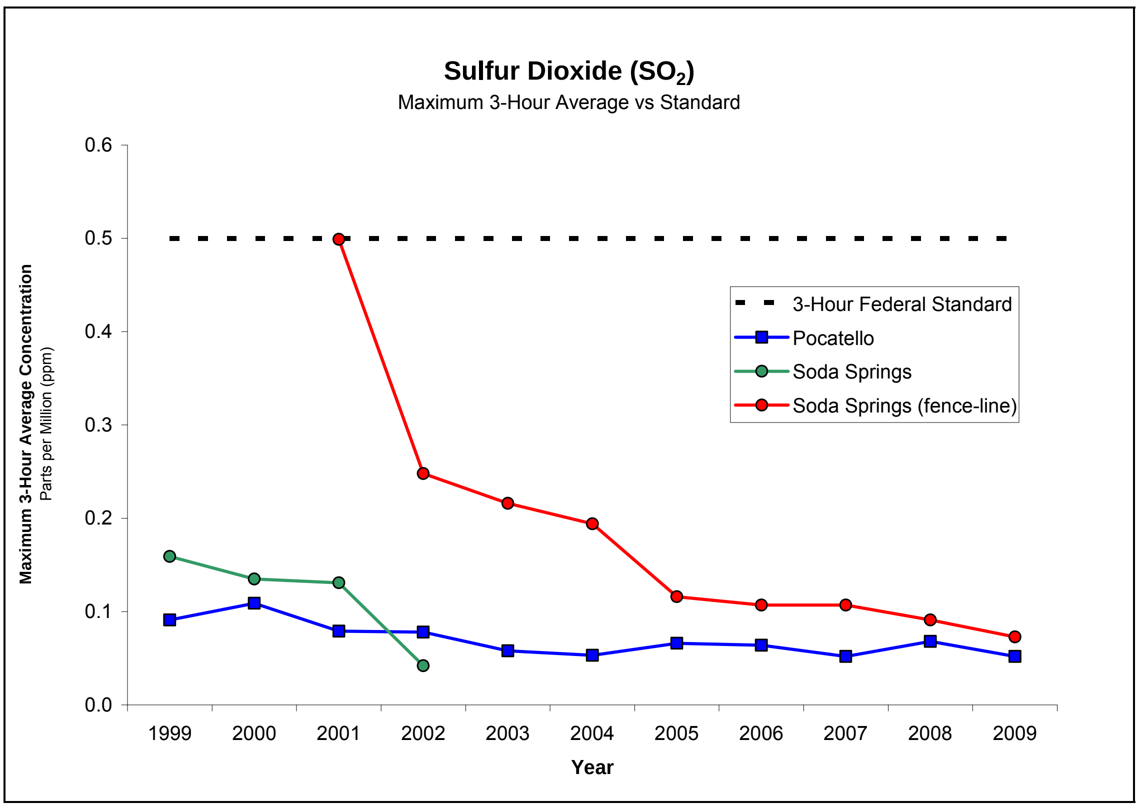


Figure C-17. Maximum Daily 3-hour SO_2 Levels in Idaho

DEQ terminated the Soda Springs High School monitor after 2002 due to measurements being far below the NAAQS. DEQ has been operating a source-oriented (fence-line) monitor near Soda Springs since 2001 and continues to run that monitor. Physical plant changes (e.g. stack height) ant process changes at a nearby facility were changed in 2001 and since, ground-level SO_2 concentrations have been greatly reduced at the monitor.

The chart below (*Figure C-18*) shows historical maximum daily 1-hour data compared to the new standard. As can be seen, Idaho is expected to remain below the new standard.

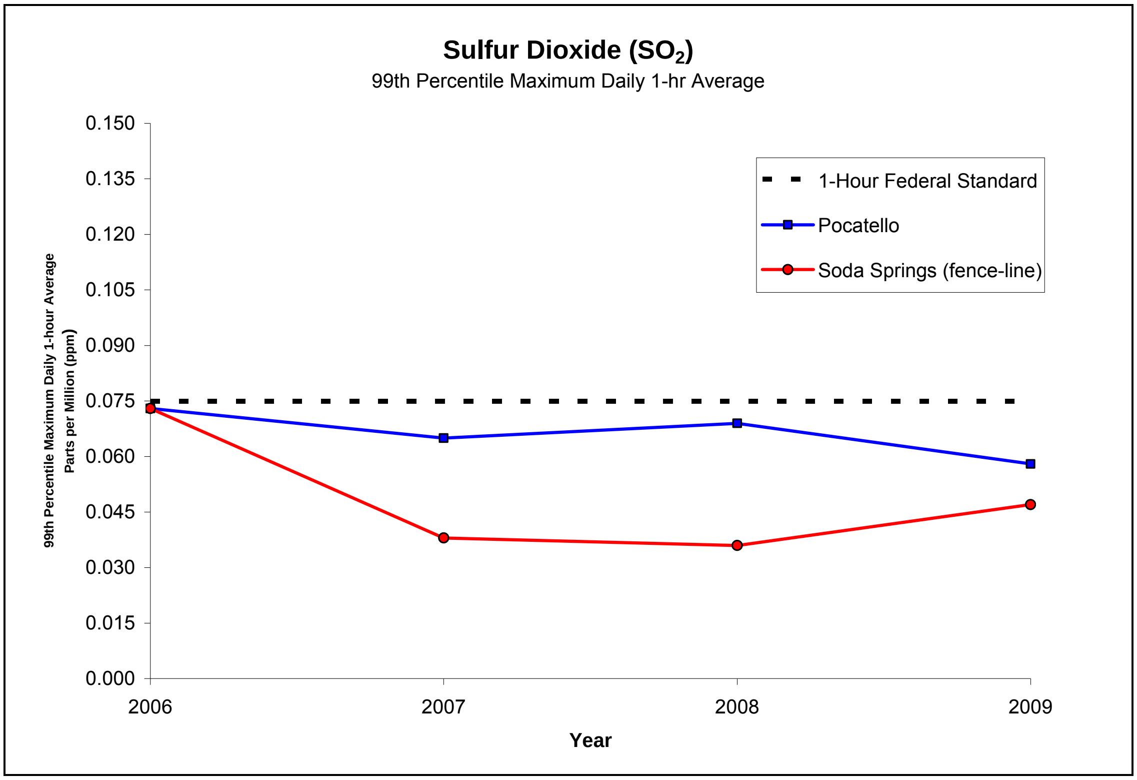


Figure C-18. Maximum Daily (1-hour) SO_2 Levels in Idaho

D. NETWORK ASSESSMENT

As described in the Introduction to this report, network assessment is required at the site scale, at the airshed scale, and at the statewide scale by pollutant. Recommendations are made for certain sites and summarized at the end of the section.

D.1 Network Assessment: Site Scale

The following section describes each monitor at the site scale and characterizes the local geography. The appropriateness of the designated scale of representation relative to land use, population density, and prevailing winds is discussed and the relationship between monitoring objectives, site types, and geographic location are assessed. The referenced figures are included after the recommendations summary, at the end of Section D.1.

Boise – Eastman Garage

The Boise Eastman Garage site (*Figure D-1*), located in the urban core of Boise, in the Treasure Valley airshed, aims to measure the source impact of mobile emissions on CO. The monitor is designed to capture the concentrations required for assessing limited maintenance in the Northern Ada County CO nonattainment area (*Figure B-2*). The micro scale of representation (several meters to 100 meters) is appropriate for a source impact site type (Code of Federal Regulations, 2009). Land use within the micro area is consistently urbanized and the population is uniformly high. Winds from all directions, including along the prevailing northwest-southeast axis, blow pollutants from mobile sources, but its location amongst tall buildings, as an urban canyon site, undoubtedly influences the pollution vectors as well. The CO concentrations measured at the site have been decreasing overall since 1993 and are currently well below the 8-hour NAAQS federal standard (IDEQ, 2010). No exceedances were measured in 2006, 2007, or 2008 (IDEQ, 2010; IDEQ, 2009; IDEQ, 2008).

Boise – Fire Station #5

The Boise Fire Station site is another urban monitoring location in downtown Boise, and the Treasure Valley airshed (*Figure D-2)*. A population-oriented site, its objective is to measure PM_{10} concentrations for NAAQS compliance and AQI forecasting, and for assessing the limited maintenance of the Northern Ada County PM_{10} nonattainment area. The neighborhood scale of representation is appropriate for the site type (Code of Federal Regulations, 2009). Distance to Interstate 184 and annual daily traffic (ADT) on the nearest lane to the monitor comply with 40 CFR Part 58, Appendix E, Figure E-1. Land use in the neighborhood is developed, medium intensity, and the population is uniformly dense. Winds from the northwest, west, and southeast bring typical concentrations experienced throughout the neighborhood to the monitor. This site is located adjacent to Interstate 184 and aims to capture these mobile emissions. The monitor has measured 3-year average daily maximums well below the NAAQS for the past ten years (IDEQ, 2010). No exceedances were recorded in 2006, 2007, or 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010).

Boise – Idaho Transportation Department

The Boise Idaho Transportation Department (ITD) site (*Figure D-3)*, located slightly northwest of Boise's urban core in the Treasure Valley airshed, aims to measure typical concentrations of ozone in areas of high population density. The neighborhood scale of representation (0.5-4 km) is appropriate for a population-oriented site type (Code of Federal Regulations, 2009). Though the immediate neighborhood (within 0.5 km) of the monitor includes a park and the Boise River, the larger neighborhood (up to 4 km) is well-developed with low-intensity residential neighborhoods and the medium-intensity business corridors of State Street and Chinden Boulevard. The entire neighborhood is densely populated and the diurnal northwesterly-southeasterly flows bring pollutants that are representative of the neighborhood to the monitor. Installed in 2006, the ITD monitor has measured ozone concentrations just below the 8-hour NAAQS (IDEQ, 2010). In 2008, the 3-year average fourth-highest concentration equaled 0.075 ppm, equivalent to the new Federal Standard (0.074 in 2006 (IDEQ, 2008), 0.080 ppm in 2007 (IDEQ, 2009)). In 2006, there were no recorded exceedances at this site. In 2007, there were six days that measured above the standard. In 2008, there was one recorded exceedance.

Boise – White Pine Elementary

The Boise White Pine site (*Figure D-4*), located at the eastern end of the Treasure Valley airshed in Boise, aims to measure the highest concentrations of ozone in the airshed. The neighborhood scale of representation (0.5-4 kilometers [km]) is appropriate for a highest concentration site type (Code of Federal Regulations, 2009). Land use is mostly developed and population density is uniformly high within the neighborhood area. White Pine's location in the southeast end of the airshed allows the monitor to receive ozone blown by prevailing northwesterly winds across the entire airshed, including the city center of Boise and the high traffic central valley and interstate areas. The monitor was installed in May of 2009 and regularly measured the highest concentrations in the Treasure Valley airshed. During the 2009 ozone season (May through September), this monitor recorded 47 moderate/yellow days on the AQI and 2 orange days. The four highest 8-hour concentrations were at or above the new 8-hour Federal Standard.

Coeur d'Alene – Lancaster Road

The Coeur d'Alene Lancaster site (*Figure D-5*), located on the northern edge of the Coeur d'Alene urban area, aims to measure concentrations of $PM_{2.5}$, O_3, and NO_x for NAAQS compliance and AQI forecasting. The monitor is co-located with a meteorology station. This population-oriented site has an urban scale of representation (4 km–50 km). This designation seems appropriate since an area less than 4 km would not characterize the Coeur d'Alene area. The site is on the Rathdrum Prairie where land use consists of cultivated crops and grassland. The urban area to the south is developed, as is the Interstate 90 corridor connecting Coeur d'Alene with Spokane to the west. The farther surroundings are mountainous evergreen forest. The monitor is adjacent to but not within relatively densely populated areas, but 40% of the annual winds blow pollutants from the more populated south and southwest. This monitor may capture some pollutants from two major point sources to the north-northeast and southwest and, during the summer months when synoptic or regional winds bring air from the west and northwest, probably captures some from major point sources to the west and northwest as well (*Figure D-6*). O_3 has been measured at this site since 2004 and has been below the Federal Standard from 2005 to 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010). Ten days were recorded in the AQI yellow category attributable to ozone in 2006, 14 days in 2007, and three days in 2008. Lancaster began monitoring $PM_{2.5}$ in 2009. NO_x/NO_y have been well below the federal standard since 2005 and there were no exceedances recorded for this pollutant from 2006 through 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010).

Franklin

The Franklin monitor is a rural site, located at the northern end of the Cache Valley near the city of Franklin (*Figure D-7*). The monitor measures $PM_{2.5}$ for NAAQS compliance. This site has an urban scale of representation but a neighborhood scale would be more appropriate at this population-oriented site because at the urban scale the land use, terrain, and population density is too varied. The Cache Valley contains small towns like Franklin, larger cities like Logan, Utah, and large tracts of cultivated crops and pasture. Population density is the highest in the southern, Utah side of the valley. An urban scale of representation would be more appropriate for a regional transport site type. Synoptic winds in the valley blow from the south in the winter and are calm and variable during the summer (*Figures D-8* and *D-9*). The Franklin monitor is within the Cache Valley $PM_{2.5}$ Nonattainment Area, designated in 2009. This recent nonattainment designation occurred because the Logan monitor violated the 3-year average 98th-percentile daily concentration standard in 2007. In 2008, there was one exceedance of the annual average

NAAQS at Franklin (IDEQ, 2010). In 2007 and 2006 there were no exceedances of the annual average (IDEQ, 2008; IDEQ, 2009). Four days measured in the moderate AQI range in 2008 and one day was unhealthy for sensitive populations. In 2007, eleven days were moderate, one was unhealthy. The portion of the year in the moderate range was 6.9% in 2006.

Garden Valley

The Garden Valley monitor is located at a stand-alone site in a small rural valley in Boise County (*Figure D-10*). The site aims to measure $PM_{2.5}$ for smoke management. The neighborhood scale of representation (0.5 km to 4 km) is appropriate for a population-oriented site (Code of Federal Regulations, 2009), but an urban scale (4 km to 50 km) might be a better fit for the monitoring objective of measuring the impact of smoke on the population. The area is very sparsely populated. Land use is a mixture of pasture, evergreen forest, grassland, and shrubland. Winds are very calm at this site and regularly blow from the south, according to the annual average wind rose. Synoptic-level winds blow from the south during the winter and from the west during the summer (*Figures D-11* and *D-12*). However, as a small mountain valley, Garden Valley is particularly affected by local winds draining from surrounding mountains, so significant air parcels can arrive from the north as well, flowing down the Middle Fork of the Payette River or down Anderson Creek, or from the east down the South Fork of the Payette River. The Garden Valley monitor measured very low concentrations during 2009, recording one day in the moderate or yellow AQI range.

Grangeville

The Grangeville monitor is located in this small town perched on the southern edge of an agricultural plateau, the Camas Prairie, above the Clearwater and Snake River Canyons (*Figure D-13*. This population-oriented site aims to measure $PM_{2.5}$ for AQI forecasting and smoke management. It is co-located with a meteorological station and has a neighborhood scale of representation, a designation appropriate for the site type (Code of Federal Regulations, 2009). Land use in the town is developed, ranging in intensity from low to high, and the surrounding environs are dedicated to cultivated crops. Population density reflects the land use: dense in town and scattered throughout the farmland. The local wind rose indicates annual average winds tend to come from the southwest and south. This is especially true during the winter. The summer season sees synoptic-level winds blowing from the northwest regularly (*Figure D-14*). The monitor was established in 2000. In 2008, three days measured in the moderate, or yellow, range of the AQI at the Grangeville monitor.

Idaho City

The Idaho City $PM_{2.5}$ monitor is another site located in a small town in a mountain valley affected by wildfire smoke in the summer, wood burning in the winter, and prescribed fire in the spring and fall (*Figure D-15*). The monitor measures air quality in a small developed area surrounded by evergreen forest and mountainous terrain. Very few people live in the area but it is a popular recreation site. The monitoring objectives are smoke management and AQI forecasting. Local annual average winds are generally calm and originate from the north, northwest, and west. Synoptic winds come from the south in winter and from the northwest in summer (*Figures D-11 and D-12*). The neighborhood scale of representation is appropriate for a population-oriented site type (Code of Federal Regulations, 2009). The Idaho City monitor recorded 15 moderate or yellow days on the AQI in 2009.

Idaho Falls

The Idaho Falls site is located in a residential area at the southern edge of this city (*Figure D-16*). $PM_{2.5}$ is monitored here for AQI forecasting and smoke management. The neighborhood scale of representation is a reasonable designation for this population-oriented site (Code of Federal Regulations, 2009). Land use in the neighborhood is developed to the north of the monitor and is agricultural to the south. Population density is relatively high. It is windy throughout the Idaho Falls airshed as synoptic flows that have traveled the Snake River Plain arrive from the southwest throughout the year. Calmer local winds from the north are also important. The Idaho Falls monitor seems reasonably placed to fulfill its objective to forecast air quality for the neighborhood population base. The monitor was moved to its current site in May 2008. During the remainder of that year, 20 days in the AQI moderate range were recorded (IDEQ, 2010).

Ketchum

The Ketchum monitor is located at a stand-alone site in the Wood River Valley (*Figure D-17*). The town of Ketchum is densely populated and is surrounded by population-free national forests and high mountains. The monitor measures $PM_{2.5}$ for AQI forecasting and smoke management. Land use is highly developed in town and along the valley while evergreen forest and shrubland dominate the hills beyond. The urban scale of representation is an appropriate scale at which to measure the air quality impacts of smoke and provide AQI forecasts for the population (Code of Federal Regulations, 2009). Local winds predominantly blow from the northwest, descending from the high terrain to the north and channeling through the valley. Synoptic winds prevail from the west during the winter and are calm and variable during the summer (*Figures D-18* and *D-19*). Similar to other high mountain valleys in Idaho, like Garden Valley or McCall, Ketchum is particularly affected by local drainage flows, such as Warm Springs Creek or Trail Creek. The Ketchum monitor was established in 2009.

Lewiston

The Lewiston site is located on the eastern edge of town in a local park in the Lewiston airshed (*Figure D-20*). The monitor is co-located with a meteorology station and aims to measure $PM_{2.5}$ for AQI forecasting and smoke management. The site type is population-oriented and the neighborhood scale of representation is an appropriate designation (Code of Federal Regulations, 2009). The land use in the immediate area of the monitor is developed open space and there is low to high intensity development to the north, south, and west. To the east are cultivated crops and shrubland. Population is dense to the west and south and less so to the east and north. The wind in this small city is particularly affected by the local topography. Synoptic-level winds tend to blow from the south in the winter and from the northwest during the summer (*Figures D-21* and *D-22)*. However, as the local wind rose shows, easterly and southeasterly winds predominate at the monitor site, presumably flowing downhill from the surrounding upland terrain. The location of the monitor seems representative of a neighborhood in which pollutant concentrations are reasonably similar (Code of Federal Regulations, 2009). In 2008, the monitor recorded ten days in the moderate (or yellow) range of the AQI for $PM_{2.5}$ (IDEQ, 2010). Seven yellow days were recorded in 2007 (IDEQ, 2009), and eight yellow days and three orange (unhealthy for sensitive groups) days were recorded in 2006 (IDEQ, 2008).

McCall

The McCall monitor is located at the southern end of this mountain resort town (*D-23*). Situated at the northern end of Long Valley and on the southern shore of Payette Lake, McCall is a small mountain valley community impacted by wildfire smoke in the summer and wood burning emissions in the winter. The monitor measures $PM_{2.5}$ for AQI forecasting and smoke management purposes. This population-oriented site is designated a neighborhood scale of representation but an urban scale might be more representative of the physical dimensions of the populated area. Land use around the monitor is varied and includes developed land, pasture, shrubland, and evergreen forested mountains. Population density is low but it is a popular recreation area. Synoptic winds generally flow up valley from the south but local terrain is an important influence and significant flow can come from the north, west, and southeast. In 2008, the McCall monitor recorded seven days in the moderate, or yellow, range of the AQI.

Meridian – St. Luke's

The Meridian St. Luke's site is located in the center of the Treasure Valley airshed, about 200 meters to the north of Interstate 84 (I-84) (*Figure D-24*). The monitor distance from the roadway complies with 40 CFR Part 58, Appendix E, Table E-2. This is an NCore site that measures all the pollutants currently monitored in Idaho. It is co-located with a meteorology station. Monitoring objectives include NAAQS compliance for O_3, $PM_{2.5}$, and NO_x/NO_y, AQI forecasting for all criteria pollutants measured, trace gas measurements for CO and SO_2, chemical speciation for $PM_{2.5}$, and support for modeling and research studies. The neighborhood scale of representation is appropriate for a population-oriented site type (Code of Federal Regulations, 2009). The neighborhood area within 4 km is mixed use, with highly developed transportation corridors (I-84, Eagle Road, Franklin Road) interspersed with agriculture and lower intensity residential development. The population density of the block group within which the monitor is located is lower than the surrounding block groups because the development is more commercial than residential. However, the physical dimensions of the air parcel measured at the monitor should be reasonably similar throughout the neighborhood. There were no exceedances of the 24-hour $PM_{2.5}$ registered at St. Luke's in 2006, 2007, or 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010). There were no days above the 8-hour ozone standard in 2006, 2007, or 2008. Fourteen days were recorded in the yellow AQI category (0.06 – 0.075 ppm) for ozone in 2008 and 13 days were yellow in 2007. Measurements of NO_x/NO_y, SO_2, and CO began in 2009 (IDEQ, 2010).

Middleton – Purple Sage

The Middleton Purple Sage site is located on the edge of a golf course in a rural town in the western region of the Treasure Valley airshed (*Figure D-25*). The monitor aims to measure $PM_{2.5}$ concentrations for regional transport and population-oriented purposes. The urban scale of representation is appropriate for these site types (Code of Federal Regulations, 2009). There is a co-located meteorological monitor here. The objectives for the Middleton monitor are to provide data for AQI forecasting and smoke management. With a regional transport site type, the assumption is that Middleton, upwind, captures background $PM_{2.5}$ levels that are lower than those of the larger urban areas of the Treasure Valley to the southeast. However, the annual average wind direction measured at the site indicates that Middleton is in fact downwind. It appears that winds blowing from the southeast, south, and east quadrants are dominant. Wind vectors derived from 30-year monthly averages and gridded using the WINFLO model support these findings (Ferguson et al., 2003) (*Figures D-26* and *D-27*). During the main $PM_{2.5}$ season

(December–February), winds blow from the southeast. If this is the case, then the Middleton monitor might capture $PM_{2.5}$ concentrations more typical of the urban area to the southeast and it is therefore incorrectly located to capture background concentrations. However, for the purpose of capturing $PM_{2.5}$ emitted from wildfires for the smoke management objective, the winds during wildfire season (summer) do seem to blow from the west and then the Middleton site would indeed be upwind of Boise. The location of this monitor does not seem capable of accomplishing both stated objectives. The monitor was established at the end of 2009 so few data are available to examine.

Moscow

The Moscow monitoring site is located in the southeast corner of the city, surrounded by agricultural lands (*Figure D-28*). Land use in the area is a mixture of cultivated crops and low intensity development. The more densely populated part of the city lies to the west and northwest. This population-oriented site has a neighborhood scale of representation but an urban scale might more closely describe the physical dimensions of the air parcel experienced by the main population base (Code of Federal Regulations, 2009). Local winds blow mostly from the east which would bring air to the monitor from outside the city instead of inside the city. However, synoptic winds blow from the northwest for seven months of the year (April through October), phenomena which not reflected in the local wind rose. The monitor, therefore, seems to be located in a reasonable place to accomplish the monitoring objectives of AQI forecasting and smoke management. The monitor is co-located with a meteorological station and was established in 2001. In 2008, the Moscow monitor recorded three days in the moderate, or yellow, AQI range (IDEQ, 2010). In 2007, ten moderate days were recorded (IDEQ, 2009), and in 2006, ten moderate days and one orange, or unhealthy for sensitive groups, days were recorded (IDEQ, 2008).

Nampa

The Nampa site is located in the western part of the Treasure Valley, but is centrally situated within the airshed (*D-29*). A population-oriented site, it is designated a neighborhood scale of representation, which is appropriate for the site type (Code of Federal Regulations, 2009). The neighborhood is densely populated and highly developed. Winds tend to blow along the northwest-southeast axis, but a fair amount comes from the west. The site is well-situated to represent neighborhood concentrations of $PM_{2.5}$ and PM_{10} for NAAQS compliance and AQI forecasting. The 3-year average daily maximum for PM_{10} has been increasing over the last ten years. In 2007, it measured just below the federal standard. There were no exceedances for PM_{10} in 2006 or 2008, but there was one exceedance in 2007, during a high wind event (IDEQ, 2010; IDEQ, 2008; IDEQ, 2009). The Nampa site began monitoring $PM_{2.5}$ in June 2008. For the remainder of that year, one day measured in the orange (unhealthy for sensitive groups) category of the AQI (35.5-65.4 $\mu g/m^3$) and nine days measured in the moderate, or yellow, range (15.5-35.4 $\mu g/m^3$). There were no $PM_{2.5}$ exceedances at the Nampa site in 2008 (IDEQ, 2010).

Pinehurst

The Pinehurst monitor is located in a small community nestled among the mountains in the Silver Valley (*D-30*). Sitting just south of I-90, this small valley is particularly susceptible to wintertime inversions where the pollutants are trapped for days. Winds are typically low and blow mostly from the southwest. The monitor is situated centrally in town and is designated a neighborhood scale. This location and scale of representation is appropriate for a population-oriented monitor (Code of Federal Regulations, 2009). The Pinehurst monitor measures $PM_{2.5}$ for NAAQS compliance and AQI forecasting and PM_{10} for SIP compliance and AQI forecasting. It is co-located with a meteorological monitor. Land use in the neighborhood is developed in town and along the interstate corridor and the farther surroundings are mountains covered in stands of Ponderosa pine. Population is concentrated within the city limits and is otherwise sparse. Three-year average daily maximum PM_{10} concentrations decreased rapidly from 1998 to 2001, then steadily increased to 2005, where they have been since holding steady (IDEQ, 2010). These concentrations remain well below the NAAQS. The 3-year average 98th-percentile daily $PM_{2.5}$ concentrations violated the NAAQS in 2005, 2006, and 2007, and were just below the federal standard in 2008 (IDEQ, 2010). Pinehurst was recommended by IDEQ for a $PM_{2.5}$ nonattainment area designation in 2008 (for the 3-year average 98th-percentile daily NAAQS for 2005-2007), but the proposal was withdrawn because the 2006-2008 design value was below the standard. The $PM_{2.5}$ 3-year average annual mean concentration has been steady (but below the NAAQS) since 2001. Pinehurst has measured the highest of all the Idaho $PM_{2.5}$ monitors for this metric since 2001 (IDEQ, 2010). In 2008, Pinehurst recorded 109 yellow AQI days, 11 orange days, and seven $PM_{2.5}$ exceedances (IDEQ, 2010). In 2007, 114 yellow days, 10 orange days, and no exceedances were recorded (IDEQ, 2009). In 2006, there were 49 yellow days, one orange day, and no exceedances (IDEQ, 2008). No PM_{10} exceedances were recorded for 2006, 2007, or 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010).

Pocatello – Garrett and Gould

The Pocatello Garrett and Gould site is urban in character, located centrally in Pocatello amongst commercial development near a rail yard (*Figure D-31*). The monitor measures $PM_{2.5}$ for AQI forecasting and PM_{10} for SIP maintenance and AQI forecasting. It is co-located with a meteorological station. A neighborhood scale of representation is appropriate for a population-oriented site type (Code of Federal Regulations, 2009). Land use in the neighborhood is developed, medium to high intensity, and population density is high. Synoptic winds from the southwest are funneled through the local terrain to blow from the southeast through the Portneuf Valley. PM_{10} concentrations have been trending downwards for the last ten years and the 3-year average daily maximum is well below the NAAQS (IDEQ, 2010). There were no PM_{10} exceedances during 2006, 2007, or 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010). For $PM_{2.5}$, this monitor recorded three moderate or yellow days in 2006, four yellow days and one orange day in 2007, and six yellow and two orange days in 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010).

Pocatello – Sewage Treatment Plant

The Pocatello Sewage Treatment Plant monitor is located on the northeastern edge of the sewage treatment facility (*D-32*). It aims to measure the source impact of SO_2 emitted from the sewage treatment plant. The middle scale of representation is appropriate for the site type (Code of Federal Regulations, 2009), though it is unclear why this site scale differs from the previously described Soda Springs site. This is a windy place, with the majority of the air travelling over the facility from the southwest. The annual average, maximum 24-hour average, and maximum 3-hour average concentrations have stayed steady and well below the federal standards since 1999 (IDEQ, 2010). There were no exceedances at this site in 2006, 2007, or 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010).

Salmon

The Salmon $PM_{2.5}$ monitor occupies a narrow mountain valley along the Salmon River (*Figure D-33*). The small community is surrounded by high mountains and rugged terrain. The neighborhood scale of representation is appropriate for this population-oriented site type (Code of Federal Regulations, 2009). Land use in the area is a mix of developed, pasture/hay, and grassland or shrub-covered hills. Population density is low. The diverse geography causes local wind patterns to be quite variable. Wind speeds are normally low and air drainage from the high country surrounding the valley is prevalent. During 2007 a total of six daily concentrations exceeded the standard. DEQ petitioned EPA to have these data flagged for exceptional event due to wildfire. EPA has concurred and the 2007 exceedances will not count toward a violation of the daily $PM_{2.5}$ NAAQS. During 2007 there were many wildfires in the region and the concentrations at the Salmon monitor reflect this. There were 35 yellow days, 6 orange days, and 3 red days that year (IDEQ, 2009). In 2008, there were 16 moderate days in the AQI index and no exceedances (IDEQ, 2010).

Sandpoint

The Sandpoint monitor is located in an urban area on the northwest shore of Lake Pend Oreille (*Figure D-34*). The city occupies a flat, north-south trending valley surrounded by evergreen covered mountains. The urban scale of representation is appropriate for a population-oriented site type (Code of Federal Regulations, 2009). The monitor measures $PM_{2.5}$ for AQI forecasting and PM_{10} for SIP and NAAQS compliance and AQI forecasting. The area surrounding the monitor is generally urban, along with water features, pasture, scrub, and forest. The monitor is located in a relatively dense census block group, to the southwest of the denser city center. There are two major point-source facilities within the scale of representation and they are situated along the same southwest-northeast axis along which local winds tend to blow, so these facilities may have some impact on the monitor. Synoptic winds are directionally similar to the local winds because the valley topography is oriented in the same direction. The PM_{10} monitor was established in 2009 so there are few data to examine. However, PM_{10} monitors at two different sites in the Sandpoint area operated from 1998 to 2008. They regularly recorded 3-year average daily maximum concentrations well below the NAAQS and they were the lowest of all Idaho PM_{10} monitors for five of those years. There were no $PM_{2.5}$ exceedances at the Sandpoint monitor during 2006, 2007, or 2008. In 2008, the monitor recorded 30 yellow AQI days and one orange day (IDEQ, 2010). In 2007, there were ten yellow days and one orange day and in 2006, there were 14 yellow days and one orange day (IDEQ, 2008; IDEQ, 2009). During those three years, only four yellow or orange AQI days were attributable to PM_{10}, all in 2006.

Soda Springs

The Soda Springs monitor is located at the northwest corner of the Monsanto P4 Title V facility (*Figure D-35*). It is a source impact monitor designed to measure SO_2 concentrations emitted from the P4 facility. The micro scale of representation is appropriate for this site type (Code of Federal Regulations, 2009). Prevailing local winds blow across the facility towards the monitor. There were no exceedances at this site in 2006, 2007, or 2008 (IDEQ, 2008; IDEQ, 2009; IDEQ, 2010). The annual average, maximum 24-hour average, and maximum 3-hour average concentrations have all measured well below the NAAQS since the monitor was established in 2005 (IDEQ, 2010).

St. Maries

The St. Maries site is in a small mountain valley town on the south bank of the St. Joe River (*Figure D-36*). St. Maries is in the Coeur d'Alene airshed, positioned at the southernmost tip of Coeur d'Alene Lake. The monitor measures $PM_{2.5}$ for NAAQS compliance and AQI forecasting. Synoptic winds blow from the south in the winter and from the west in the summer. These winds are probably funneled through the east-west and southeast trending valleys by the surrounding hills. The neighborhood scale of representation is appropriate for this population-oriented site (Code of Federal Regulations, 2009). Land use surrounding the monitor is developed and the population is dense. The monitor seems well-positioned to capture ambient air quality concentrations experienced by the area population. Since 2005 (when it exceeded the standard), the 3-year average 98th percentile daily concentration at St. Maries has been trending slightly downward (IDEQ, 2010). The 3-year average annual mean has stayed steady since 2005, at concentrations well below the standard (IDEQ, 2010). In 2008, 19 moderate days on the AQI and no exceedances of the NAAQS were recorded (IDEQ, 2010). In 2007, 24 moderate days on the AQI and no exceedances of the NAAQS were recorded (IDEQ, 2009). In 2006, no exceedances were recorded (IDEQ, 2008).

Twin Falls

The Twin Falls monitor is an urban site, centrally located in the Twin Falls airshed, on the Snake River Plain (*Figure D-37*). The monitor measures $PM_{2.5}$ for AQI forecasting and smoke management purposes. The neighborhood scale of representation is appropriate for a population-oriented site type (Code of Federal Regulations, 2009). Land use in the neighborhood is highly developed and population is uniformly dense. The terrain is flat, so wind speeds are relatively high and local geographic features do not play a large part in wind direction. Westerly winds prevail in the summer and in the winter winds blow from the south and southwest. Lack of terrain features makes this a well-ventilated site. In 2008, the Twin Falls monitor recorded nine days in the moderate AQI range (IDEQ, 2010). In 2007, 22 days were yellow (IDEQ, 2009), and, in 2006, eight yellow days were recorded (IDEQ, 2008).

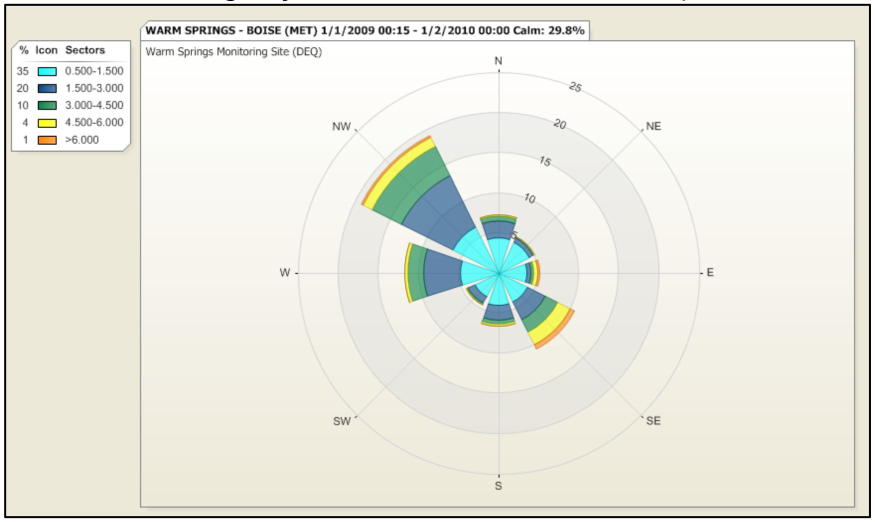
Recommendations

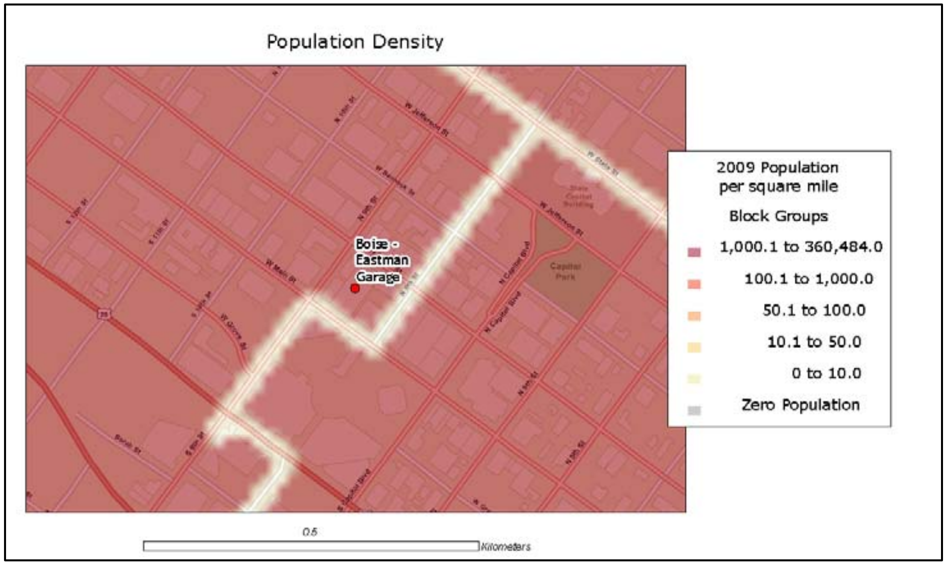
Following is the summary of monitor network recommendations derived from the site scale assessment:

- ***Garden Valley*** – change the scale of representation from neighborhood to urban
- ***McCall*** – change the scale of representation from neighborhood to urban
- ***Moscow*** – change the scale of representation from neighborhood to urban
- ***Franklin*** – change the scale of representation from urban to neighborhood
- ***Soda Springs*** and ***Pocatello Sewage Treatment Plant*** – normalize the scale of representation to either micro or middle for both sites
- ***Middleton –***
  - Drop one objective for $PM_{2.5}$ (summer smoke management or winter AQI forecasting) because the site cannot fulfill both.
  - Change the pollutant monitored to O_3 from $PM_{2.5}$ if the site type is to remain regional transport.

Figure D-1. Boise – Eastman Garage

Site Type	Source impact
Scale of Representation	Micro
Area Represented	Northern Ada County
Airshed	Treasure Valley
Pollutant(s) Monitored	PM_{10}, CO
Monitoring Objectives	NAAQS compliance, CO SIP





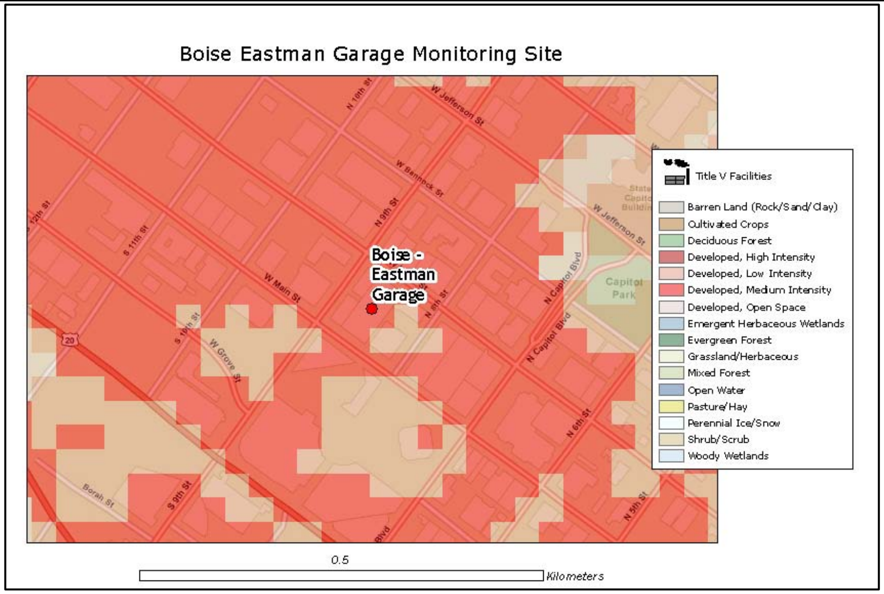
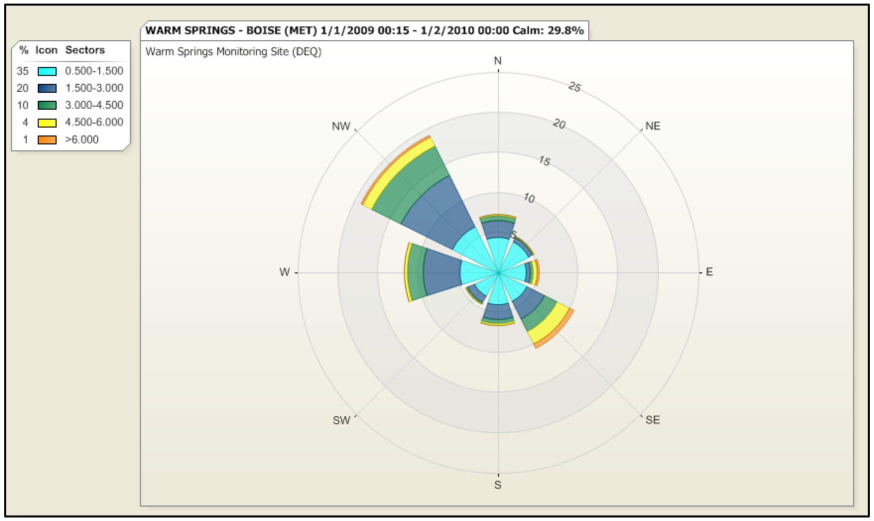
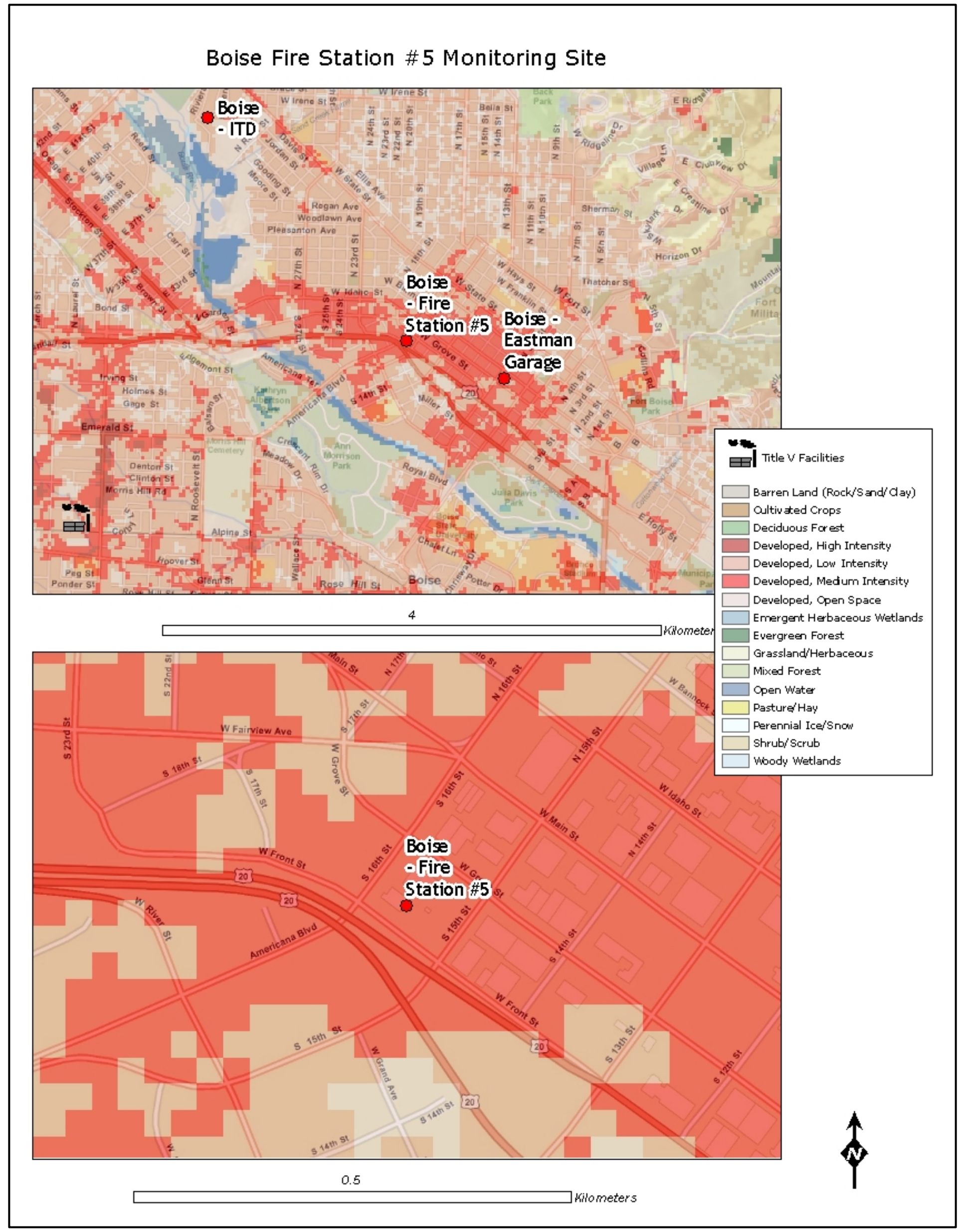


Figure D-2. Boise – Fire Station #5

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Northern Ada County
Airshed	Treasure Valley
Pollutant(s) Monitored	PM_{10}
Monitoring Objectives	NAAQS compliance, AQI, PM_{10} SIP





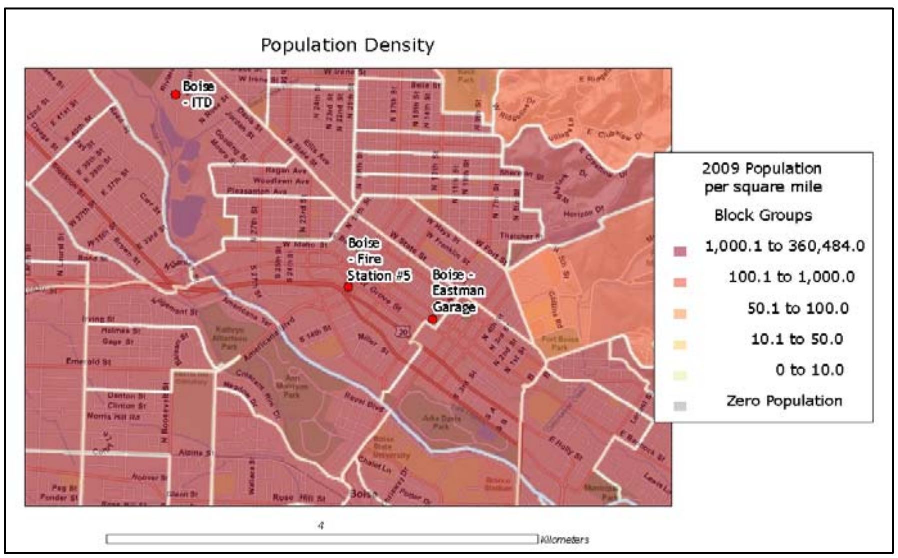
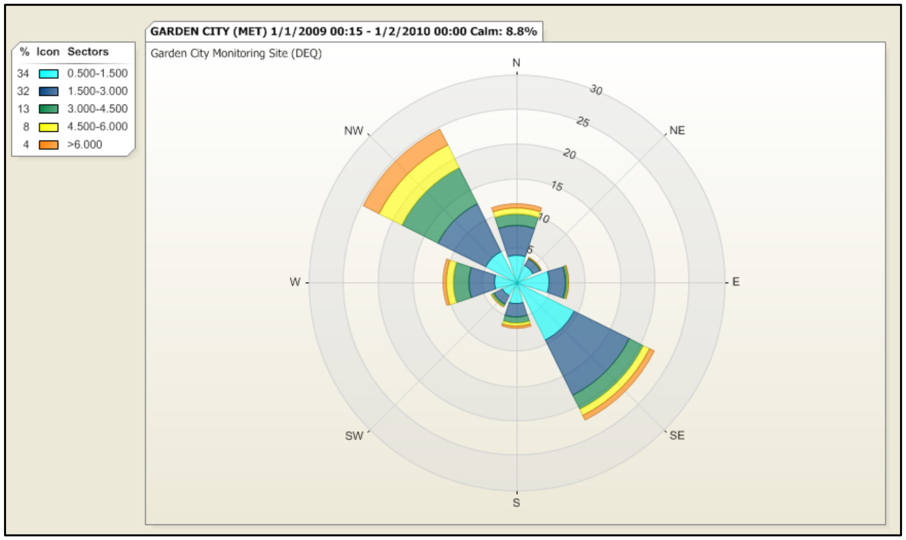
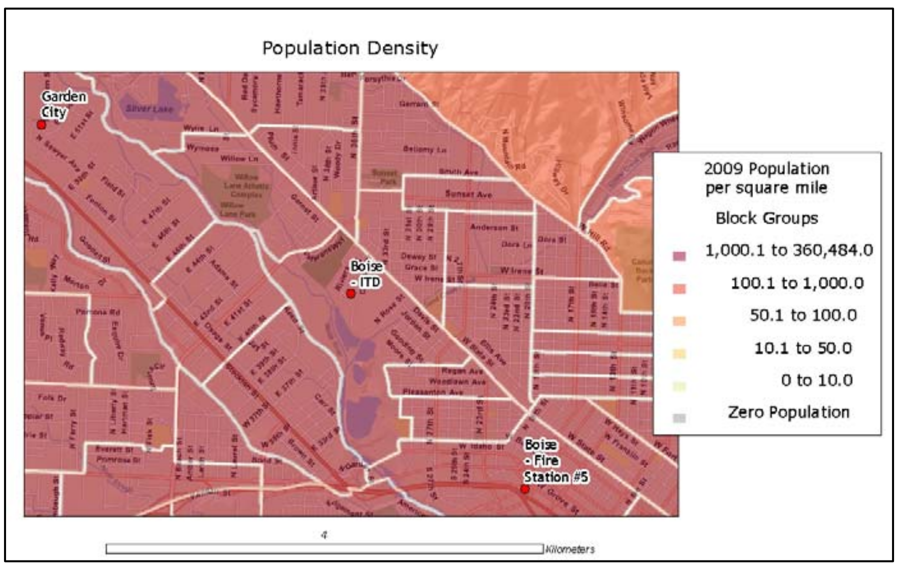


Figure D-3. Boise – Idaho Transportation Department (ITD)

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Boise City/Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	O_3
Monitoring Objectives	NAAQS compliance





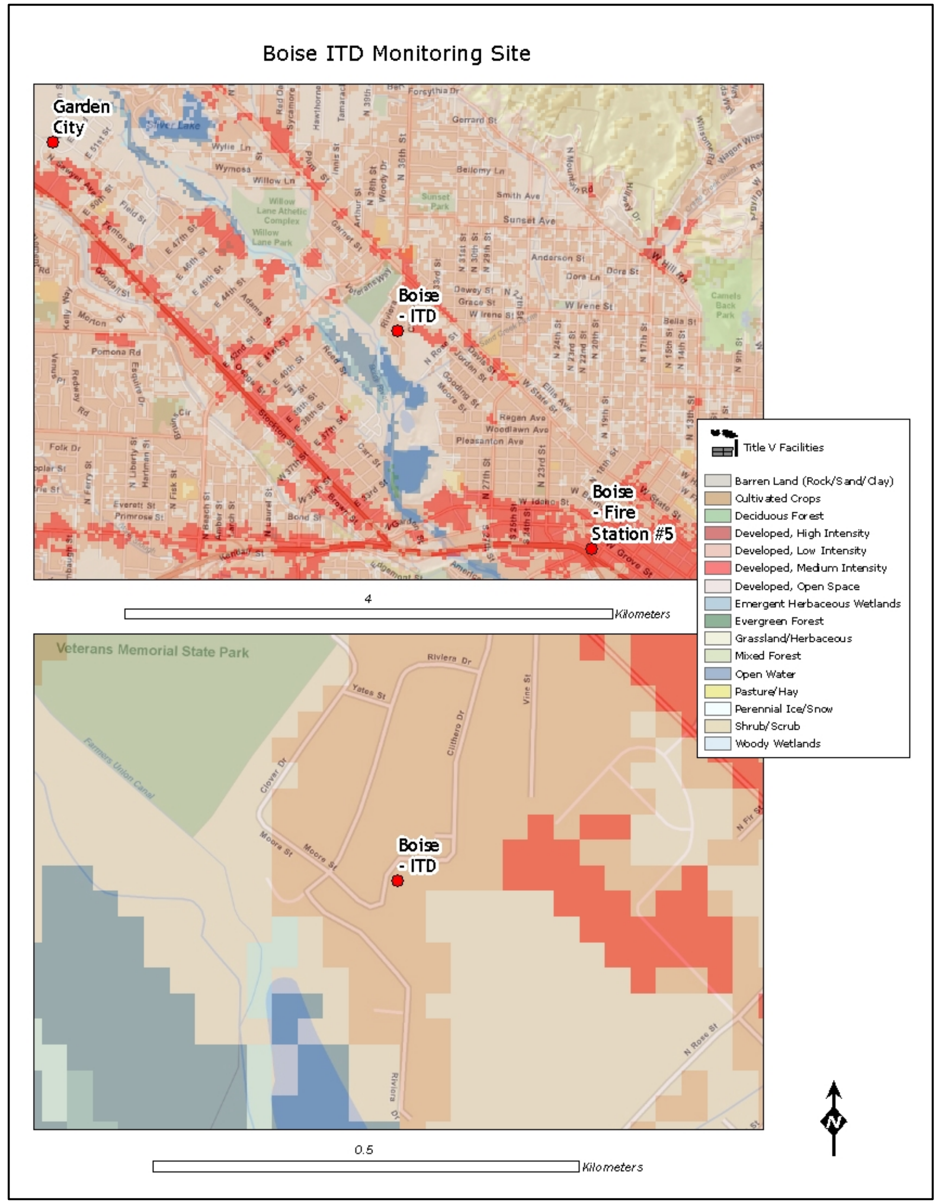
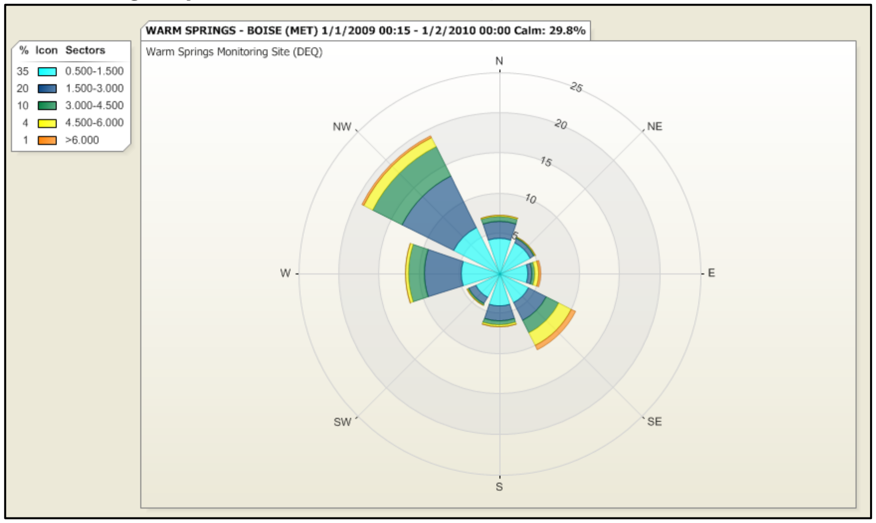
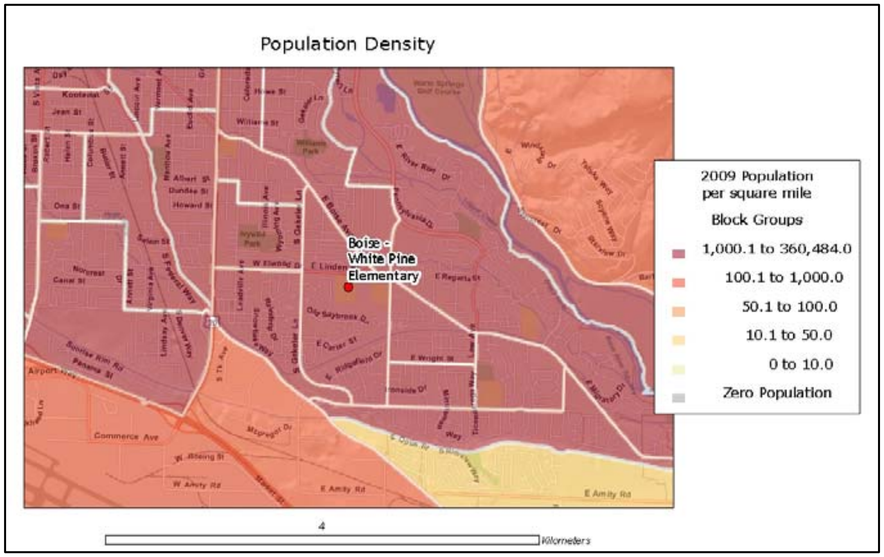


Figure D-4. Boise – White Pine Elementary

Site Type	Highest concentration
Scale of Representation	Neighborhood
Area Represented	Boise City/Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	O_3
Monitoring Objectives	NAAQS compliance





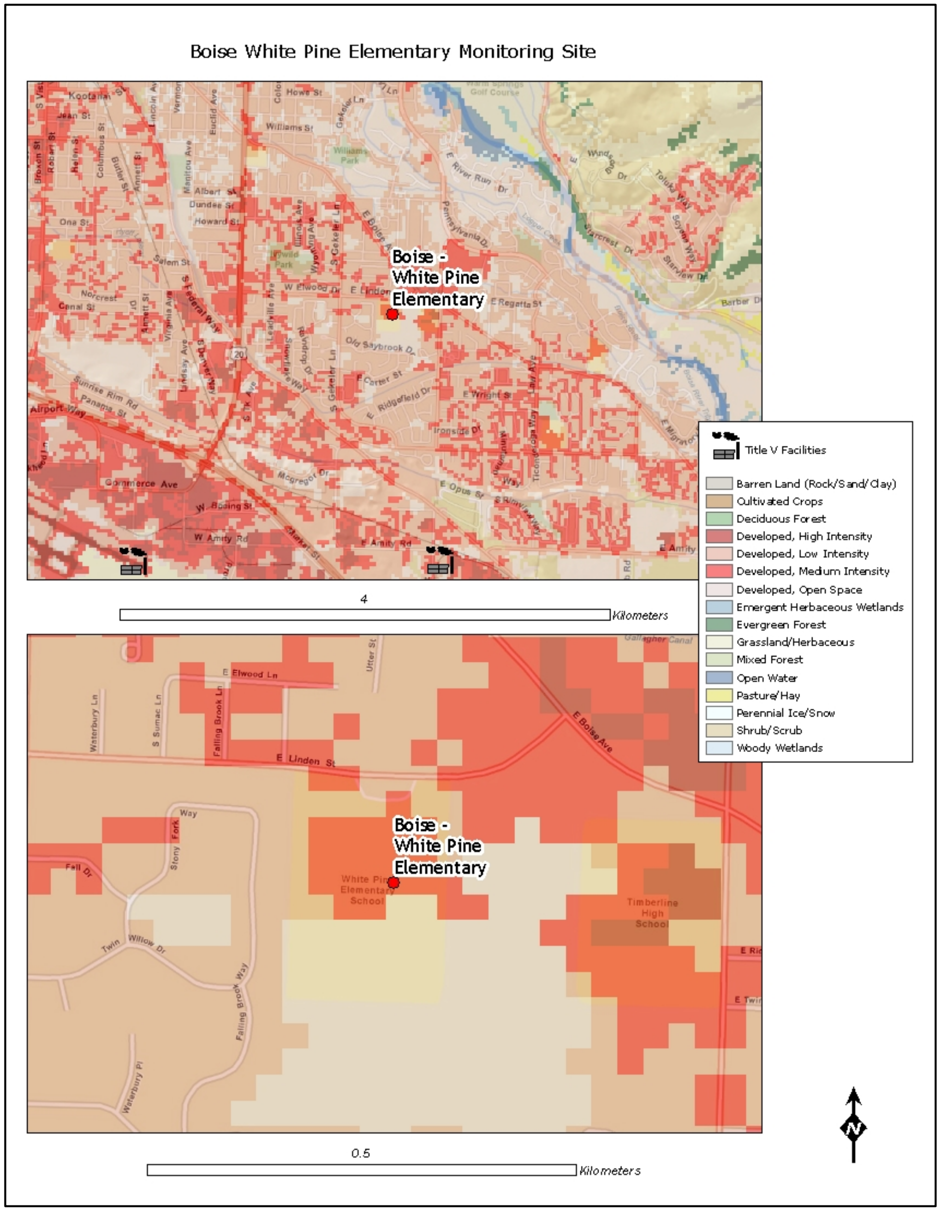
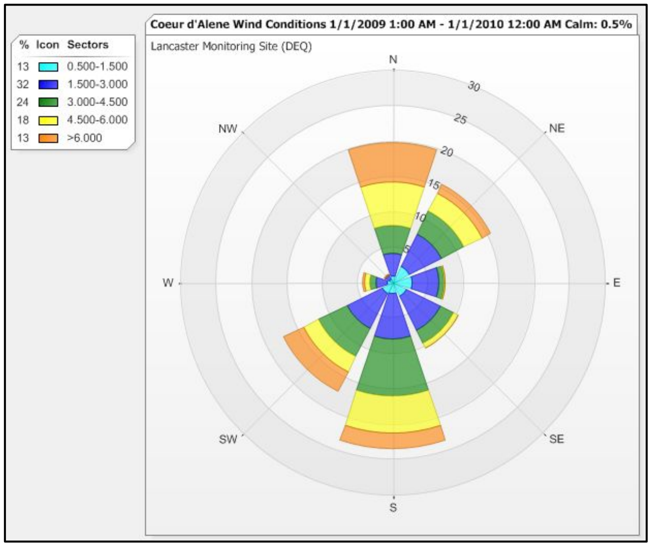
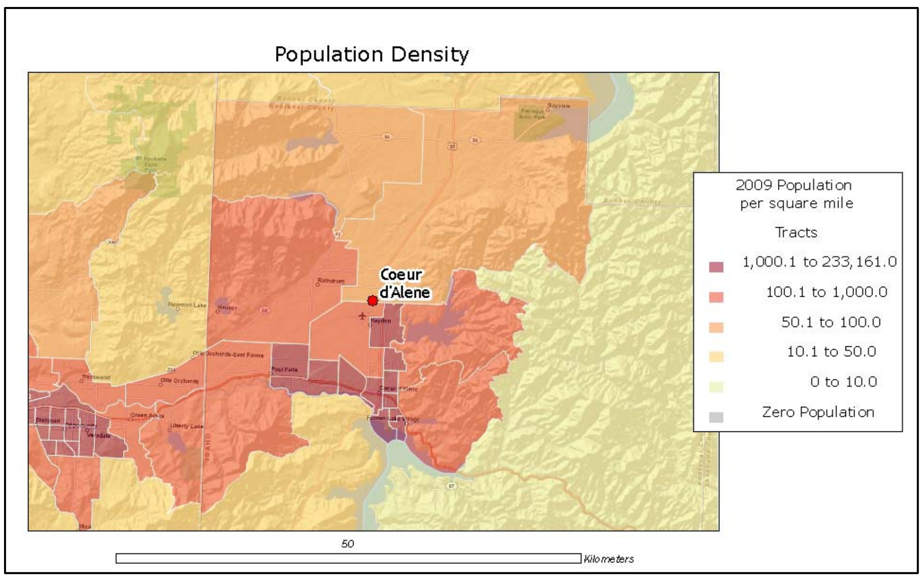


Figure D-5. Coeur d'Alene - Lancaster Rd.

Site Type	Population-oriented
63	Urban
Scale of Representation	
Area Represented	Coeur d'Alene MSA
Airshed	Coeur d'Alene
Pollutant(s) Monitored	$PM_{2.5}$, O_3, NO_x, meteorology
Monitoring Objectives	NAAQS compliance, AQI, modeling/met





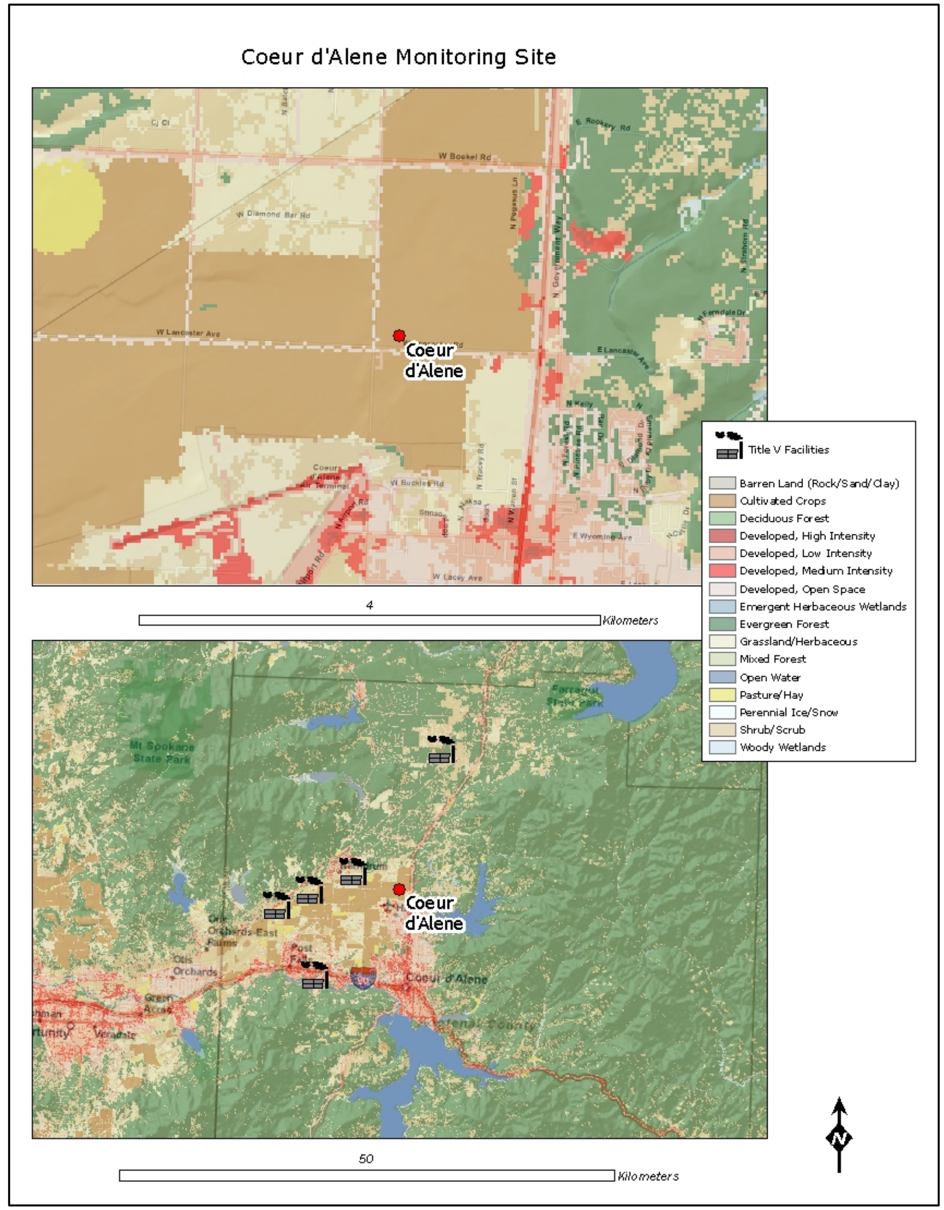


Figure D-6. Coeur d'Alene Airshed Summertime Synoptic Winds

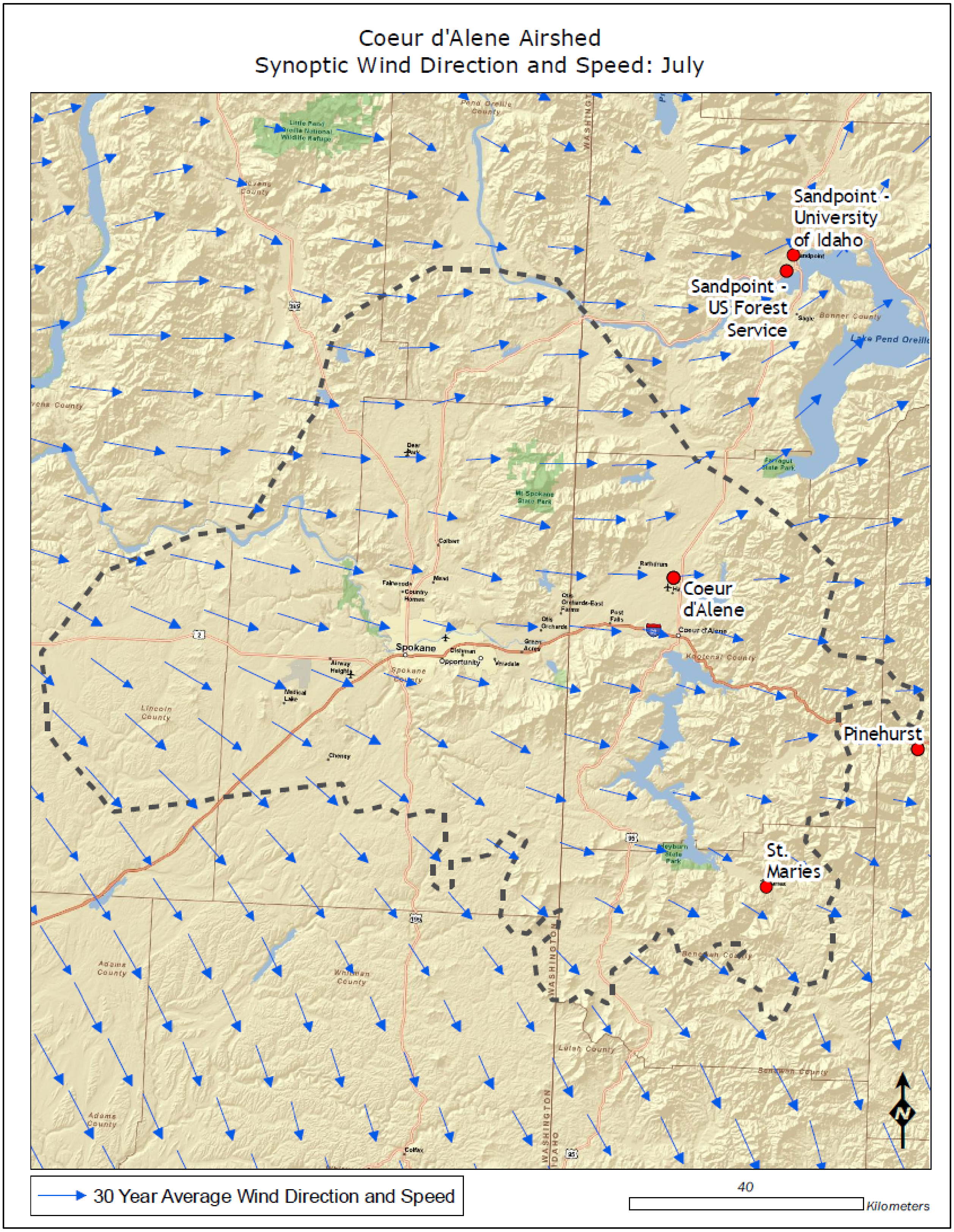
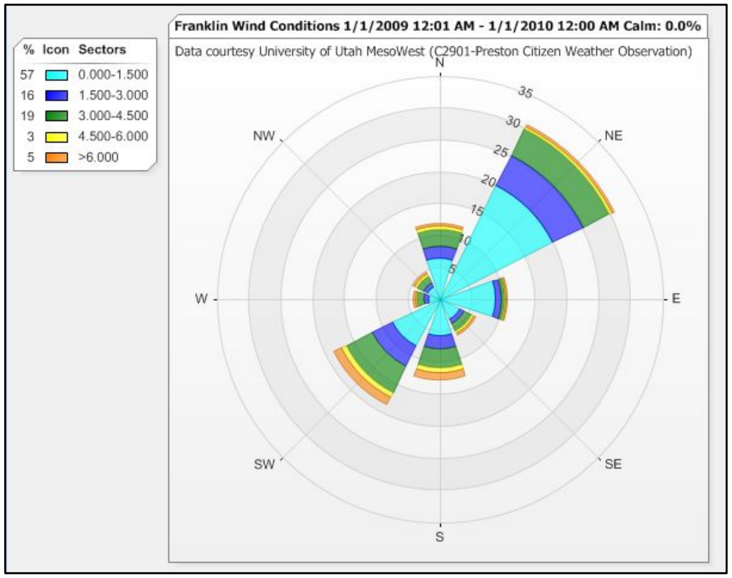
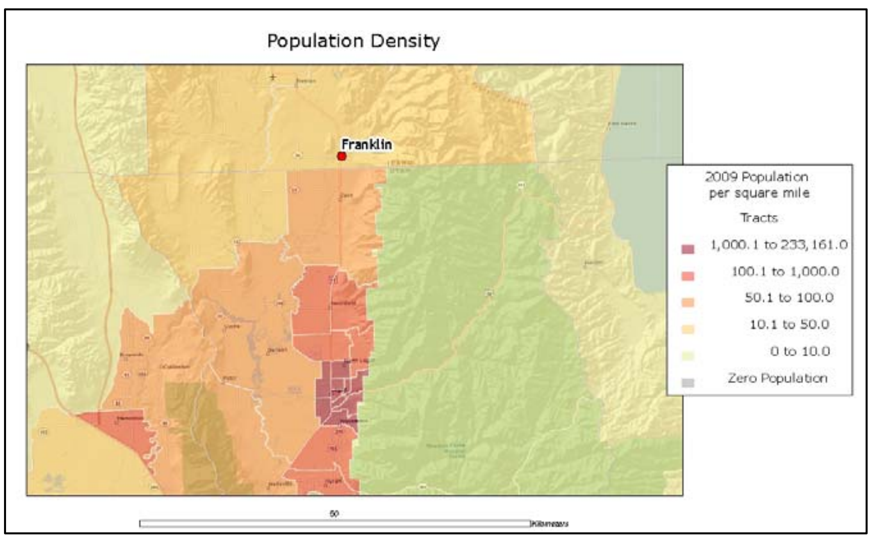


Figure D-7. Franklin

Site Type	Population-oriented
Scale of Representation	Urban
Area Represented	Logan, UT/ID MSA
Airshed	Cache Valley (not defined)
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	NAAQS compliance, AQI





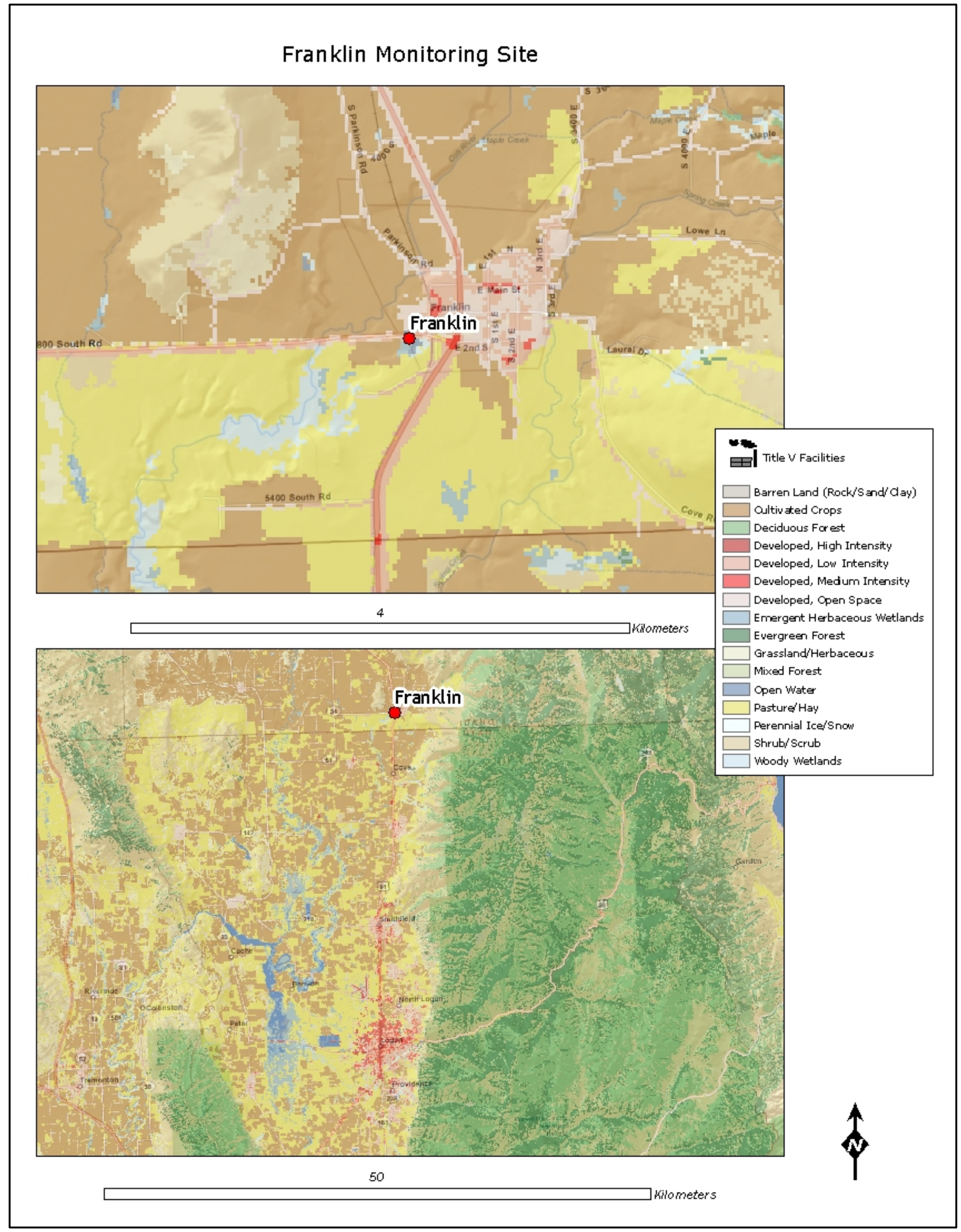


Figure D-8. Logan MSA Wintertime Synoptic Winds

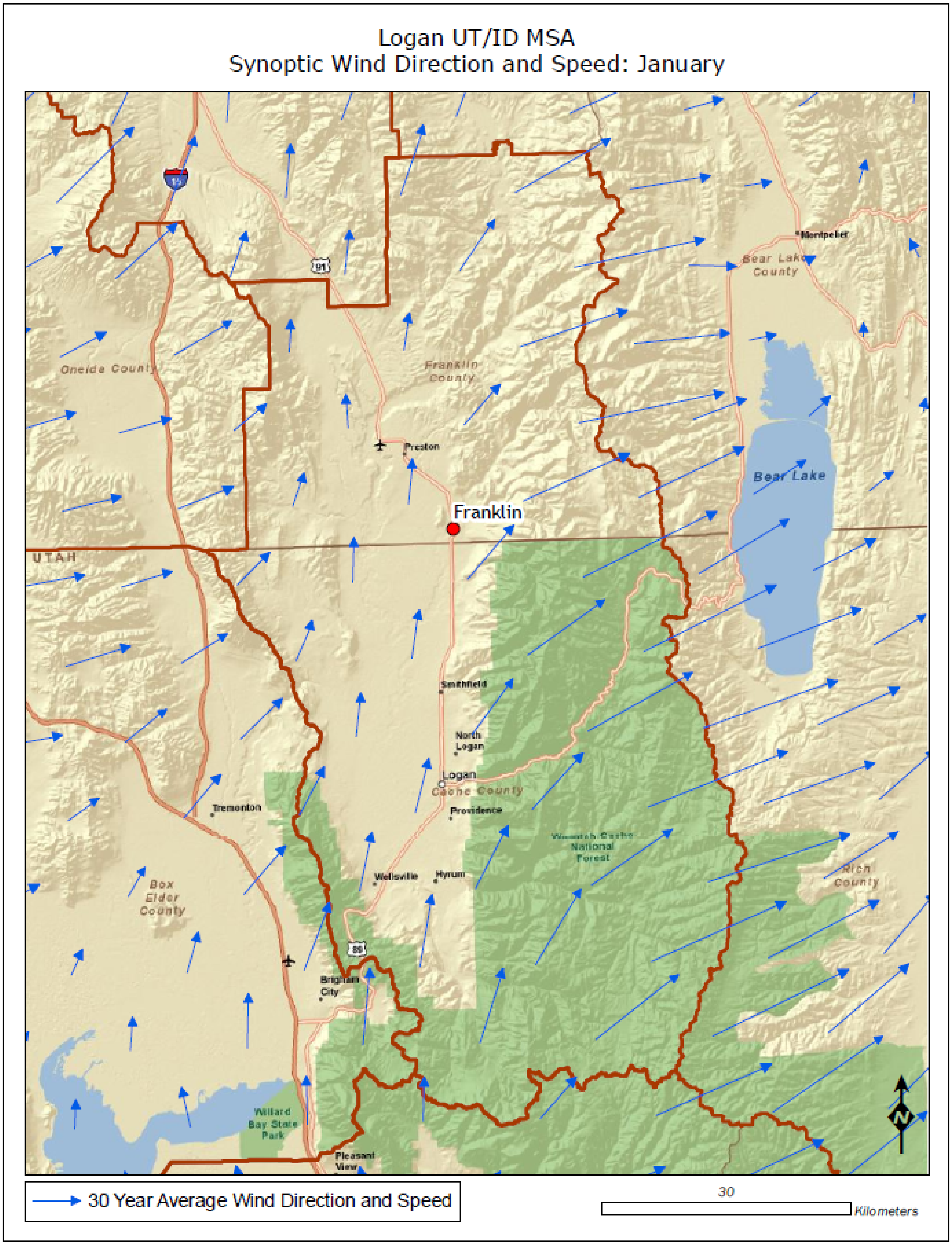


Figure D-9. Logan MSA Summertime Synoptic Winds

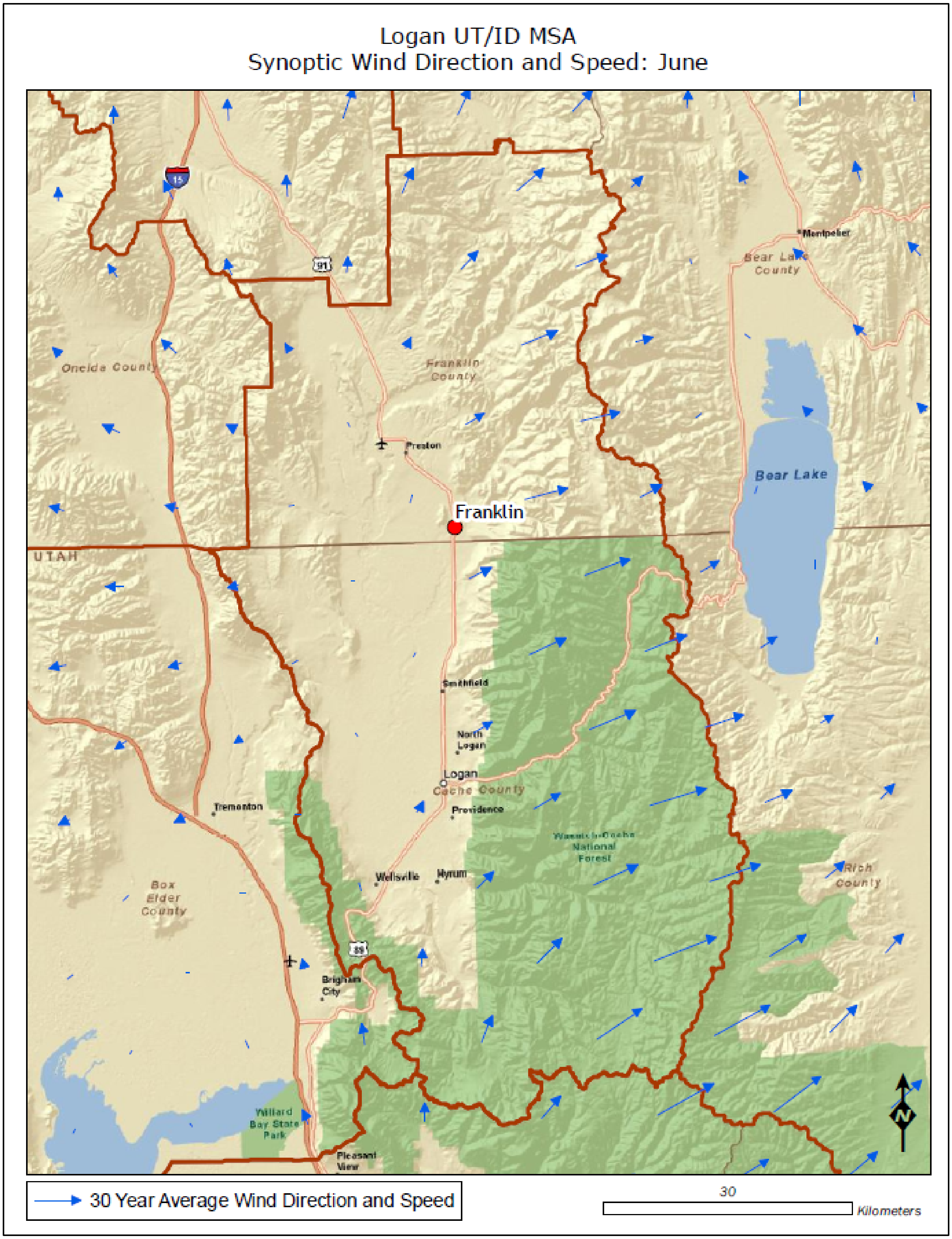
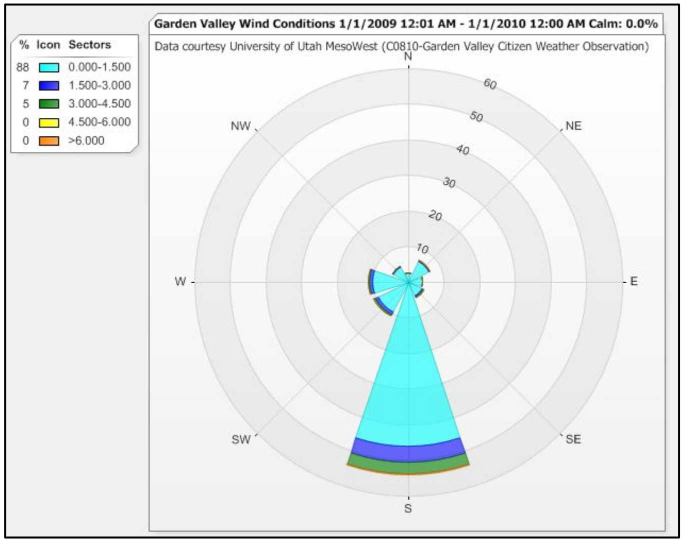
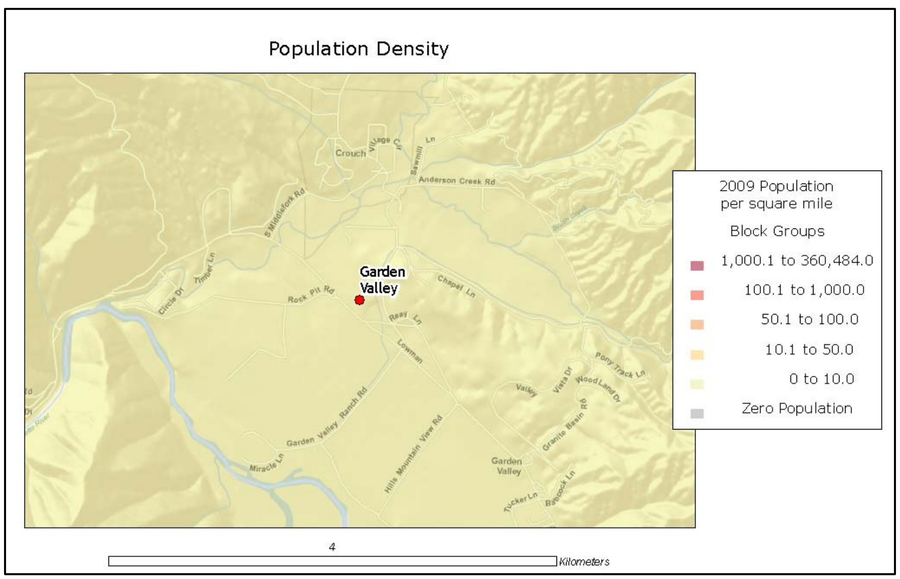


Figure D-10. Garden Valley

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Boise County
Airshed	not defined
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	smoke management





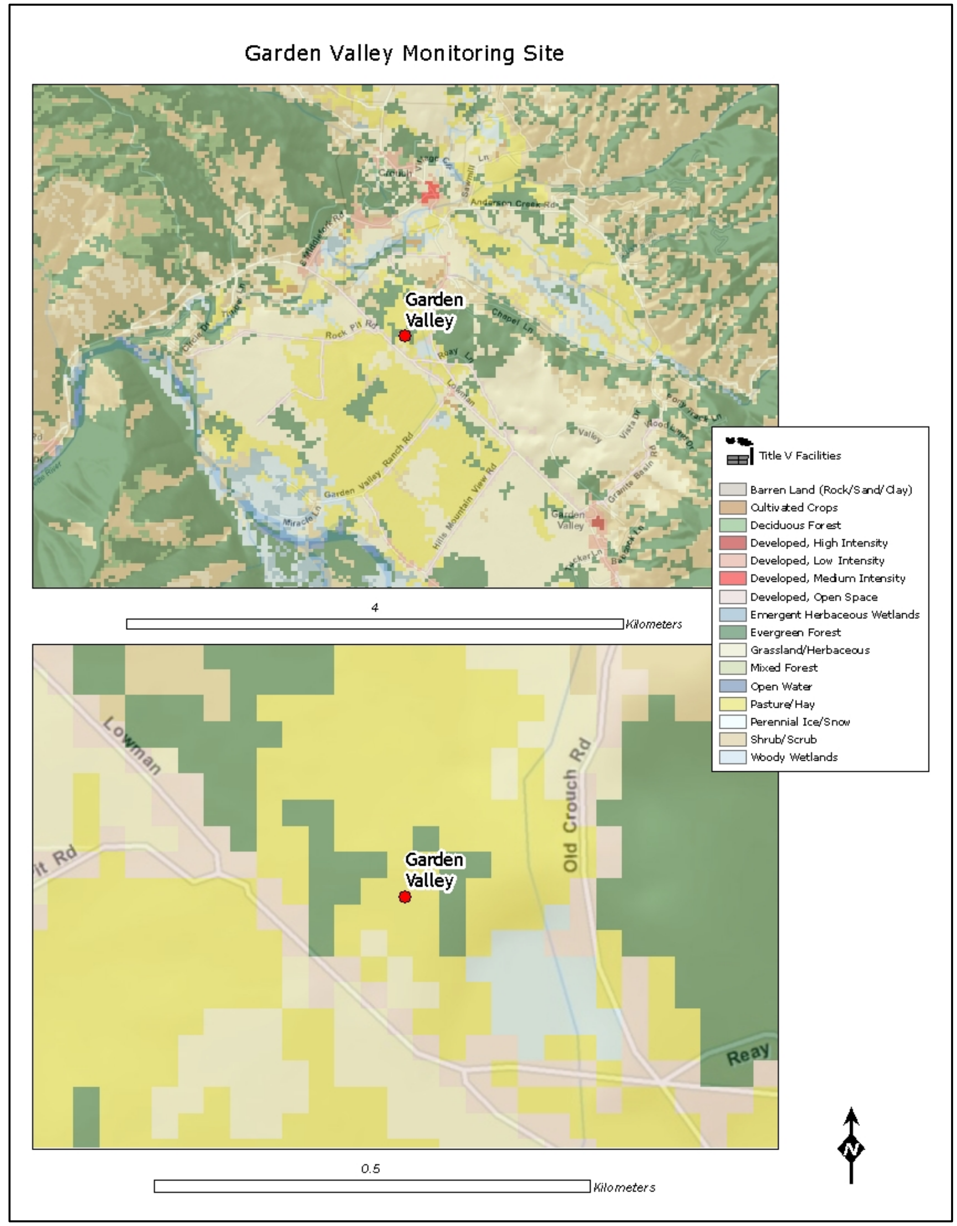


Figure D-11. Boise County Wintertime Synoptic Winds

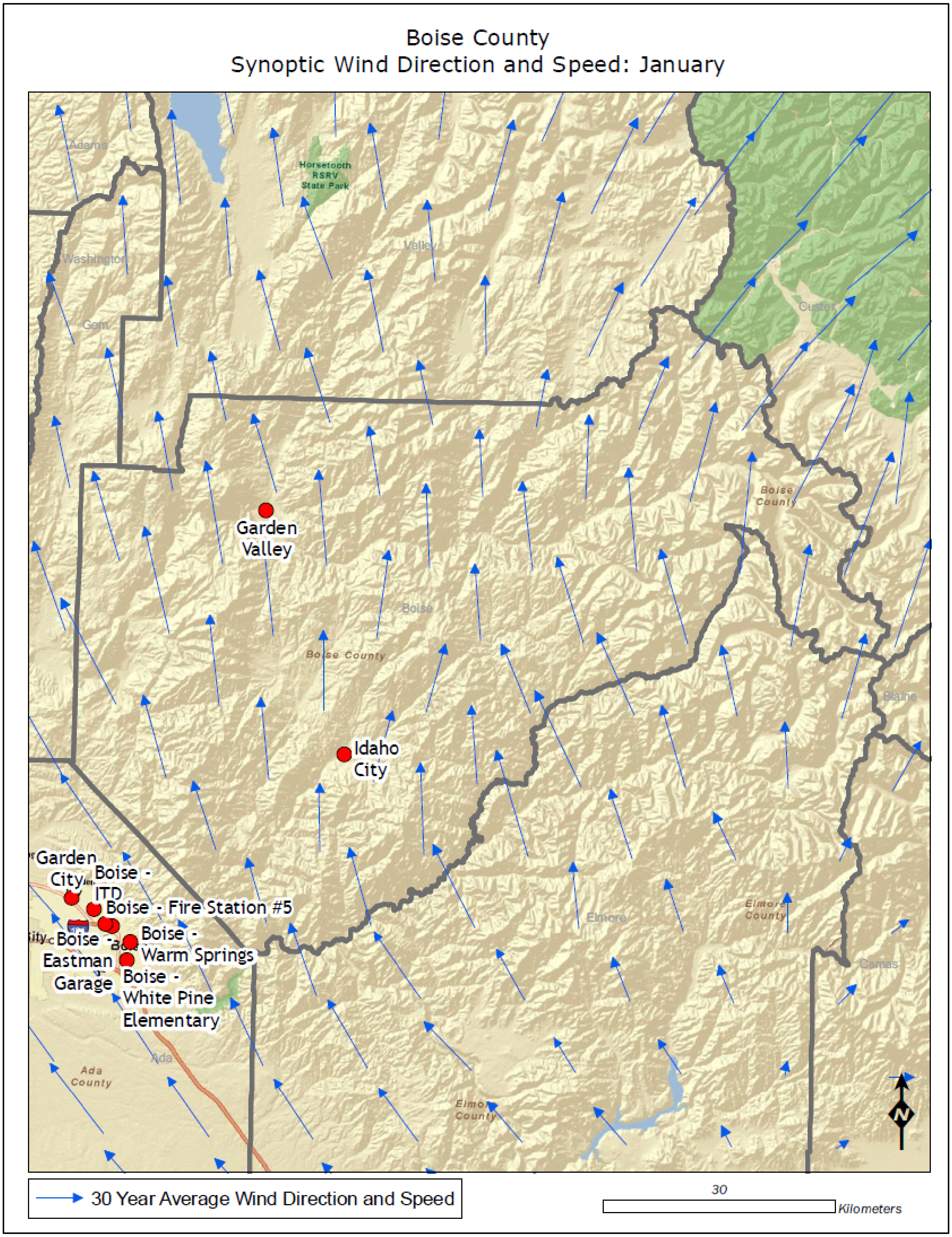


Figure D-12. Boise County Summertime Synoptic Winds

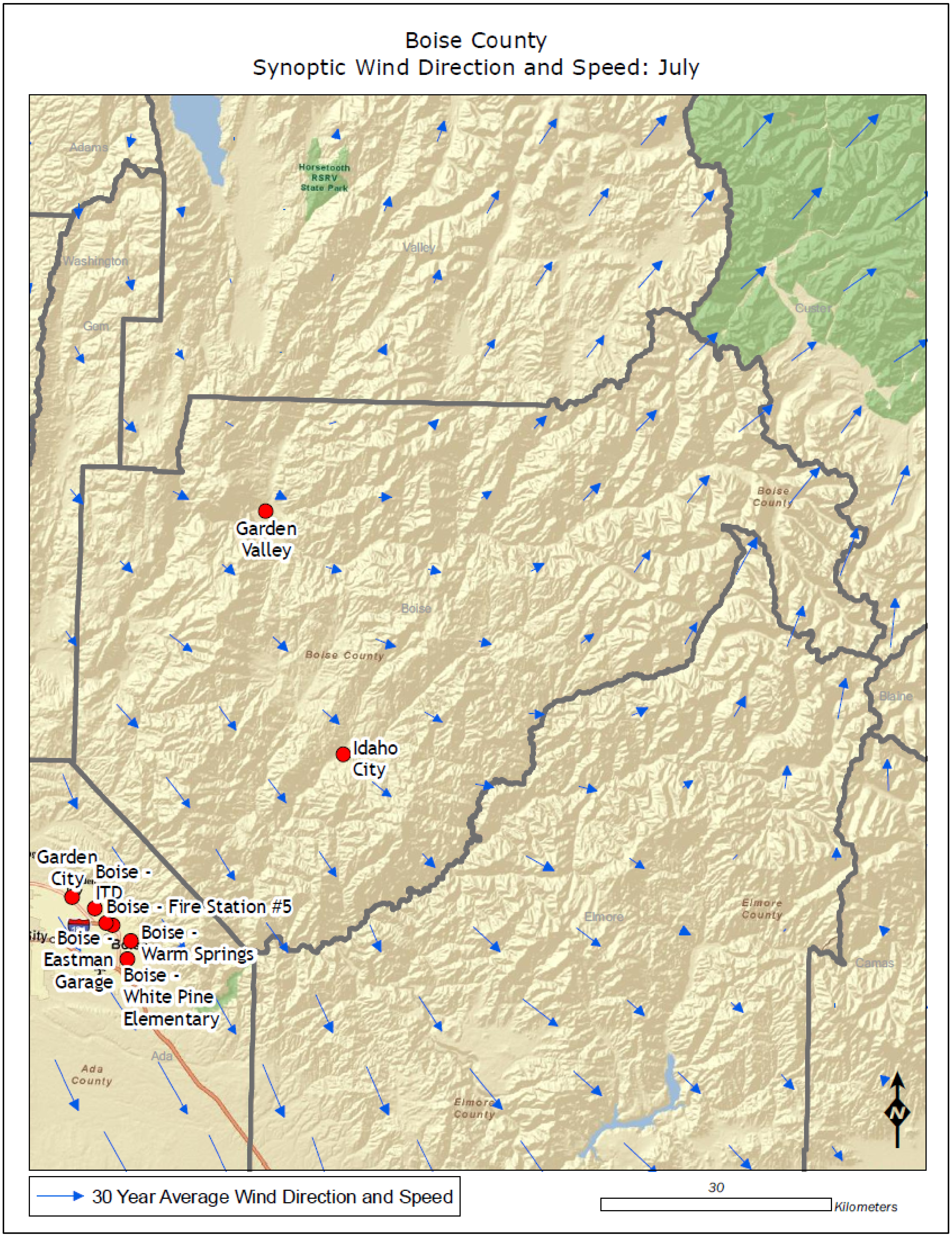
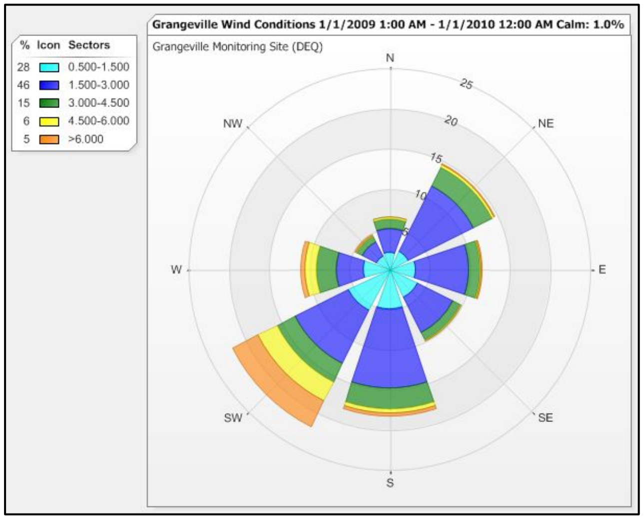
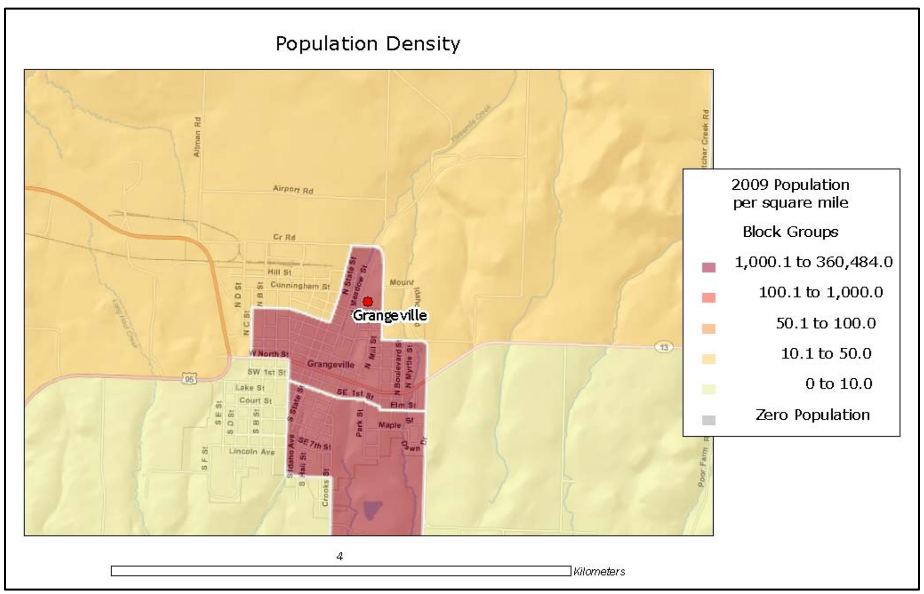


Figure D-13. Grangeville

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Idaho County
Airshed	not defined
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	AQI, smoke management, modeling/met





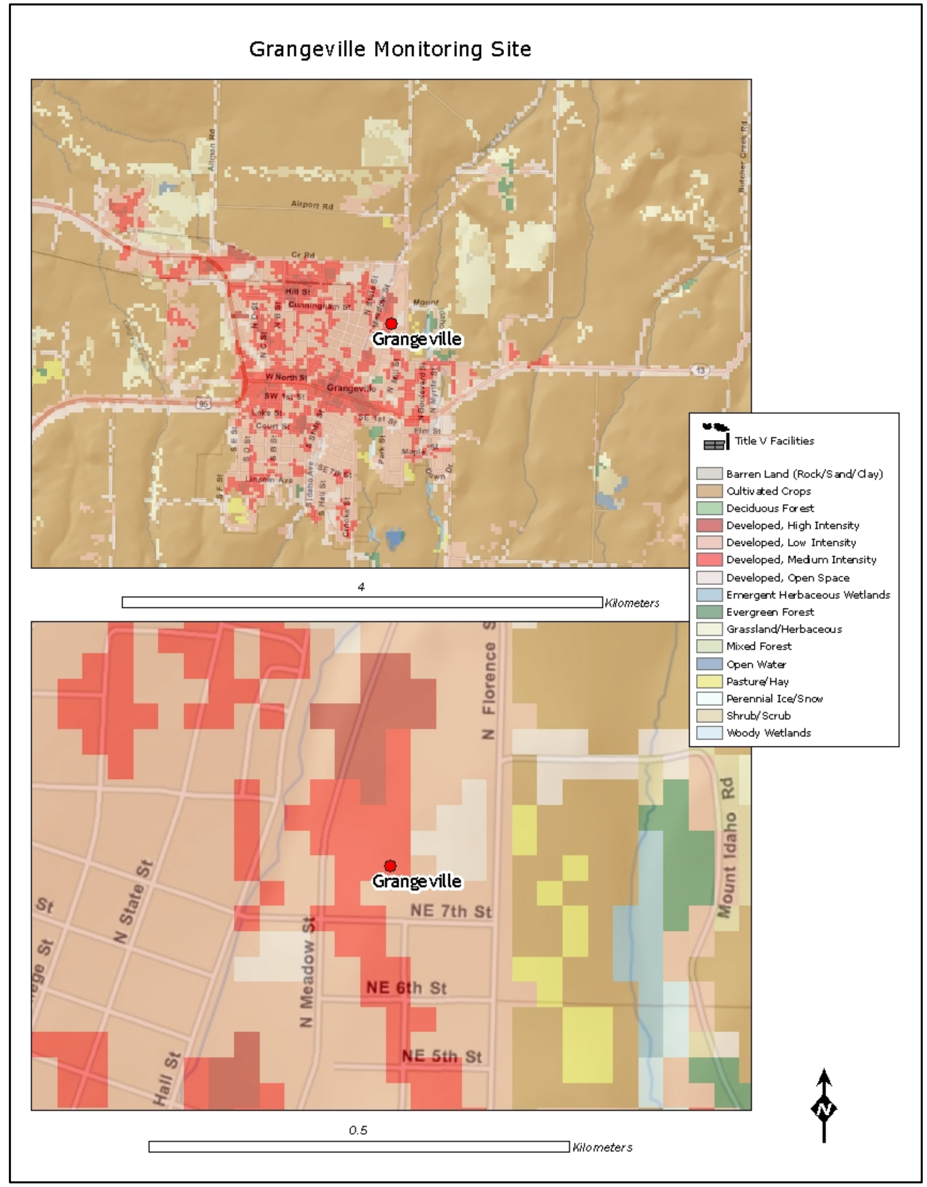


Figure D-14. Idaho County Summertime Synoptic Winds

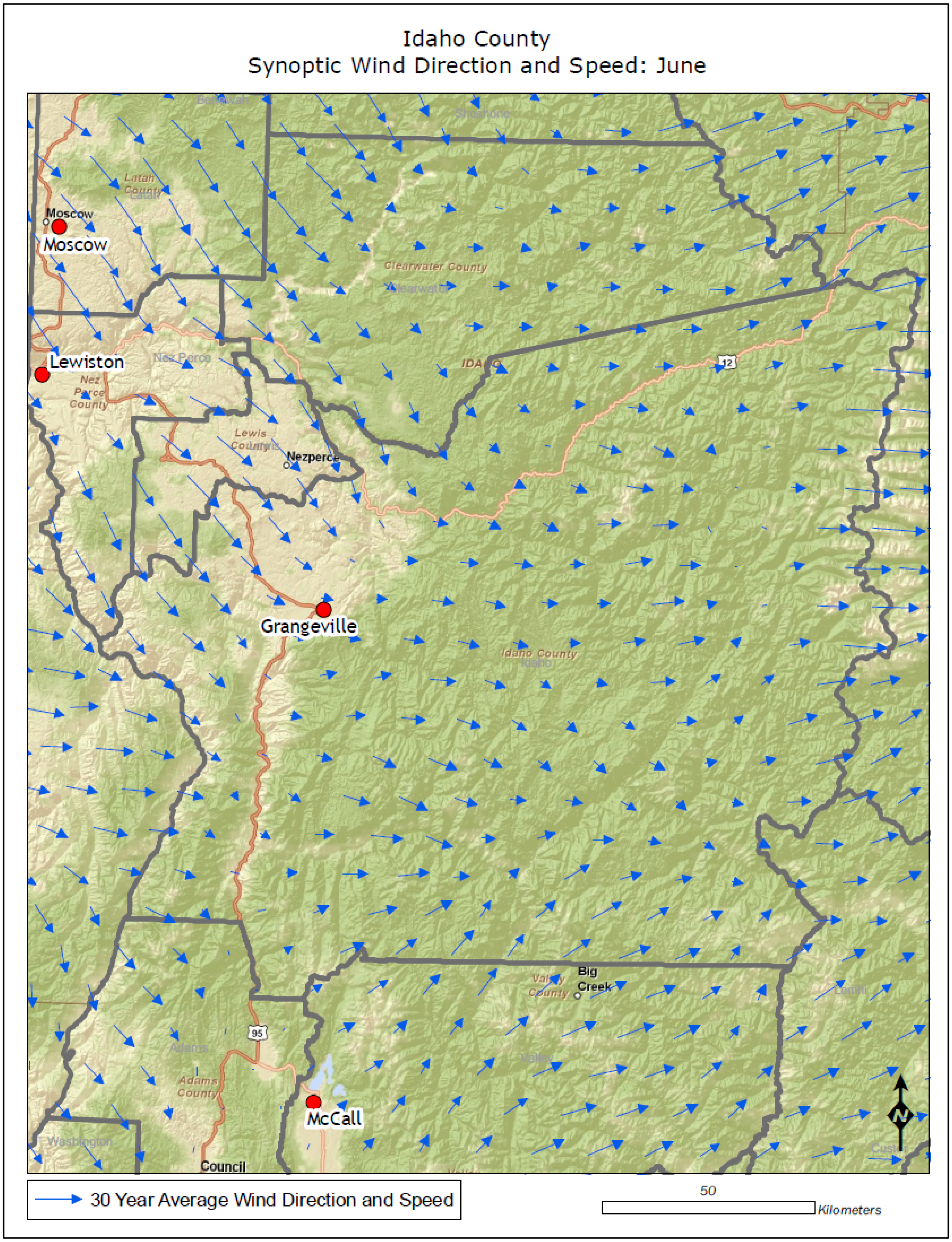
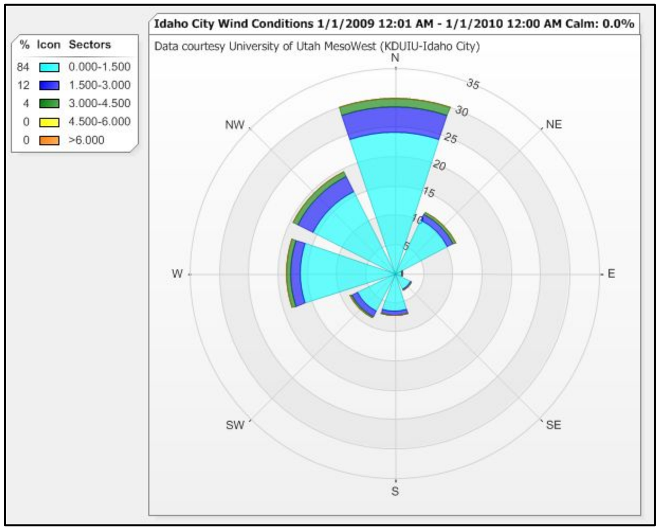
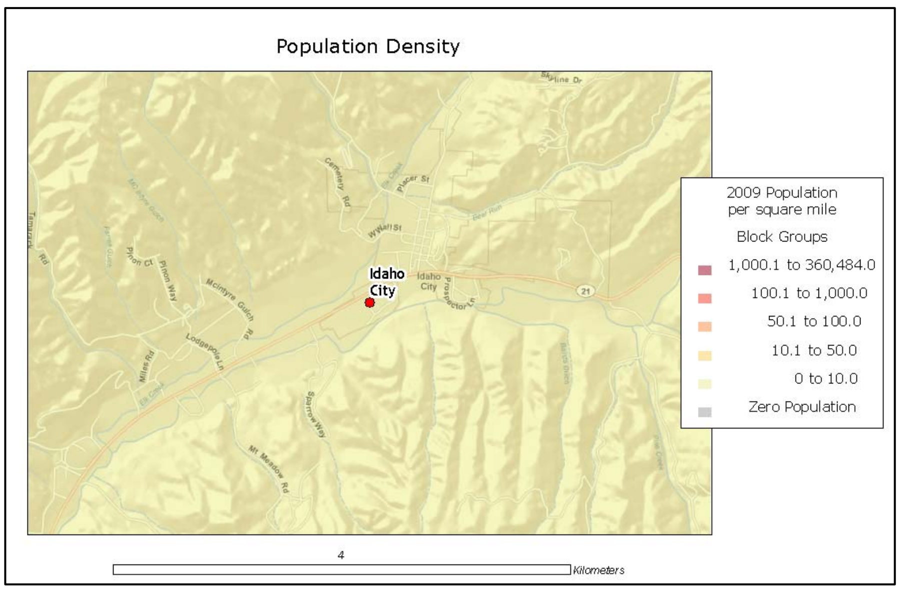


Figure D-15. Idaho City

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Boise County
Airshed	not defined
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management





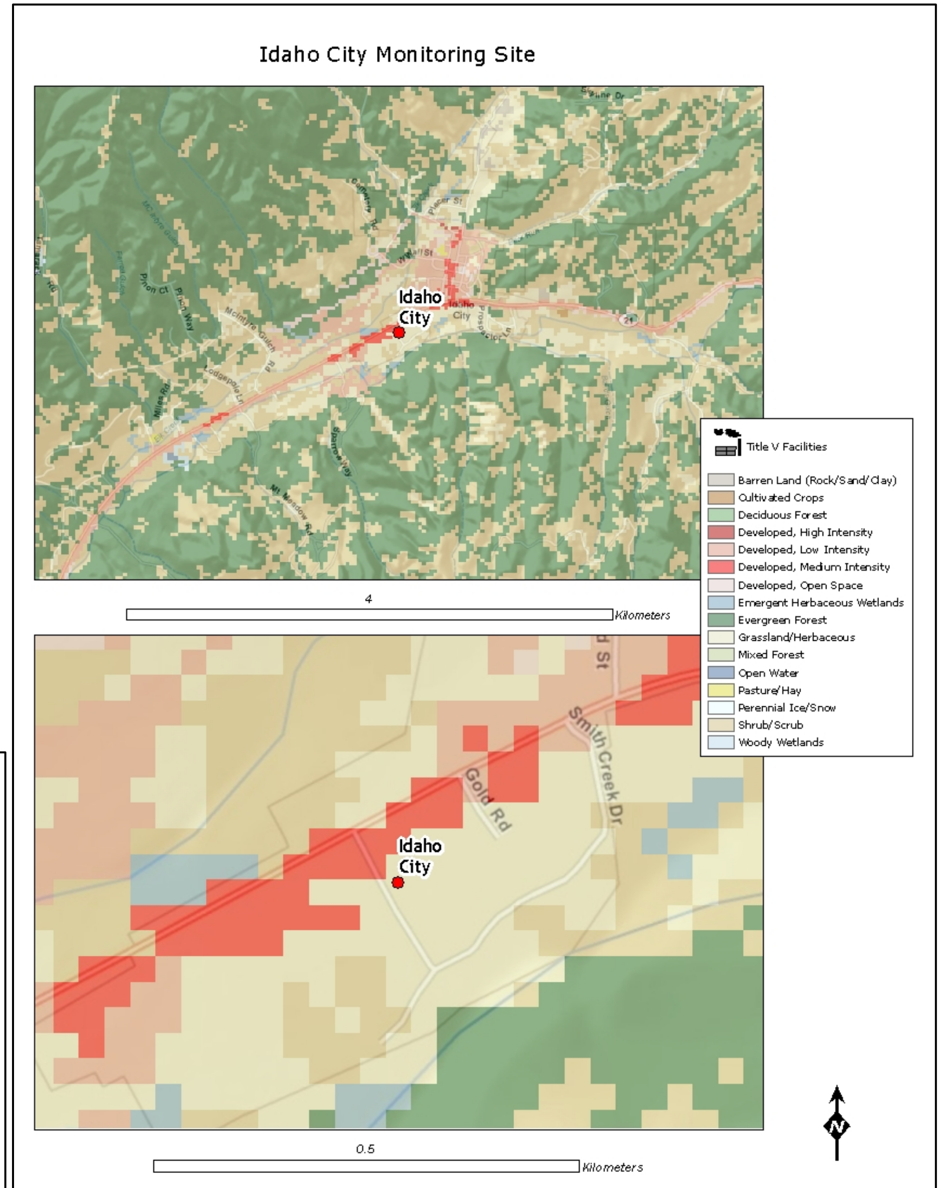
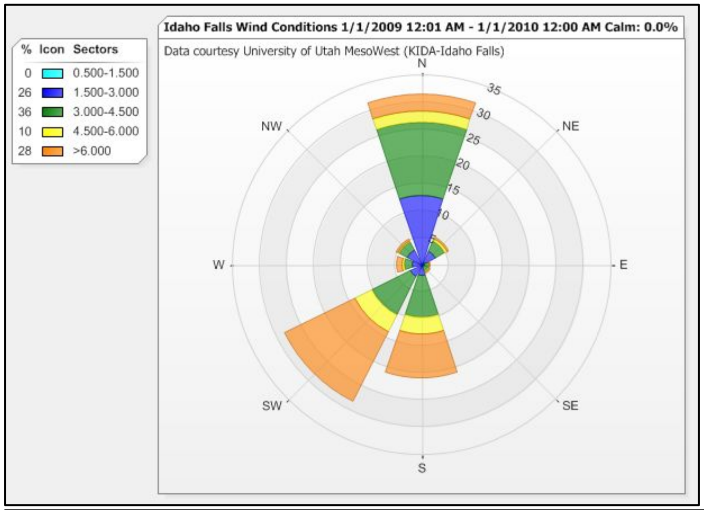
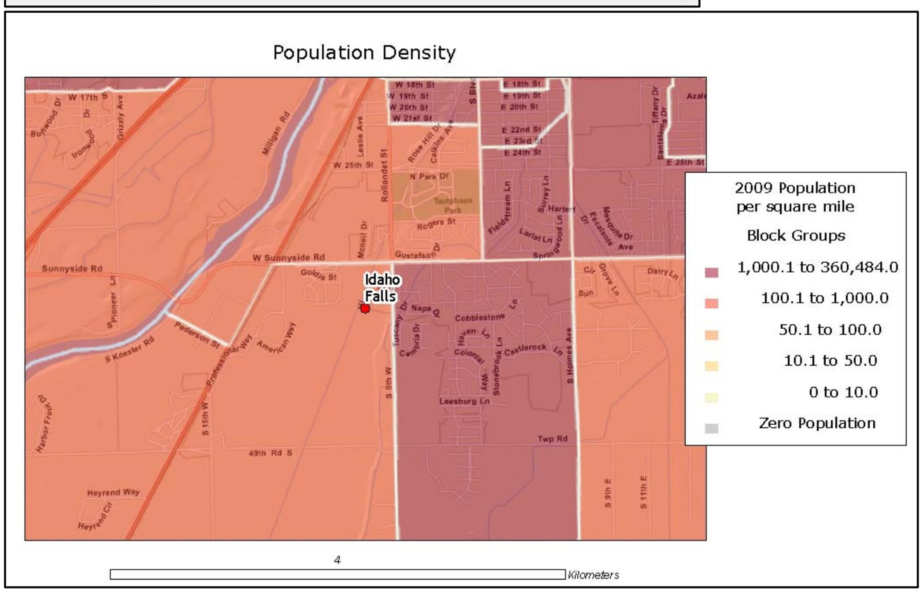


Figure D-16. Idaho Falls

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Idaho Falls MSA
Airshed	Idaho Falls
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management





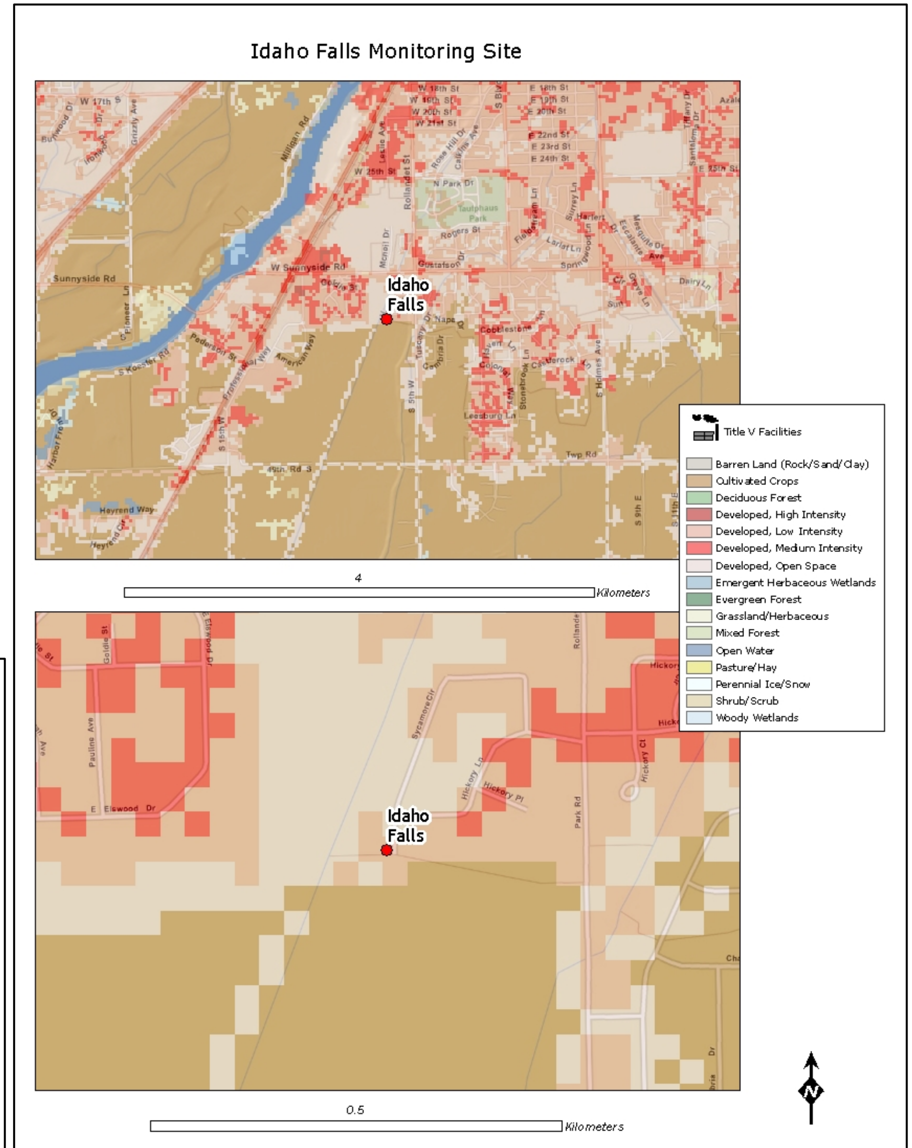
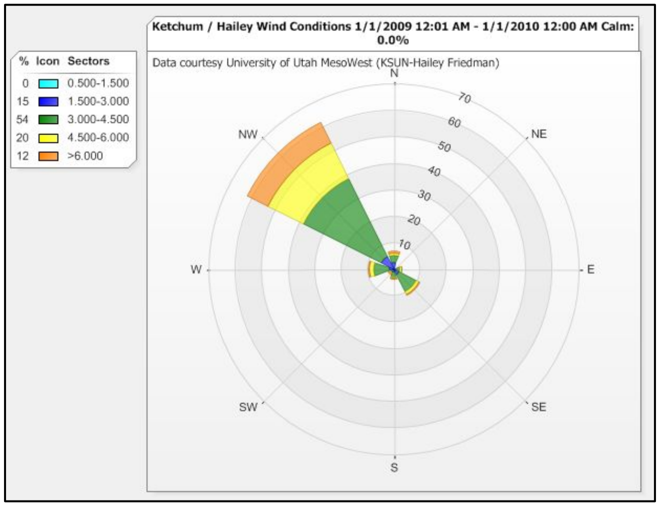
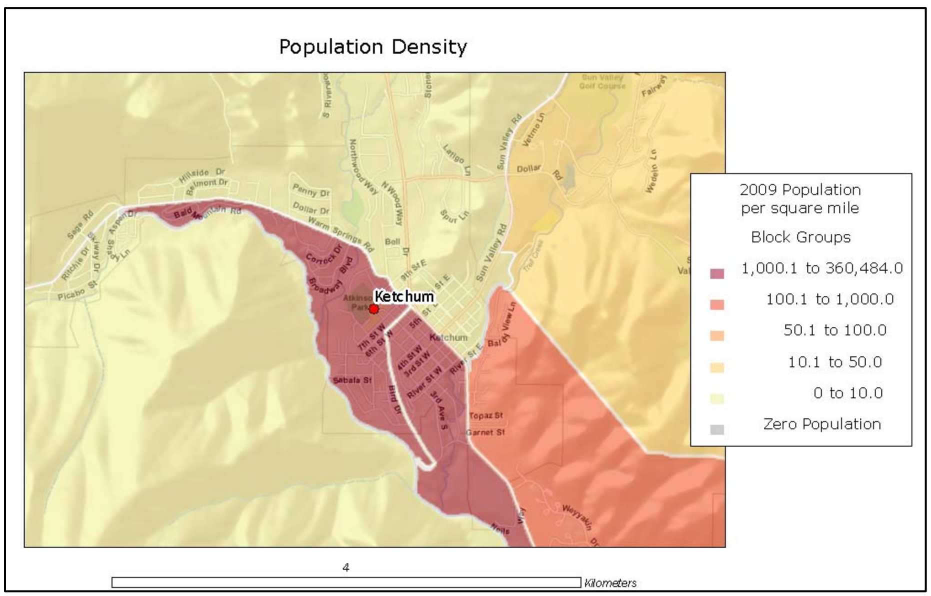


Figure D-17. Ketchum

Site Type	Population-oriented
Scale of Representation	Urban
Area Represented	Blaine County
Airshed	not defined
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management





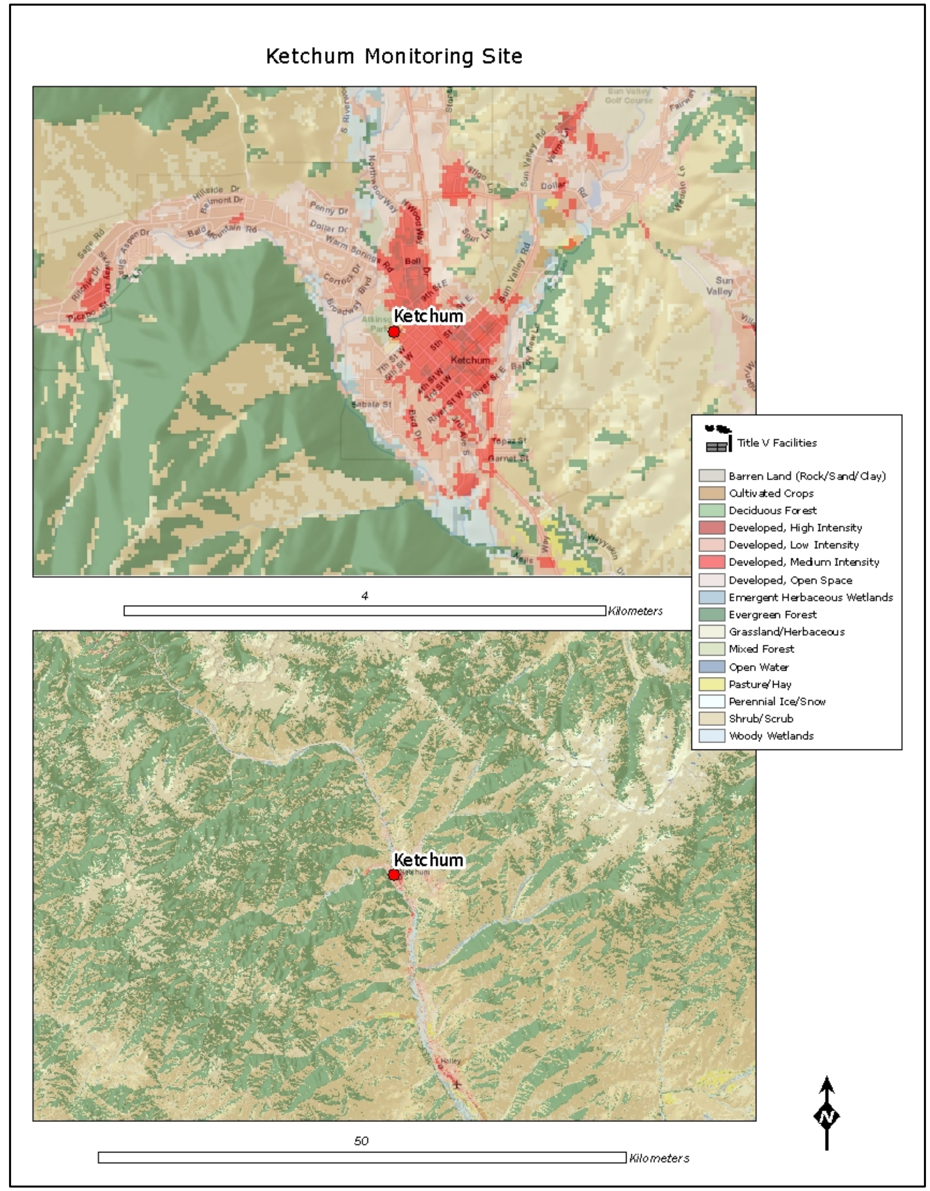


Figure D-18. Blaine County Wintertime Synoptic Winds

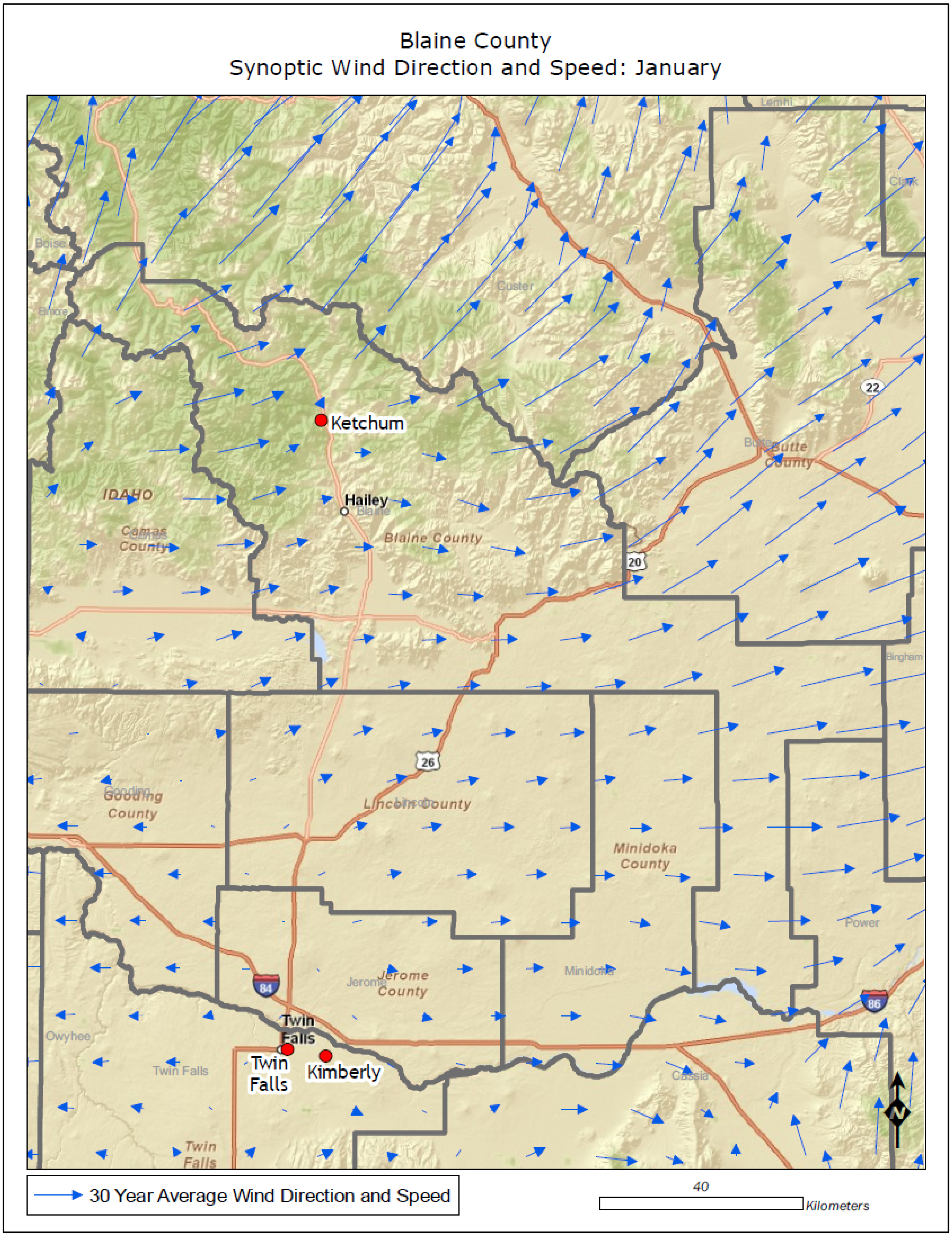


Figure D-19. Blaine County Summertime Synoptic Winds

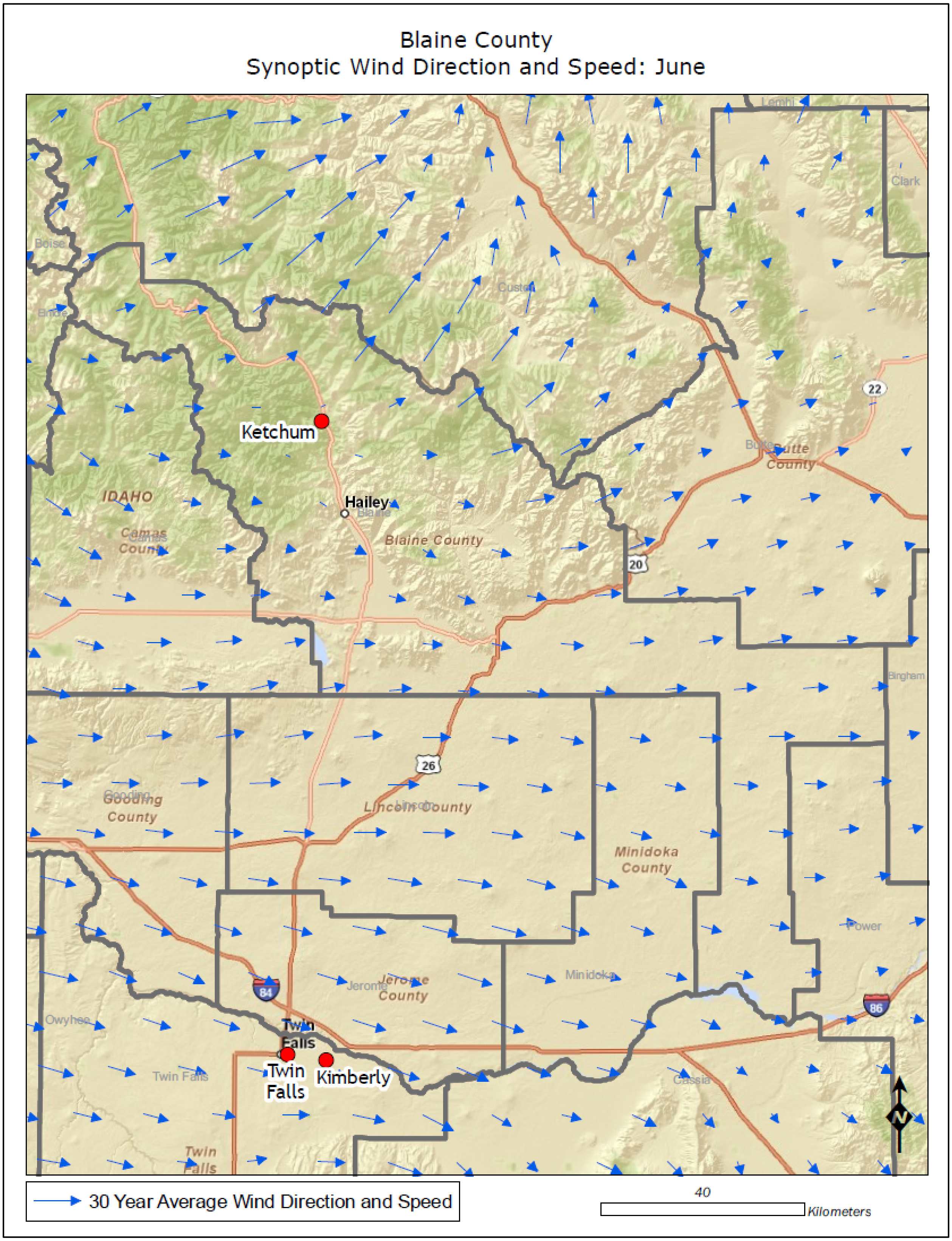
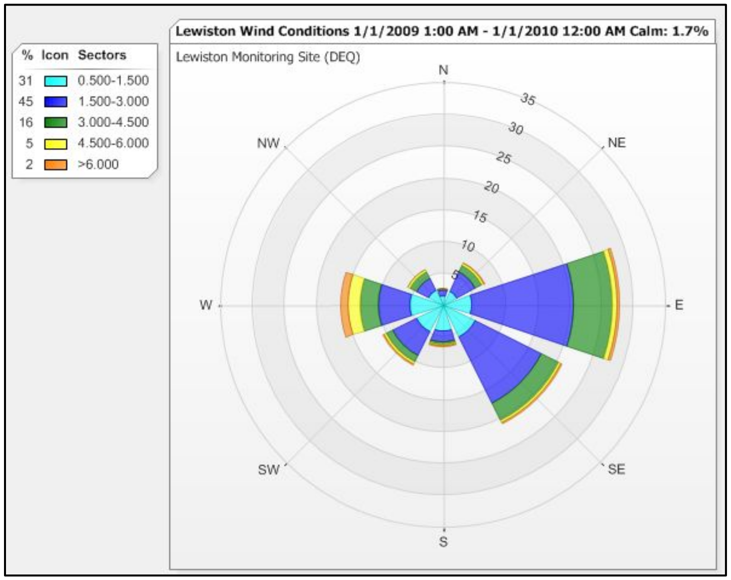
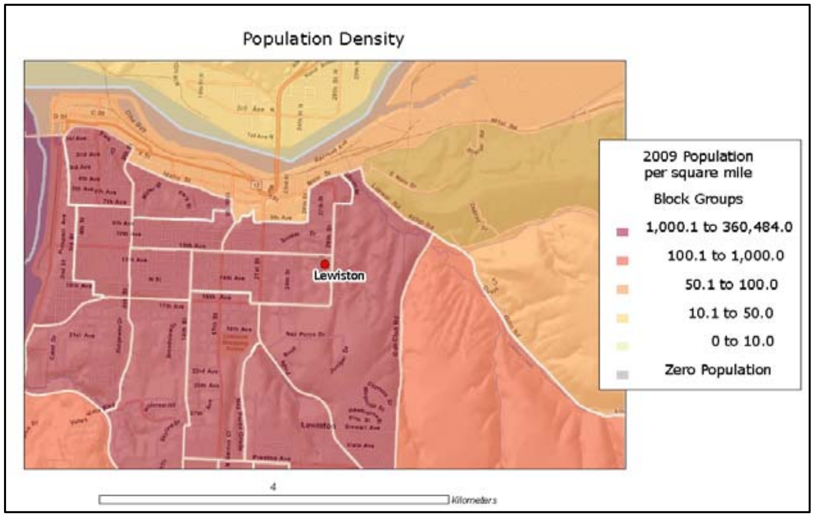


Figure D-20. Lewiston

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Lewiston, ID/WA MSA
Airshed	Lewiston
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	AQI, smoke management, modeling/met





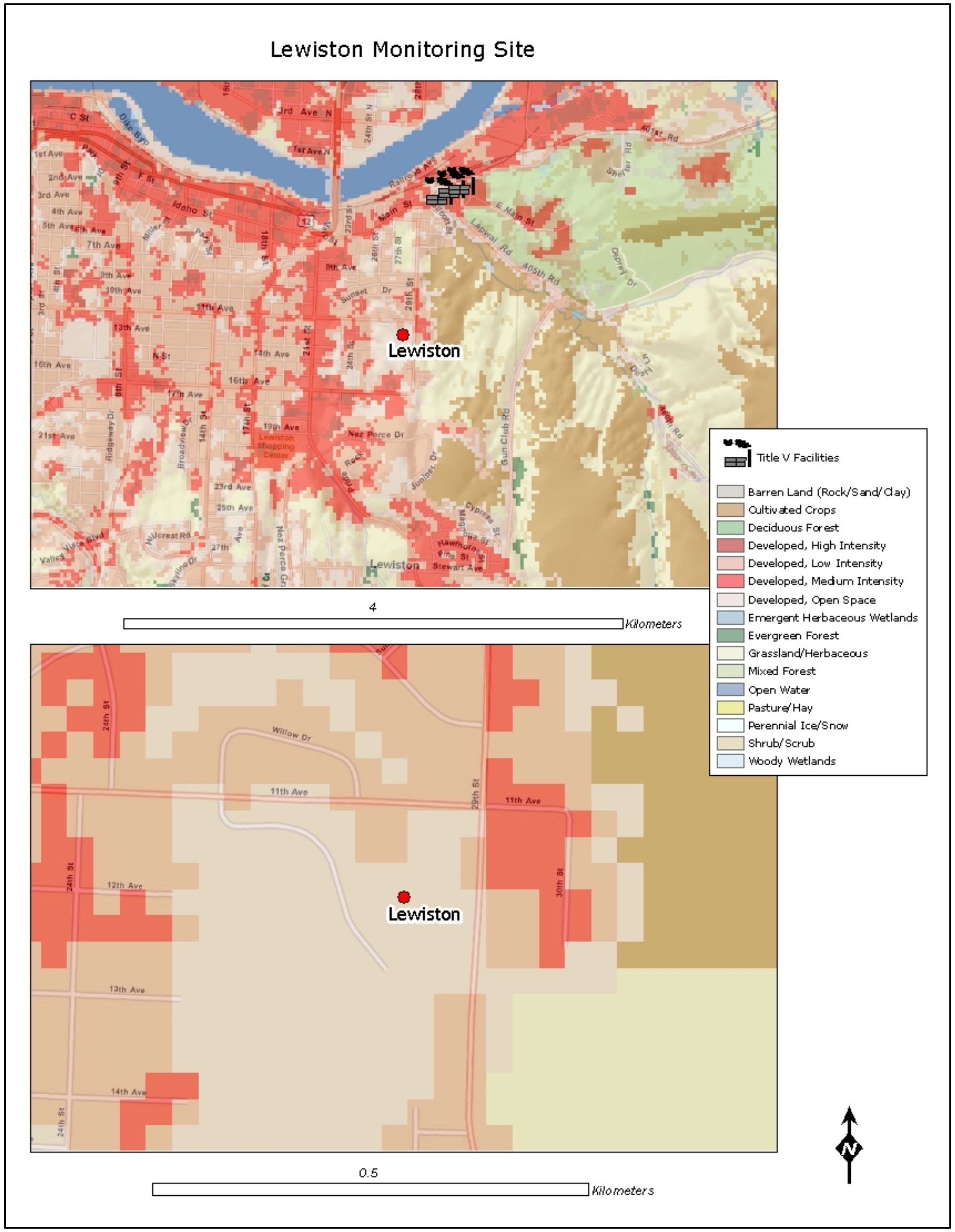


Figure D-21. Lewiston Airshed Wintertime Synoptic Winds

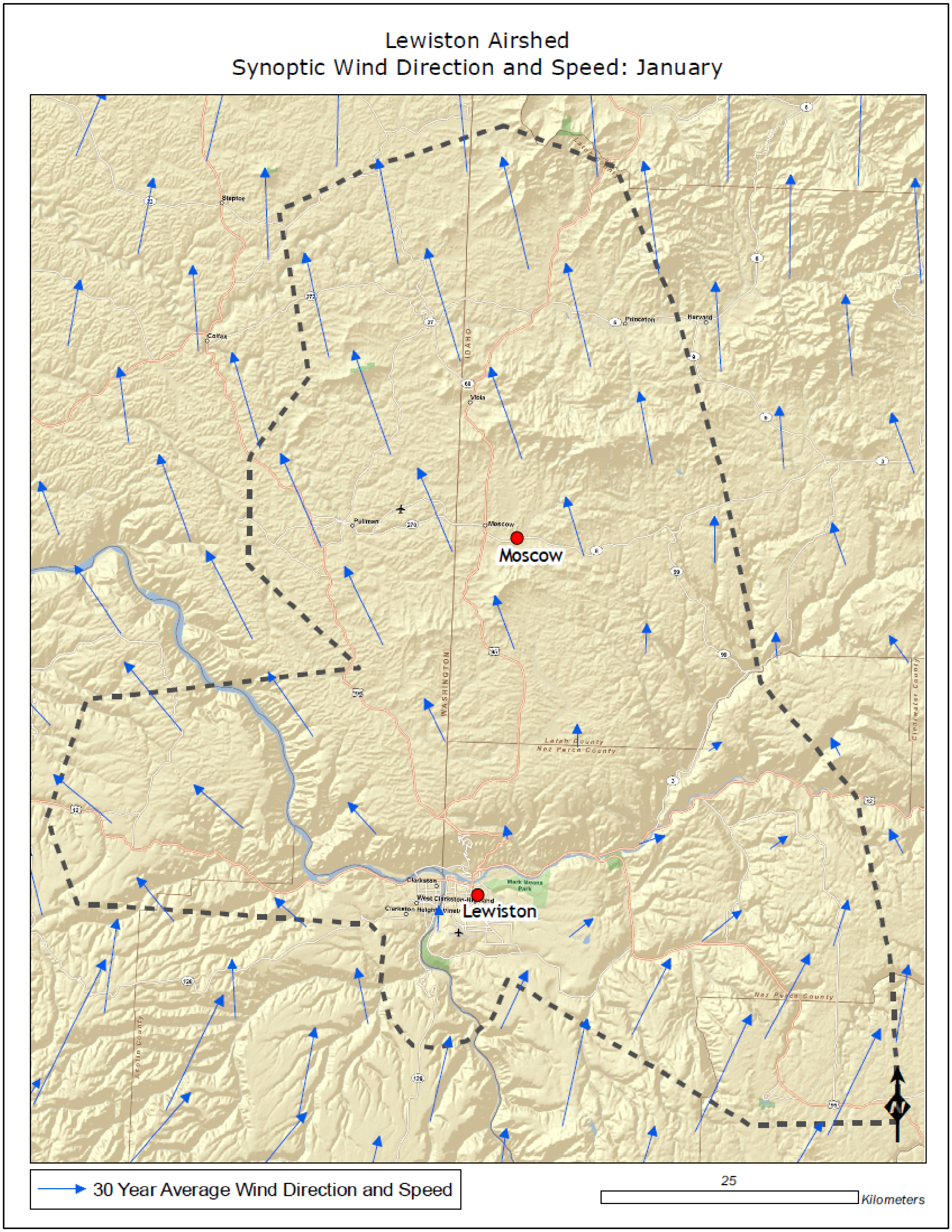


Figure D-22. Lewiston Airshed Summertime Synoptic Winds

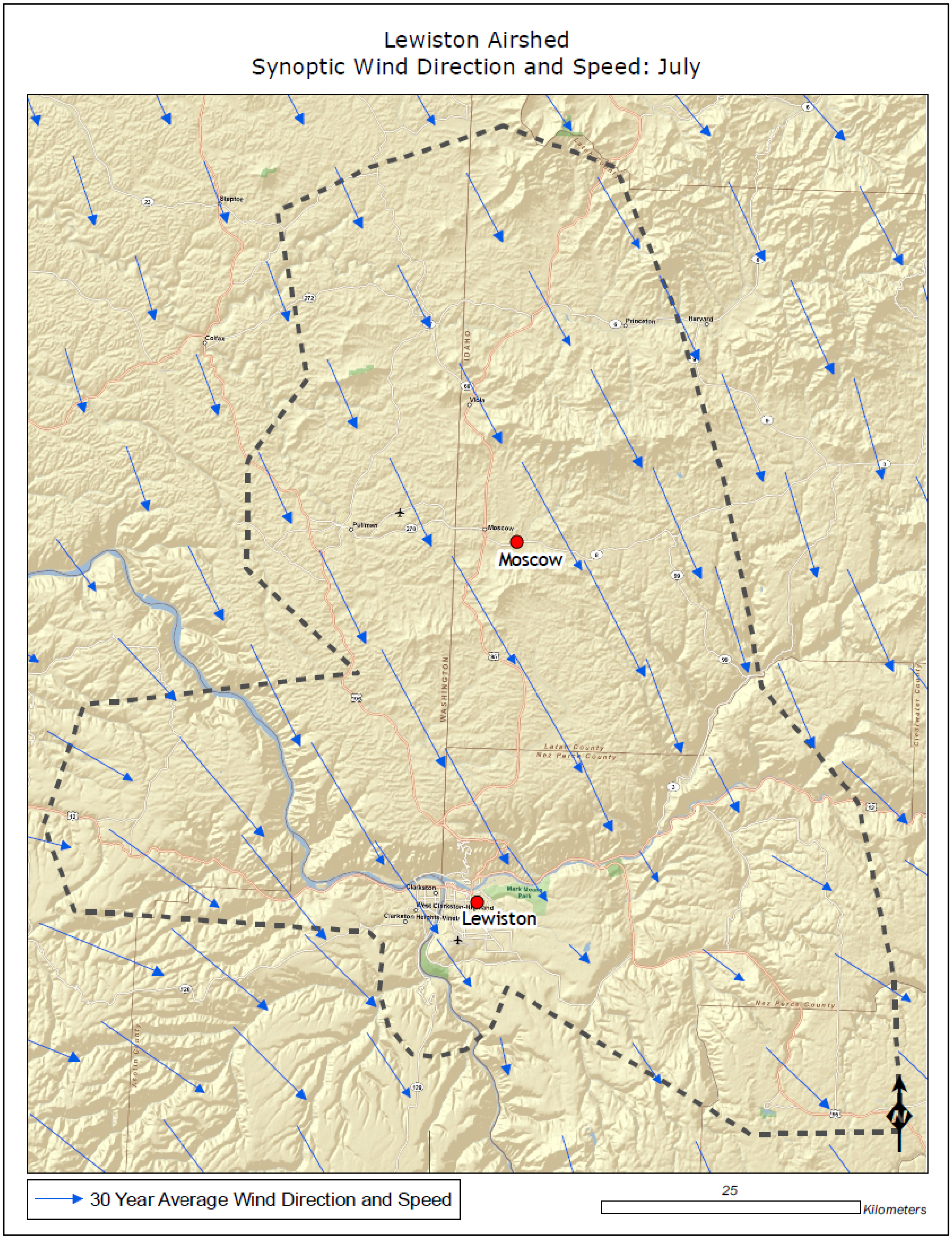
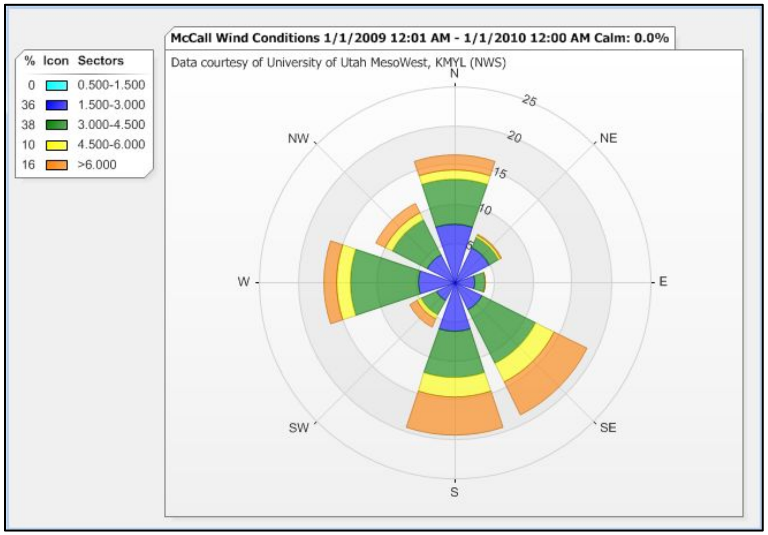
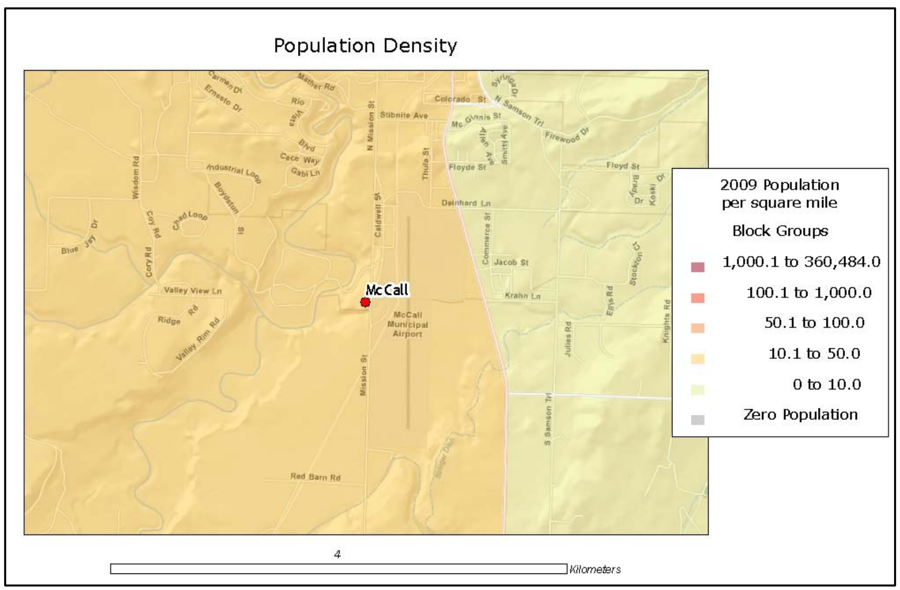


Figure D-23. McCall

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Valley County
Airshed	not defined
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management





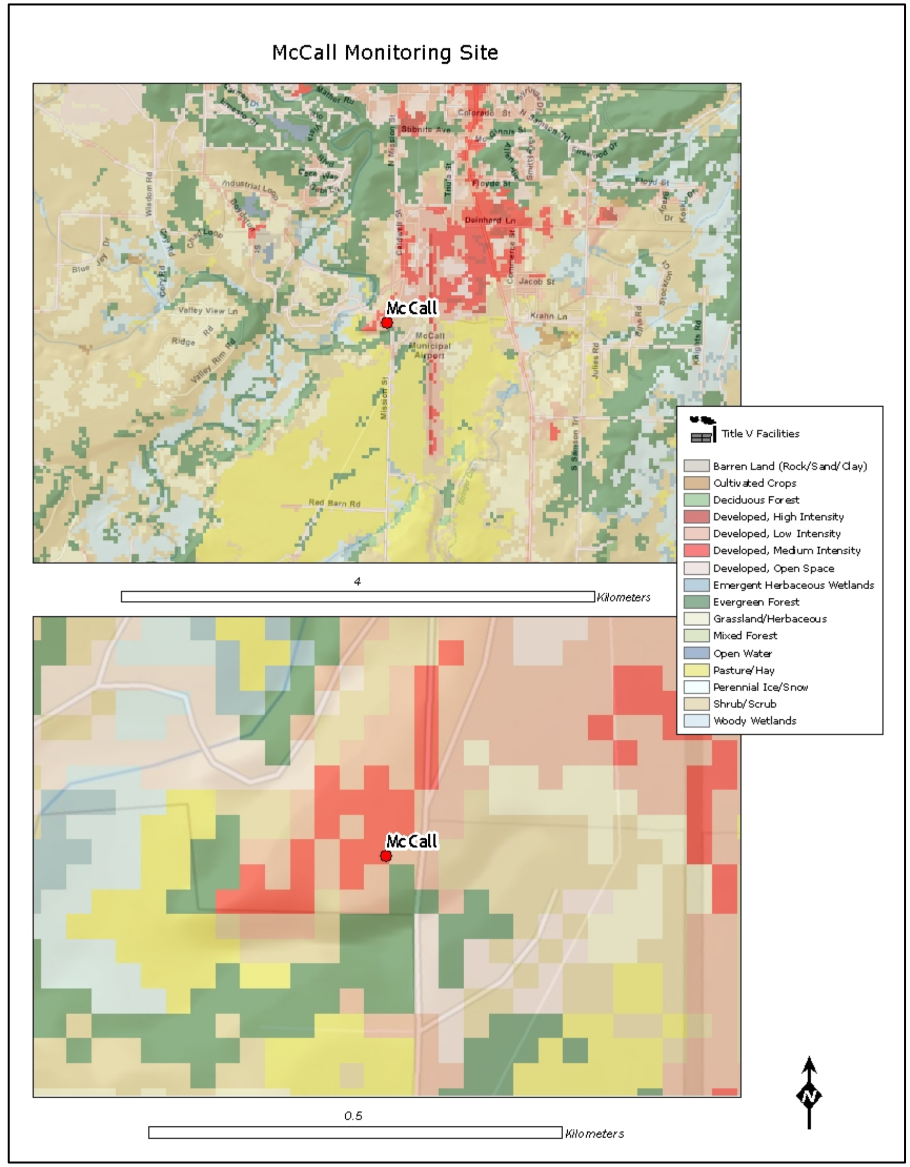
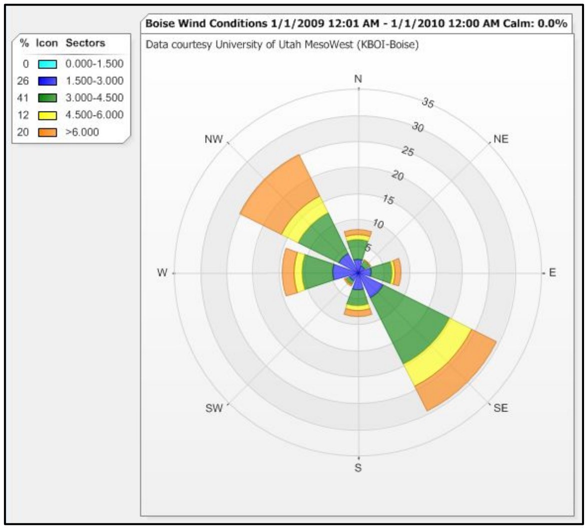
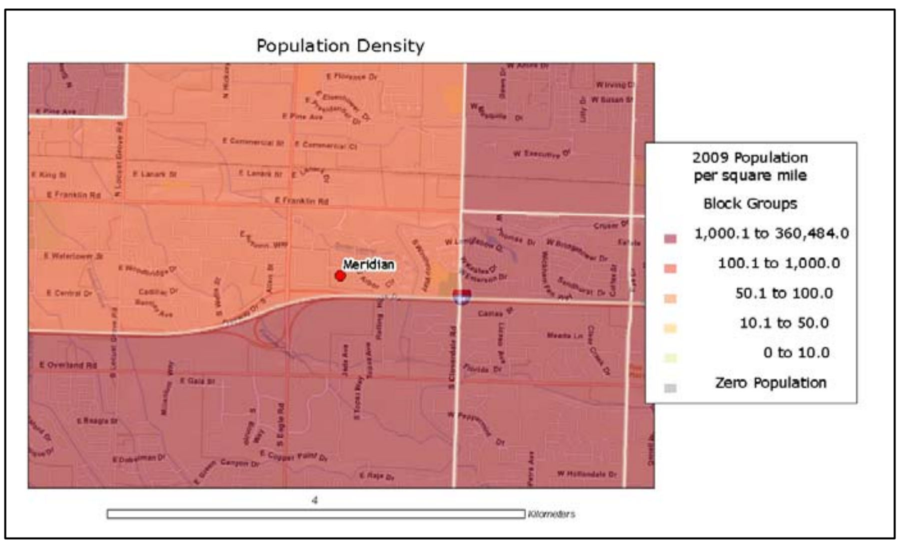


Figure D-24. Meridian – St. Luke's

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Boise City/Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	$PM_{2.5}$, O_3, NO_x/NO_y, met
Monitoring Objectives	NAAQS compliance, AQI, modeling/met, NCore-trace gas,chemical speciation





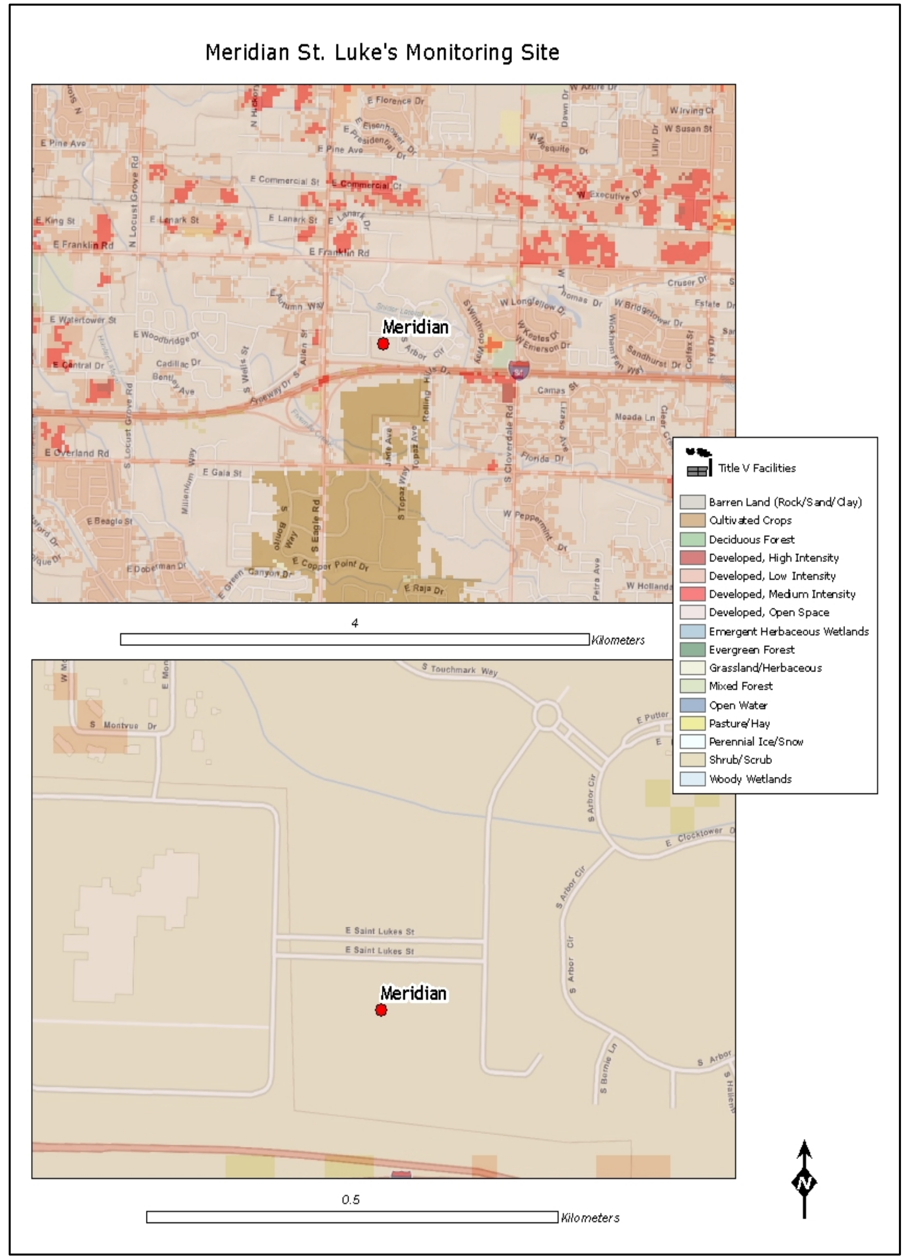
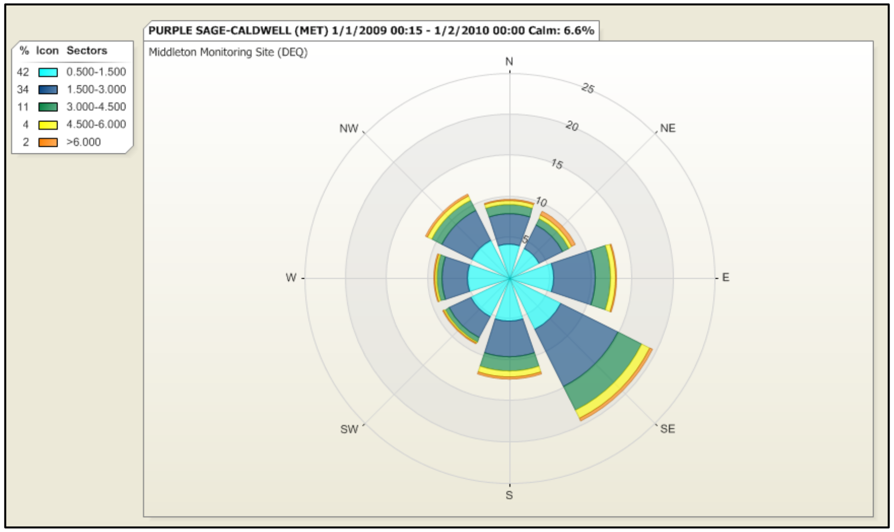
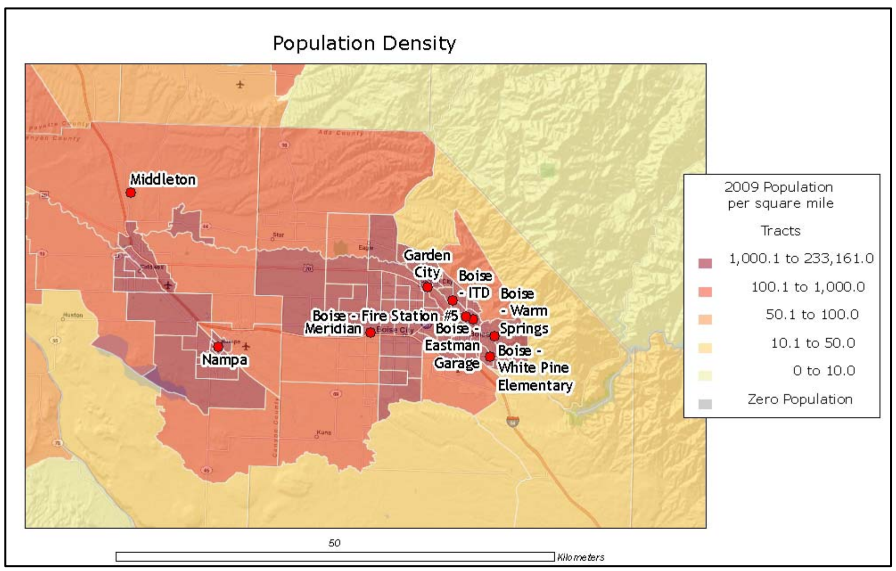


Figure D-25. Middleton – Purple Sage

Site Type	Population-oriented
Scale of Representation	Urban
Area Represented	Boise City/Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	AQI, smoke management, modeling/met





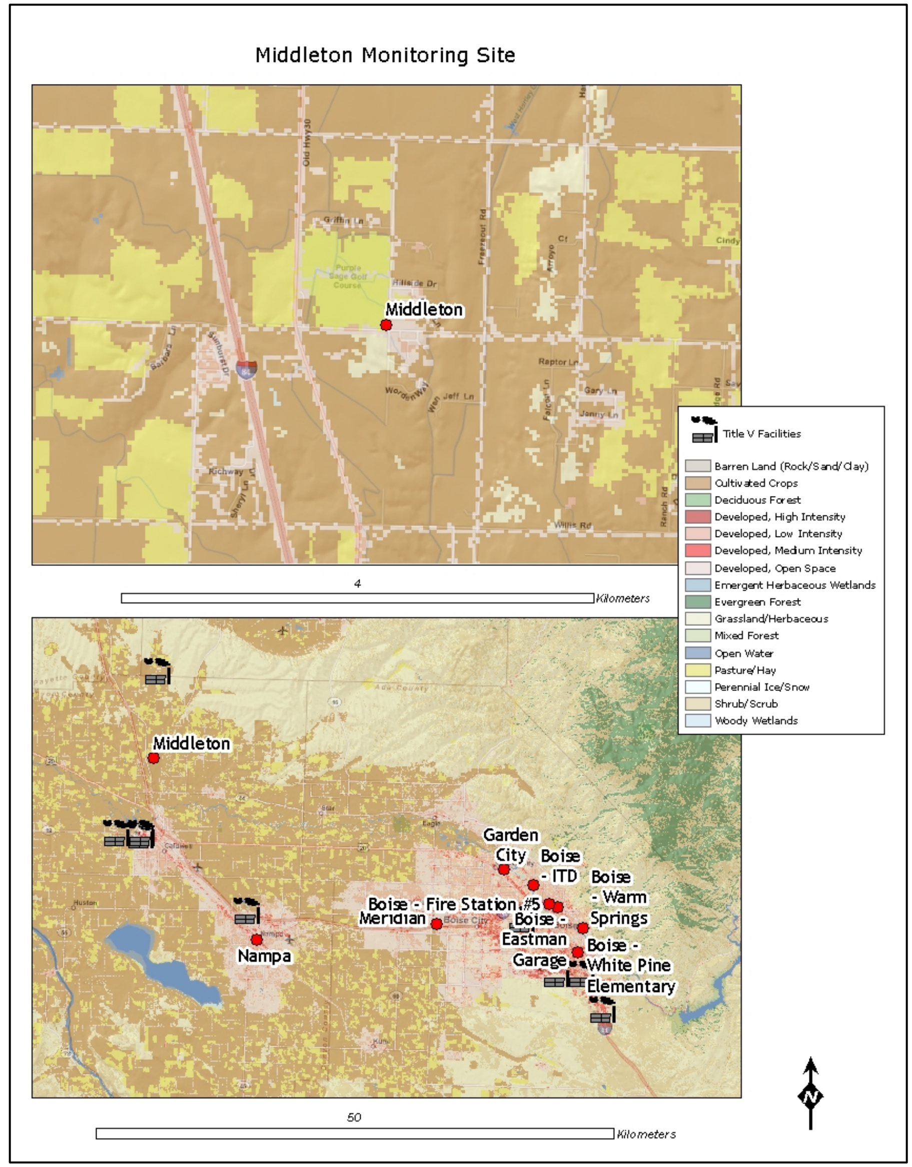


Figure D-26. Treasure Valley Airshed Wintertime Synoptic Winds

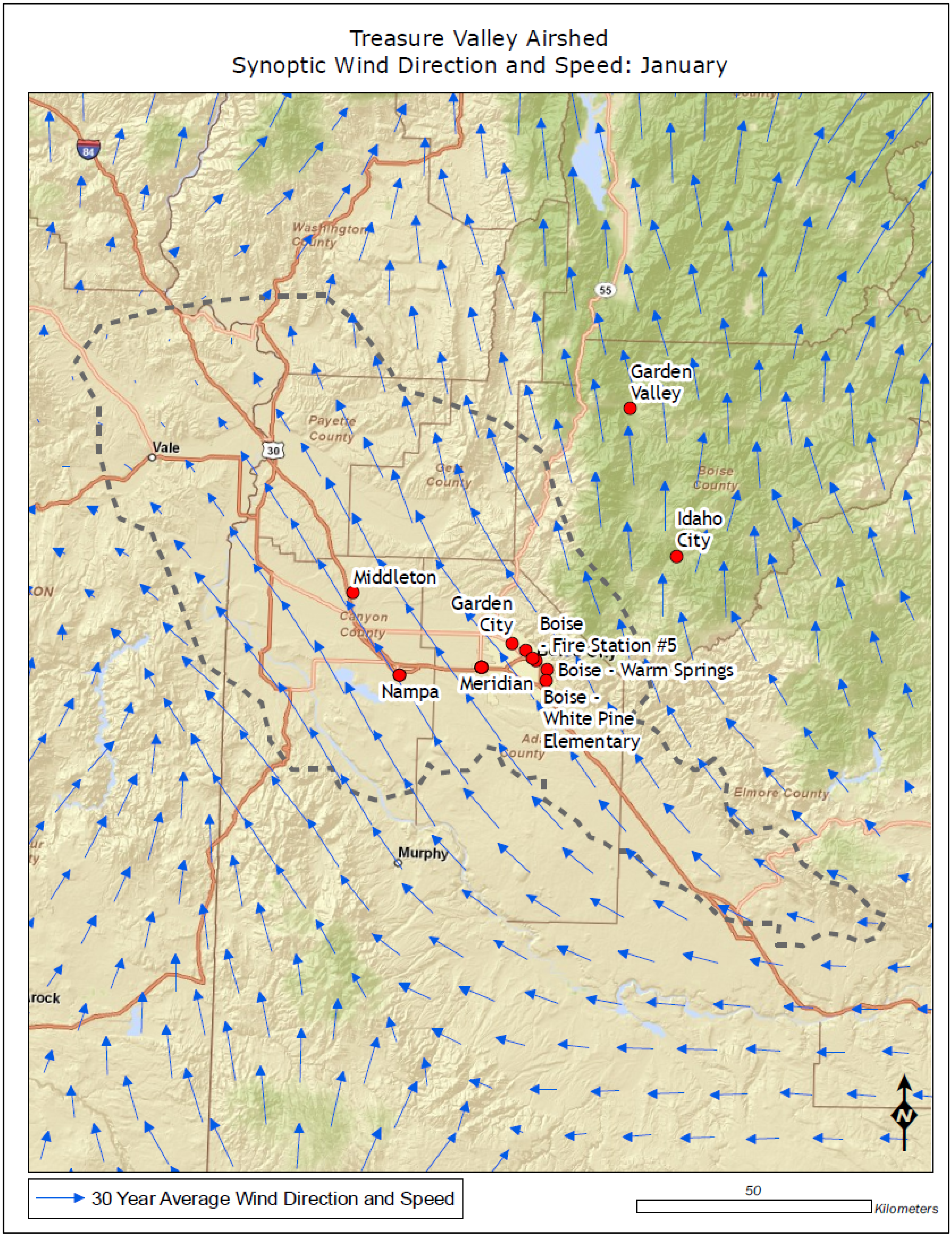


Figure D-27. Treasure Valley Summertime Synoptic Winds

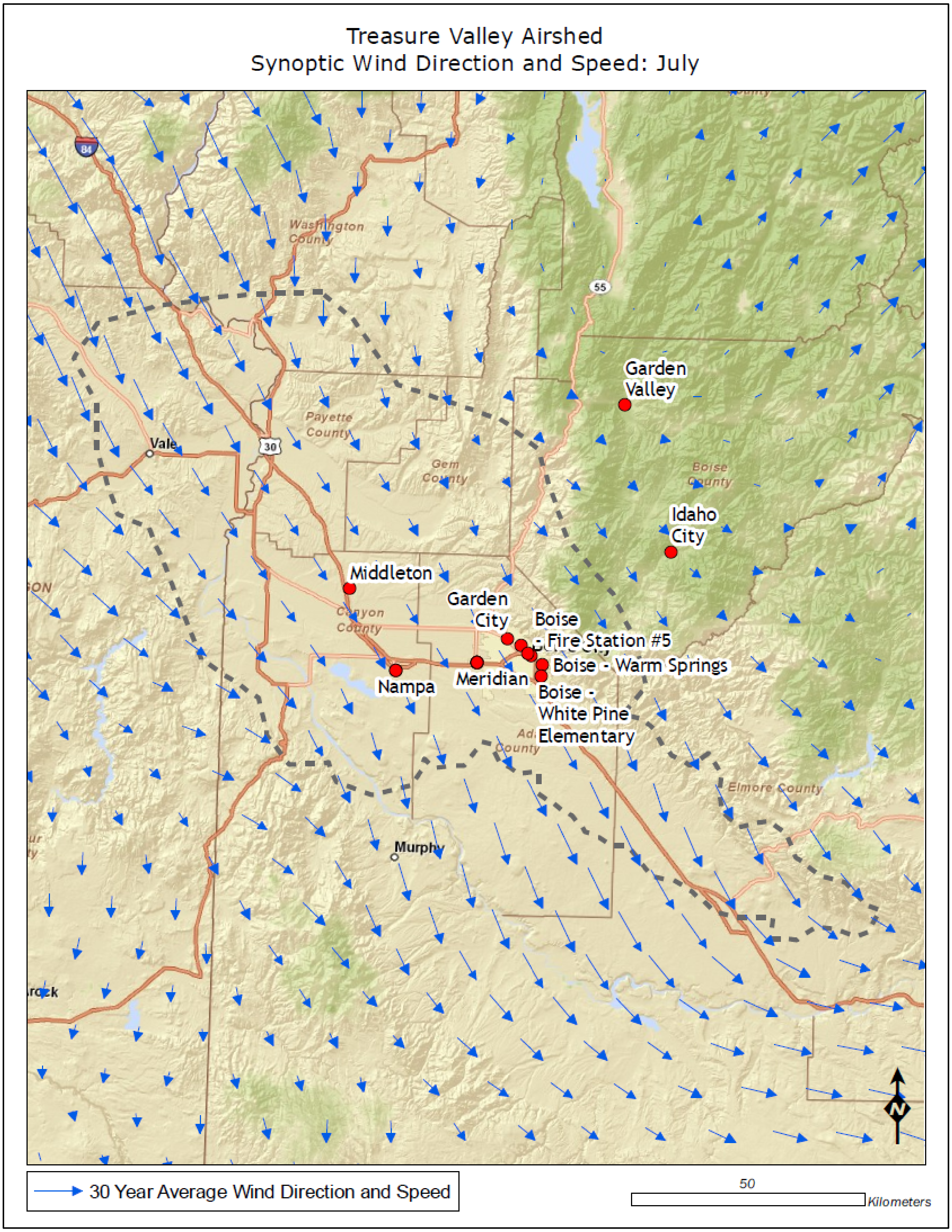
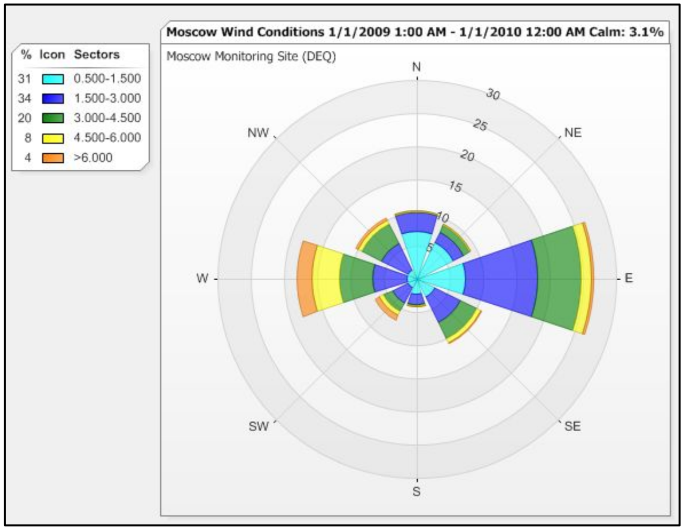
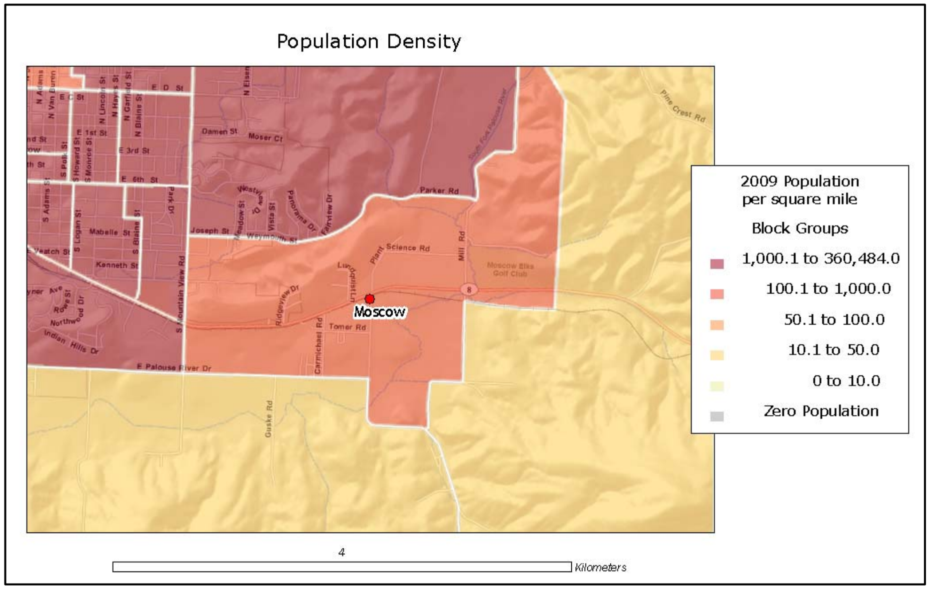


Figure D-28. Moscow

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Moscow, ID MSA
Airshed	Lewiston
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	AQI, smoke management, modeling/met





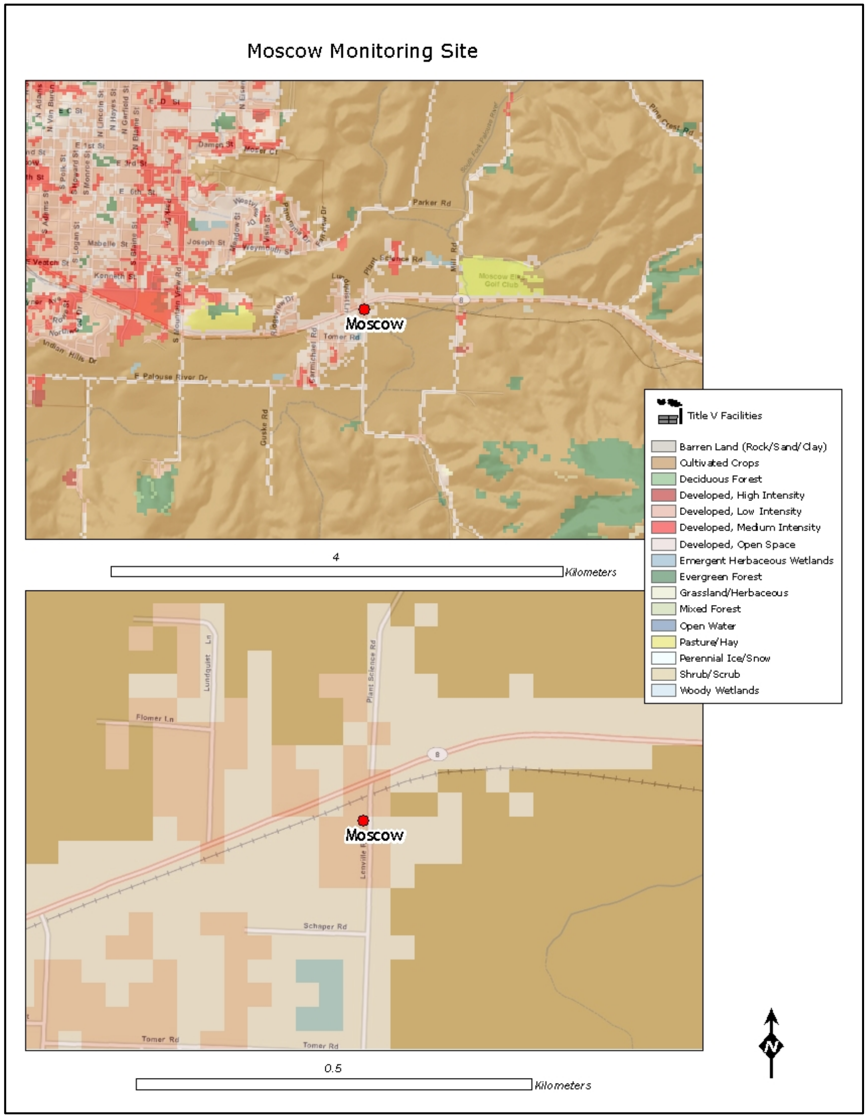
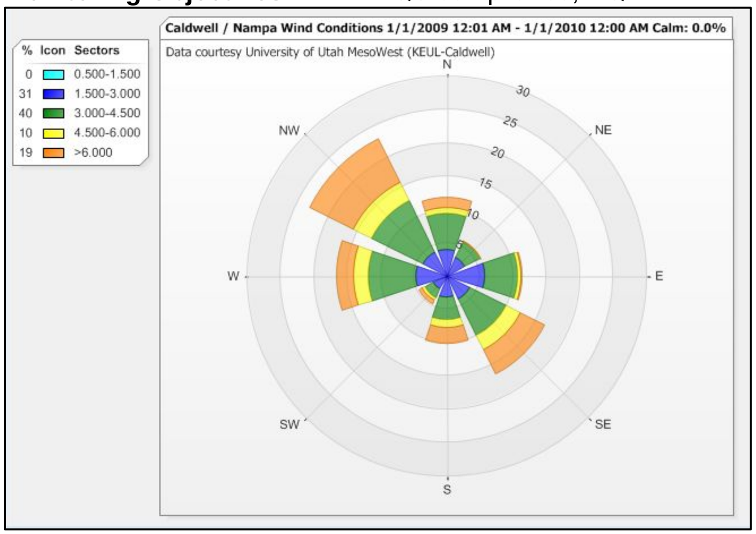
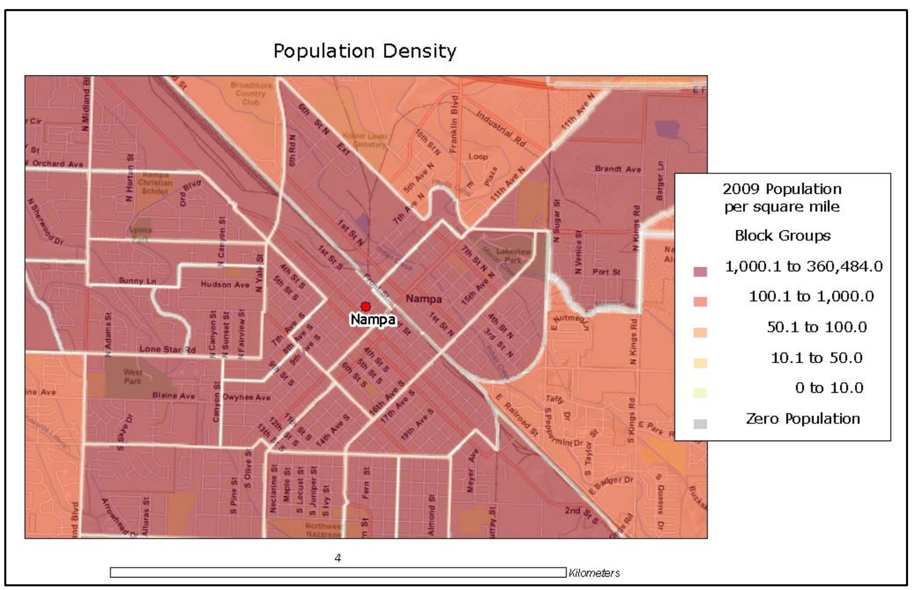


Figure D-29. Nampa

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Boise City/Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	$PM_{2.5}$, PM_{10}
Monitoring Objectives	NAAQS compliance, AQI





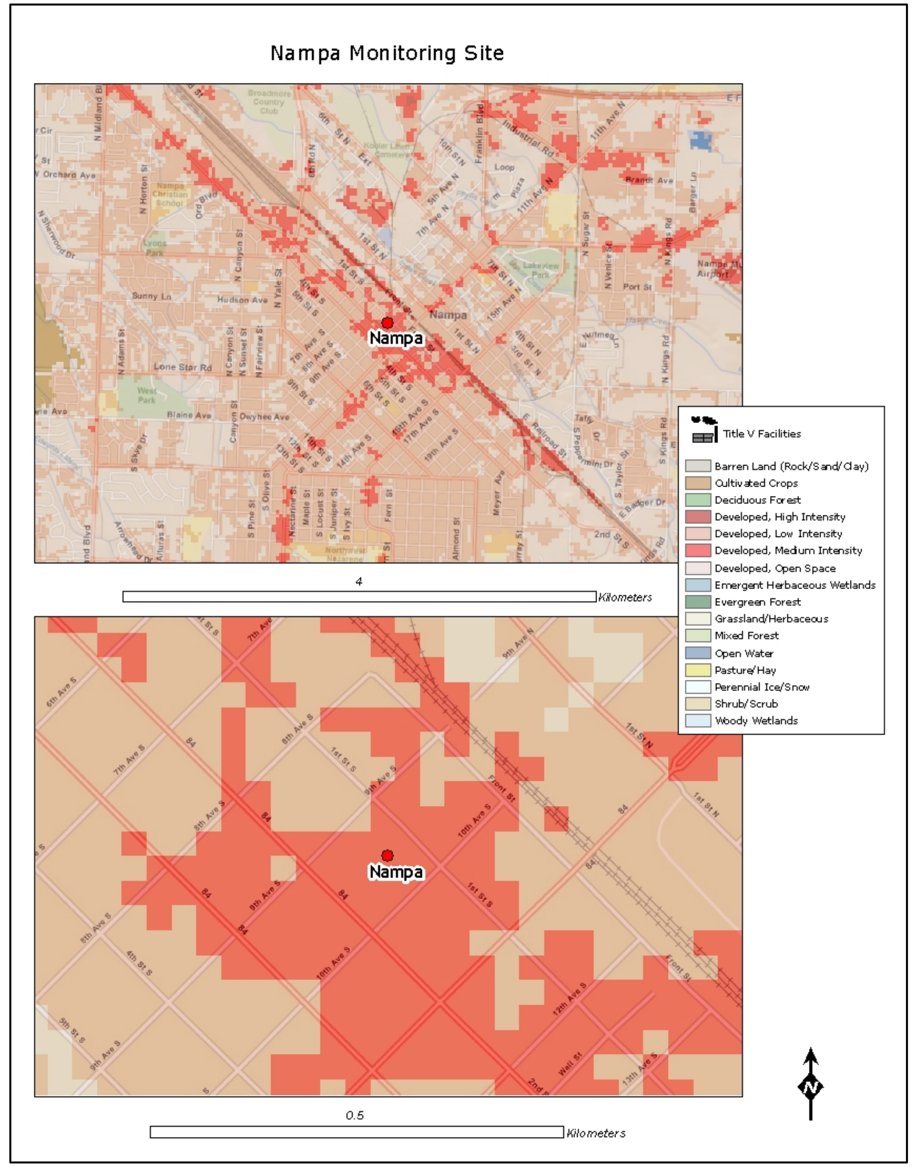
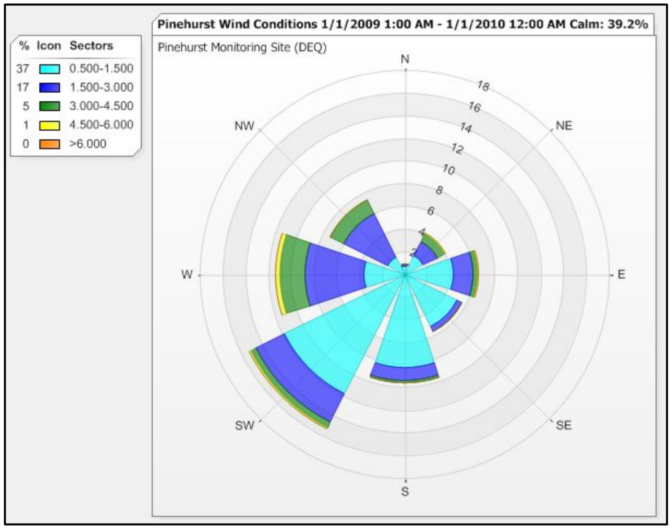
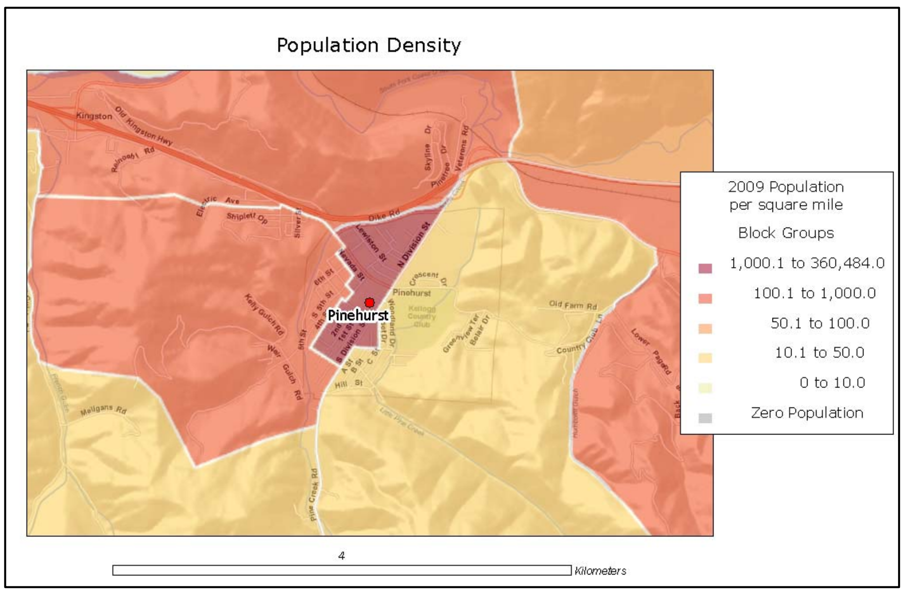


Figure D-30. Pinehurst

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Shoshone County
Airshed	not defined
Pollutant(s) Monitored	$PM_{2.5}$, PM_{10}, meteorology
Monitoring Objectives	NAAQS compliance, AQI, PM_{10} SIP, modeling/me





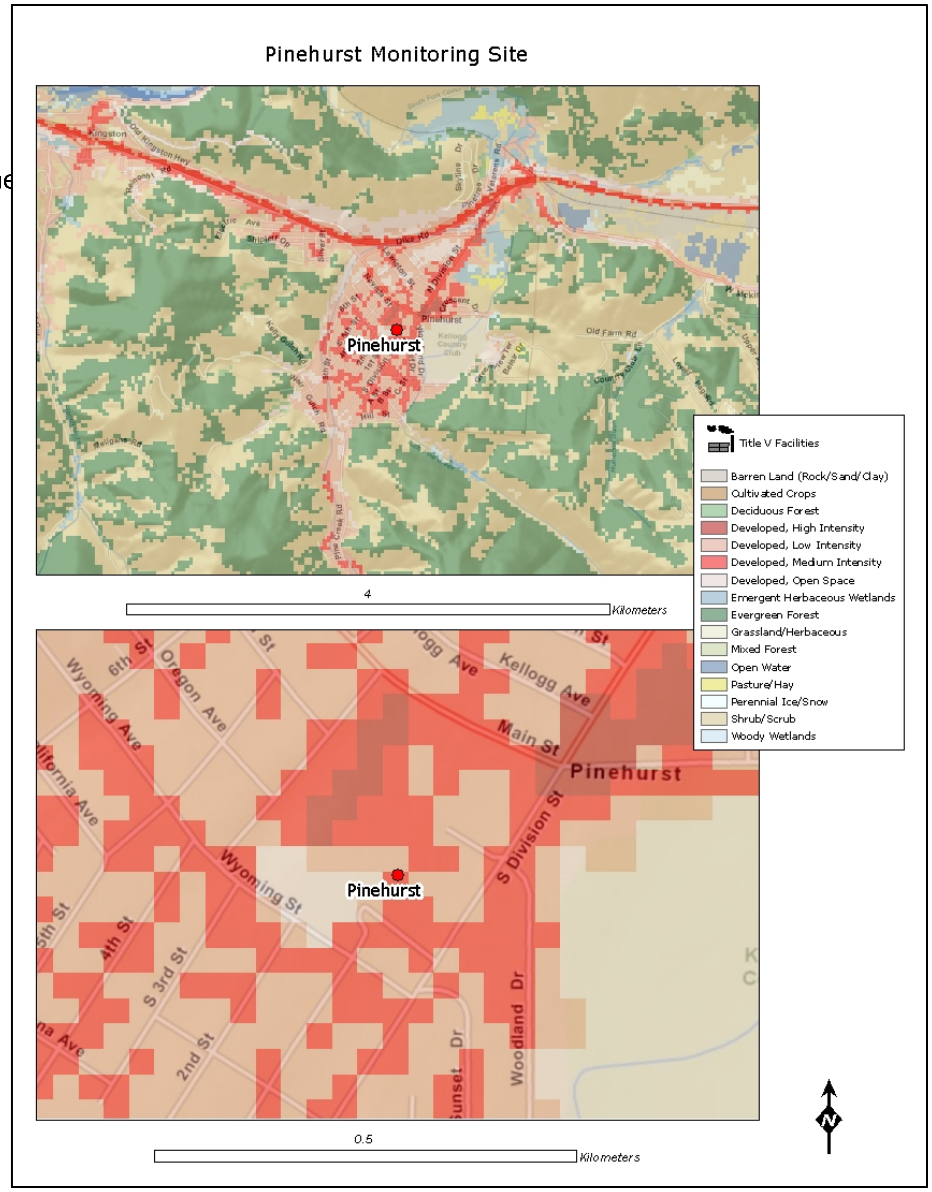
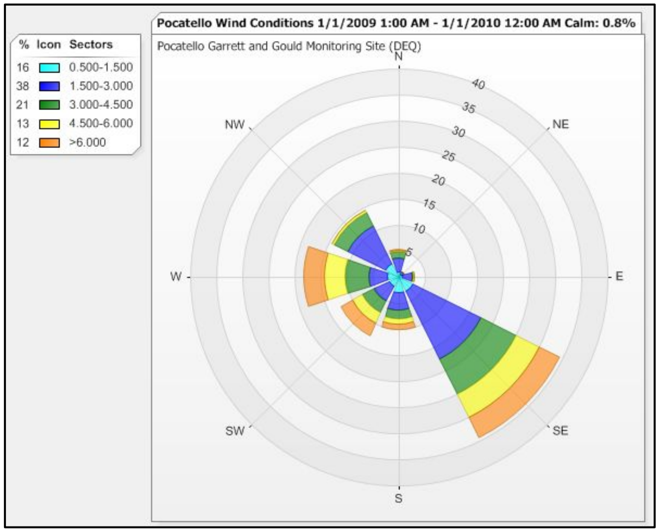
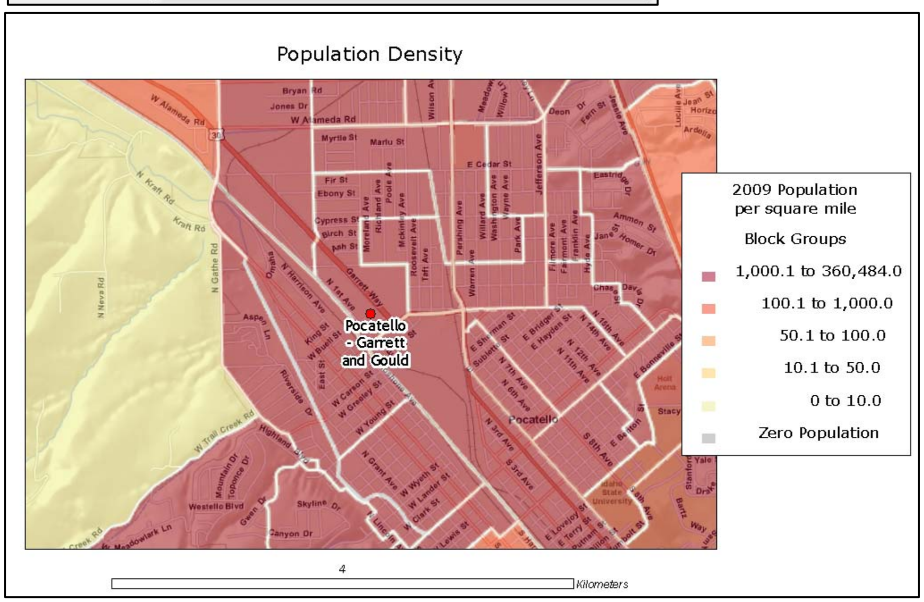


Figure D-31. Pocatello – Garrett & Gould

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Pocatello, ID MSA
Airshed	Pocatello
Pollutant(s) Monitored	$PM_{2.5}$, PM_{10}, meteorology
Monitoring Objectives	NAAQS compliance, AQI, PM_{10} SIP, modeling/met





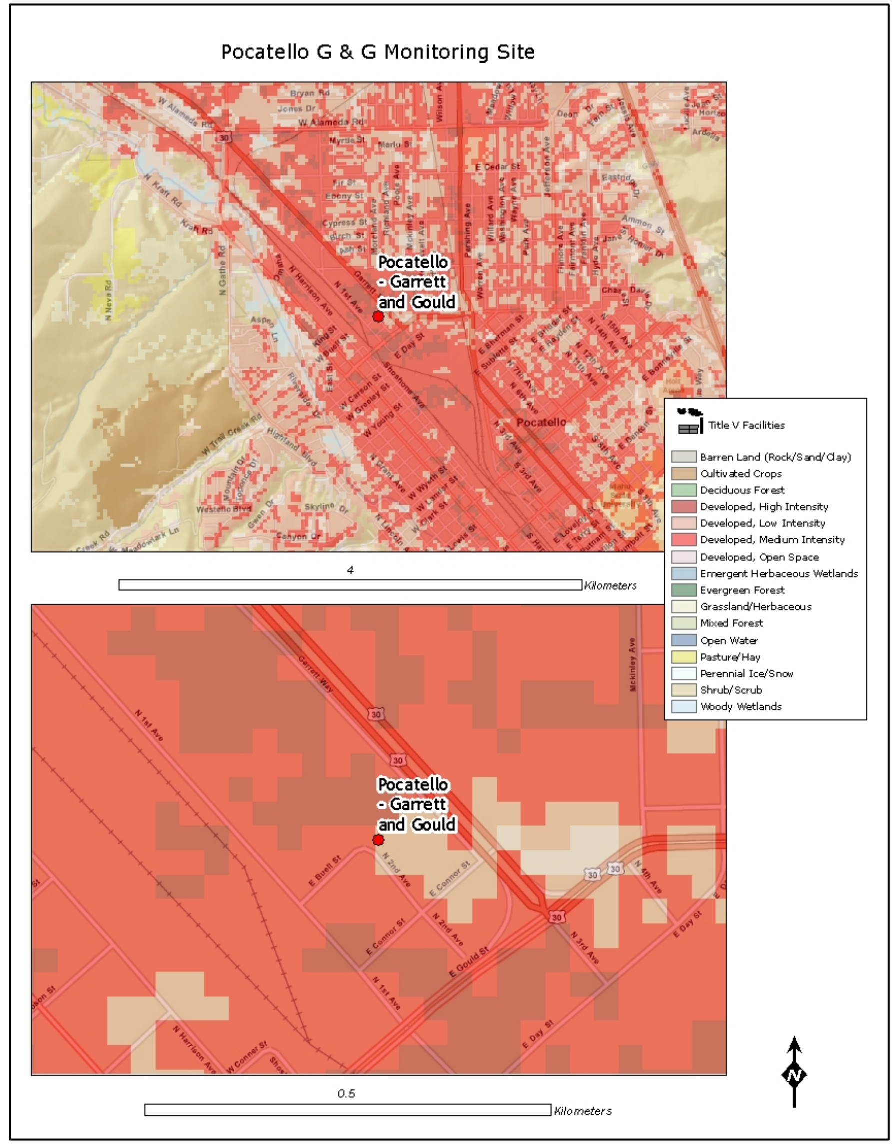
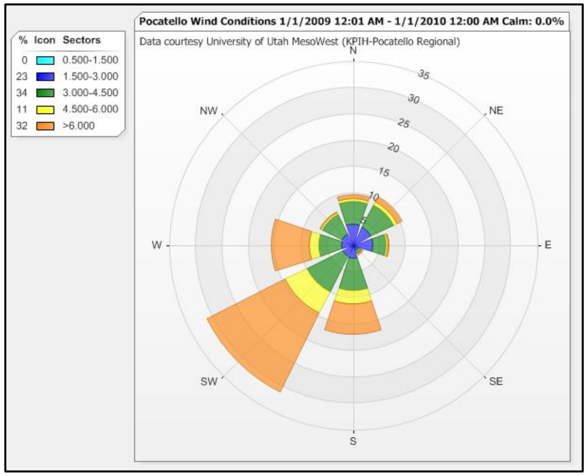
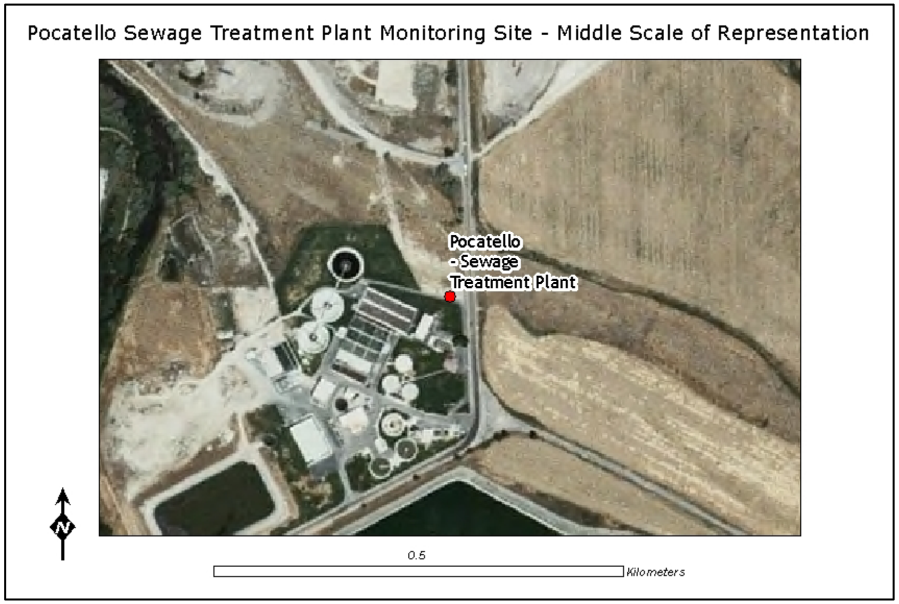
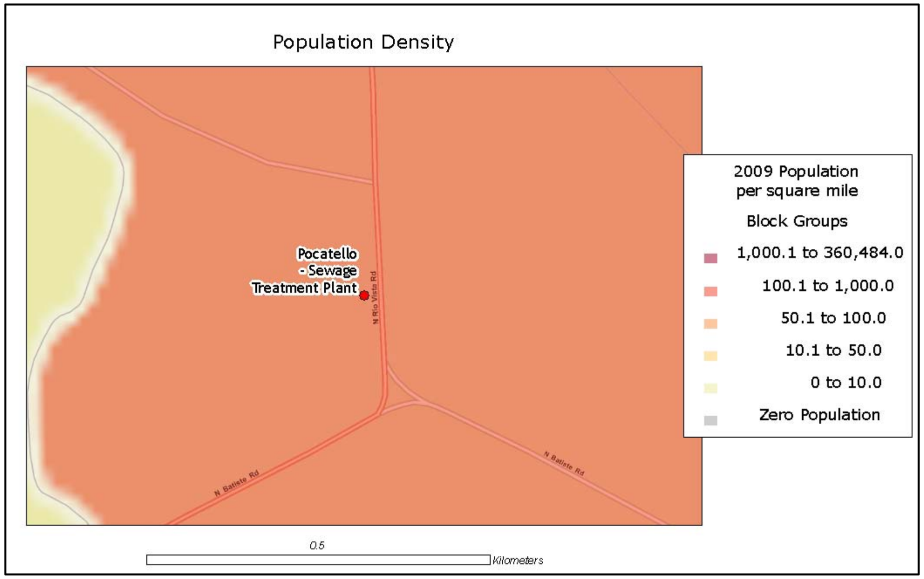


Figure D-32. Pocatello – Sewage Treatment Plant

Site Type	Source impact
Scale of Representation	Middle
Area Represented	Pocatello, ID MSA
Airshed	Pocatello
Pollutant(s) Monitored	SO_2
Monitoring Objectives	NAAQS compliance







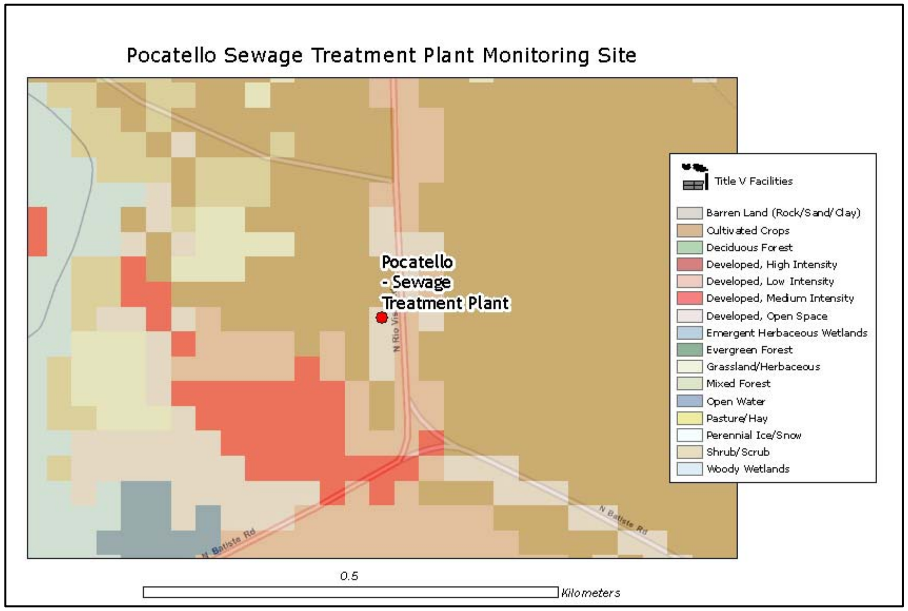
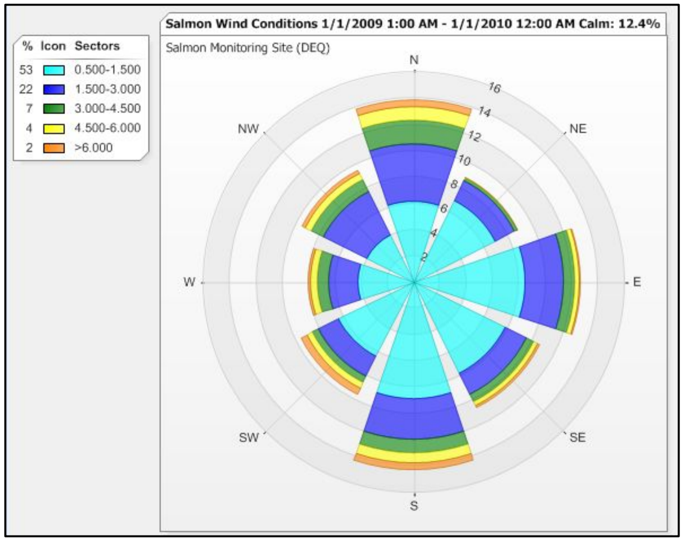
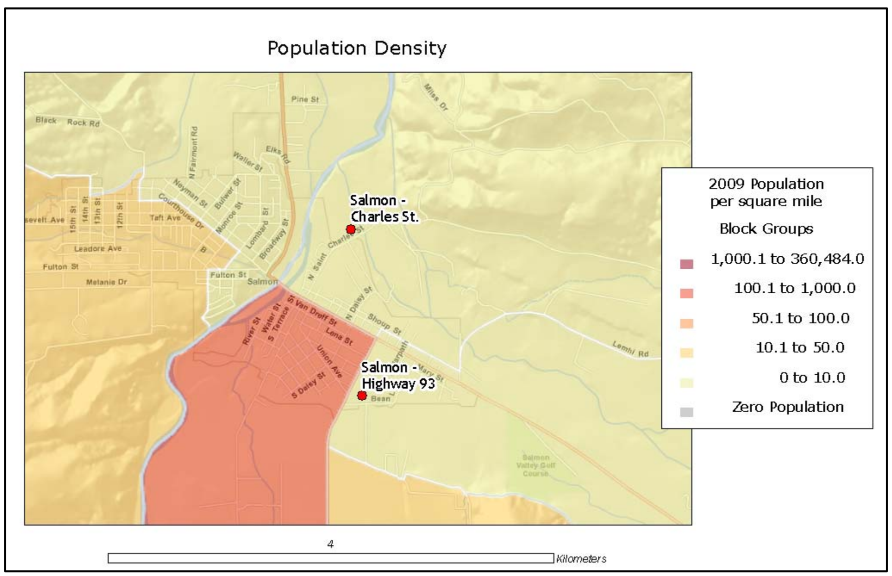


Figure D-33. Salmon – Charles St. and Highway 93

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Lemhi County
Airshed	not defined
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	NAAQS compliance, AQI, modeling/met





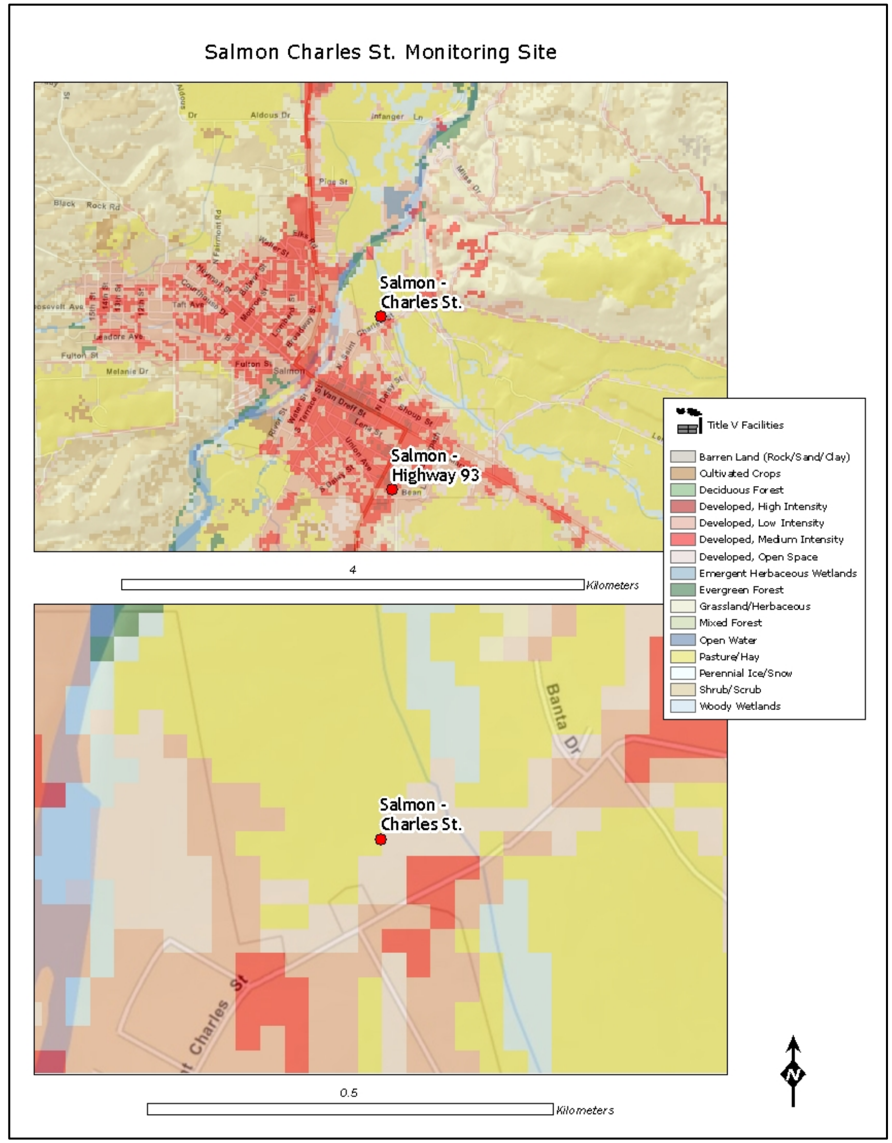
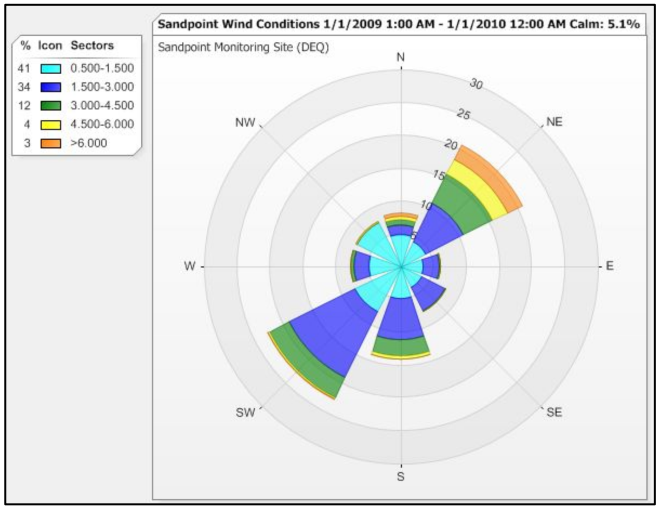
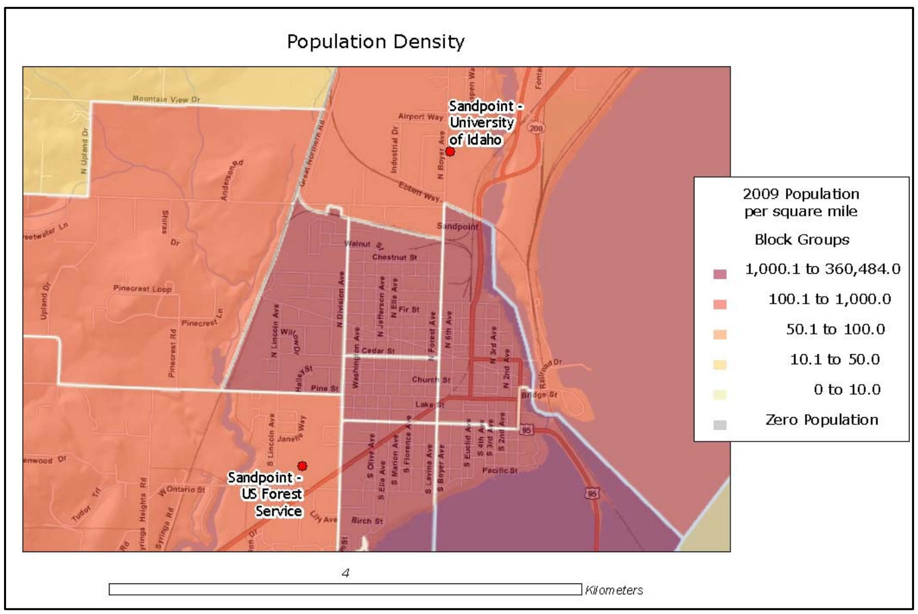


Figure D-34. Sandpoint

Site Type	Population-oriented
Scale of Representation	Urban
Area Represented	Bonner County
Airshed	not defined
Pollutant(s) Monitored	$PM_{2.5}$, PM_{10}, meteorology
Monitoring Objectives	NAAQS compliance, AQI, PM_{10} SIP, modeling/met





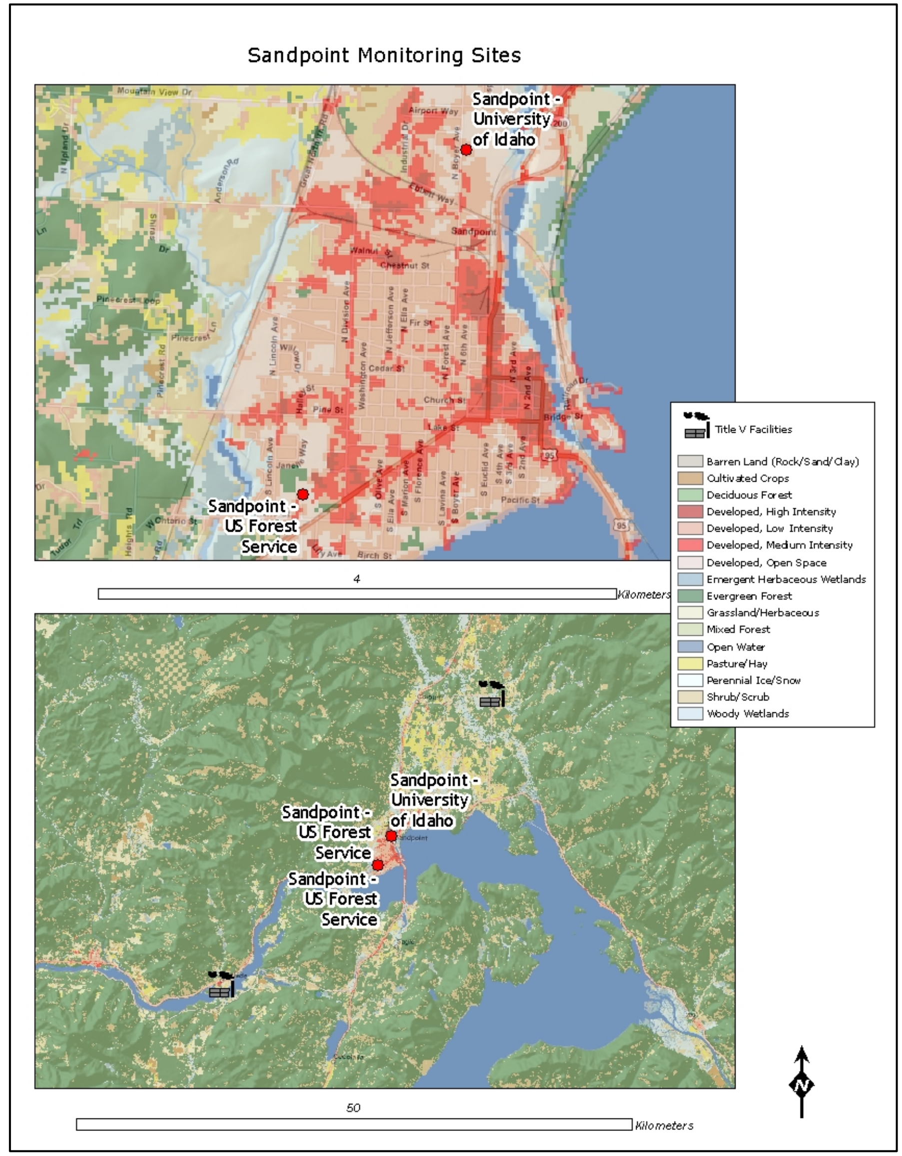
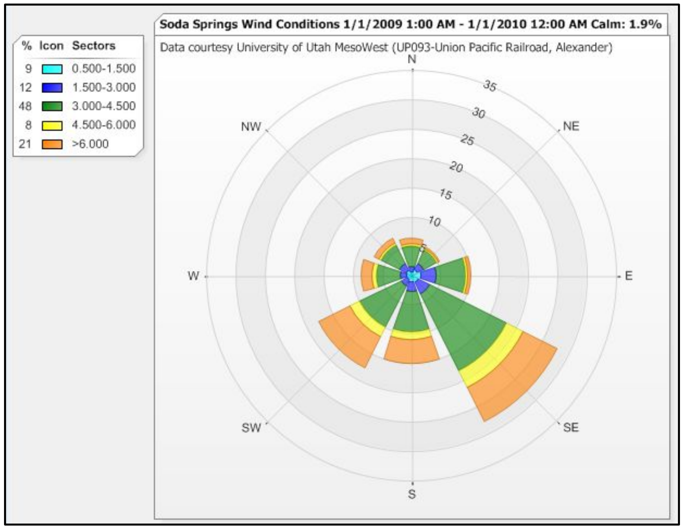
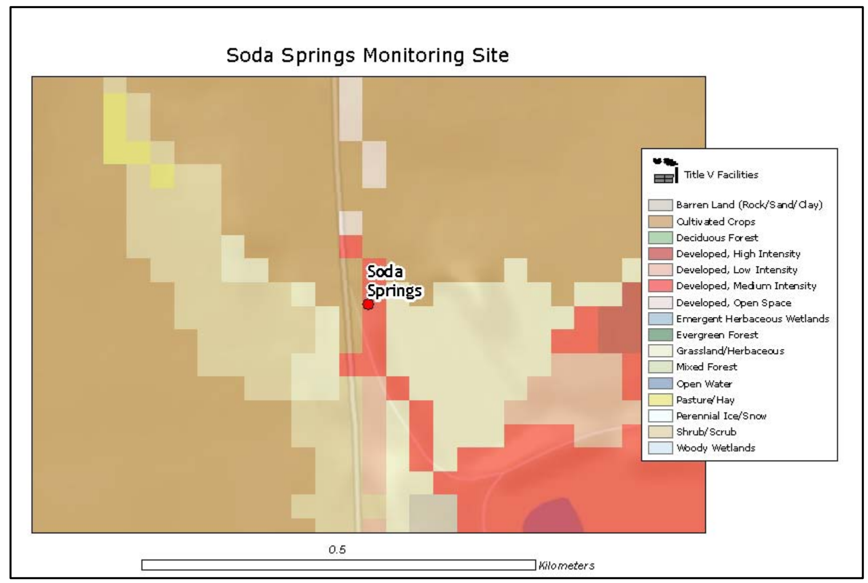


Figure D-35. Soda Springs

Site Type	Source impact
Scale of Representation	Micro
Area Represented	Caribou County
Airshed	not defined
Pollutant(s) Monitored	SO_2
Monitoring Objectives	NAAQS compliance





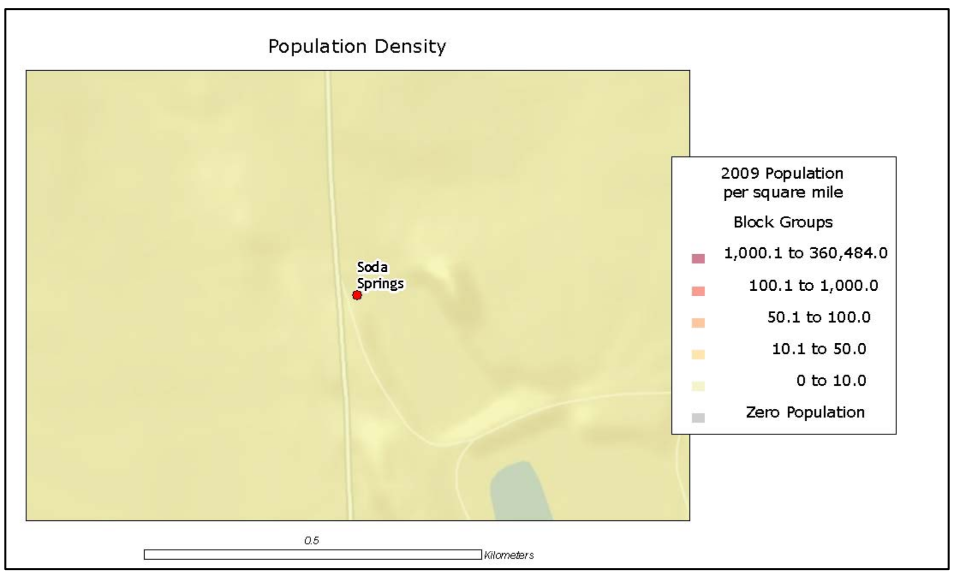
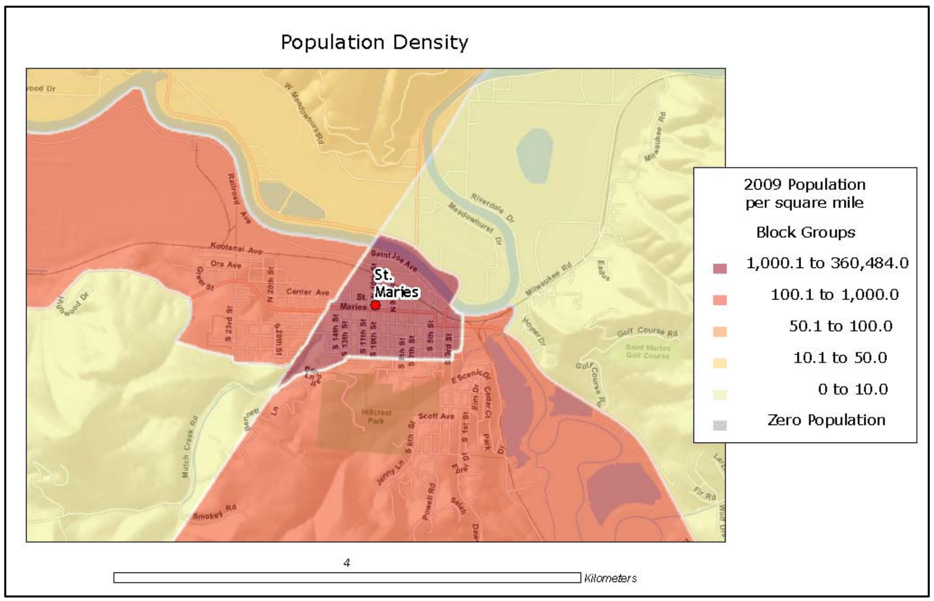


Figure D-36. St. Maries

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Benewah County
Airshed	Coeur d'Alene
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	NAAQS compliance, AQI

No wind rose is available for this location.



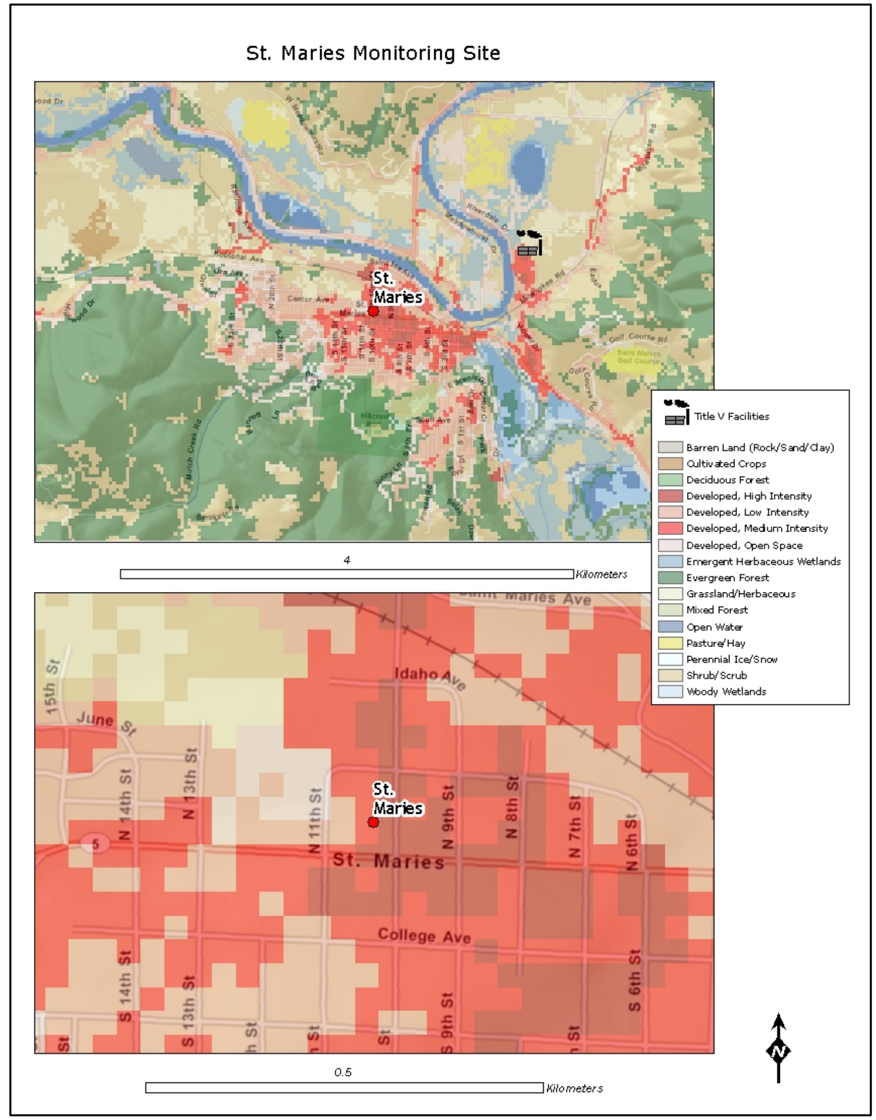
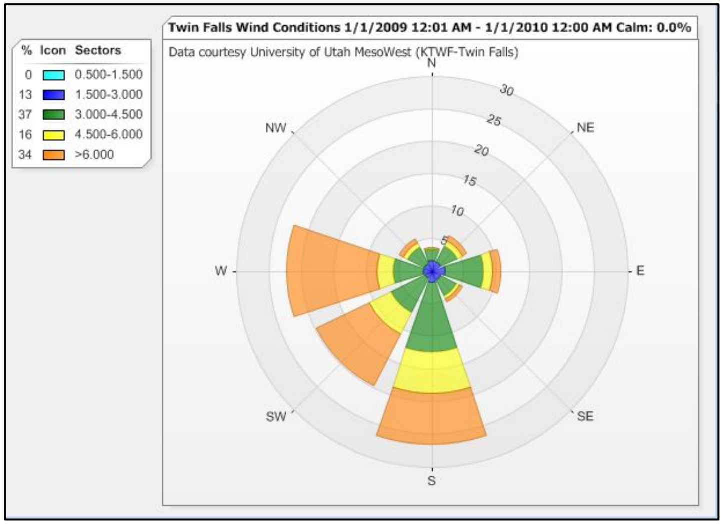
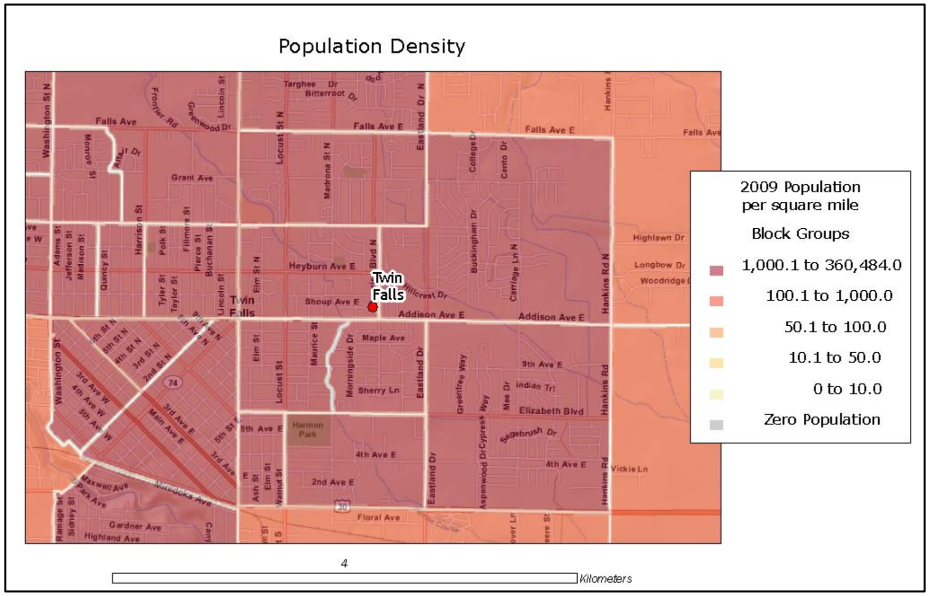
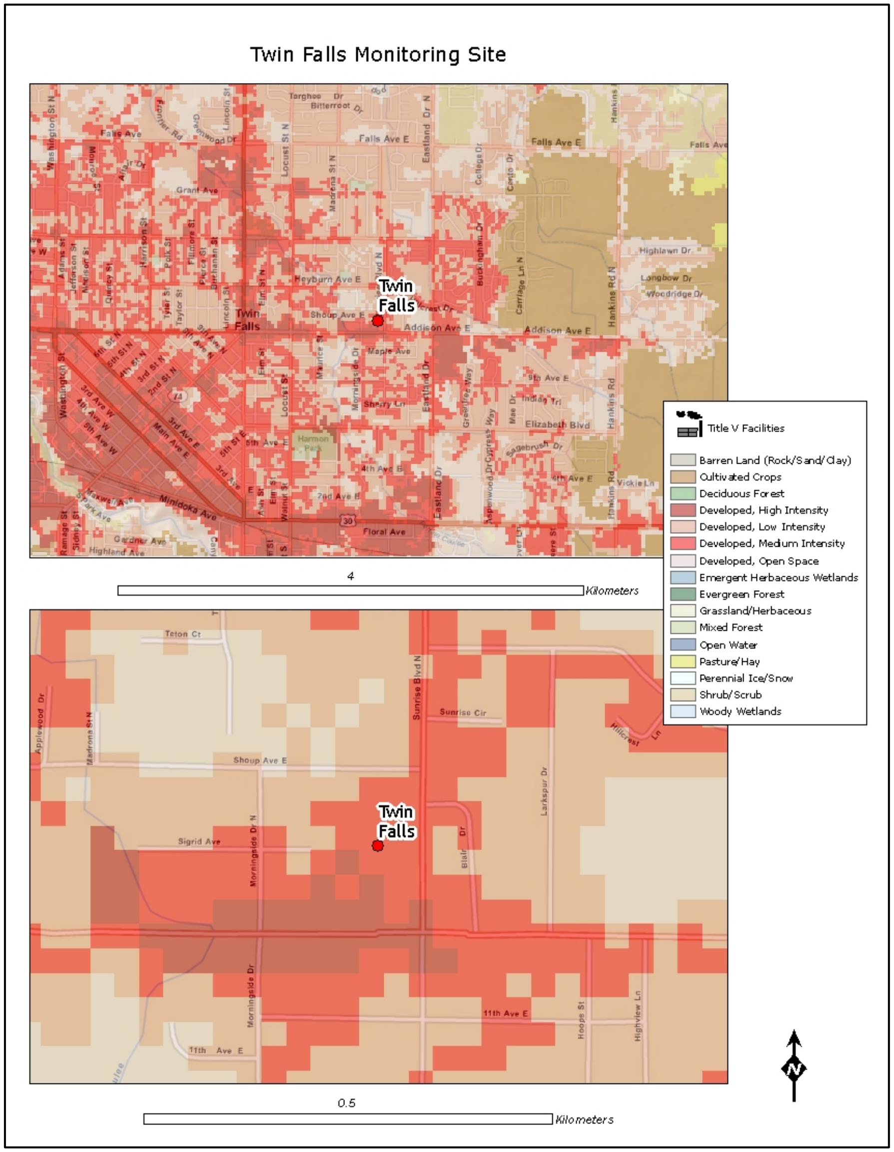


Figure D-37. Twin Falls

Site Type	Population-oriented
Scale of Representation	Neighborhood
Area Represented	Twin Falls, ID MSA
Airshed	Twin Falls
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management







D.2 Network Assessment: Airshed Scale

The Treasure Valley is the only airshed in Idaho containing multiple monitors measuring the same pollutant. This airshed is therefore discussed separately, at the airshed scale, in terms of recent and projected demographic shifts. This discussion is not applicable to other monitoring areas in Idaho because most other monitors are at stand-alone (single-pollutant) sites or, if not, are adjacent to monitors measuring different pollutants with dissimilar objectives.

The Treasure Valley airshed is the most populous place in Idaho. It contains two cities with the highest rates of growth in the network. Nampa averaged a growth rate of 5% from 2000 to 2008 and Meridian had an average growth rate of 8% during the same period. The Boise City-Nampa MSA, which contains all the cities in the Treasure Valley (Boise, Meridian, Nampa, Caldwell, Kuna, Emmett, and others), had a mean growth rate of 3.13% from 2000 to 2008, again the highest in the network. Cities within the airshed illustrate an interesting spatial story: population growth is rising fastest in the central and western regions of the valley. Boise's growth rate rose from a low of -0.25% in 2003-2004 to a high of 1.38% in 2006-2007 (*Figure D-38*). Meridian has had high growth rates overall (the highest in the state network), peaking at 14.64% in 2004-2005 and with a low of 4% in 2007-2008. Nampa also has had high rates of growth, with the highest in 2000-2001 at 6.42% and the lowest in 2007-2008 at 1.85% (US Census, 2010).

The spatial shift of the population within the airshed is relevant to the network assessment. The following discussion will focus on the central core of the airshed which contains the greatest part of the population, namely Canyon County and northern Ada County. *Figure D-39* shows the 2009 population distribution in the airshed. Recent population growth rates notwithstanding, density remains highest in Boise. Daytime to nighttime population ratios for 2009 show movement towards the city centers of Caldwell, Nampa, the commercial corridors along the freeway, Franklin Rd., and Eagle Rd. in Meridian, and towards downtown Boise and Garden City (*Figure D-40*). However, recent growth has been greater to the west, southwest, and northwest of Boise, concentrated in the suburban areas around Meridian, Eagle, Nampa, and Caldwell (*Figure D-41*). Projected growth to 2014 is expected to follow a similar pattern (*Figure D-42*), with the highest growth rates in the suburban areas surrounding Nampa and Caldwell, in Meridian and Eagle and the Boise Foothills. The only two monitors currently within these projected high growth areas are Meridian and Middleton. The Nampa monitor is surrounded by high growth areas, but is not in one itself.

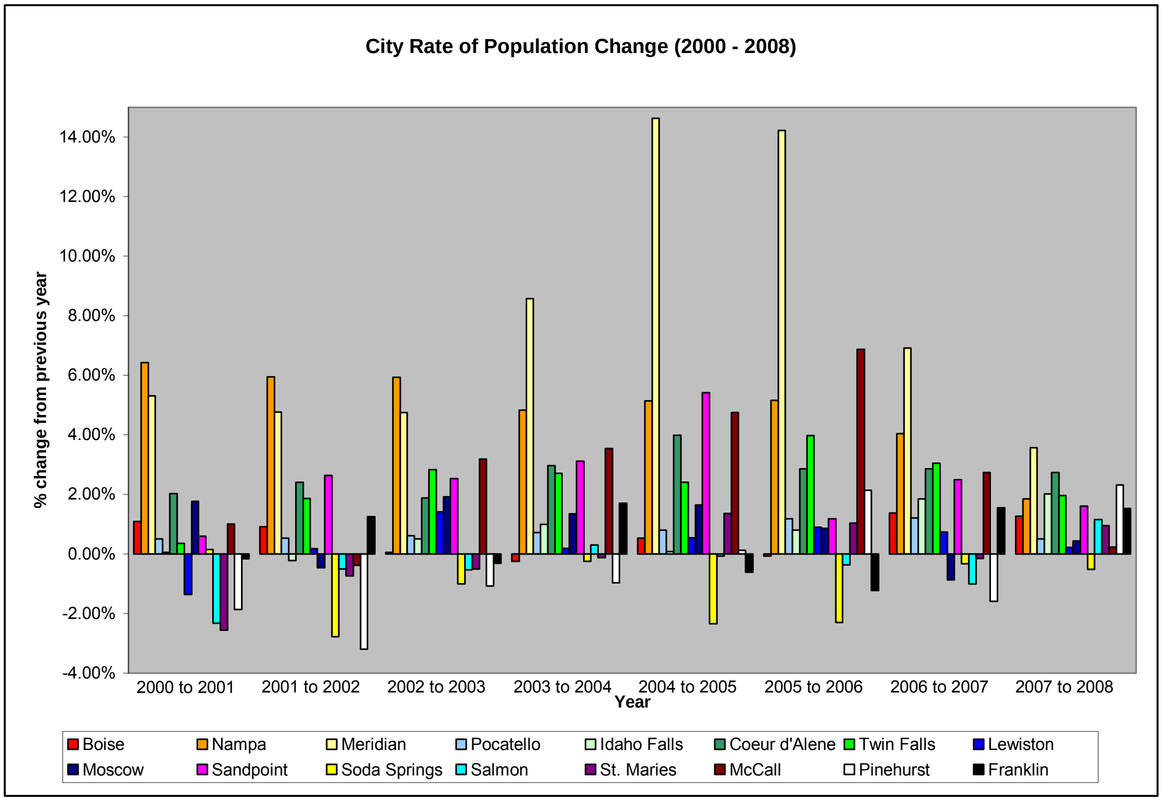


Figure D-38. Population Change in Idaho Cities

Most of the monitors within the Treasure Valley airshed are clustered around Boise, on the downwind side of the valley, where population is currently the highest. But considering the rapid population growth to the west of Boise since 2000, and the projection that this growth pattern will continue for the next five years, it might be prudent to shift some resources west. All the monitors in the Treasure Valley are population-oriented. By concentrating the monitors in Boise, a good portion of the population is not being represented. Land use in Meridian, Eagle, and suburban Nampa and Caldwell is different from the downtown core of Boise and monitoring ambient air quality in these areas might provide added insight to the conditions experienced by those living and working there. For example, a recent ozone study in the Treasure Valley (IDEQ, 2005) recommended siting a new ozone monitor in the corridor between downtown Boise and Eagle, at the base of the foothills, where some of the highest concentrations of ozone in the valley were suspected to occur. Subsequently, an ozone monitor was placed at the ITD site, where it measured the highest concentrations in the valley in 2008 (IDEQ, 2010). The highest concentration site for ozone is now located at White Pine, so there might be an opportunity to move the ITD site further west to Eagle. Another excellent reason to place an ozone monitor further west is scientific: there are no ozone monitors in Canyon County, yet the county has recently been required to establish an inspection and maintenance program designed to help reduce the ozone levels in the valley and to put off nonattainment status as long as possible. This requirement was developed from Ada County monitoring data and air dispersion modeling. It would be useful to have observational data from Canyon County to support the model results.

For $PM_{2.5}$ monitors in the Treasure Valley, the current sites in Meridian, Nampa, and Middleton are correctly situated to capture mobile-related $PM_{2.5}$ during the main $PM_{2.5}$ season (December–February), when winds blow from the southeast. The PM_{10} monitors at the Nampa and Boise Fire Station sites give a dual perspective on mobile emissions in the population centers in the eastern and western sides of the valley.

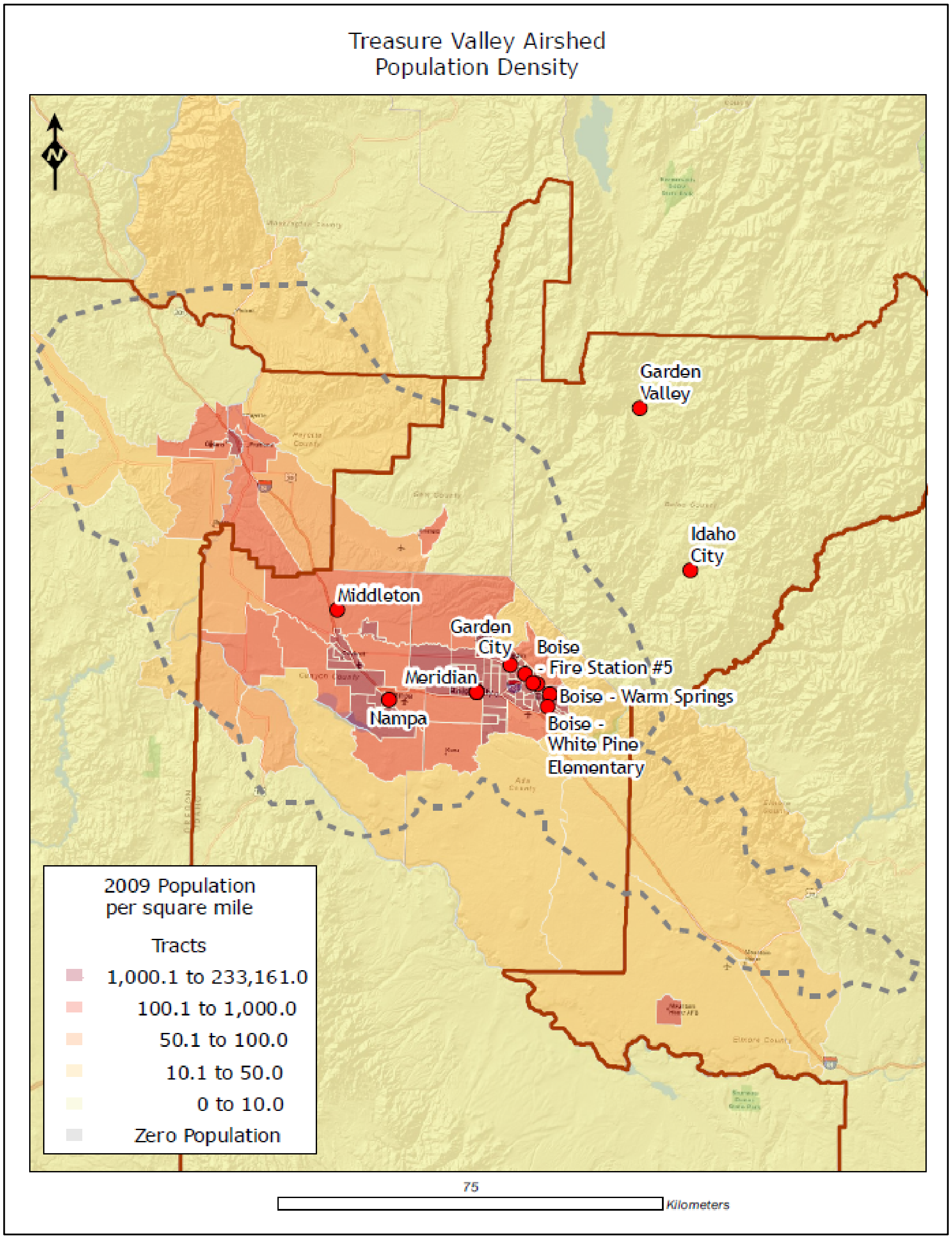


Figure D-39. Treasure Valley Population Density

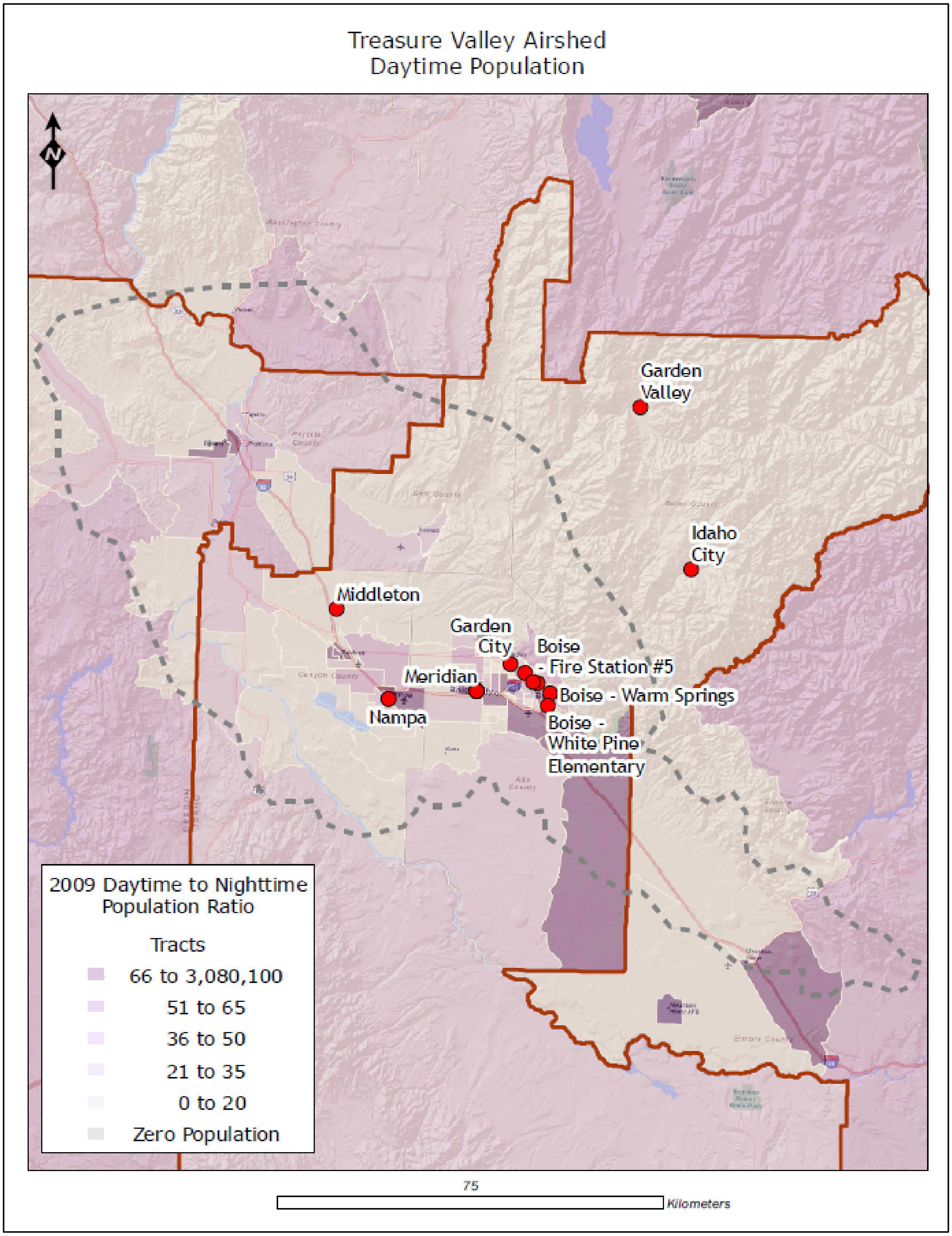


Figure D-40. Treasure Valley Daytime Population

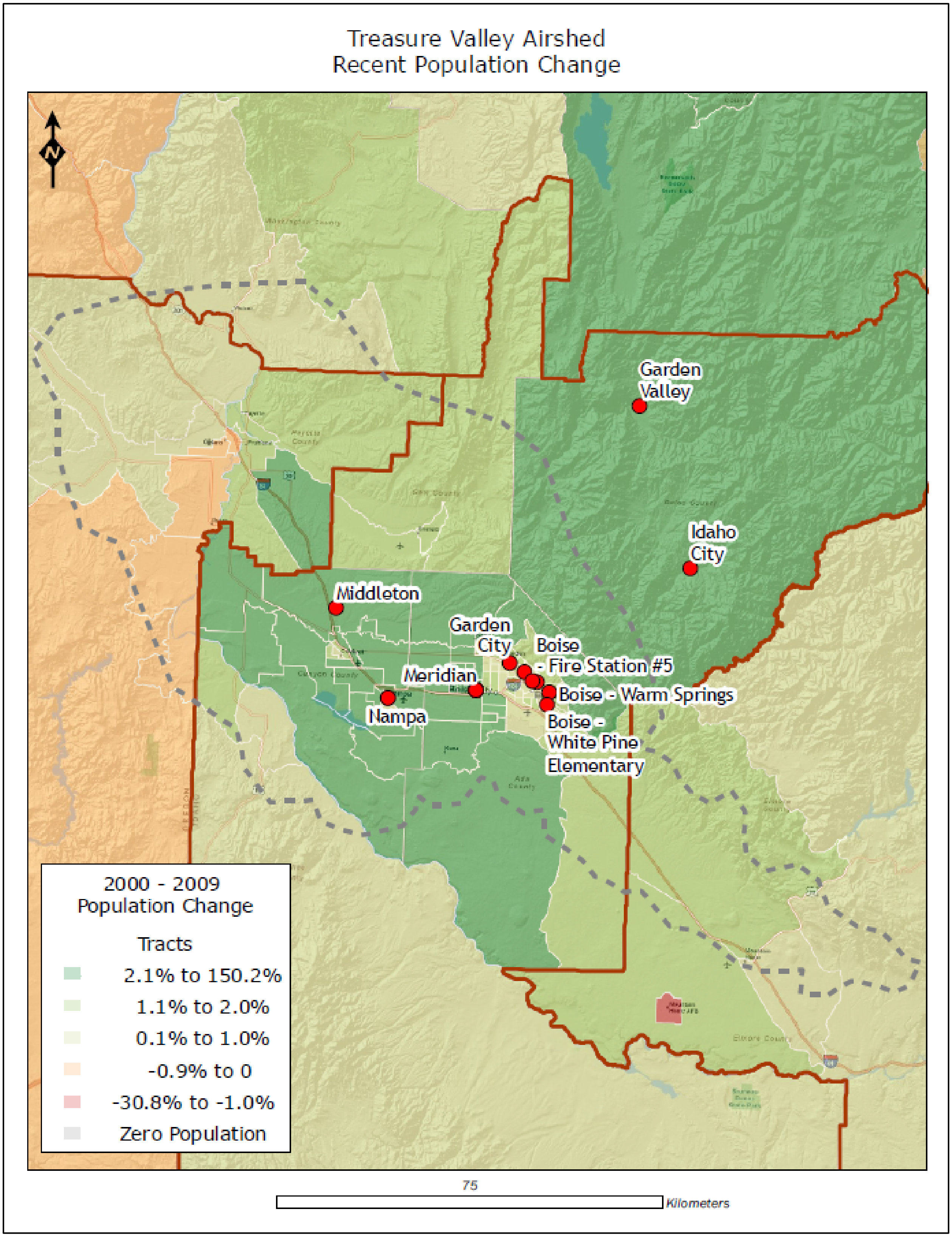


Figure D-41. Treasure Valley Population Change

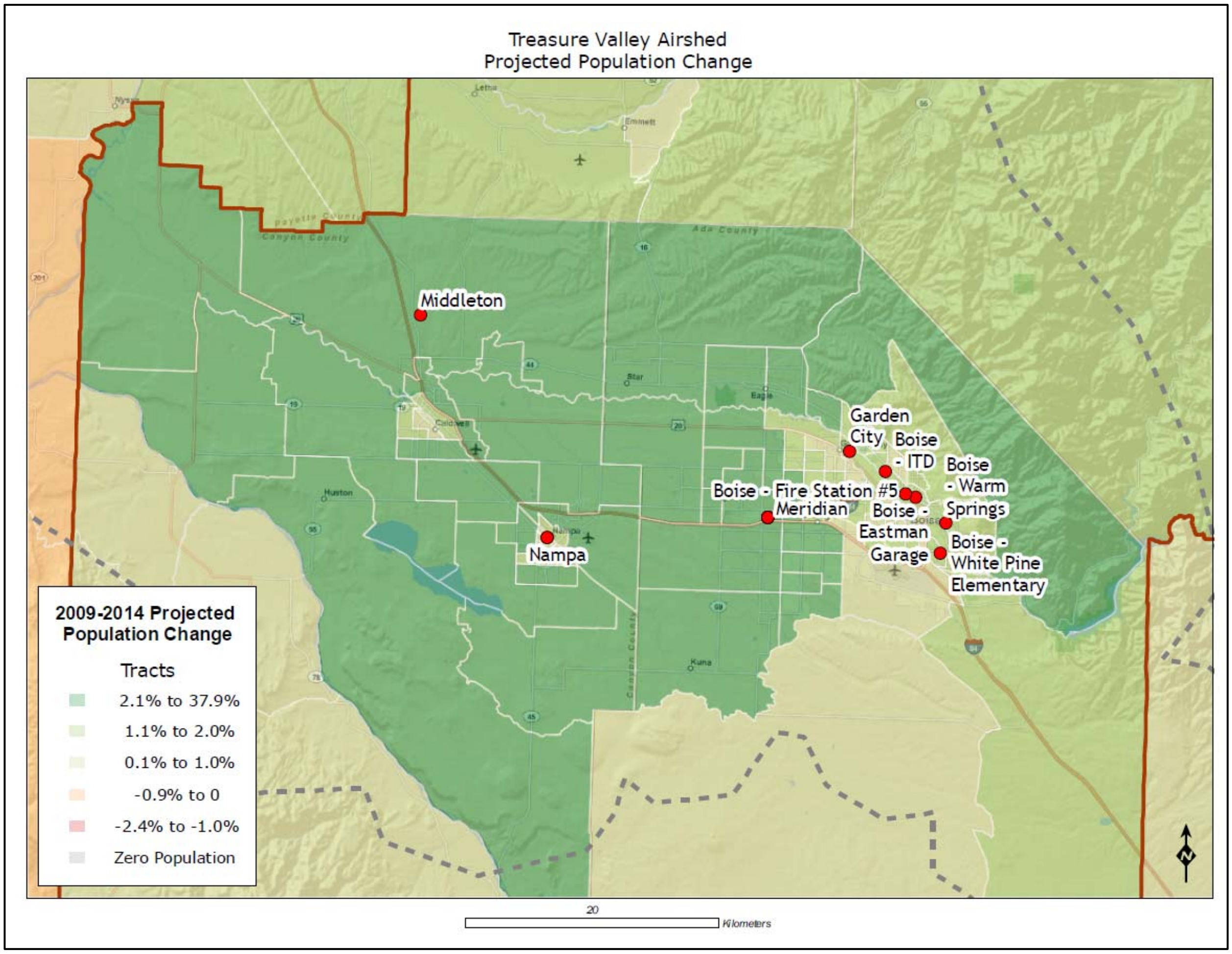


Figure D-42. Treasure Valley Airshed Population Projections

D.3 Network Assessment: Statewide Scale, by Pollutant

The statewide scale part of the network assessment aims to answer two questions for each pollutant monitored by the network:

1. Are the network requirements described in CFR Title 40, Part 58, Appendix D (Code of Federal Regulations, 2009) fulfilled?
2. Are locations with high emissions and high modeled concentrations covered by the network?

This section examines regulations, emissions, and modeled concentrations only. Any other considerations, such as unusual circumstances, value judgments, or phenomena not captured by emissions inventories, are addressed in the site ranking in the next section. The ranking sorts and summarizes the findings and analyses from the site scale, airshed scale, and statewide scale assessments. The rankings are followed by final recommendations for removal, addition, or relocation of monitors in Idaho's network.

Carbon Monoxide (CO)

Figure D-43 shows the location of CO monitors in Idaho's network.

There are no federal minimum requirements for the number of CO monitoring sites (Code of Federal Regulations, 2009). Micro or middle scales of representation are most appropriate for measuring CO (Code of Federal Regulations, 2009). The Boise Eastman monitor is a maximum concentration, urban canyon site. It is designated micro scale. Ludwig et al. (1975) state that urban canyon sites should be middle scale, so this site's scale should be reevaluated. The Eastman monitor fulfills the monitoring requirement for the Northern Ada County CO Maintenance Plan. The Meridian monitor measures trace CO to meet NCore site requirements.

CO is primarily emitted from vehicle exhaust. There are significant point sources of CO in Idaho (*Figure D-44*), but none near any monitors. Ada, Canyon, and Kootenai counties have the highest onroad source emissions (*Figure D-45*), which is not surprising since these are the two largest MSAs in the state. Ada, Blaine, and Kootenai have the highest nonroad source emissions (*Figure D-46*), and Ada, Idaho, and Nez Perce counties have the highest nonpoint source emissions (*Figure D-47*). Overall, the CO network in Idaho targets the airshed with the highest CO emissions.

CO has been monitored in Boise since 1991, and concentrations have been trending downwards since then. Current measurements are well below the NAAQS. Discontinued CO monitors in Lewiston and Nampa followed similar trends. If current CO concentrations in Boise, the county with the highest CO emissions in the state, are so low, then it stands to follow that other areas of the state with lower CO emissions do not need CO monitors.

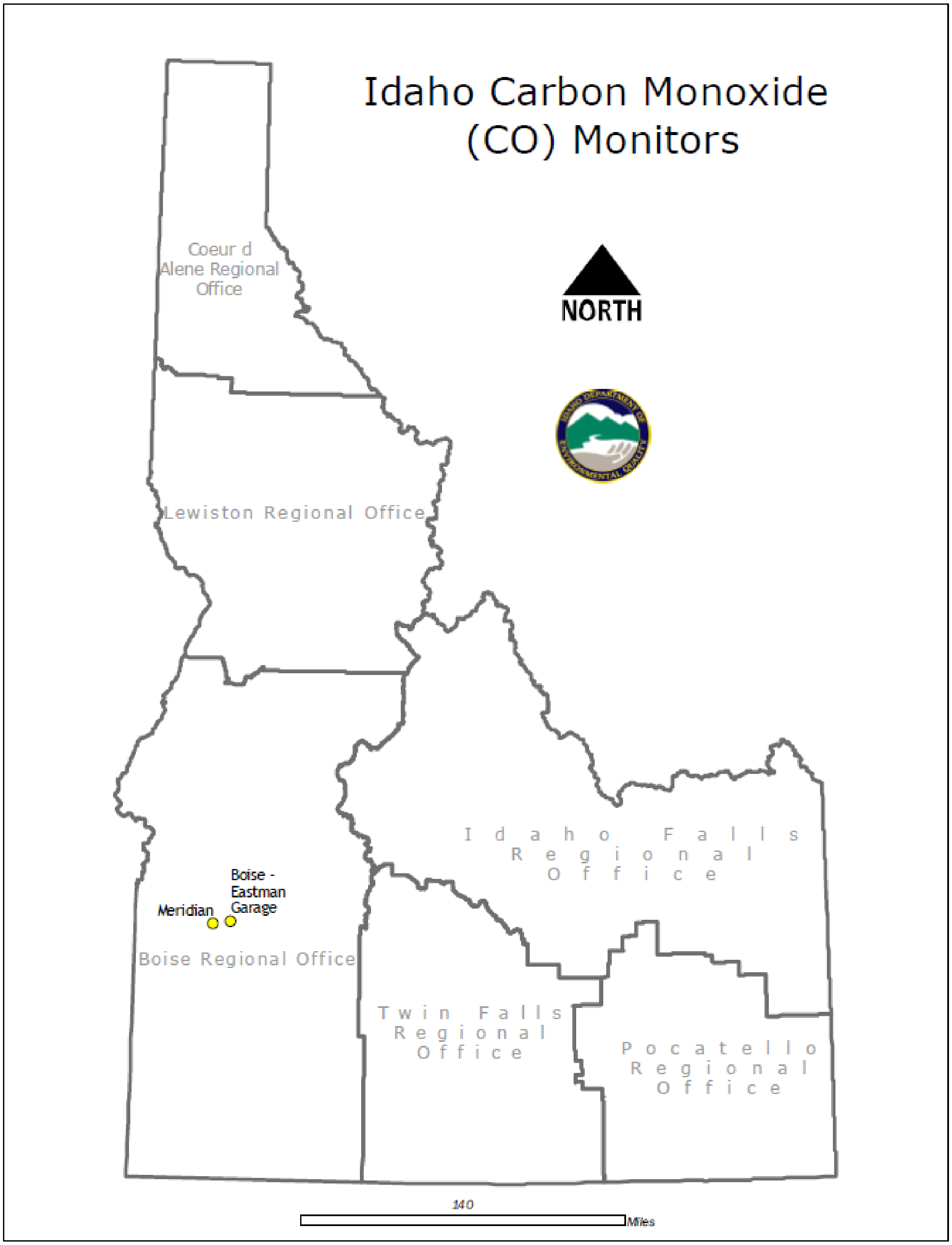


Figure D-43. Idaho's CO Monitoring Network

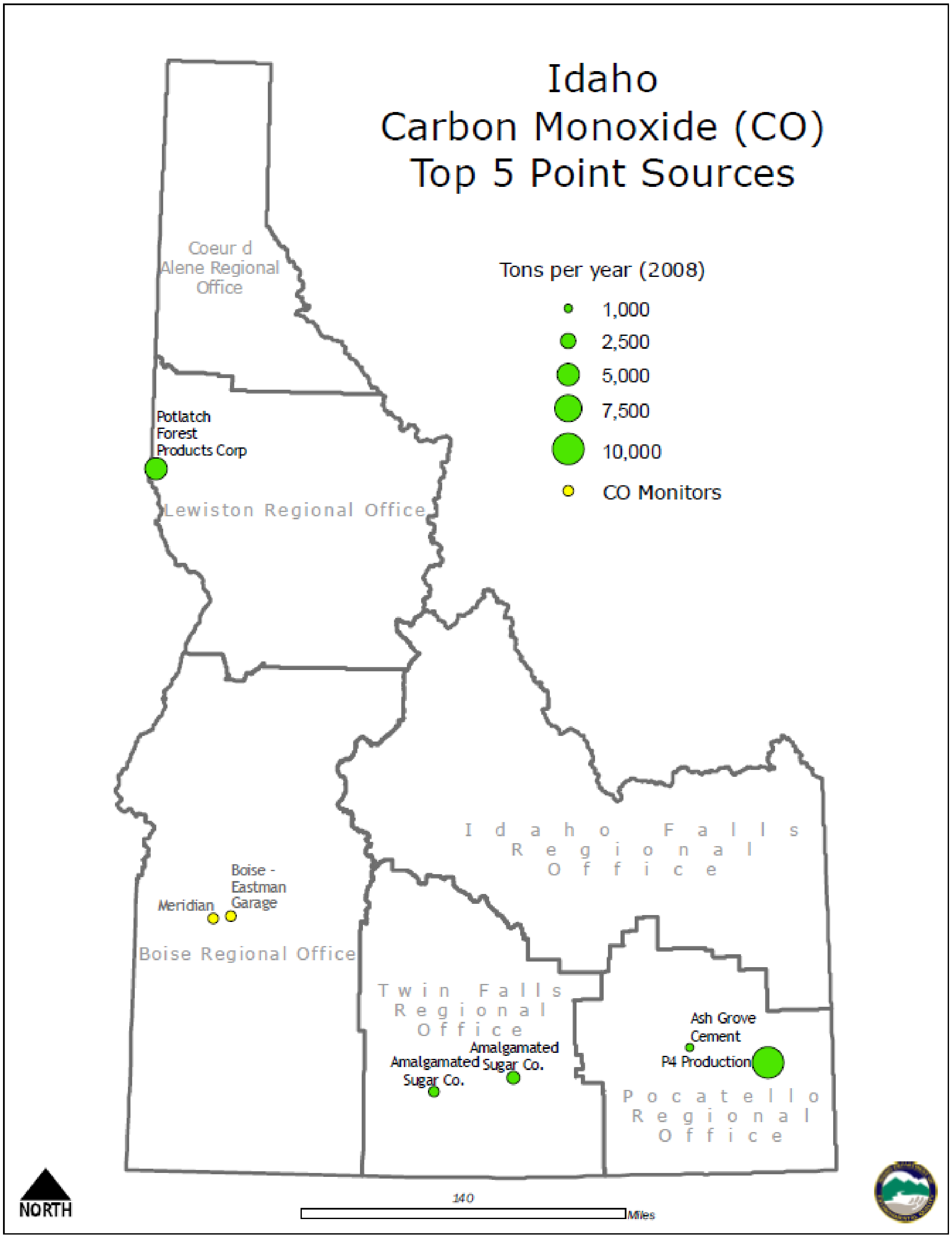


Figure D-44. Top Five CO Emissions Point Sources in Idaho

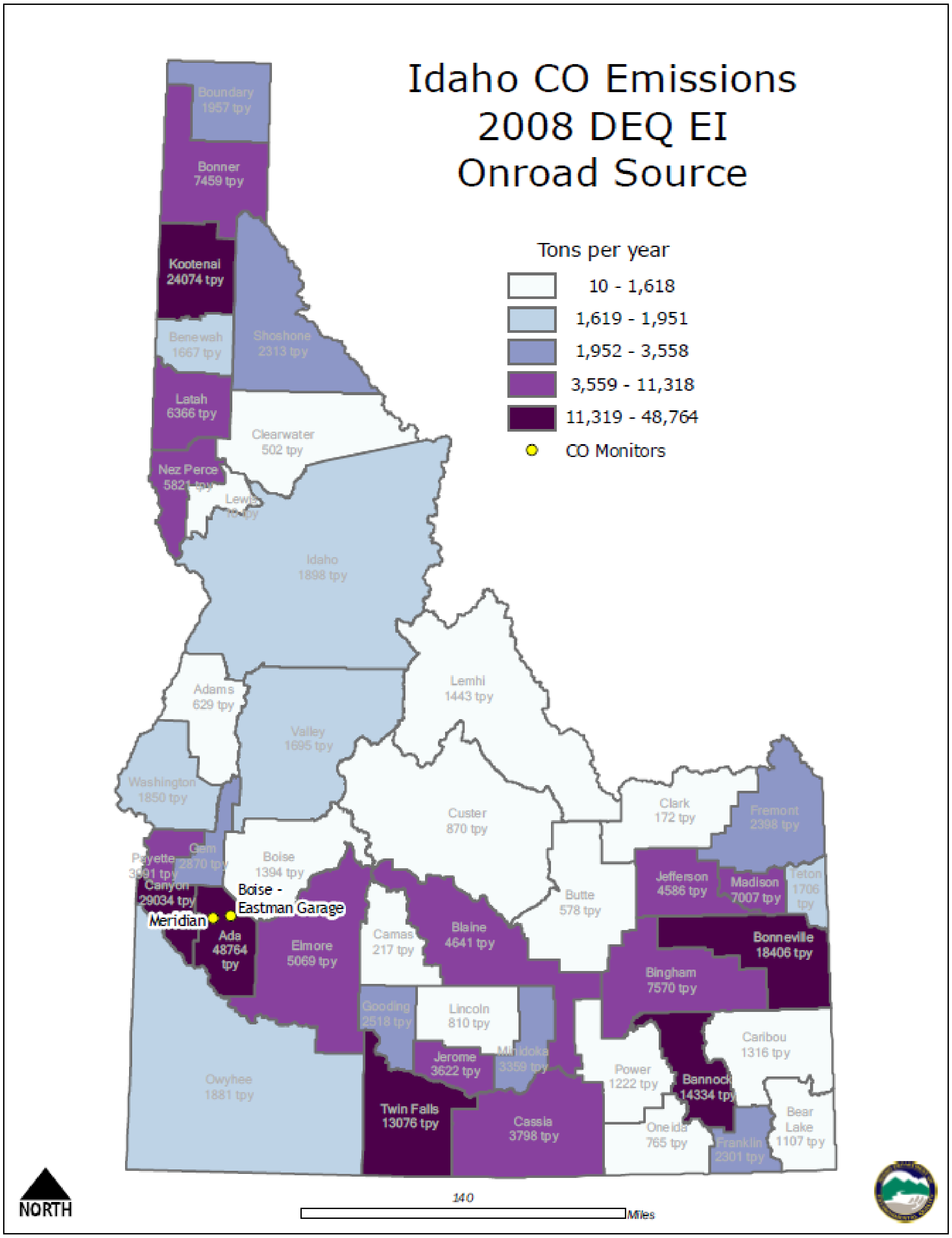


Figure D-45. County-level Onroad Source Emissions of CO

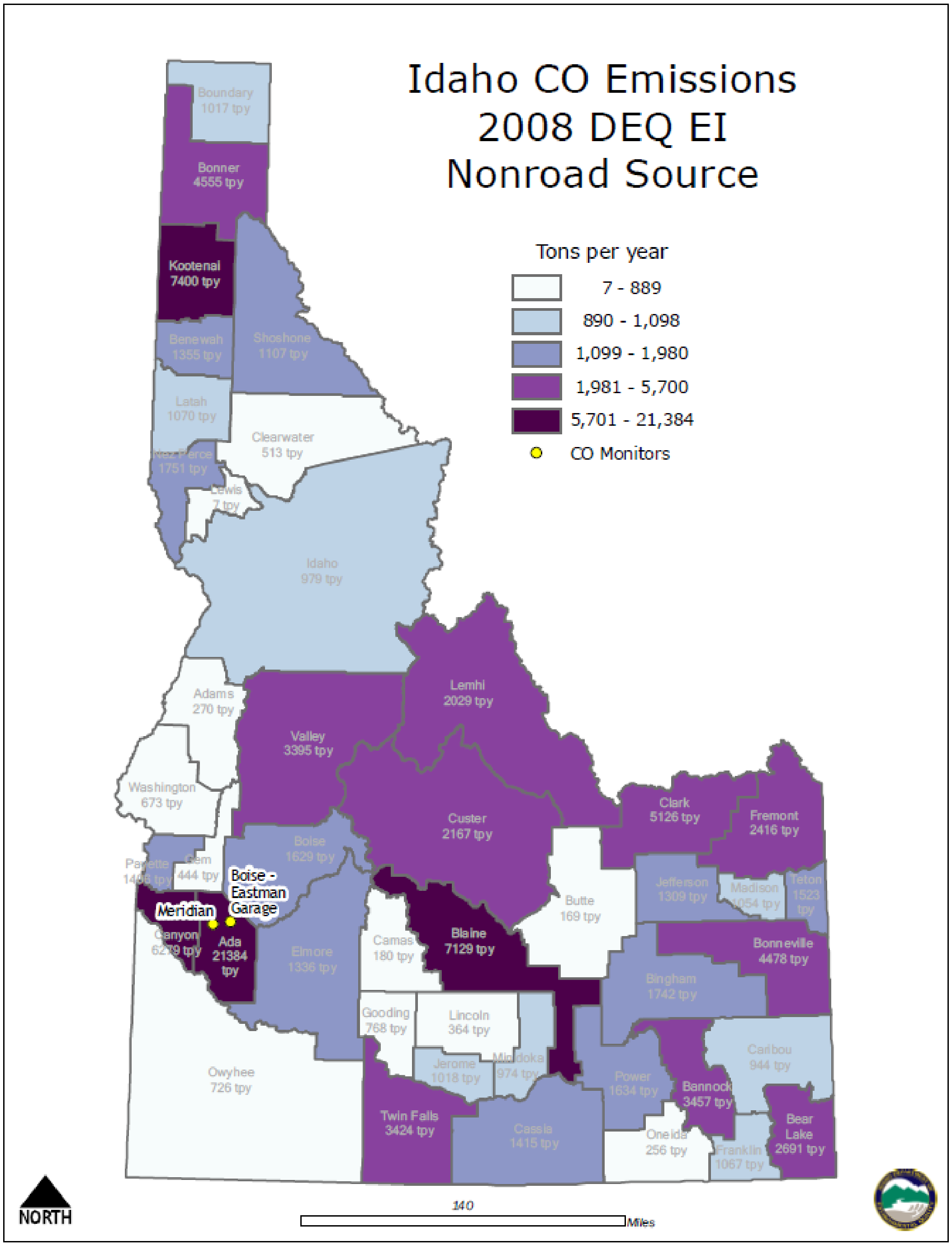


Figure D-46. County-level Nonroad Source Emissions of CO

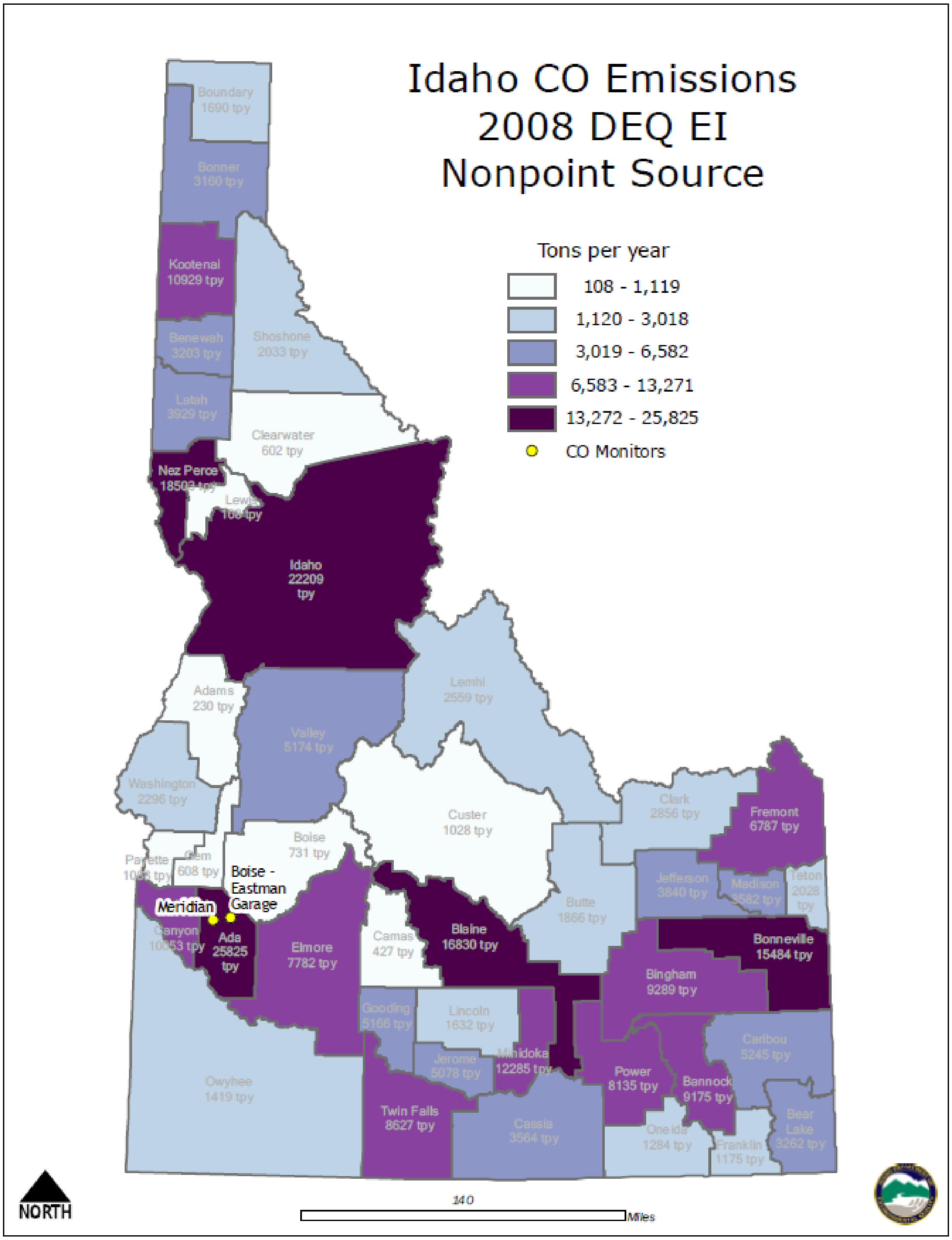


Figure D-47. County-level Nonpoint Source Emissions of CO

Lead (Pb)

In October 2008, EPA strengthened the standard for lead. The revised NAAQS are ten times lower than the previous NAAQS. The 2008 lead NAAQS were set at $0.15 \mu g/m^3$. The monitoring requirements for the 2008 standard were based on MSA population thresholds of 500,000 and based on facility (or clusters of facilities) emissions thresholds of greater than or equal to 1.0 tons per year. Therefore, monitors would have to be placed near facilities that meet those emissions thresholds.

In December 2009, EPA announced it is reconsidering the monitoring requirements, proposing that agencies monitor at NCore monitoring sites (in lieu of basing monitoring requirements on MSA population thresholds), and source-oriented monitoring emissions thresholds of 0.5 tons per year. Monitoring for lead at NCore sites will begin January 1, 2011 or 2012, pending outcome of EPA's final decision.

Nitrogen Dioxide (NO_2)/NO_y

Figure D-48 shows the location of NO_x/NO_y monitors in Idaho's network.

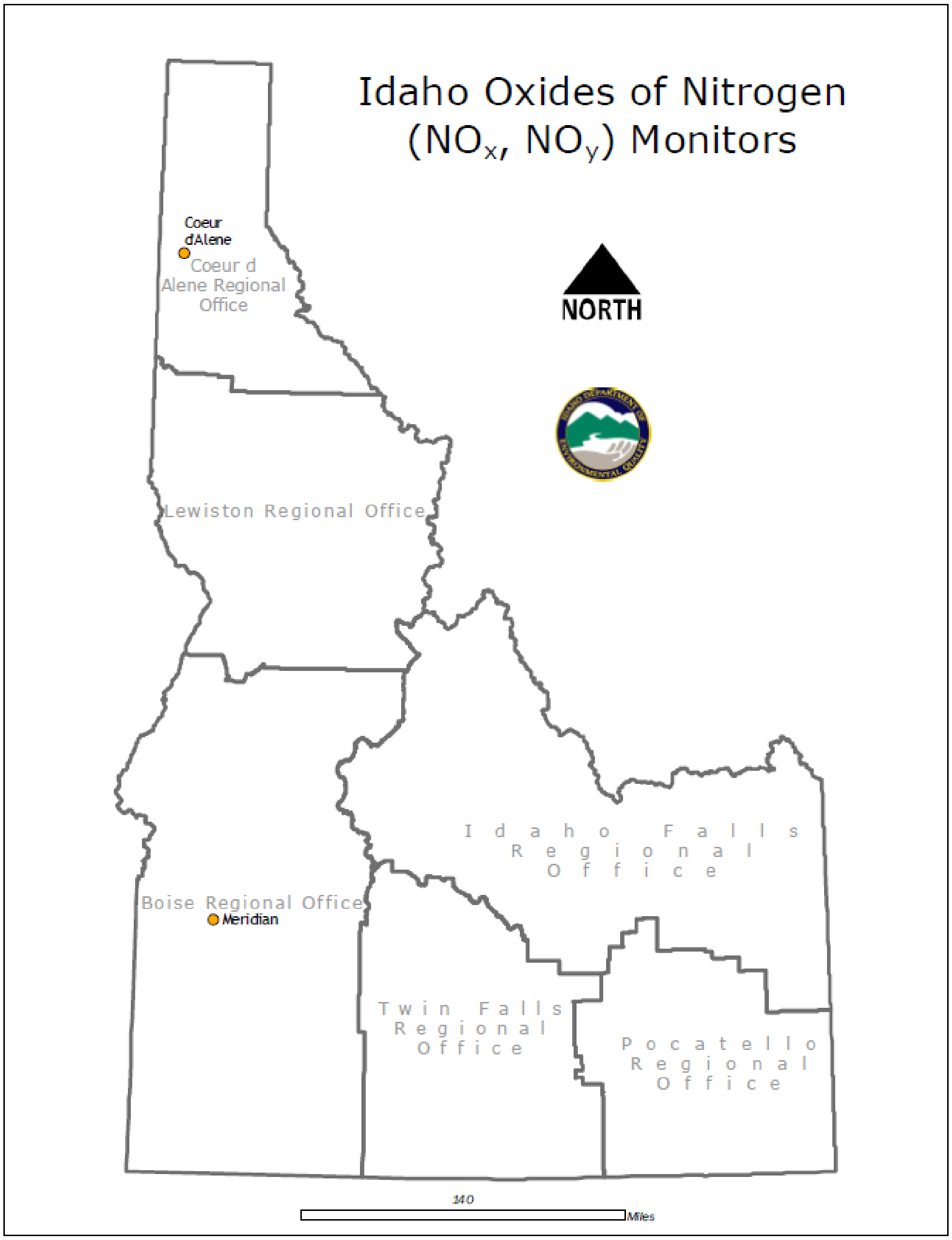


Figure D-48. Idaho's NO_2/NO_y Monitoring Network

Prior to January 2010, there were no minimum requirements for the number of NO_2/NO_y monitoring sites (Code of Federal Regulations, 2009). The Meridian site fulfills the requirement for NO_y monitoring at NCore sites, and the Coeur d'Alene site is situated to measure the maximum concentration of NO_2 within its scale of representation. This also fulfills the required network design criteria (Code of Federal Regulations, 2009). All NO_2 network requirements are fulfilled.

In January 2010, EPA strengthened the primary NAAQS for NO_2 and concurrently imposed new monitoring requirements that are to begin January 1, 2013. Based on these new requirements, near-roadway monitoring will be required in the Boise MSA. One site will be required to monitor NO_2 at a distance of no more than 50 meters to the nearest traffic lane of the roadway segment with the highest annual average daily traffic (AADT).

NO_x is emitted from mobile sources and industrial combustion processes. It is released primarily as NO but rapidly oxidizes to NO_2, the pollutant which is responsible for health effects. *Figure D-49* shows the location of the top five point sources of NO_x in Idaho (tons per year, 2008). The Meridian monitor is in the same airshed as the fourth largest NO_x point source in the state. There are no monitors near the other top point sources.

Figure D-50 shows the distributions of onroad NO_x emissions by county in 2008. Ada, Canyon, and Kootenai counties are by far the largest emitters for this category. A monitor in each of these airsheds may provide sufficient coverage.

The NO_x source contribution chart indicates that nonroad and nonpoint sources contribute significant NO_x emissions as well (*Figure D-51*). The nonroad category describes a similar dominance by Ada, Canyon, and Kootenai counties (*Figure D-52*). The nonpoint category does as well, with the glaring exception of high emissions for Blaine County (*Figure D-55*). However, when all the EI source categories are summed, Blaine County's contribution loses prominence.

Historical NO_2 monitoring in Idaho has recorded very low annual 1-hour average concentrations relative to the NAAQS. The January 2010 1-hour standard was set at 100 ppb. The first and second maximum values at Meridian in 2009 were 53 and 52 ppb, respectively. The design value for the Coeur d'Alene site from 2006 to 2008 was 27 ppb. By itself, NO_2 is not considered a major pollutant in Idaho; however, it is an important precursor to O_3 formation.

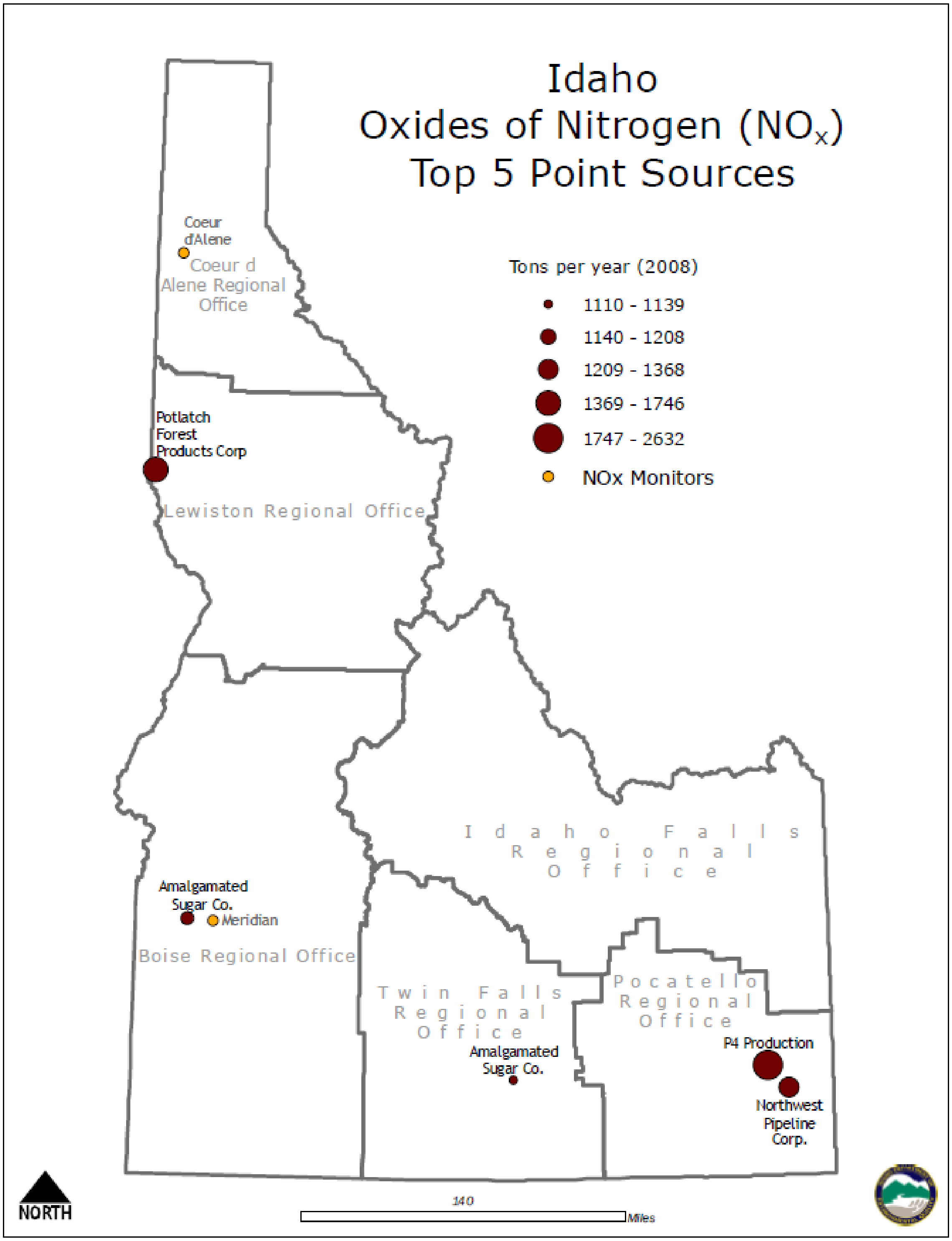


Figure D-49. Top Five NO_x Emissions Point Sources in Idaho

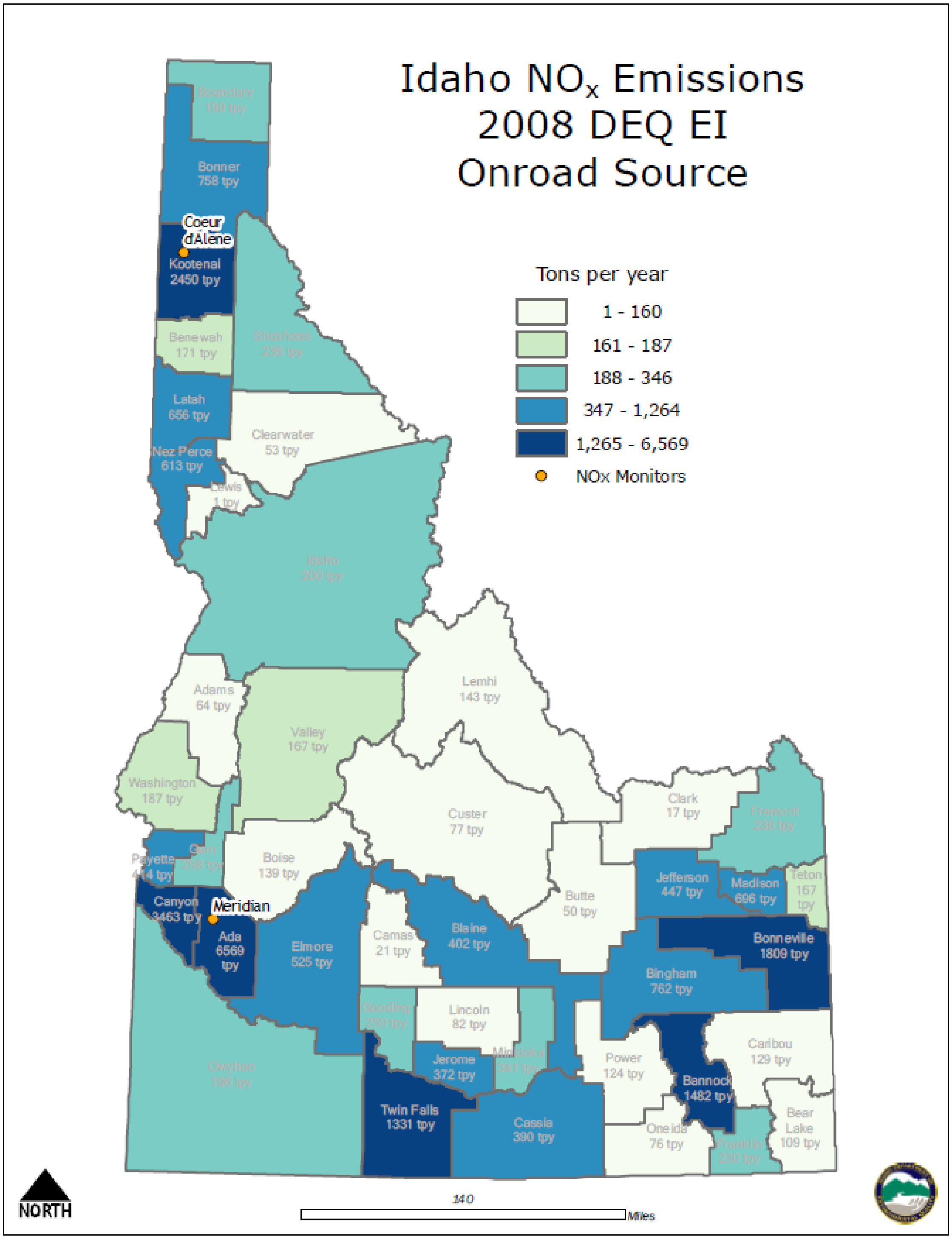


Figure D-50. County-level Onroad Source Emissions of NO_x

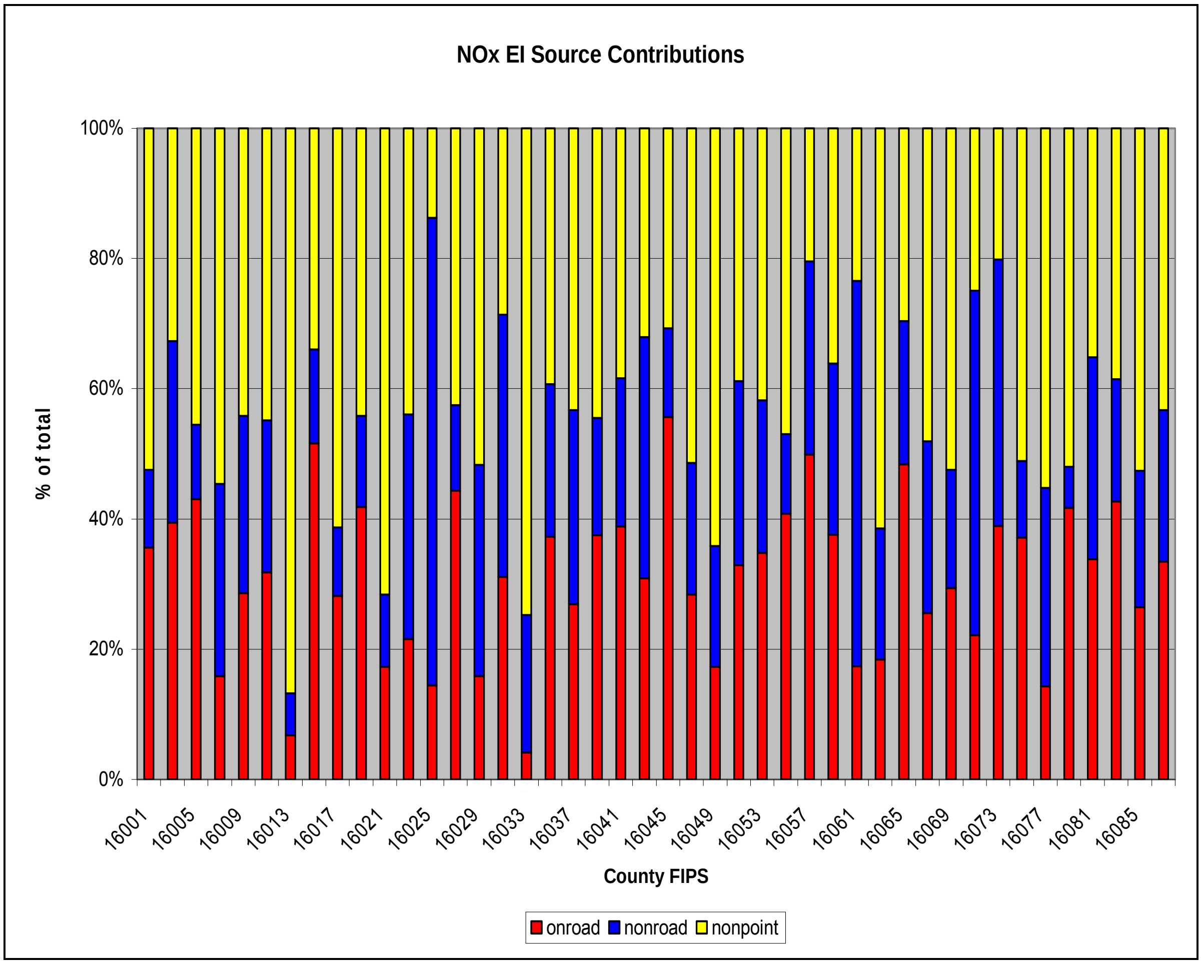


Figure D-51. NO_x Emissions

Overall, Idaho's NO_x monitoring network sufficiently covers areas with high emissions from the onroad, nonroad, and nonpoint source categories, but insufficiently covers point source emissions.

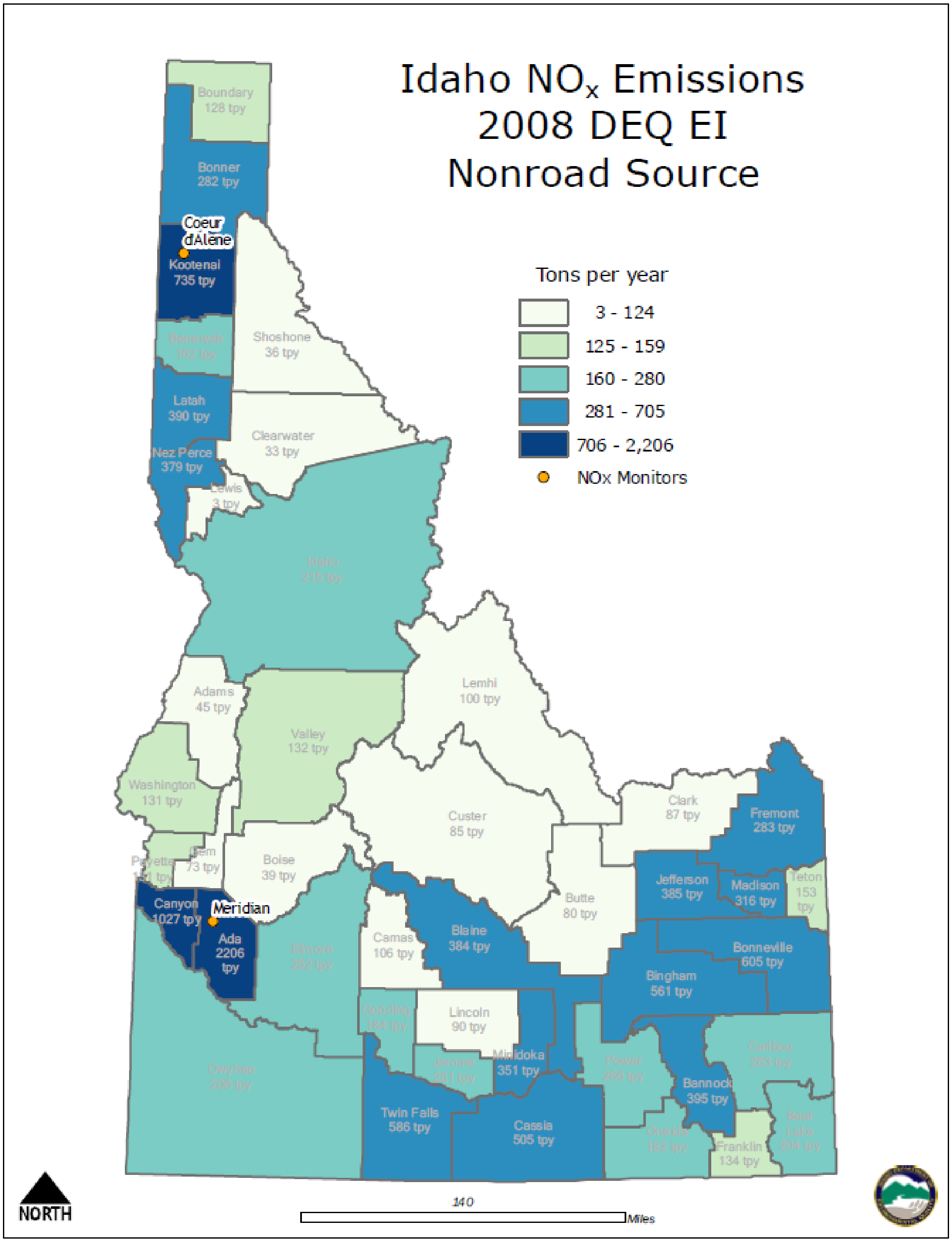


Figure D-52. County-level Nonroad Source Emissions of NO_x

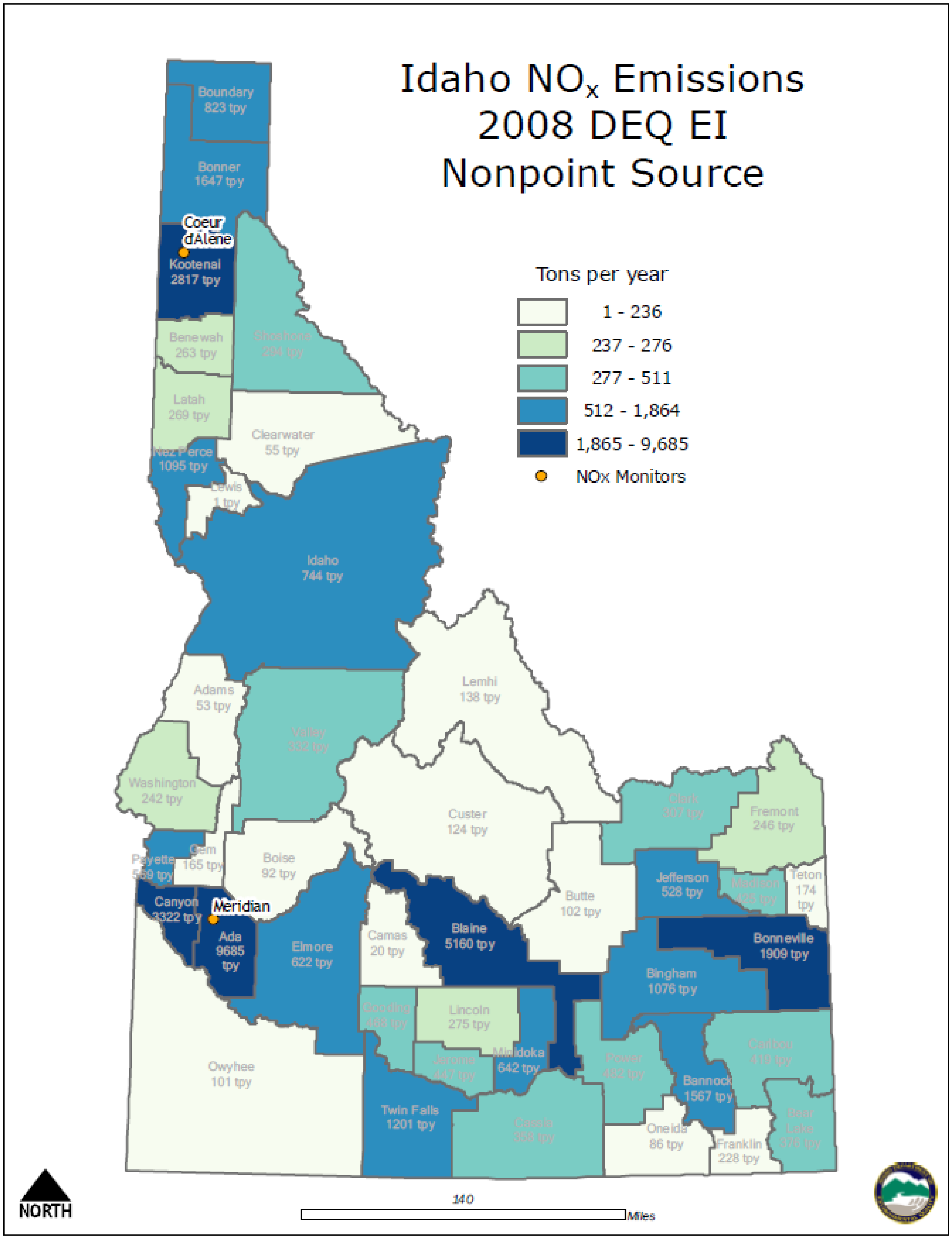


Figure D-53. County-level Nonpoint Source Emissions of NO_x

Ozone (O_3)

Figure D-54 shows the location of O_3 monitors in Idaho's network.

Network design criteria for ozone requires 0 - 1 monitoring stations in MSAs with populations between 50,000 and 350,000 (Code of Federal Regulations, 2009) depending on whether the most recent 3-year design value is above, below, or equal to 85% of the NAAQS. Idaho has five MSAs that meet these criteria, but O_3 monitoring has occurred only in the Coeur d'Alene MSA, where design values have been above and below 85% of the NAAQS. Ozone monitoring was initiated in 2005 for the Coeur d'Alene airshed due to the frequently forecasted AQI moderate category on AirNow, due to transport from Spokane, Washington. MSAs with populations between 350,000 and 4 million are required to have 1-2 monitors, depending on whether the most recent 3-year design values are above, below, or equal to 85% of the NAAQS. The Boise City MSA is required to have two monitors. The NCore monitoring requirements call for year-round ozone monitoring at NCore stations. NCore ozone stations can be leveraged toward minimum monitoring requirements.

One site in each MSA must be a maximum concentration site. Boise's White Pine and Coeur d'Alene's Lancaster sites fulfill this requirement. Appropriate spatial scales are neighborhood, urban, and regional. All sites in the Treasure Valley are neighborhood, and Coeur d'Alene is urban scale. Aside from NCore stations, ozone monitoring is required only during ozone season, which is May through September in Idaho (Code of Federal Regulations, 2009). The ozone network requirements are satisfactorily fulfilled.

Ozone is formed by a reaction of NO_x and VOC triggered by solar ultraviolet light. Boise has a top five NO_x point source in its airshed, and both Boise and Coeur d'Alene have top five VOC point sources in their airsheds (*Figure D-49* and *Figure D-55*). However, Lewiston and southwest Idaho have important point sources for both precursors as well. VOC emissions are dominated by the nonpoint source category (*Figure D-56*).

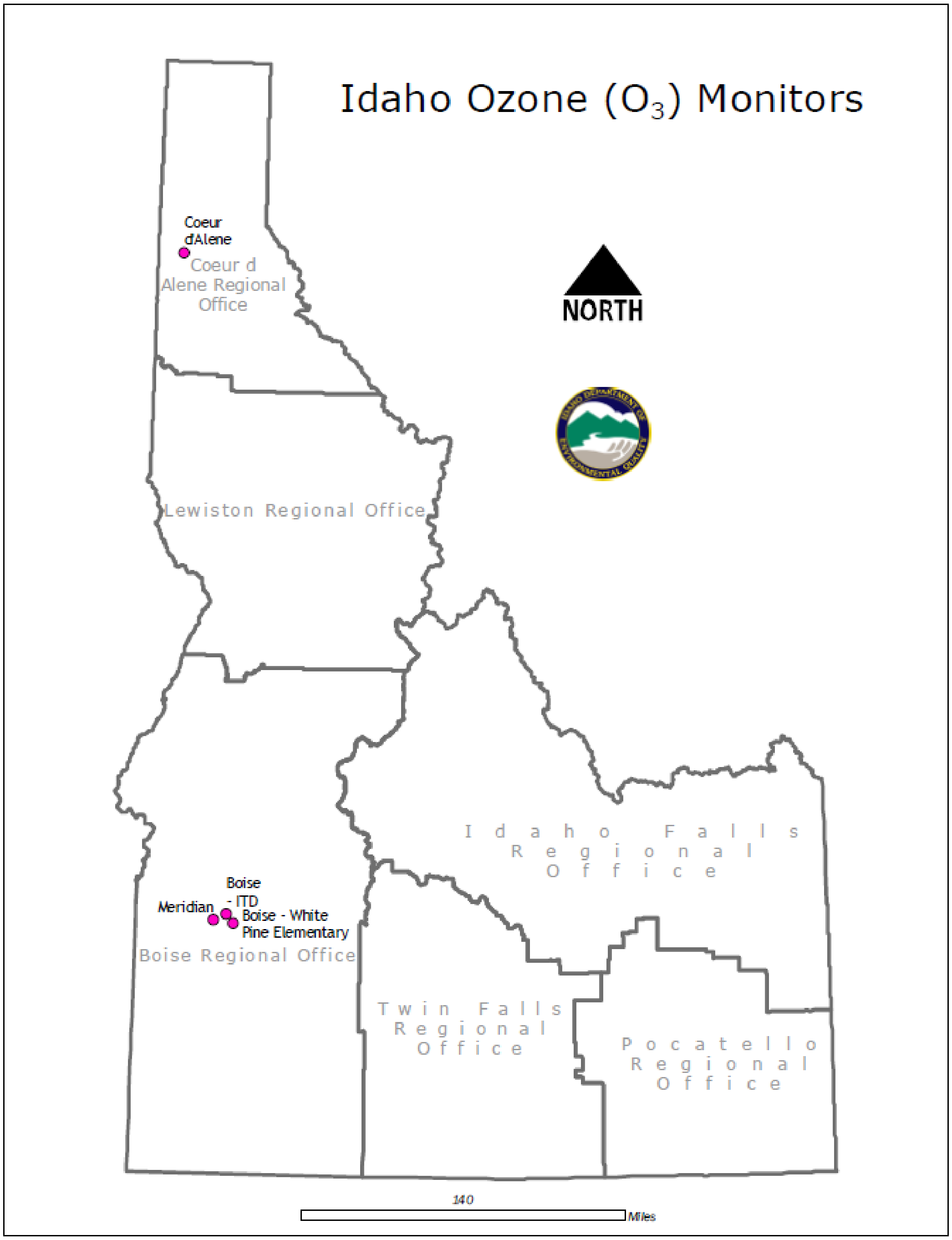


Figure D-54. Idaho's Ozone Monitoring Network

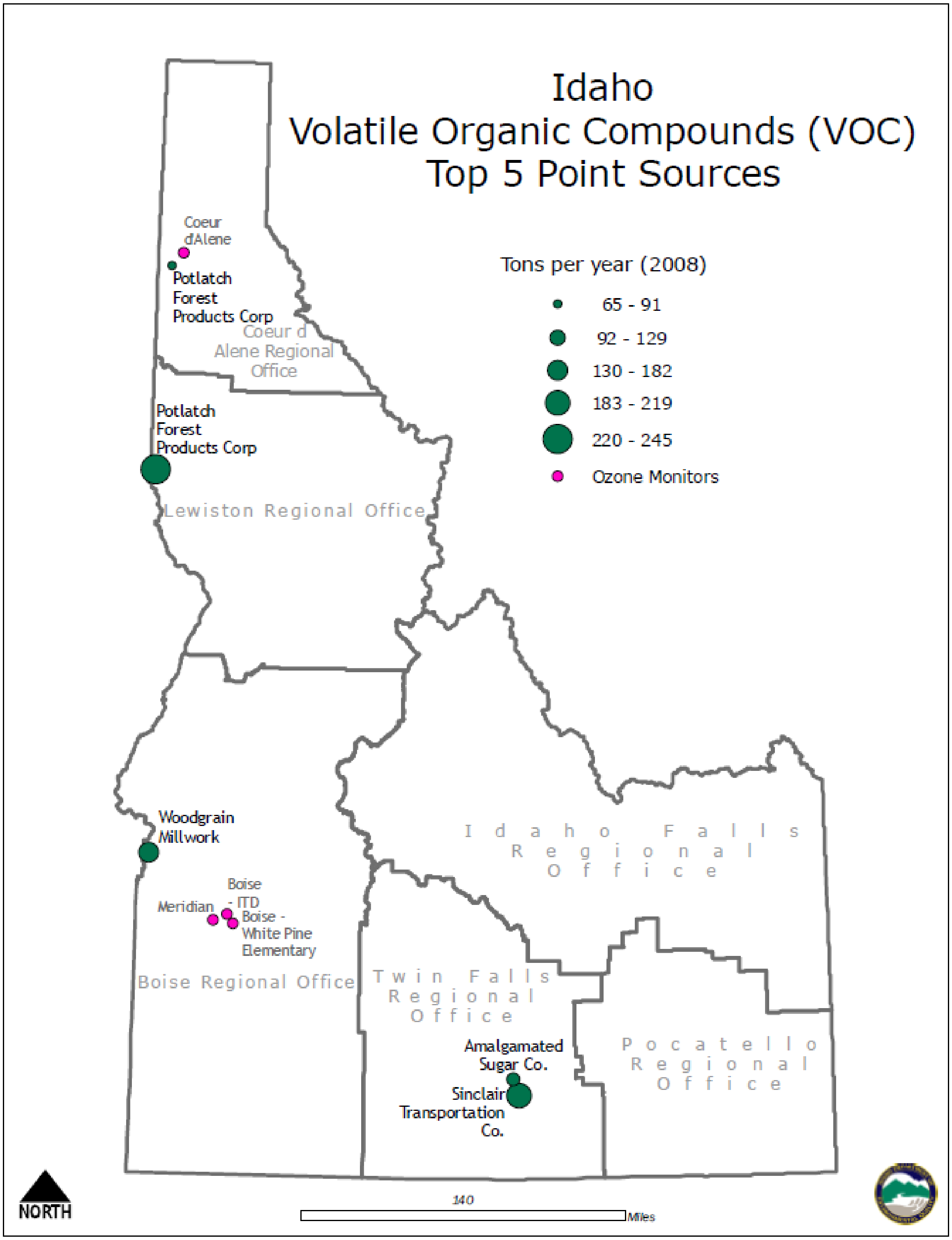


Figure D-55. Top Five VOC Emissions Point Sources in Idaho

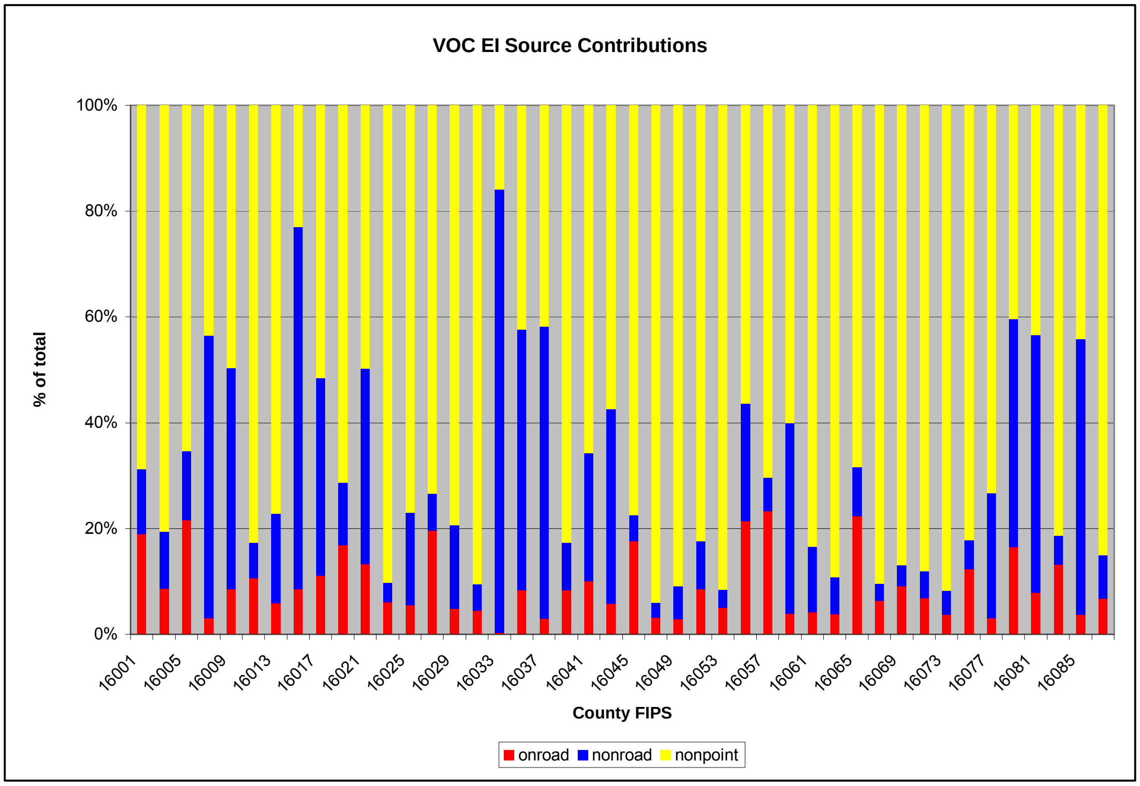


Figure D-56. VOC Emissions Chart

Ada and Canyon counties have the highest VOC emissions, followed by the agricultural areas in the Snake River Plain, and Idaho County, which is home to the largest contiguous area of forested land in the lower 48 states (*Figure D-57*). *Figures D-50, D-52, and D-54* show Ada, Canyon, and Kootenai counties have the highest NO_x emissions for all categories combined. Based on emissions sources alone, it appears that Idaho's ozone network covers the important locations.

Modeled ozone concentrations should also be considered because they incorporate all emissions of both NO_x and VOC, as well as their interaction in the ozone formation photochemistry. 2008 AIRPACT modeled episode averages of daily 8-hour average concentrations (*Figure D-58*) show a regional increase in concentrations towards the south (episode period is June 30 through September 1, 2008). Episode maximum modeled concentrations describe a more complex pattern (*Figure D-59*). Southwest Idaho and the Spokane-Coeur d'Alene region register high maximum concentrations, along with bands of high concentrations in central Idaho. These modeled concentrations tell us that ozone pollution is a regional, multi-state phenomenon; that southern Idaho generally experiences higher concentrations; and that the Coeur d'Alene area experiences short-term spikes. It seems safe to say that Idaho's ozone network targets the areas that experience high ozone concentrations and that have significant populations affected by this pollution.

Trends in Idaho ozone concentrations show the Treasure Valley is very close to violating the ozone NAAQS. Design values at Coeur d'Alene are lower, but still relatively high (0.067 ppm in 2007 and 0.064 ppm in 2008).

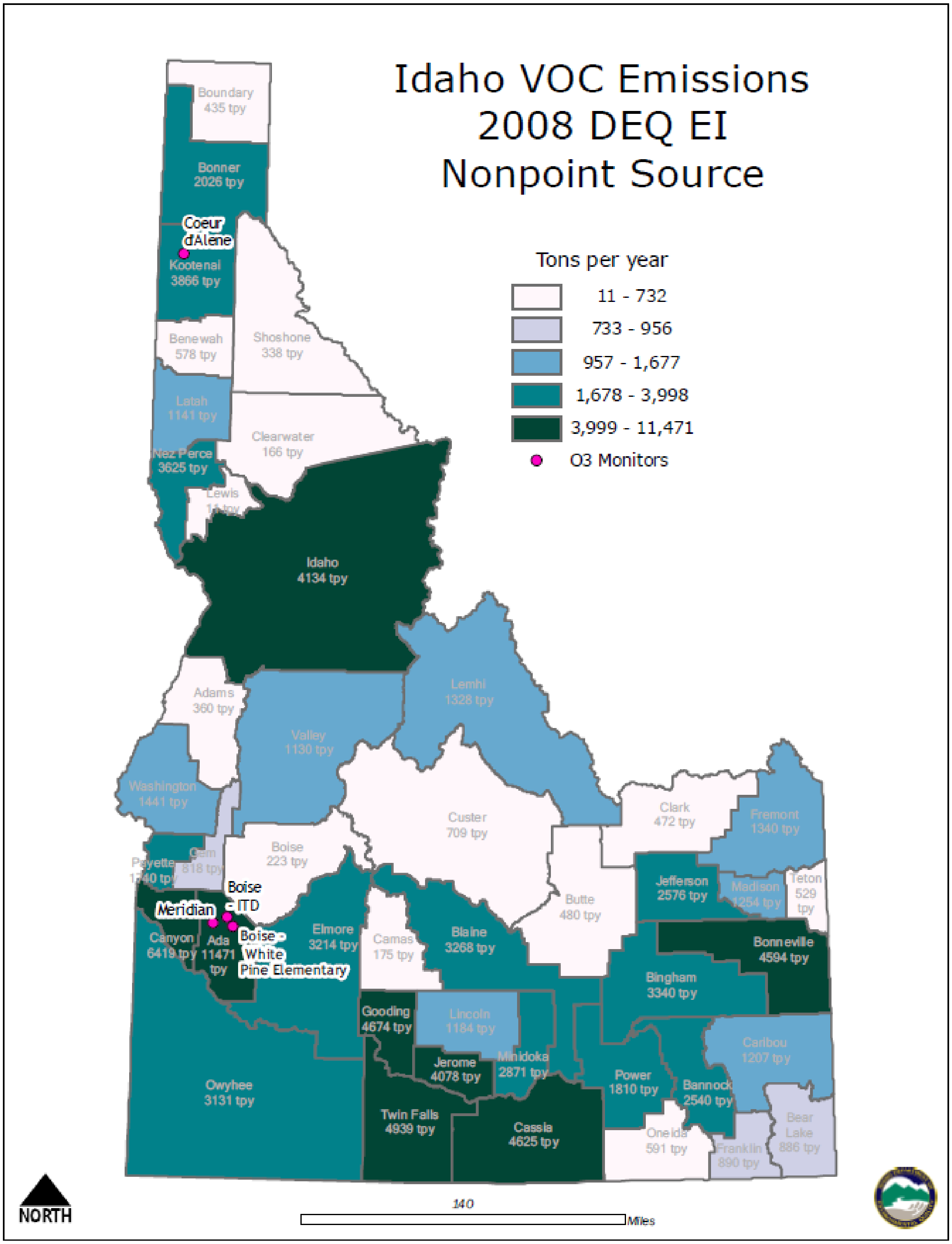


Figure D-57. County-level Nonpoint Source Emissions of VOC

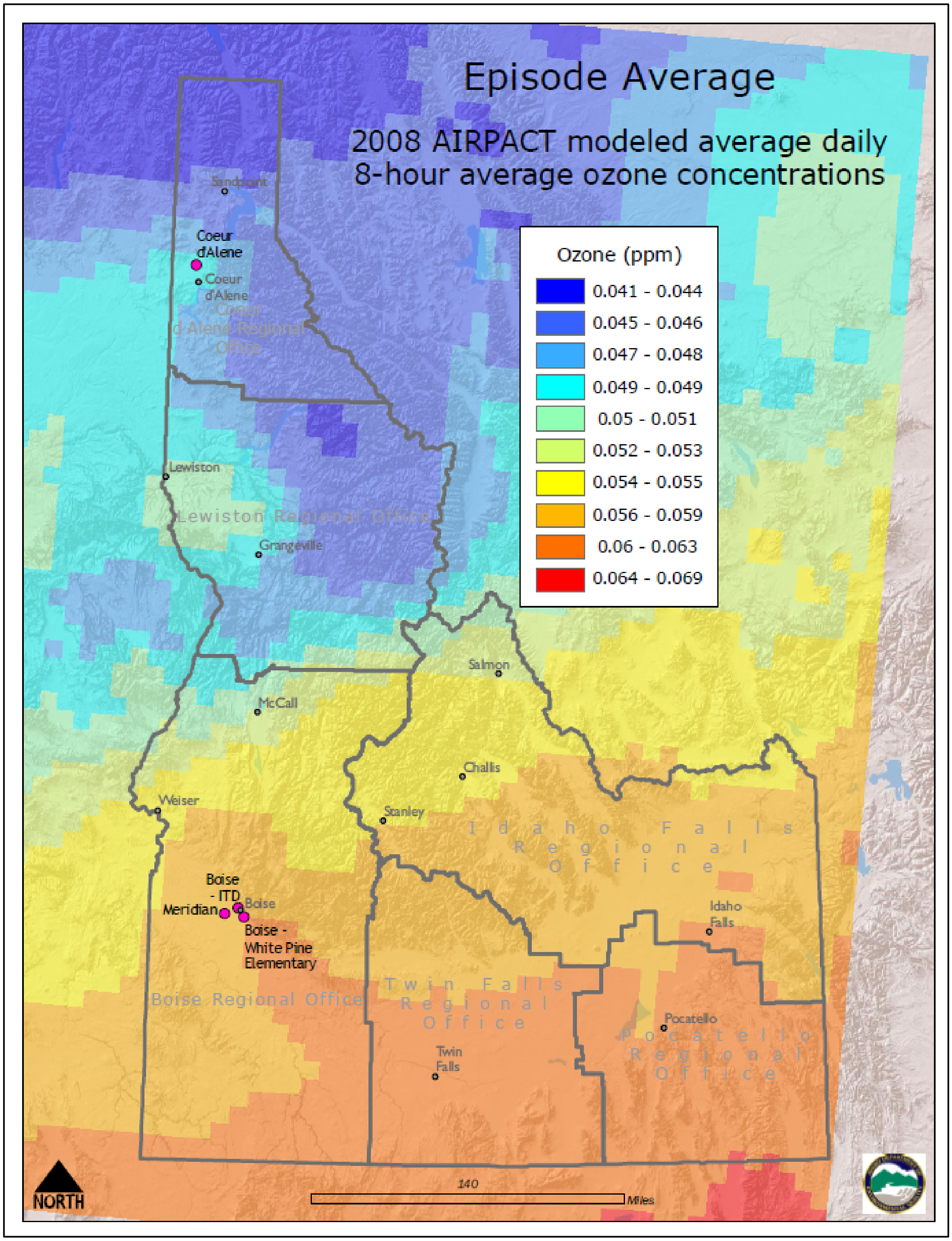


Figure D-58. AIRPACT Modeled 8-hour Ozone Average Concentrations

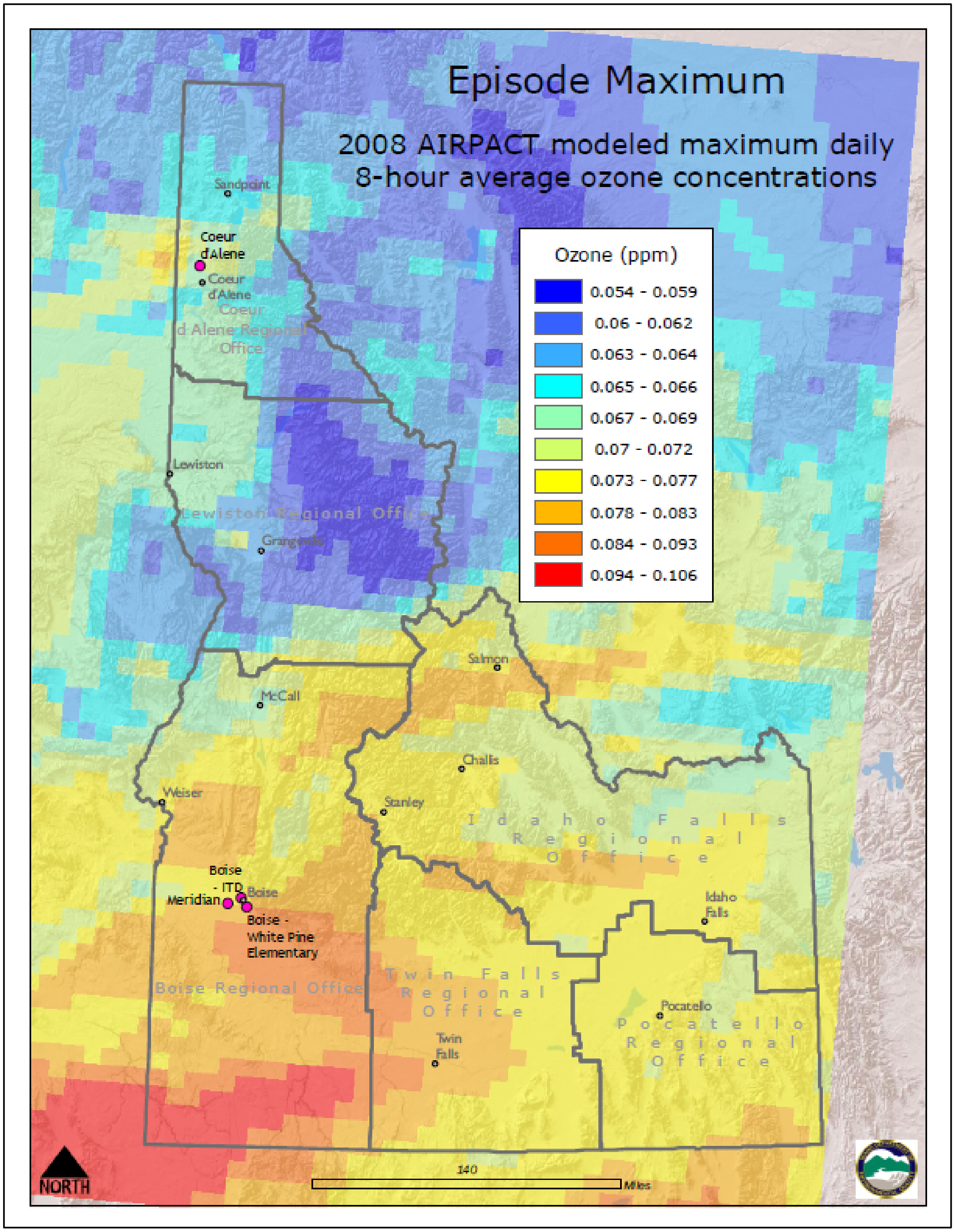


Figure D-59. AIRPACT Modeled 8-hour Ozone Maximum Concentrations

Coarse Particulate Matter (PM_{10})

Figure D-60 shows the location of PM_{10} monitors in Idaho's network.

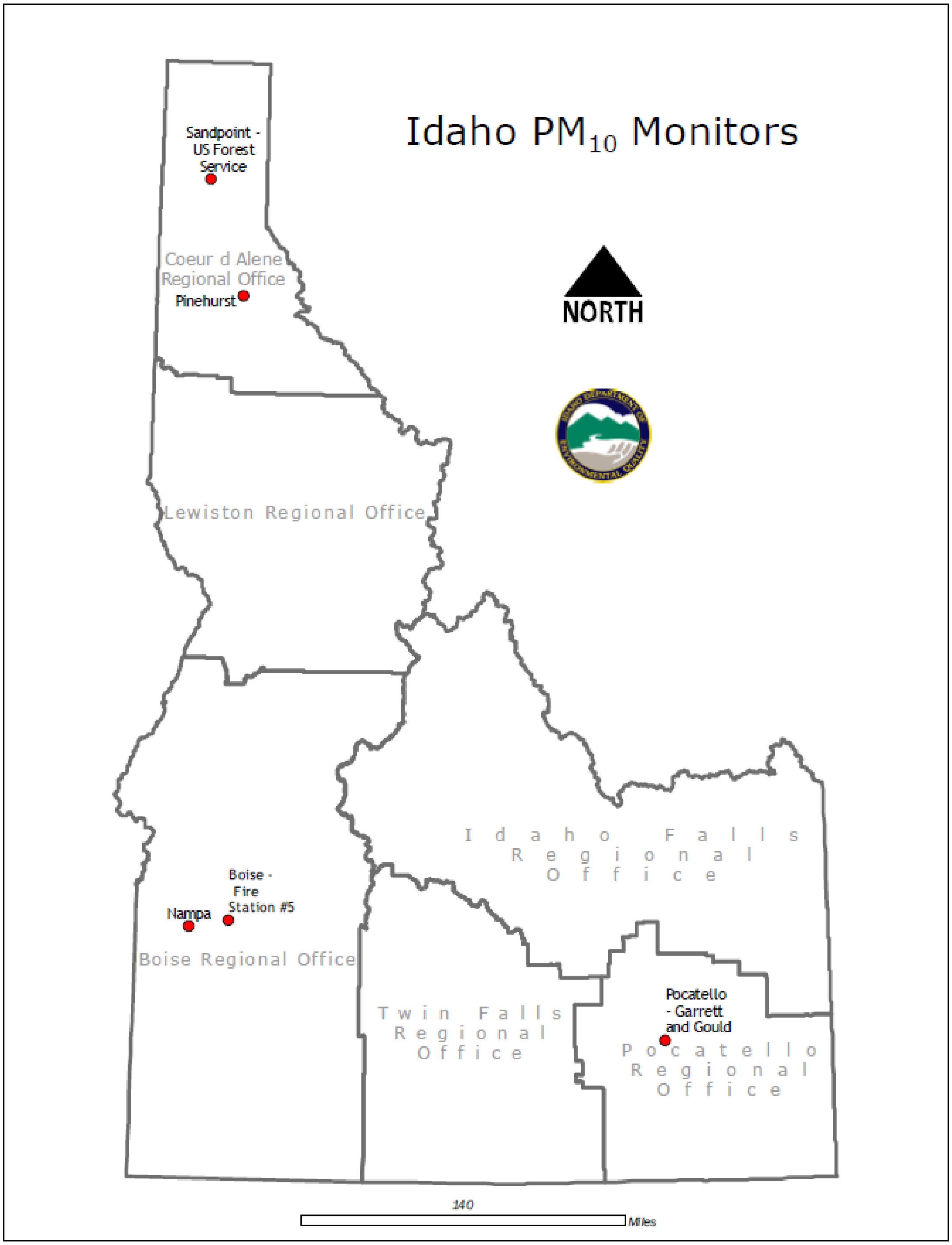


Figure D-60. Idaho's PM_{10} Monitoring Network

Design criteria for a PM_{10} network requires no more than two monitors in urban areas with populations less than one million (Code of Federal Regulations, 2009). There are two PM_{10} stations in the Boise MSA. The other three sites are in PM_{10} nonattainment areas (*Figure B-1*). Appropriate scales of representation for PM_{10} monitors are middle and neighborhood (Code of Federal Regulations, 2009). All sites are neighborhood scale except for Sandpoint, which is urban. This site's scale should therefore be reevaluated.

PM_{10} is mainly produced by industrial crushing and grinding operations, residential wood burning, and from road dust. PM_{10} also includes the $PM_{2.5}$ components such as smoke and secondary sulfate, nitrate, and organic aerosol. *Figure D-62* shows the top five point source emitters of PM_{10}. Currently, only the Pocatello site is somewhat near a significant point source. The Idaho monitors do not appear to be source-oriented. Nonpoint source emissions dominate the other EI source categories (*Figure D-63*).

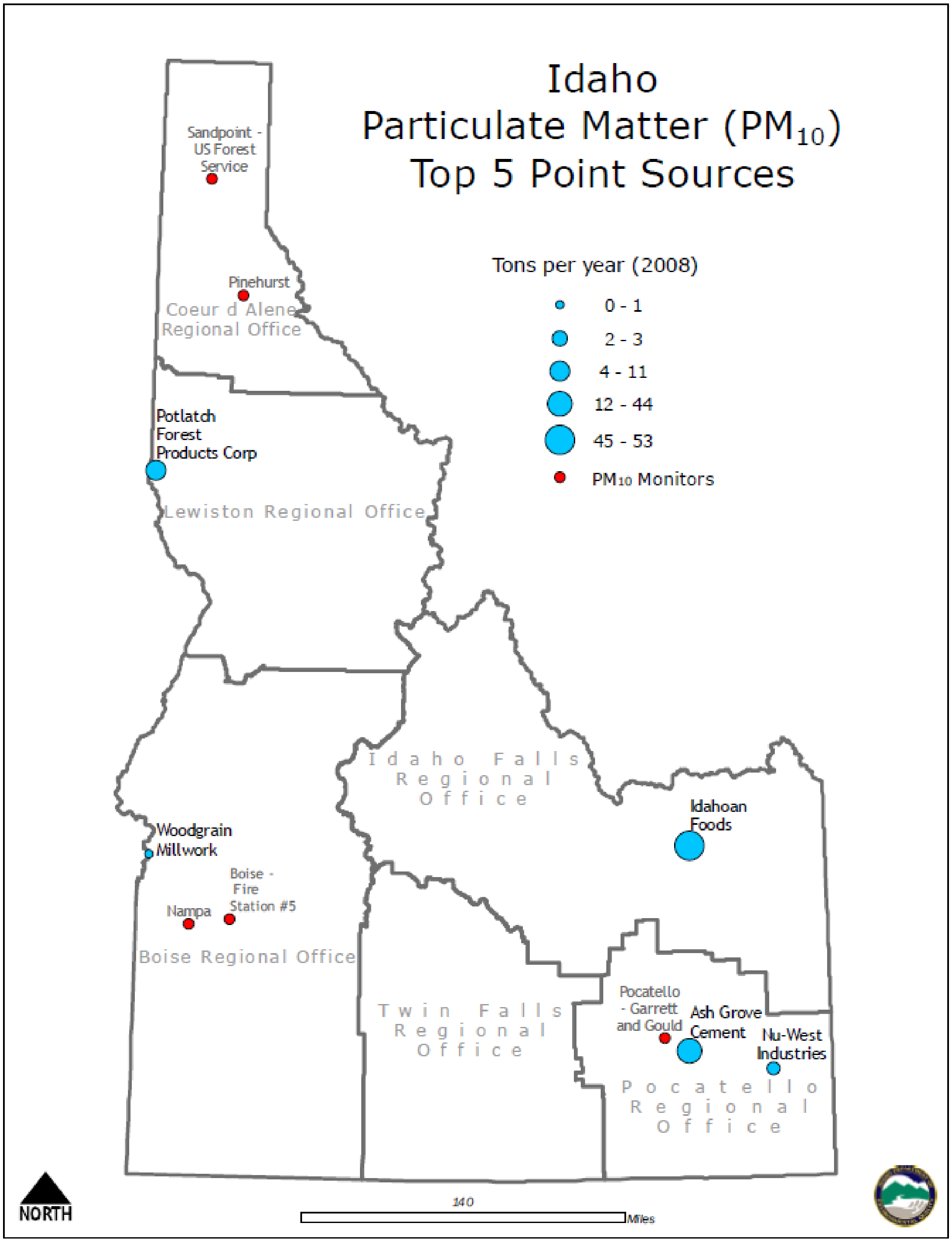


Figure D-61. Top Five PM_{10} Emissions Point Sources in Idaho

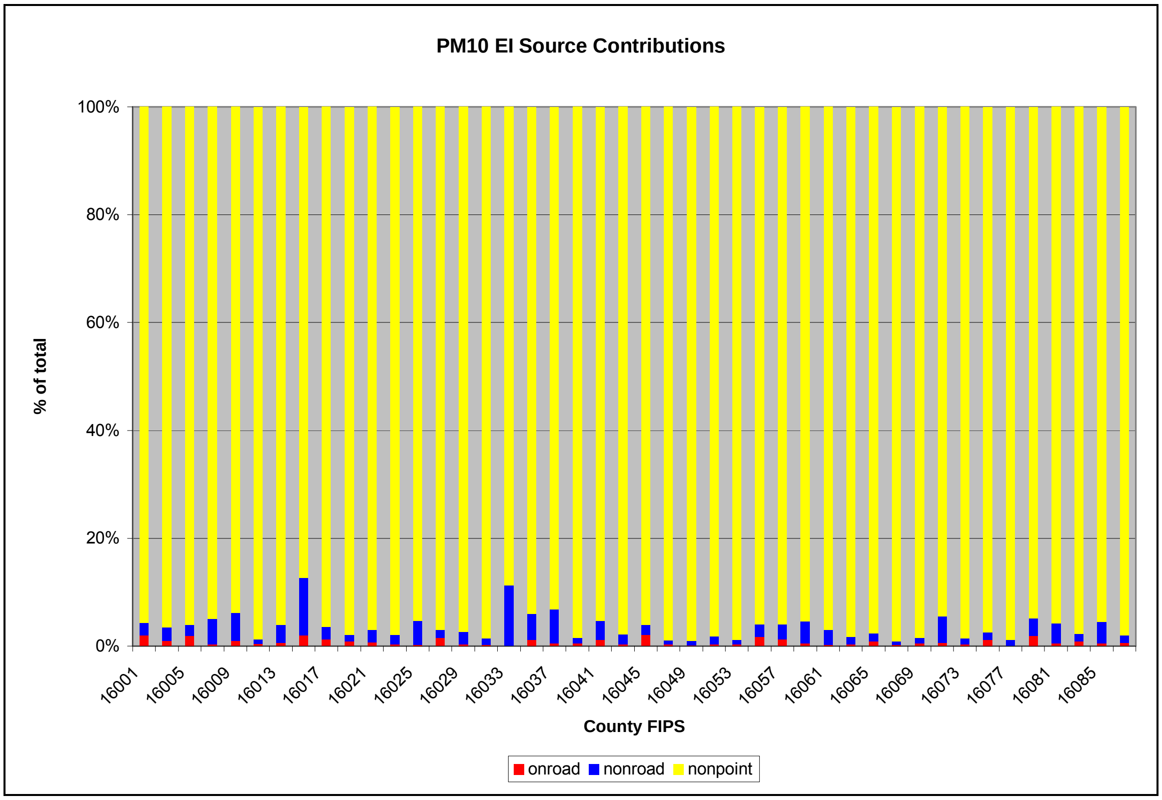


Figure D-62. PM_{10} Emissions Chart

The three emissions figures (*Figures D-63, D-64, and D-65*) show that Ada and Canyon counties have relatively high emissions for all source categories. The other emissions data representing the counties where PM_{10} monitors are located (Bonner, Shoshone, and Bannock) do not fully explain the particular local conditions that caused these areas to be declared nonattainment originally. If current source emissions are considered to represent those areas where the monitoring network should focus, then Ada, Canyon, Bingham, and Bonneville counties are where the resources should be located.

Trends in PM_{10} measurements since 1998 show Pocatello PM_{10} levels to be decreasing, Sandpoint levels holding steady well below the annual NAAQS, Boise levels increasing recently but slightly, and Nampa levels increasing significantly in recent years. The Nampa trend is likely to be skewed by the inclusion of a single high-wind event.

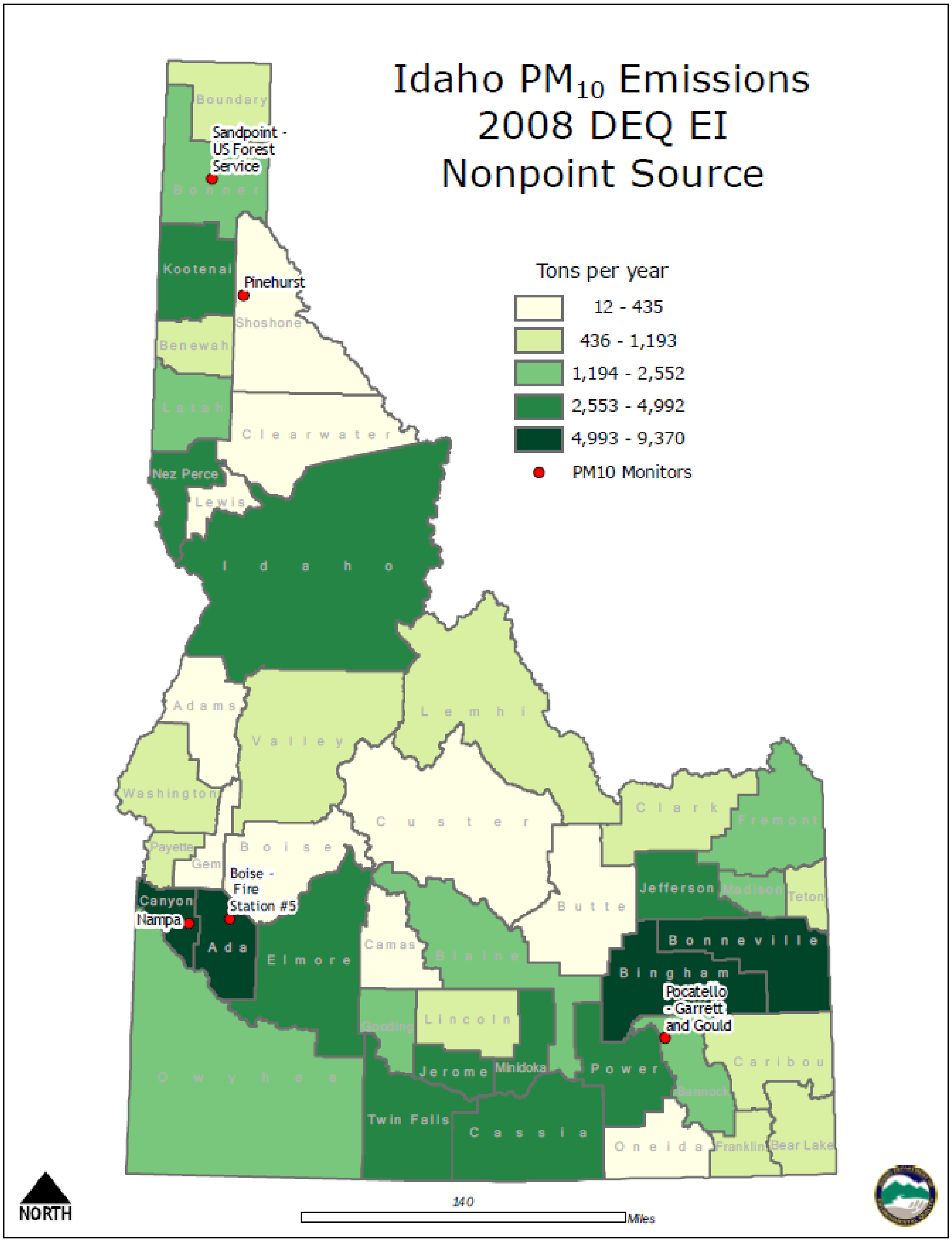


Figure D-63. County-level Nonpoint Source Emissions of PM_{10}

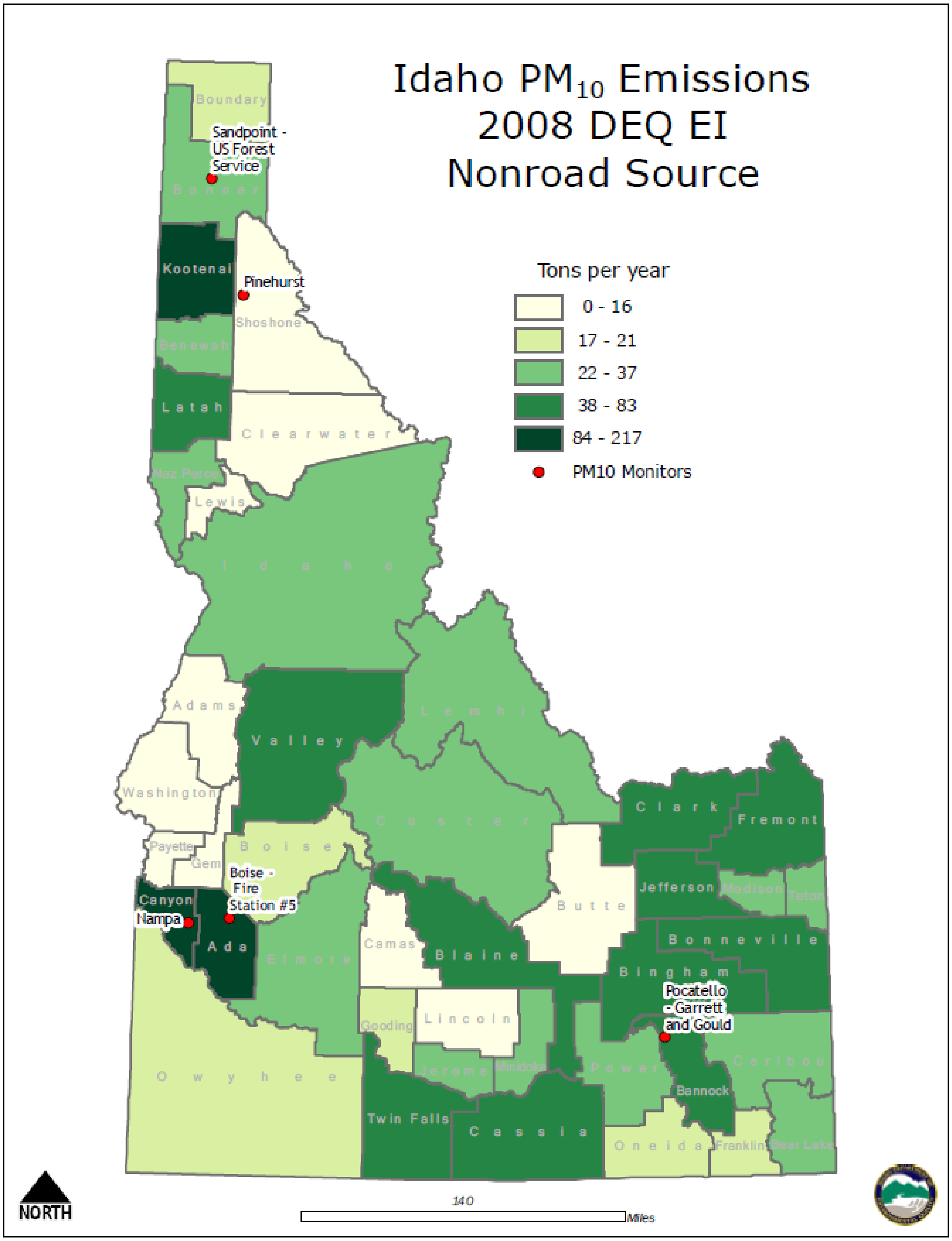


Figure D-64. County-level Nonroad Source Emissions of PM_{10}

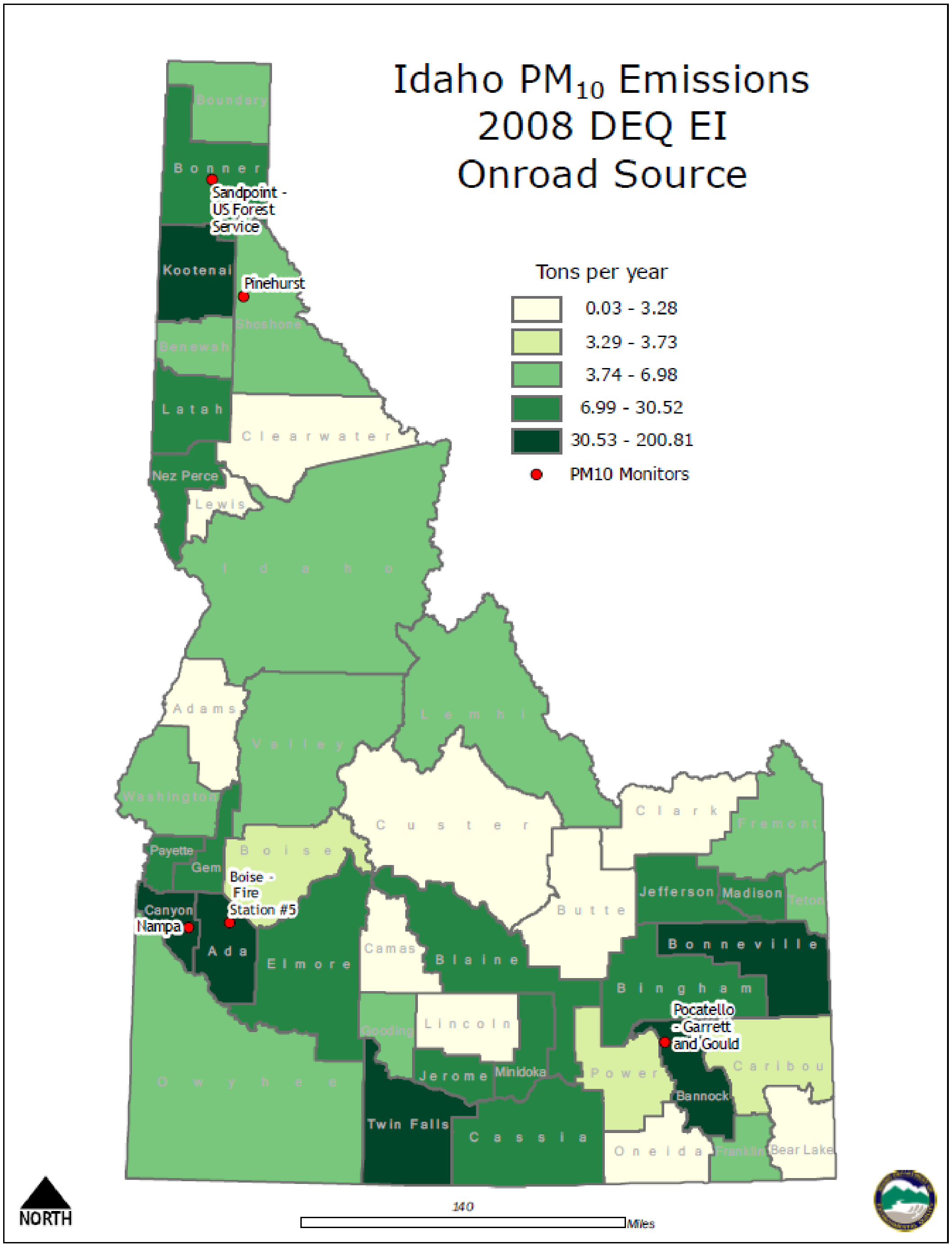


Figure D-65. County-level Onroad Source Emissions of PM_{10}

Fine Particulate Matter ($PM_{2.5}$)

Figure D-66 shows the location of $PM_{2.5}$ monitors in Idaho's network.

Network requirements for $PM_{2.5}$ monitoring call for zero or one FRM monitors in MSAs with populations between 50,000 and 500,000, depending on the design value (Code of Federal Regulations, 2009). Idaho Falls, Lewiston, Coeur d'Alene, Pocatello, and Twin Falls no longer have FRM monitors. The FRM monitors in these airsheds were discontinued due to their low design values. Monitoring continues in these airsheds with special purpose continuous monitors. In the event the continuous monitors measure 98th percentile 24-hour average concentrations within 85% of the 24-hour standard, FRM or FEM monitors will be re-installed in these airsheds.

MSAs with populations between 500,000 and one million require one or two monitors. The Boise-Nampa MSA has two. Scales of representation must be neighborhood or urban. This is the case in Idaho. Monitoring precision, determined using co-located samplers, is required at a minimum of 15% of the total number of sites, preferably at the site(s) with the highest design value(s). Idaho is required to assess precision at one site, which is the Pinehurst site. Each state must have at least one regional transport site and at least one regional background site. Two IMPROVE monitors are leveraged for these requirements: Hell's Canyon is Idaho's regional transport site, and Craters of the Moon is Idaho's regional background site. Idaho's $PM_{2.5}$ network requirements are fulfilled.

$PM_{2.5}$ is a product of smoke (wildfire, agricultural burning, residential wood burning), vehicle exhaust, and industrial combustion sources. $PM_{2.5}$ is also a secondary pollutant formed in the atmosphere by photochemical reactions involving nitrates, sulfates, ammonium, and biogenic compounds. *Figure D-67* illustrates the locations of the top five point sources of $PM_{2.5}$ in Idaho. One of the largest is in Lewiston; there is a $PM_{2.5}$ monitor there. The largest point source, Idahoan Foods, is in an area with low population. There are two other important point sources in southeast Idaho that do not have a nearby monitor.

Figure D-68 exhibits the five year annual average smoke frequency in Idaho. Calculated from MODIS satellite-detected smoke polygons (NOAA, 2010) and displayed in areas with population greater than three persons per square kilometer, the map gives the average number of days per year that smoke was detected in an area (years averaged: 2003, 2004, 2005, 2006, 2008). The origin of the smoke could be wildfire, prescribed burning, agricultural burning, or any other type large enough to be detectable by satellite. The north central area of Idaho experiences the greatest frequency of smoke, followed by northern Idaho, the Salmon River corridor from Stanley to Salmon, then south central Idaho. The far southeast area of Idaho experiences the least frequent smoke episodes. $PM_{2.5}$ monitor network coverage of high smoke areas is reasonable. There are seasonal smoke monitors operating near Bonners Ferry in northern Idaho at Copeland, Athol, and Rathdrum; at Potlatch, Kendrick, and Genessee in central Idaho; and in Weiser, Paul, Soda Springs, and Rexburg in southern Idaho. Orofino and Priest River might benefit from monitoring. New monitors in Challis and to the south of Ketchum would also be beneficial because these are areas frequently impacted by smoke. One option is EBAM wildfire $PM_{2.5}$ monitors. They can be deployed where needed within 24 to 48 hours and provide a more focused approach for wildfire-based smoke management monitoring. DEQ has six portable EBAM monitors.

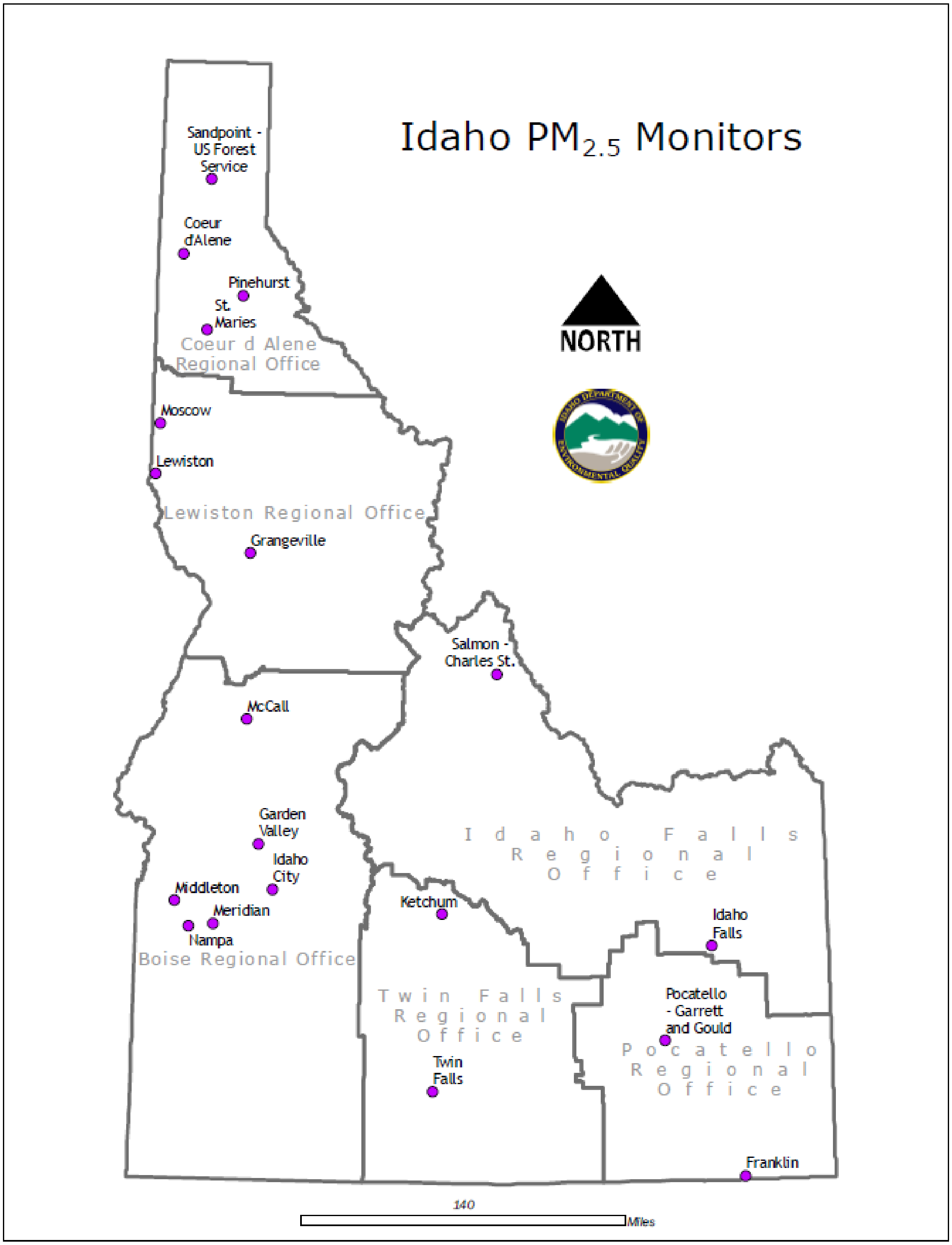


Figure D-66. Idaho's $PM_{2.5}$ Monitoring Network

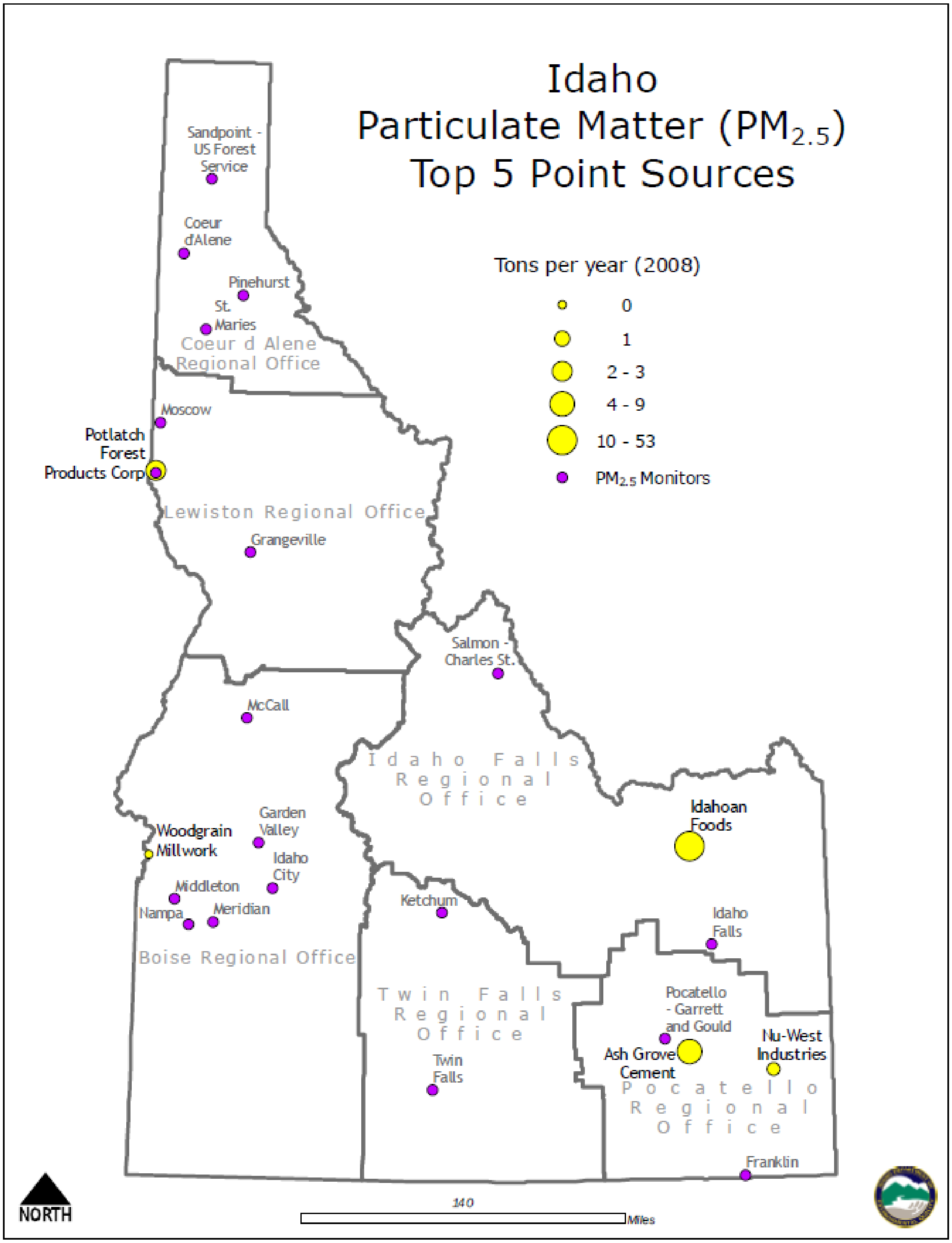


Figure D-67. Top Five $PM_{2.5}$ Emissions Point Sources in Idaho

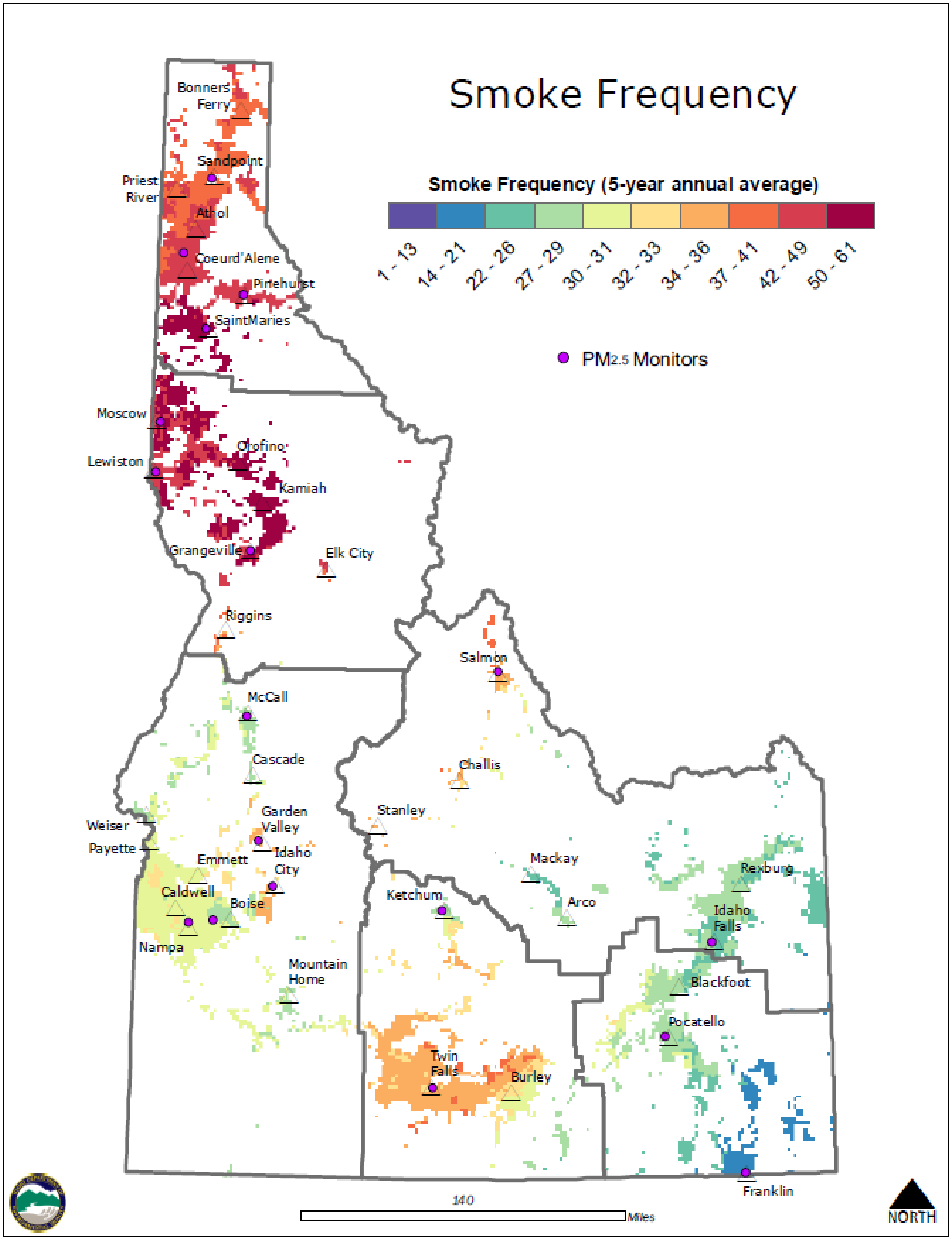


Figure D-68. Frequency of Smoke Occurrence in Idaho

Besides smoke, nonpoint emissions sources are important, as seen in *Figure D-69*. *Figure D-70* describes levels of these emissions throughout Idaho.

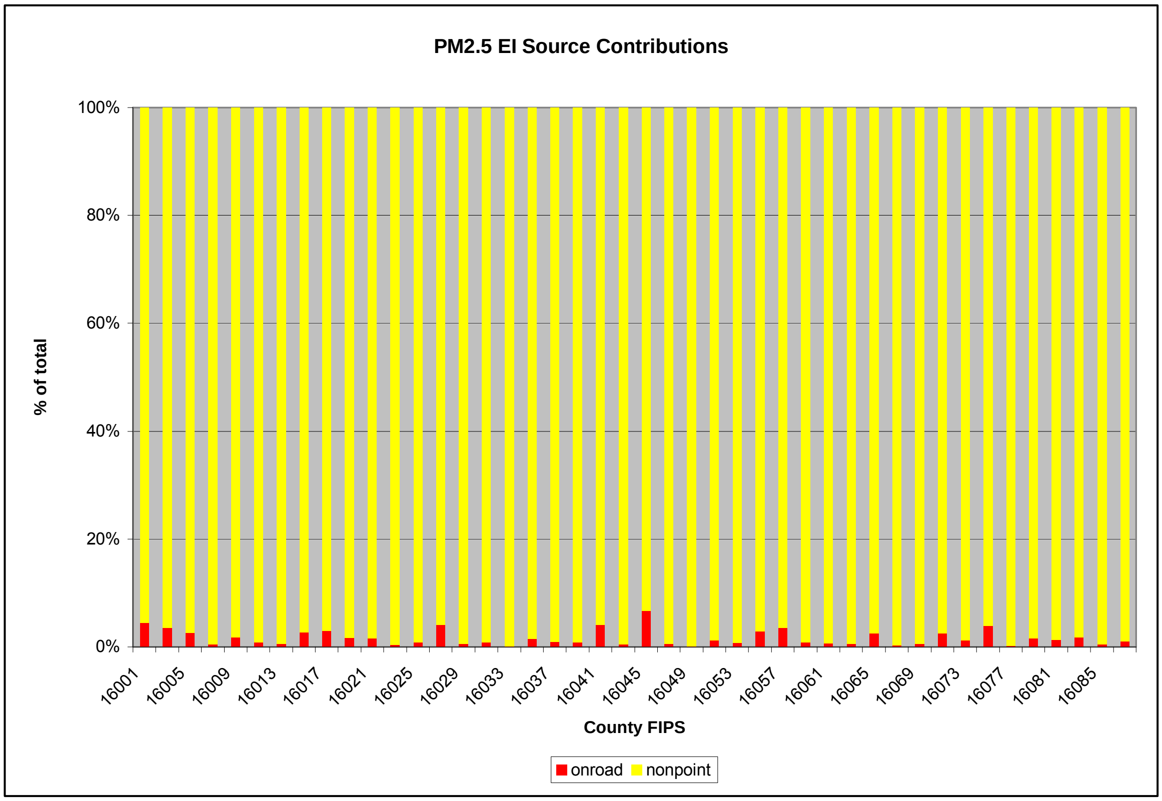


Figure D-69. $PM_{2.5}$ Emissions Chart

There are two AIRPACT model stagnation episodes available to examine for $PM_{2.5}$ concentration distributions: January 15-February 23, 2008 and January 2-January 31, 2009 (Washington State University, 2010). The 2008 and 2009 episode maximum concentrations support the current distribution of monitors (*Figure D-71* and *Figure D-72*).

The monitoring trends for $PM_{2.5}$ show why this pollutant is considered Idaho's top priority for monitoring. The 3-year average 98% daily concentrations for FRM monitors operated since 2001 show all monitors near the new federal standard and at least three sites (Salmon, Pinehurst, and Franklin) registering violations and/or exceedances.

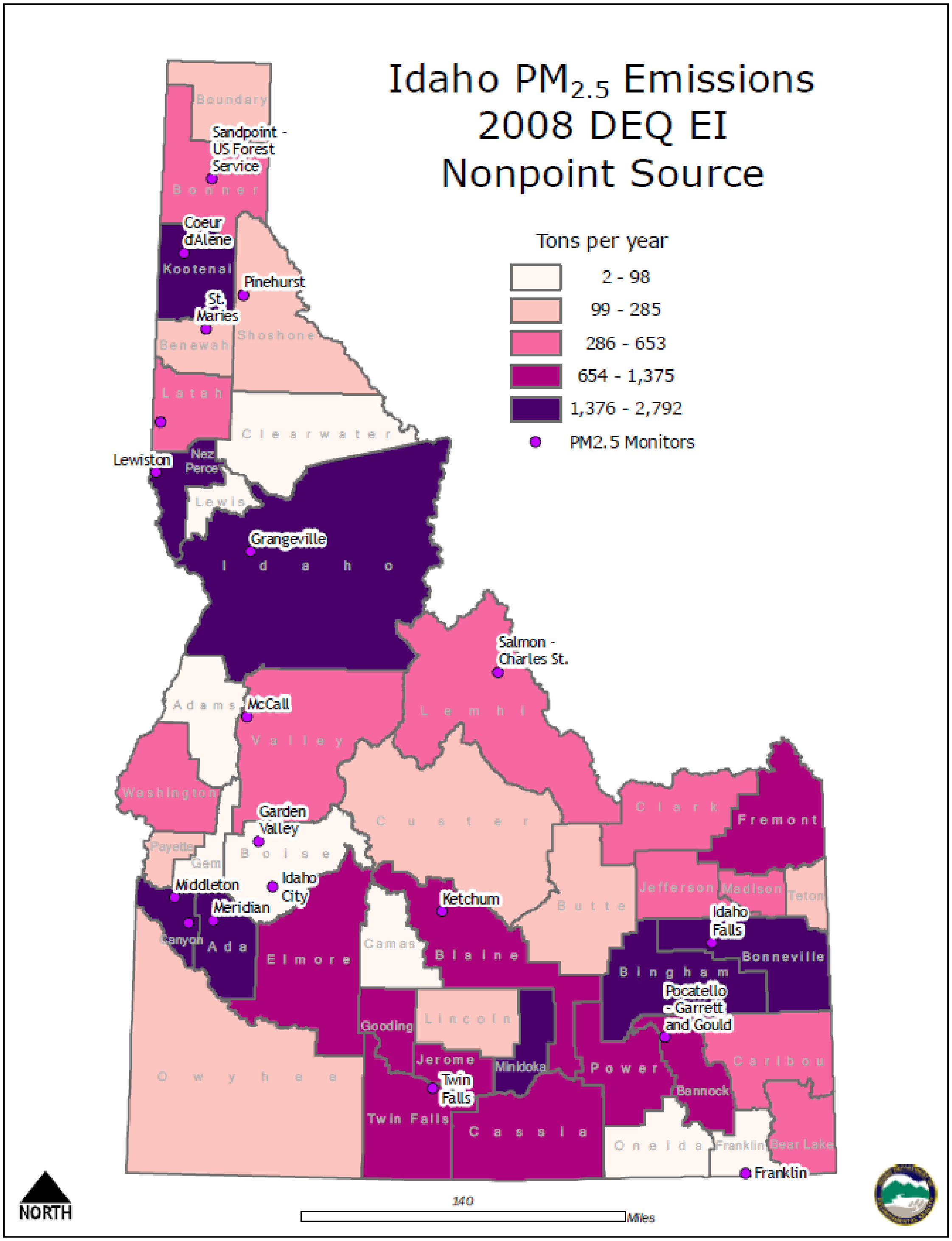


Figure D-70. County-level Nonpoint Emissions of $PM_{2.5}$

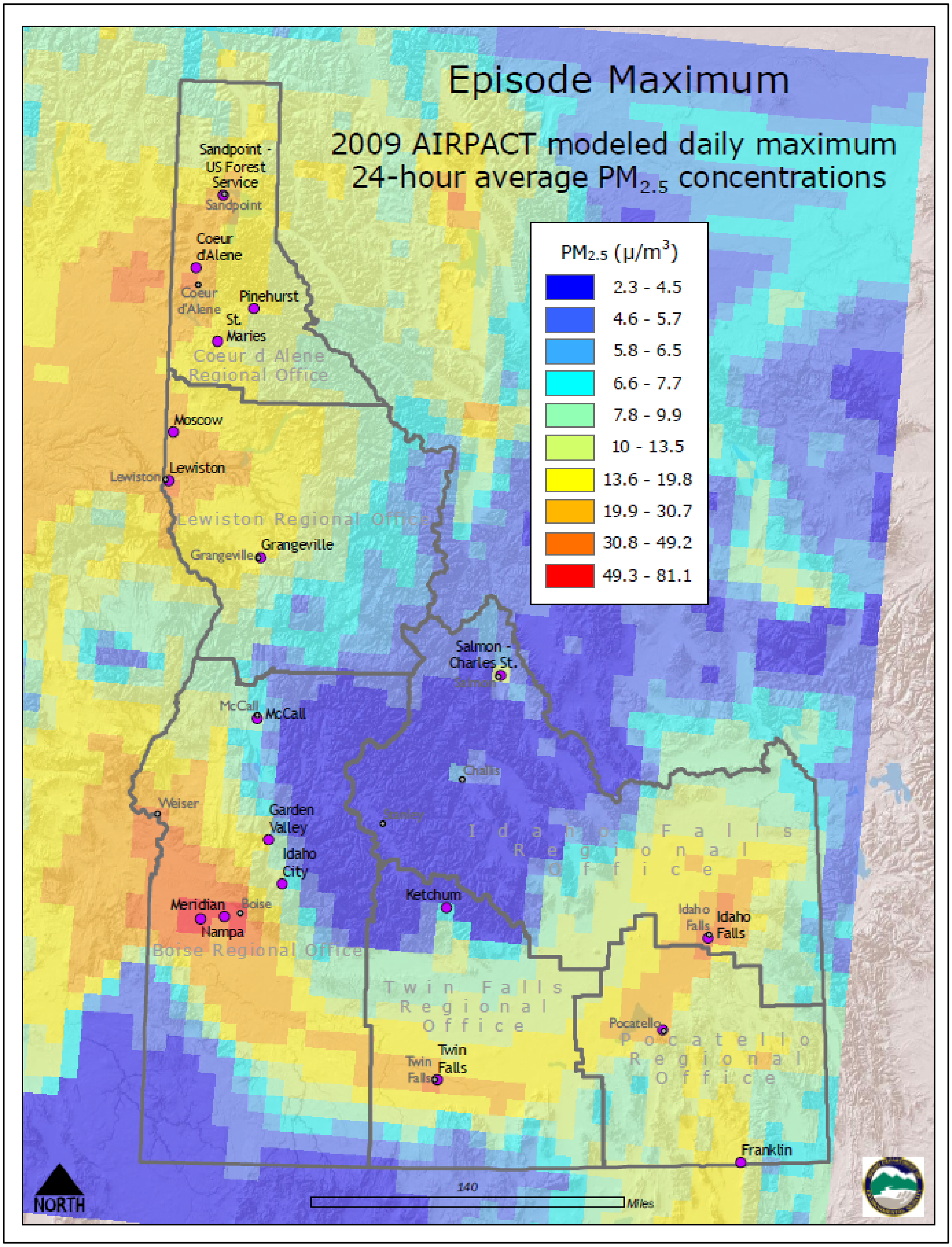


Figure D-71. AIRPACT – 2009 $PM_{2.5}$ Episode, 24-hour Maximum

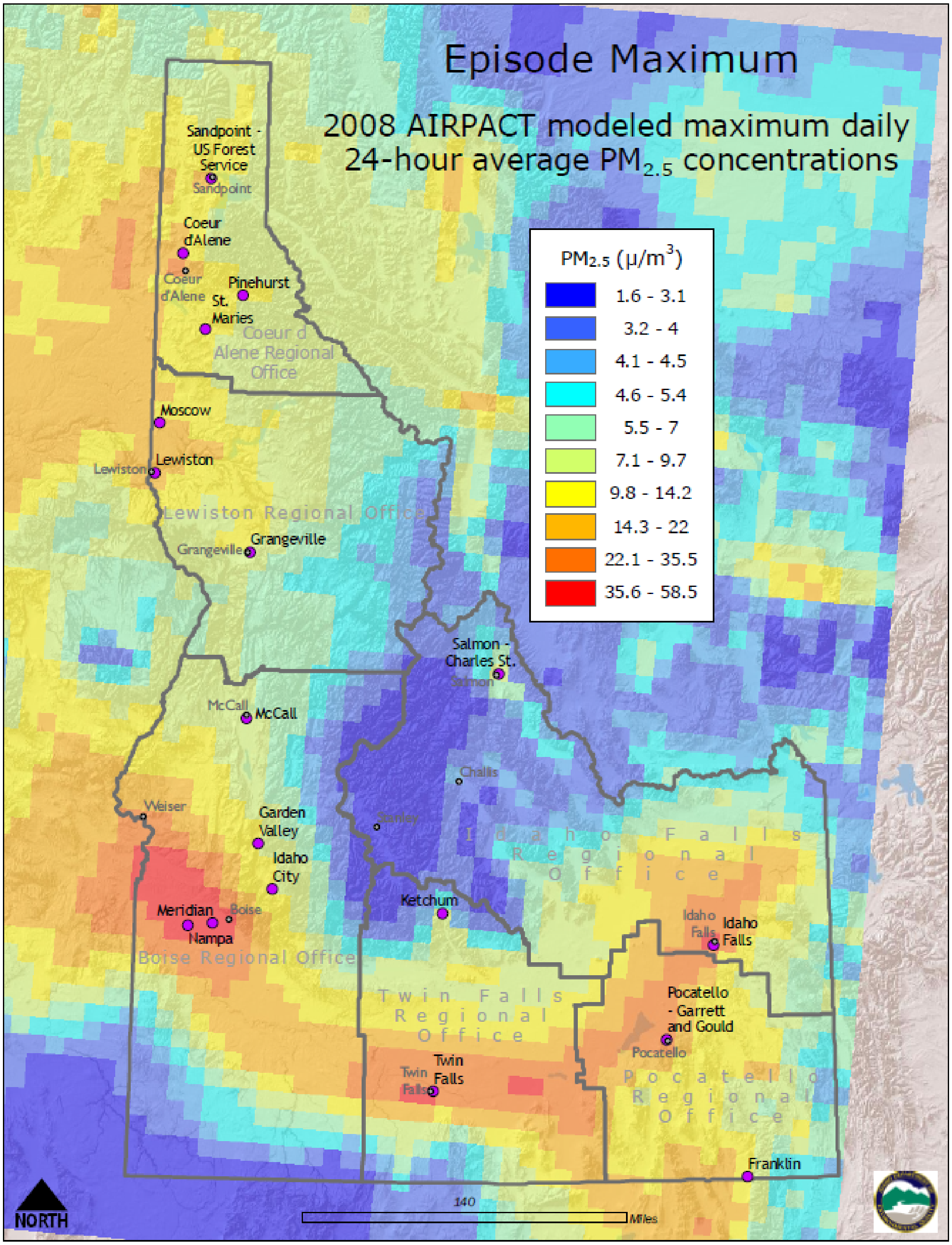


Figure D-72. AIRPACT – 2008 $PM_{2.5}$ Episode, 24-hour Maximum

Sulfur Dioxide (SO_2)

Figure D-73 shows the location of SO_2 monitors in Idaho's network.

Based on population alone, there are no minimum requirements for the number of SO_2 monitoring sites (Code of Federal Regulations, 2009). Appropriate spatial scales of representation are micro, middle, and neighborhood (Code of Federal Regulations, 2009). The Pocatello Sewage Treatment Plant site is middle scale; Soda Springs is micro scale; and Meridian, which measures trace SO_2, is neighborhood scale. Ball and Anderson (1977) state that the micro scale is only applicable for mobile monitoring, so the Soda Springs site scale should be reevaluated. Monitoring of SO_2 is required at NCore sites (Code of Federal Regulations, 2009); the Meridian NCore monitor fulfills this obligation. Except for the inappropriate scale classification at the Soda Springs site, the network requirements are fulfilled for SO_2 monitoring.

In June 2010, EPA adopted a new 1-hour SO_2 NAAQS: the 3-year average of the 99th percentile daily maximum 1-hour average concentration. The NAAQS was set at 75 ppb. At the same time, EPA revoked the 24-hour and annual primary standards. Minimum monitoring requirements according to the new standard are based on a population-weighted emissions index (PWEI). According to the PWEI, Idaho is not required to monitor SO_2. However, the new SO_2 NAAQS have provisions for modeling as a tool to assess compliance, and if subsequent modeling indicates nonattainment, then monitoring will be required as a part of the SIP process.

Monitoring of SO_2 typically focuses on measuring pollution from specific stationary sources. *Figure D-74* shows the location of the top five point sources of SO_2 in Idaho (in tons per year, 2008). The Soda Springs site monitors the fourth largest point source, P4 Production (Monsanto). The Meridian trace SO_2 monitor is in the same airshed (Treasure Valley) as Idaho's largest point source (Amalgamated Sugar), but the site is not source oriented. The Pocatello Sewage Treatment Plant monitor is in the same airshed (Pocatello) as the second largest SO_2 emitter in the state (Simplot). The locations in Idaho with the largest stationary SO_2 emissions sources appear to be adequately covered by the network.

Other than point sources, the dominant emissions category for SO_2 is nonpoint, or area, sources (*Figure D-75*). *Figure D-76* indicates that Ada and Canyon counties have significant emissions of nonpoint source SO_2, as does Bonneville County. In this case, the network does not seem to fully cover locations with high emissions of nonpoint sources.

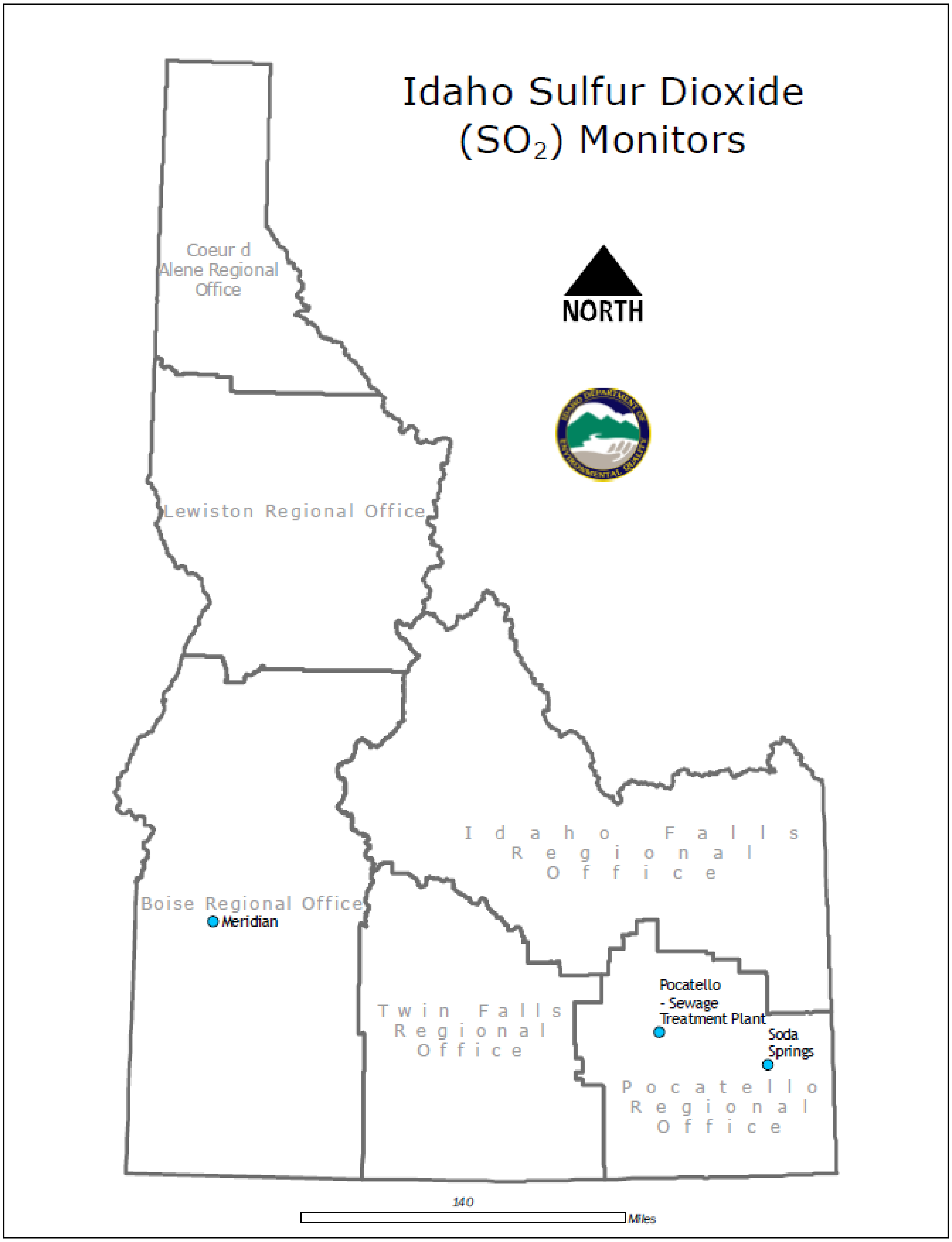


Figure D-73. Idaho's SO_2 Monitoring Network

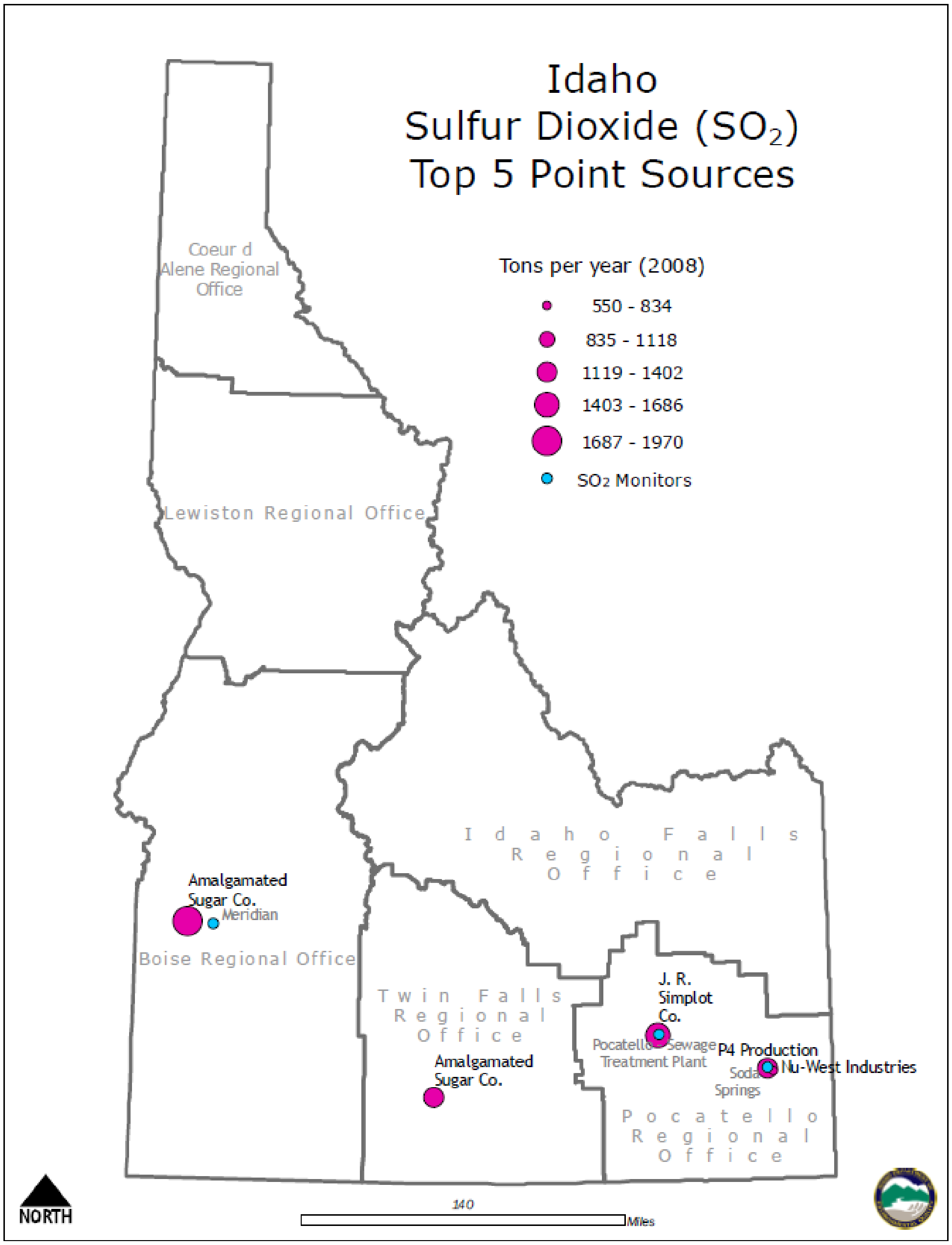


Figure D-74. Top Five SO_2 Emissions Point Sources in Idaho

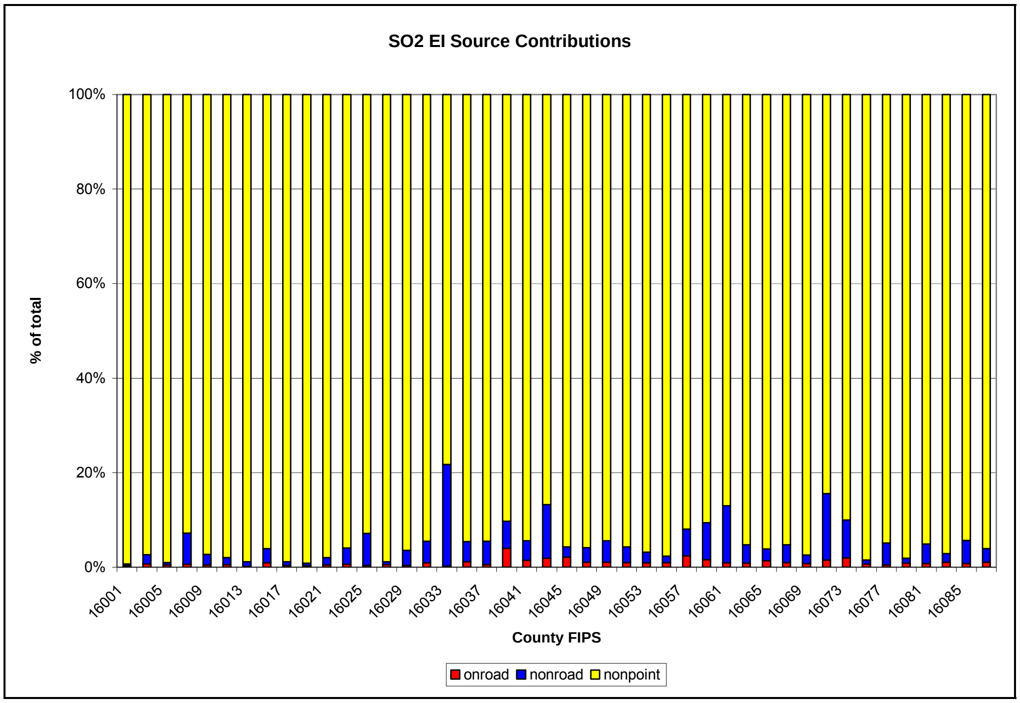


Figure D-75. SO_2 Emissions

An assessment of the SO_2 network based purely on emissions would conclude that the monitoring network is inadequate. However, if historical measured concentrations are considered, the result is not as clear. Since 2002, SO_2 concentrations measured in Pocatello and Soda Springs have remained well below the annual, 24-hour, and 3-hour NAAQS. Trends have remained steady, except for a spike at Soda Springs in 2007. These trends are predicted to continue. Compared to the 2010 SO_2 NAAQS of 75 ppb, the Soda Springs 2007-2009 design value is 40 ppb (53% of NAAQS), and the Pocatello 2007-2009 design value is 64 ppb (85% of NAAQS). These trends will be considered in the final ranking along with the emissions assessment and other priorities.

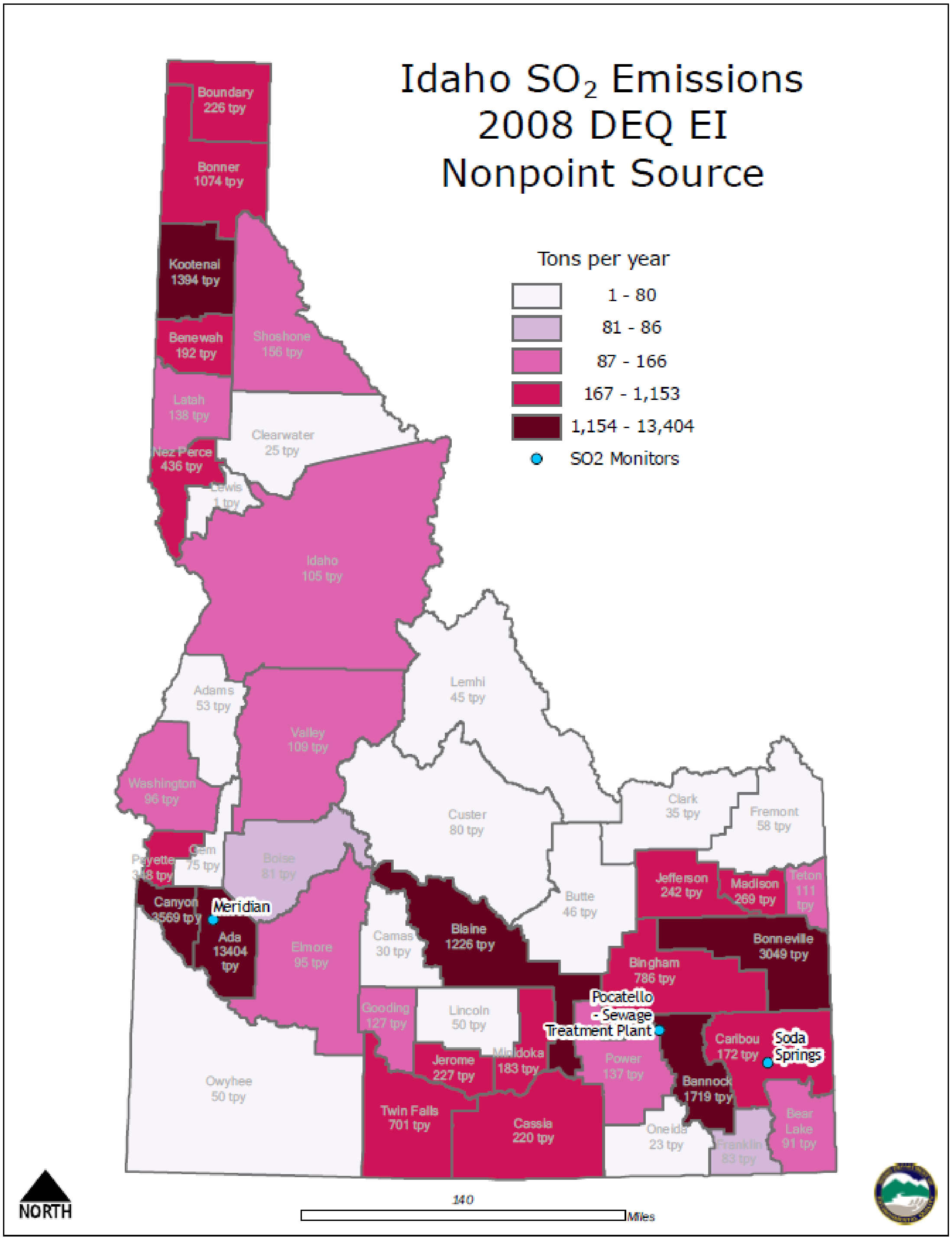


Figure D-76. County-level Nonpoint Source Emissions of SO_2

D.4 Network Assessment: Summary and Site Ranking

This section briefly summarizes the network assessment, then provides the site rankings in one table, and all the site recommendations in another table.

Summary of Network Assessment

The network assessment section analyzes Idaho's monitoring network at three spatial scales and presents a site ranking. Individual sites are assessed at the site scale by examining the scales of representation, demographics, geography, meteorology, and monitoring objectives. At the airshed scale, only one airshed within Idaho maintains multiple monitors that measure the same pollutant, the Treasure Valley airshed, which is investigated at the airshed scale by exploring recent and projected demographic shifts within the airshed. At the statewide scale, the network is examined by pollutant; for each criteria pollutant the network requirements, sources of emissions, and modeled concentrations are considered.

The site ranking matrix weighs categories of values determined to be important by Idaho DEQ. The result applies one of four value categories to each site: critical, high, moderate, or low (*Table D-1*).

Table D-2 summarizes the recommendations from each of the network assessment sections and provides a final recommendation for each site. One site is recommended for relocation and five sites will require a reevaluation of their scales of representation. One site is recommended to begin monitoring ozone. Another site requires a reexamination of the monitoring objectives and pollutants monitored in order to reconcile seasonality and interaction of pollutants and meteorology at the site.

Overall, Idaho operates an efficient monitoring network with limited resources, so no sites are recommended for termination. If, in the future, Idaho needs to remove a monitor, those sites assigned a Low value in the Site Ranking should be targeted first. Should funds become available to deploy new monitors, those locations frequently impacted by smoke which lack $PM_{2.5}$ monitors, such as Orofino, Priest River, Challis, or Shoshone, should be prioritized.

Table D-1. DEQ Ambient Air Monitoring Network Site Ranking

	Site required for NAA?	Site required for NAAQS?	Site required for permit?	Monitor leveraged for agricultural smoke management?	Standalone monitor?	Site paired with met station?	Site uses multiple measurement methods (FRM, TEOM, BAM)?	Site has long-term record?	Site used for modeling?	# of days over 50 on AQI (% of total AQI days)	# of days over 100 on AQI (% of total AQI days)	Population served?	*# hits e-f-h-i-j (weighted)*	*Rank of # weighted hits*	*Rank yellow AQI days*	*Rank population Served*	*Site Value*	Site Value	Site
Middleton						1			1	16.79	0.36	599,753	*1.25*	*7*	*1*	*1*	*3.0*	*High*	Middleton
Lewiston				1	1	1		1	1	2.77	0	60,395	*3.50*	*1*	*8*	*5*	*4.7*	*High*	Lewiston
Boise ITD										16.79	0.36	599,753	*0.00*	*12*	*1*	*1*	*4.7*	*High*	Boise ITD
Twin Falls				1	1	1		1		3.34	0	94,752	*2.75*	*4*	*7*	*4*	*5.0*	*Moderate*	Twin Falls
Idaho Falls				1	1					4.09	0	122,995	*1.50*	*6*	*6*	*3*	*5.0*	*Moderate*	Idaho Falls
Moscow				1	1	1		1	1	0.8	0	35,906	*3.50*	*1*	*10*	*6*	*5.7*	*Moderate*	Moscow
Grangeville				1	1	1		1	1	0.84	0	15,448	*3.50*	*1*	*9*	*8*	*6.0*	*Moderate*	Grangeville
St. Maries				1	1		1	1		7.97	0	9,352	*2.50*	*5*	*5*	*9*	*6.3*	*Moderate*	St. Maries
McCall					1					8.8	0	8,862	*0.75*	*8*	*3*	*10*	*7.0*	*Low*	McCall
Ketchum					1					no data	no data	21,731	*0.75*	*8*		*7*	*7.4*	*Low*	Ketchum
Idaho City					1					8.27	0.75	7,504	*0.75*	*8*	*4*	*11*	*7.7*	*Low*	Idaho City
Garden Valley					1					0	0	7,504	*0.75*	*8*	*11*	*11*	*10.0*	*Low*	Garden Valley
Weight				0.75	0.75	0.50	0.25	0.75	0.75					0.33	0.33	0.33	1		Weight
Boise Eastman Garage	x (CO)																	*Critical*	Boise Eastman Garage
Boise Fire Station #5	x (PM_{10})																	*Critical*	Boise Fire Station #5
Boise White Pine Elementary		x (O_3)																*Critical*	Boise White Pine Elementary
Coeur d'Alene		x (O_3)																*Critical*	Coeur d'Alene
Franklin	x ($PM_{2.5}$)																	*Critical*	Franklin
Meridian		x ($PM_{2.5}$)																*Critical*	Meridian
Nampa		x ($PM_{2.5}$)																*Critical*	Nampa
Pinehurst	x (PM_{10})																	*Critical*	Pinehurst
Pocatello Garrett and Gold	x (PM_{10})																	*Critical*	Pocatello Garrett and Gold
Pocatello Sewage Treatment Plant			x															*Critical*	Pocatello Sewage Treatment Plant
Salmon		x ($PM_{2.5}$)																*Critical*	Salmon
Sandpoint	x (PM_{10})																	*Critical*	Sandpoint
Soda Springs			x															*Critical*	Soda Springs
		Required, therefore don't rank																	

Table D-2. Final Site Recommendations

	Recommendations				
Site	**Site Scale**	**Airshed Scale**	**State Scale**	**Site Ranking**	**Final**
Boise Eastman Garage			reevaluate scale (micro to middle)	Critical	**Keep; reevaluate scale (micro to middle)**
Boise Fire Station #5				Critical	**Keep; reevaluate scale (micro to middle)**
Boise ITD		move to Eagle		High	**Keep, but possibly relocate within Treasure Valley airshed**
Boise White Pine Elementary				Critical	**Keep**
Coeur d'Alene				Critical	**Keep**
Franklin	reevaluate scale (urban to neighborhood)			Critical	**Keep; reevaluate scale (urban to neighborhood)**
Garden Valley	reevaluate scale (neighborhood to urban)			Low	**Keep; reevaluate scale (neighborhood to urban)**
Grangeville				Moderate	**Keep**
Idaho City				Low	**Keep**
Idaho Falls				Moderate	**Keep**
Ketchum				Low	**Keep**
Lewiston				High	**Keep**
McCall	reevaluate scale (neighborhood to urban)			Low	**Keep; reevaluate scale (neighborhood to urban)**
Meridian				Critical	**Keep**
Middleton	drop one objective for $PM_{2.5}$; change pollutant monitored to O_3 from $PM_{2.5}$ if site type to remain regional transport			High	**Keep; drop one objective for $PM_{2.5}$; change pollutant monitored to O_3 from $PM_{2.5}$ if site type to remain regional transport**
Moscow	reevaluate scale (neighborhood to urban)			Moderate	**Keep; reevaluate scale (neighborhood to urban)**
Nampa		begin to monitor O_3		Critical	**Keep; add O_3 if funds allow**
Pinehurst				Critical	**Keep**
Pocatello Garrett and Gold				Critical	**Keep**
Pocatello Sewage Treatment Plant	normalize scale to match Soda Springs			Critical	**Keep; scale should remain middle**
Salmon				Critical	**Keep**
Sandpoint			reevaluate scale (urban to neighborhood)	Critical	**Keep; reevaluate scale (urban to neighborhood)**
Soda Springs	normalize scale to match Pocatello STP		reevaluate scale (micro to middle)	Critical	**Keep; reevaluate scale (micro to middle)**
St. Maries				Moderate	**Keep**
Twin Falls				Moderate	**Keep**

E. TECHNOLOGY

The ambient air monitoring network in Idaho is comprised of several types of monitors that have been purchased over time to meet monitoring needs. Because monitoring equipment is often exposed to weather directly or operates continually instrument lifetime is generally accepted as seven years of service. As budget allows, replacement equipment is purchased on a cycle as close to every seven years as possible.

E.1 Ambient Air Monitoring Methodology

The analytical method employed for a specific criteria pollutant evaluation is dependent upon the monitoring technology used. For the gaseous criteria pollutants, SO_2, CO, NO_x, and O_3, the analyzers are designed as completely contained monitoring units that do not require additional analysis to establish the pollutants' environmental concentrations. For the particulate matter criteria pollutants, PM_{10} and $PM_{2.5}$, some of the units use analytical methods that establish concentrations within a self-contained system while other units require the use of additional analytical methods that evaluate the captured sample in order to establish the pollutant concentrations present in the environment.

Methods

In general, DEQ employs the following measurement methods:

Non-dispersive Infrared Photometry for Carbon Monoxide (CO) — The detection and measurement of CO utilizes this chemical's propensity to absorb infrared (IR) radiation at wavelengths near 4.7 microns. Broadband IR radiation is generated using a high-energy heated element. The IR radiation is modulated using gas filter correlation technology. Gas filter correlation uses a rotating wheel containing two gas-filled cells that selectively modulate the IR radiation. One cell contains nitrogen (the measure cell), while the other contains CO (the reference cell). Concentrations are proportional to the differences observed between the two cells.

Fluorescence for Sulfur Dioxide (SO_2) — The physical principle used in SO_2 molecule measurement relies on exciting an electron shell, which occurs in the presence of a specific wavelength (214 nanometers [nm]) of ultraviolet (UV) radiation, and the subsequent relaxation which produces a photon of light. A photo multiplier tube allows the light emissions to be measured as the SO_2 molecule returns to the ground state. The intensity of this light is proportional to the quantity of SO_2 present in the sample.

Chemiluminescence for Oxides of Nitrogen (NO, NO_2, NO_x, NO_y) — The principle of measurement is based upon the reaction of a nitrogen monoxide (NO) molecule with an internal source of O_3 in an evacuated reaction cell that results in the emission of light. The resulting light emitted by the reaction is monitored and correlated to the concentration of NO in the sample.

Secondary measurement of other oxides of nitrogen (NO_2, NO_x, NO_y) is accomplished by catalytic conversion of those species to NO during a separate measurement cycle.

Ultraviolet Photometry for Ozone — The physical principle used to measure ozone relies on the absorption of UV radiation by the O_3 molecule at approximately 255 nm. The concentration of ozone present in the sample stream is proportional to the amount of light absorbed.

Time-integrated Samplers for Particulate Matter — This methodology uses precisely weighed filters that are placed in a carefully controlled volumetric flow for a specified period of time. The combination of flow and duration identify a controlled volume that has passed through the clean filter. The mass added to the filter, determined by subsequent weighing, determines the particulate concentration of the air. Further speciation analysis is occasionally used to characterize the composition of the particulate matter. Intermittent filter-based methods require the use of an independent analytical testing laboratory that DEQ contracts with for these services.

Continuous Operation for Particulate Matter — Multiple techniques are used for the near-real-time measurement of particulate matter.

Tapered Element Oscillating Microbalance (TEOM) — The TEOM units use an inertial mass measurement technique for making real time direct measurement of particle mass collected on a filter. This measuring equipment can determine the fine changes in mass that accumulate on the filter through changes in the frequency of the filter oscillations.

Nephelometry — Light is emitted from an internally mounted, variable-rate flashing light source. The light's wavelength is limited by an optical filter to 475 nm. Particulate concentrations are proportional to the amount of light scattered onto the optical detector.

Beta-attenuation — In a beta-attenuation monitor (BAM), a small Carbon-14 element emits a constant source of high-energy electrons known as beta particles. An external pump pulls a measured amount of dust-laden air through a filter tape. The difference in the attenuation of the beta particle signal before and after particle accumulation is proportional to the particulate concentration in the air.

E.2 Monitoring Technology Benefits and Challenges

Over time, advancements in technology have provided both benefits and challenges for monitoring organizations. Benefits of advances include the availability of near "real-time" instruments available from multiple manufacturers for nearly all pollutants. Real-time instruments provide very timely feedback on ambient concentrations making the feedback more useful for public health advisories.

Additionally, modern computing and digital capabilities are increasingly being integrated into instruments, which provides more reliable access to measurements and instrument diagnostic and control information. Combined with data acquisition or "smart DAS" systems, significant efficiencies and quality improvement processes can be implemented at monitoring organizations.

The advances do not come without challenges. Due to the increasing complexity and sophistication of monitoring instruments, purchase costs have increased dramatically. Because of this, monitoring organizations tend to acquire new instrumentation in small increments resulting in a monitoring network with instruments of significantly varying maturities and capabilities. This increases operational complexity in technical infrastructure, procedure development, and equipment maintenance.

Additionally, technology advances at a rate exceeding that of EPA's ability to evaluate and approve a given technology for use in determining NAAQS compliance. Agencies are left in a position of choosing to stay with older technology that is approved, or to implement new technology that may be less expensive to acquire and be more mature in its capabilities but may not be approved and applicable to agency monitoring objectives. DEQ uses only EPA-approved federal equivalent (FEM) or federal reference method (FRM) methods for determining pollutant concentration for all NAAQS compliance determinations. However, for special-purpose monitoring (such as smoke monitoring or community-specific AQI determination), DEQ generally does not use an FEM or FRM method for measurement. This limits DEQ's ability, should the need arise, to use the data collected to demonstrate NAAQS compliance in those areas.

Measurement of the gaseous pollutants (CO, SO_2, NO_2, O_3) requires the use of specialized equipment, and considerations for calibration and proper operation. Gas calibrators and pure air (zero-air) are required to provide known concentrations of each pollutant for calibration and quality control checks. Calibrators, certified pollutant standards, and zero-air sources are selected for use at a particular monitoring site and for particular pollutants based on careful consideration of their ability to fulfill monitoring objectives.

Concentrations for certified pollutant gas cylinders are carefully chosen to ensure that they can be used for calibrations and instrument checks within the instrument linear operating ranges. Careful consideration must include delivery volume capabilities of the zero-air source and dilution ratios of the calibrator. Additionally, pollutant concentrations in cylinders must be sufficient that they maintain concentration stability for a useful period.

Zero-air systems are capable of delivering a minimum of 10 liters/min of air that is free of ozone, NO, and NO_2; free of SO_2 to 0.001 ppm; and free of CO and non-methane hydrocarbons to 0.1 ppm.

DEQ uses certified zero-air canisters obtained from Scott Marrin, Inc. (6531 Box Springs Blvd. Riverside, CA). Ultra Pure air is certified to the following specifications:

Total Hydrocarbon (THC)	< 0.01 ppm
CO	< 0.01 ppm
NO_x	< 0.001 ppm
SO_2	< 0.001 ppm

In situations in which high volumes of zero-air are used, zero-air generators are used. Zero-air generators are maintained according to the manufacturer's recommendations using defined procedures in order to provide a consistent and reliable source of zero-air.

Ideally, zero-air generator outputs are compared to National Institute of Science and Technology (NIST) certified pollutant-free air, typically from pressurized canisters. Direct comparisons can only be made by introducing air from both zero-air generators and certified pollutant-free air to an instrument measuring pollutants. Any difference in response for the two air sources on the instrument represents differences in impurities. When zero-air generator outputs are comparable to the certified zero–air, the generator is certified to deliver pollutant-free air. Because DEQ does not have separate monitoring equipment that can be used to certify zero-air sources as pollutant-free, zero-air generator outputs are checked using field-deployed equipment which increases down-time for that equipment.

All instrument calibrations are performed using NIST-traceable standards to ensure that the ambient air quality and meteorological data meets DEQ and EPA quality objectives.

Traceability is ensured by:

- Using standards for calibration that are purchased and re-certified by vendors with accredited NIST-traceable calibration processes;
- Using certified gas mixtures that meet EPA Protocol gas requirements for both traceability and stability;
- Retaining primary and transfer standard calibration certificates as part of the quality control documentation process;
- Using internally certified transfer standards that are certified against NIST-traceable primary standards in accordance with approved standard operating procedures (SOPs);
- Ensuring that ASTM Class 1 weights are used by the Bureau of Laboratories to calibrate and check the filter-processing balances; and
- Documenting calibration procedures and frequency requirements in pollutant-specific or technique-specific Standard Operating Procedures.

DEQ maintains an air monitoring workshop where parts and supplies are inventoried. Recently DEQ has expanded the use of the workshop to assist with managing the many complexities of operating an ambient air quality monitoring network. The workshop operations have been expanded to the degree currently possible to include:

- Equipment storage;
- A staging area for consumables, parts, and supplies;
- Certification of equipment for field-readiness;
- Equipment performance testing and initial acceptance;
- Field-operator training; and
- Procedure development.

E.3 Ambient Air Monitoring Technology Needs

Idaho ambient air quality monitoring efforts would benefit greatly through investment in additional technology. The following are areas offering the greatest benefits:

Robust network of FEM monitors for special purpose / AQI monitoring. Most monitors in operation for AQI forecasting purposes are not FEM or FRM designated monitoring methods and therefore data cannot be used to demonstrate compliance with NAAQS. Investment in FEM designated equipment, as equipment is replaced or upgraded, will provide the added opportunity to demonstrate NAAQS compliance in many more communities around the state.

Trace-gas calibrator for St. Luke's Meridian NCore monitoring site. Trace-gas monitoring measures pollutants at very low ambient concentrations. Many gaseous standards are not able to be prepared at very low concentrations without losing stability and usefulness over time. Special calibrators capable of diluting stable gas mixtures for instrument calibration, method detection limit determinations, and quality control checks have recently become available to address short-comings and challenges of previous calibrators. Acquiring a new three (3) MFC calibrator for use at the NCore site will provide improved operational efficiency and improve the quality of measurements.

Addition of real-time $PM_{2.5}$ FEM in Treasure Valley. $PM_{2.5}$ precursor studies in the Treasure Valley demonstrated that secondary aerosols contribute significantly to the total $PM_{2.5}$ concentrations particularly during winter-time inversion episodes. These secondary aerosols are often lost during the manual handling and processing of samples collected by filter-based FRM measurement methods. Recently, real-time FEM monitors have been approved that are less prone to secondary aerosol loss. Acquiring and operating a real-time FEM in the Treasure Valley will determine the significance of secondary aerosols and identify any "under-measurement" by filter-based FRM monitors.

Measurement of oxides of nitrogen (NO_x) and real-time measurement of volatile organic compounds (VOC) at ozone monitoring sites. Ozone is formed by reaction between oxides of nitrogen (NO_x) and VOC compounds in the atmosphere. Currently DEQ is only monitoring NO_x at some ozone sites. Data demonstrating the relationship between NO_x, VOCs, and ozone at each site will provide valuable information on which control strategies are most appropriate to address ozone formation in the various areas.

Continued expansion of DEQ's air quality monitoring laboratory and workshop . The air quality workshop has successfully been expanded to support the monitoring network by providing a central location for training, equipment acceptance and readiness testing, and procedure development. Several instruments are deployed to the field and are not available at the workshop. This makes support more difficult and requires added downtime of field-deployed monitors for other uses such as training, testing, procedural development, and supplemental QA/QC procedures that could be performed at the workshop.

F. CROSS-CUTTING NETWORK CONSIDERATIONS

F.1 Program Standardization

Standardization of equipment and process offers many advantages to monitoring agencies. Due to the complexity and sophistication of analyzers, telecommunications equipment, data management systems, and other operational processes, efficiencies can be achieved and quality improved. However, the practicality of standardization offers challenges.

Because of budget constraints, monitoring organizations tend to acquire new instrumentation in small increments over time and end up with a network of instruments of significantly varying maturities and capabilities. During this time, new manufacturers emerge, others no longer support air monitoring, and others simply update and improve the equipment offerings. Standardization at the instrument level is difficult, if not impossible. As such, DEQ has made no deliberate attempts to standardize at the instrument level, instead choosing from the most appropriate technology at the time of purchase and adhering as much as possible to the following characteristics:

- Instruments are approved and designated by EPA as either Federal Reference Method (FRM) or Federal Equivalent Method (FEM) monitors
- Equipment is commercially available and is used by other air quality monitoring organizations. DEQ does not use experimental / research equipment for routine monitoring.
- Equipment is reasonably priced to acquire and maintain.
- Equipment vendors provide installation, operation, and maintenance documentation and training with equipment purchases.
- Proprietary communication software, if required, is provided with the equipment at the time of the purchase.
- Monitors utilize serial or Ethernet connectivity to external data loggers or telemetry equipment. Analog-only communications abilities are being phased out of operation.

Some vendors have a long history and are strong in the air monitoring industry. Lines of instruments from these vendors typically contain similar features and structure easing their introduction into a network with older instruments. Although DEQ uses equipment from multiple vendors, DEQ has benefited from maintaining as much consistency in instrumentation as possible. The Thermo Scientific TEOM and Teledyne Advanced Pollution Instruments gas analyzer series are examples of this. Familiarity with these instruments has provided operational efficiency gains in areas such as staff training, procedure documentation and compliance, maintenance costs, and incident response times.

One area where DEQ has pursued standardization at the instrument level is in meteorological measurements (*Table F-1)*. Instruments measuring atmospheric meteorological conditions generally have a very long service life and devices are relatively inexpensive to replace as needed. As such, DEQ has developed what it considers a standard meteorological tower configuration and infrastructure to make meteorological measurements consistent across the state.

Table F-1. Typical Meteorological Measurements and Sensors in DEQ Meteorological Monitoring Network

Typical DEQ Meteorological Sensors								
Measurement Type	**Model**	**Operating Range (units)**	**Resolution / Accuracy**	**Applicable Measurement Quality Objectives [1]**				
				PAMS	**NCore**	**SLAMS / SPM**	**PSD**	**Modeling**
Wind Speed / Wind Direction	05305-AQ	0.4 – 50 (m/s)	± 0.2 m/s or 1%	X	X	X	X	X
Barometric Pressure	PTB110	500 – 110 (mb)	± 0.03 mb @ 20 °C	X	X	X	X	X
Barometric Pressure	PTB101B	600 – 1060 (mb)	± 0.05 mb @ 20 °C	X	X	X	X	X
Aspirated Temperature	43347 (plus shield)	-50 – 50 (°C)	± 0.1 °C w/ NIST calibration	X	X	X	X	X
Ambient Temperature	107 (plus shield)	-35 – 50 (°C)	± 0.2 °C			X		
Solar Radiation	LI200X	0 – 3000 (Watts/m^2)	± 0.2 Watts/m^2	X	X	N/A [2]	X	X
Relative Humidity	HMP45C	0 – 100 (% RH)	± 0.1 % / °C	X	X	X	X	X
Relative Humidity	CS215	0 – 100 (% RH)	± 0.2 % / °C	X	X	X	X	
Precipitation	TE525	Indefinite (inches rain)	0.01 inches / ± 5 %	X	X	N/A [2]	X	X

Another area of standardization has come in documentation. Clear, thorough, and consistent documentation is the core of the DEQ training program. The DEQ Air Quality Monitoring Training Plan identifies training objectives, roles and responsibilities, and identifies and number of resources available to staff and managers for staff development. Additionally, DEQ's Quality Assurance Project Plan (QAPP) and standard operating procedures (SOPs) are written using a requisite, department-approved template as a framework for all standard operating procedures. This framework ensures consistency of subject matter and content detail for SOPs so that it is both useful for initial training and efficiently used as reference material.

F.2 Leveraging Other Monitoring Networks

The Air Quality Research Subcommittee (AQRS) of the Committee for Environment and Natural Resources (CENR) has developed the following list of the major routine operating air monitoring networks (*Table F-2*). More information on AQRS and CENR can be obtained at http://www.epa.gov/ttn/amtic/cenvnatr.html.

The networks highlighted yellow have monitoring sites operating in Idaho. When applicable, data obtained from these monitoring sites is obtained to supplement DEQ's monitoring network (e.g. Hells Canyon and Craters of the Moon IMPROVE sites are used to supplement DEQ's $PM_{2.5}$ network for transport and background sites).

Table F-2. Other Air Monitoring Networks

MAJOR ROUTINE OPERATING AIR MONITORING NETWORKS[5]					
Network	**Lead Fed. Agcy.**	**Number of Sites**	**Initiated**	**Measurement Parameters**	**Location of Information and/or Data**
State / Local / Federal Networks					
NCore[1] -- National Core Monitoring Network	EPA	75	2008	CO, NO/NO_2/ NO_Y, O_3, $PM_{2.5}$ / $PM_{10-2.5}$[2] , $PM_{2.5}$ speciation, SO_2, NH_3, HNO_3, Surface Meteorology[3]	http://www.epa.gov/ttn/amtic/monstratdoc.html
SLAMS[1] -- State and Local Ambient Monitoring Stations	EPA	~3000	1978	CO, Pb, NO_x / NO_2, O_3, $PM_{2.5}$/ PM_{10}, SO_2	http://www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome .htm
STN -- $PM_{2.5}$ Speciation Trends Network	EPA	300	1999	$PM_{2.5}$, $PM_{2.5}$ speciation, Major Ions, Metals	http://www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome .htm
PAMS --Photochemical Assessment Monitoring Network	EPA	75	1994	O_3, NO_x /NO_Y, CO, Speciated VOCs, Carbonyls, Surface Meteorology & Upper Air	http://www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome .htm
IMPROVE -- Interagency Monitoring of Protected Visual Environments	NPS	110 plus 67 protocol sites	1988	$PM_{2.5}$/ PM_{10}, Major Ions, Metals, Light Extinction, Scattering Coefficient	http://vista.cira.colostate.edu/IMPROVE/
CASTNet -- Clean Air Status and Trends Network	EPA	80+	1987	O_3, SO_2, Major Ions, Calculated Dry Deposition, Wet Deposition, Total Deposition for Sulfur/Nitrogen, Surface Meteorology	http://www.epa.gov/castnet/
NADP/NTN --National Atmospheric Deposition Program / National Trends Network	USGS	200+	1978	Major Ions from precipitation chemistry	http://nadp.sws.uiuc.edu/
NADP/MDN -- National Atmospheric Deposition Program / Mercury Deposition Network	None	90+	1996	Mercury from precipitation chemistry	http://nadp.sws.uiuc.edu/mdn/
AIRMoN -- National Atmospheric Deposition Program / Atmospheric Integrated Research Monitoring Network	NOAA	8	1984	Major Ions from precipitation chemistry	http://nadp.sws.uiuc.edu/AIRMoN/
Air Toxics Monitoring Networks					
NATTS -- National Air Toxics Trends Stations	EPA	23	2005	VOCs, Carbonyls, PM_{10} metals4, Hg	http://www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome .htm

MAJOR ROUTINE OPERATING AIR MONITORING NETWORKS[5]					
Network	**Lead Fed. Agcy.**	**Number of Sites**	**Initiated**	**Measurement Parameters**	**Location of Information and/or Data**
Tribal Monitoring Networks					
Tribal Monitoring[2]	EPA	120+	1995	CO, Pb NO_x / NO_2, O_3, $PM_{2.5}$/ PM_{10},S O_2	http://www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome .htm
Industry / Research Networks					
New Source Permit Monitoring	None	variable	variable	CO, Pb, NO_x / NO_2, O_3,$PM_{2.5}$/ PM_{10}, SO_2	Contact specific industrial facilities
National/Global Radiation Networks					
RadNet -- formerly Environmental Radiation Ambient Monitoring System (ERAMS)	EPA	200+	1973	Radionuclides and radiation	http://www.epa.gov/enviro/html/erams/
Other Networks					
UV Index -- EPA Sunwise Program	EPA	~50 U.S. cities	2002	Calculated UV radiation index	http://www.epa.gov/sunwise/uvindex.html
BioWatch	No details				

Footnotes:

1. NCore is a network proposed to replace NAMS, as a component of SLAMS; NAMS are currently designated as national trends sites.
2. The number of sites indicated for tribal monitoring is actually the number of monitors, rather than sites. The number of sites with multiple monitors is probably less than 80.

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APPENDIX A.
NAAQS SUMMARY

Introduction

Section 7409 of the Clean Air Act requires EPA to review criteria pollutant NAAQS at five year intervals. Typically a revised NAAQS will include changes in ambient monitoring requirements. This has been the case in recent years and will likely continue in coming years. *Table AA-1* provides a list of recently completed plus ongoing and upcoming NAAQS review schedules.

Table AA-1. EPA NAAQS Review Schedule

Pollutant	NAAQS Level	Status of Current NAAQS Review	Proposed Changes?	Expected Date of Final Decision?
CO	9 ppm 8-hour 35 ppm 1-hour	Early in Review		May 2011
Pb	0.15 µg/m3 rolling 3-month average	Reconsideration of Monitoring Requirements		December 2010
NO_2	53 ppb annual mean New - 100 ppb one-hour	Final Rule signed with new one-hour NO_2 NAAQS at 100 ppb. Retained annual average of 53 ppb. Includes provisions for near-roadway monitoring network.		Final Rule was signed on January 22, 2010
Ozone	0.075 ppm 8-hour	Reconsideration of level and secondary NAAQS	Proposal expected in December 2009	October 31, 2010
PM_{10}	150 µg/m^3 daily	Integrated Science Assessment nearing completion; Visibility Assessment and Risk and Exposure Assessment just reviewed by CASAC	Proposal expected by November 2010 – subject to change	July 2011 – subject to change
$PM_{2.5}$	15 µg/m^3 annual average 35 µg/m^3 daily			
SO_2	0.075 ppm	Proposal published on December 8, 2009	Proposal to revise primary to a level of between 50 and 100 ppb measured over one-hour	Final Rule was signed on June 2, 2010

APPENDIX B.
POTENTIAL MONITORING REQUIREMENTS ASSOCIATED WITH REVISED NAAQS MONITORING NETWORKS

Introduction

Both recent and upcoming NAAQS revisions will have an impact to DEQ's monitoring program. In most cases, additional monitors and new monitoring sites will be required in Idaho. The addition of new sites will come at substantial cost and could likely force reductions of monitoring resources for non-essential monitors. Funding sources for new monitoring requirements have yet to be identified.

The following discussion of potential ambient air monitoring impacts is based on recent or proposed monitoring requirements, by pollutant.

Lead (Pb)

On December 23, 2009, EPA proposed further revision to the ambient monitoring requirements for measuring airborne lead. EPA is proposing to change the lead emissions monitoring threshold to 0.50 tons per year (tpy). Air quality monitoring agencies would use this threshold to determine if placement of an air quality monitor near a facility that emits lead is required. EPA proposes that these source-oriented monitors would begin operating one year after this rule is finalized (the final rule is expected in April 2010). EPA is also proposing to require lead monitoring at NCore sites instead of the current requirement to place lead monitors in each Core Based Statistical Area (CBSA) with a population of 500,000 or more. Under this proposal, lead monitoring at NCore sites would begin January 1, 2011.

EPA intends to finalize lead monitoring requirements by the end of 2010. If adopted, DEQ will only be required to monitor lead at its NCore site in Meridian. There are no individual or clusters of sources emitting 0.5 tpy or greater of Pb. Monitoring will begin January 1, 2011 (or 2012, pending final rule). DEQ proposed its Pb monitoring strategy in the 2010 Annual Monitoring Network Plan.

DEQ will use existing equipment to monitor Pb. Annual operations and maintenance will add approximately $20,000 to DEQ's annual monitoring costs.

Nitrogen Dioxide (NO_2)

On January 22, 2010, EPA signed the final rule that tightens the NO_2 NAAQS. Within the rule are new monitoring requirements. For Idaho, the addition of a "near roadway" monitor will be required in the Boise urban area by January 1, 2013. This site will have to be within 50 meters from the curb of the busiest road segment in the Boise City-Nampa MSA. Figure *B-10* illustrates candidate near-roadway segments in the Boise City-Nampa MSA.

DEQ's proposed NO_2 monitoring network modifications will be submitted to EPA in the 2012 Annual Monitoring Network Plan.

Capital start-up costs for the one near-roadway site will be approximately $100,000. Annual operations, maintenance, and data management costs will be approximately $20,000.

Ozone (O_3)

In December 2009, EPA proposed revise ambient air ozone monitoring requirements. In the proposal, EPA is recommending that air monitoring agencies establish ozone monitors in MSAs with populations between 50,000 and 350,000. In addition, agencies will need to establish monitors in three additional types of locations: 1) a micropolitan statistical are with population between 10,000 and 50,000, in order to characterize ozone concentrations in areas of lesser population where high ozone concentrations are expected; 2) a federally managed or tribal non-urban location, to characterize sensitive ecosystems; and 3) a rural location where high ozone concentrations transported from urban areas are expected. EPA has proposed that monitoring agencies can leverage data from ozone monitors currently operated by federal agencies (meeting all required EPA criteria), which can be applied toward the minimum network requirements.

EPA expects to issue the final ozone monitoring requirements by October 31, 2010. These additional ozone sites were originally proposed to begin monitoring January 1, 2012. However, due to the prolonged rulemaking process, and budget uncertainties, network deployment may be phased over two years (2012 and 2013).

If finalized as proposed, the impact on DEQ's ozone monitoring network will be the required addition of either five or six new sites. DEQ will propose to leverage the IMPROVE Network's Craters of the Moon monitor to fulfill requirement 2 above. If EPA approves, DEQ will be add five sites to its ozone network for implementation by the 2012 ozone monitoring season (April 1, 2012). Monitors will likely be located in the following areas:

- Idaho Falls (MSA $\geq$ 50,000 $\leq$ 350,000)
- Pocatello (MSA $\geq$ 50,000 $\leq$ 350,000)
- Lewiston (MSA $\geq$ 50,000 $\leq$ 350,000)
- Twin Falls (micropolitan statistical area)
- Site to be determined (rural transport)
- Craters of the Moon National Monument (federal lands) If approved, this already-established monitoring site would become part of the ozone network)

Assuming the addition of five new ozone sites, the capital start-up cost(s) will be approximately $450,000 and the costs for annual operations, maintenance, and data management will be approximately $92,000.

DEQ's proposed ozone monitoring network modifications will be submitted to EPA in the 2011 ambient air monitoring network plan, due July 1, 2011.

$PM_{10\text{-}2.5}$ (PM_{coarse})

PMcoarse is defined as the particulate fraction with a nominal diameter between 2.5 and 10.0 µ. PMcoarse can be monitored by calculating the fractional mass difference between co-located and matching (i.e., same type of monitor) PM_{10c} and $PM_{2.5}$ monitors. Section 3 of Appendix D, 40 CFR Part 58, requires PM_{coarse} monitoring at NCore monitoring stations. As with all NCore monitoring requirements, agencies are required to initiate this requirement by January 1, 2011. DEQ will conductPMcoarse monitoring at the Meridian – St. Luke's NCore site, beginning January 1, 2011. DEQ will determine PM_{coarse} concentrations by calculating mass difference between data collected from the existing $PM_{2.5}$ FRM sampler currently in operation and data collected from the PM_{10} sampler used for Pb determinations.

Both the $PM_{2.5}$ and PM_{10c} samplers will be operated every third day (1/3) in accordance with the national monitoring schedule.

DEQ proposed its Pb monitoring strategy in the 2010 Annual Monitoring Network Plan.

The annual operation and maintenance cost for PM_{coarse} is estimated at $9,386.

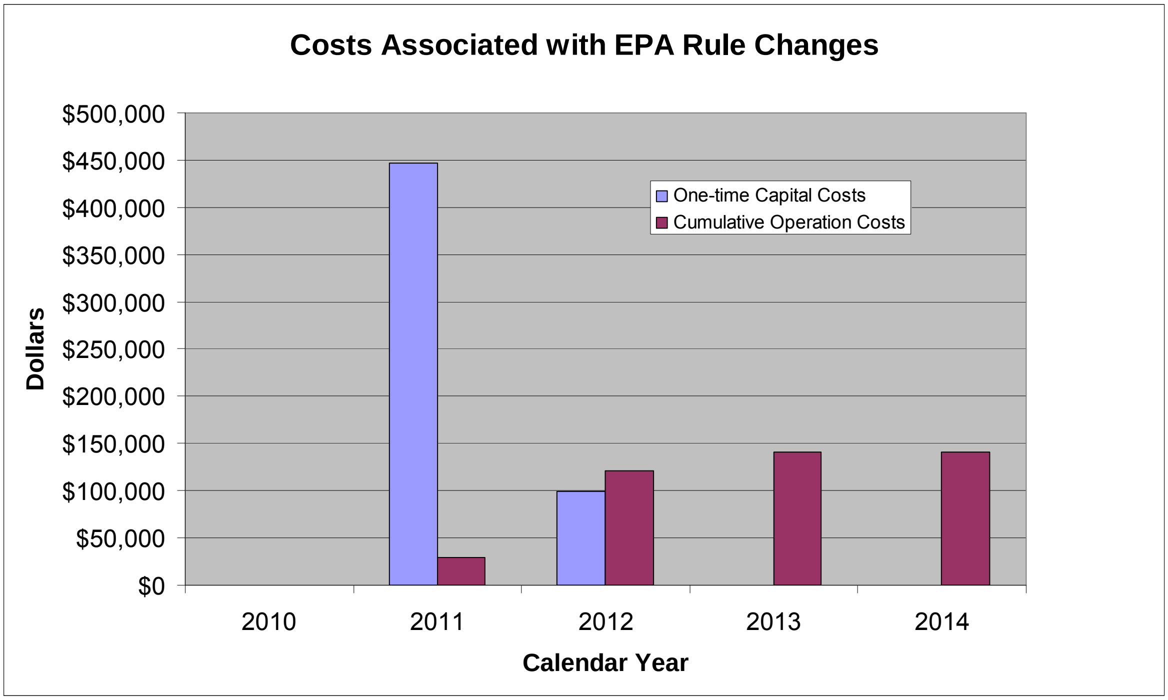
Sulfur Dioxide (SO_2)

On June 2, 2010 EPA signed the final rule that strengthens the SO2 NAAQS. The revised ambient SO_2 monitoring requirements add new SO_2 monitors based on a population-weighted emissions index (PWEI) for CBSAs. According to the PWEI thresholds, no new monitors will be required in Idaho.

Future Cost Summary

Chart AB-1 summarizes future costs anticipated by DEQ to comply with recent adopted and proposed NAAQS revisions.

Chart AB-1. Anticipated Costs for Future Monitoring Mandates



APPENDIX C.
MONITOR AND STATION NETWORK SUMMARY

Table AC-1 is a list of DEQ's air monitoring sites, including addresses, global positioning system (GPS) coordinates and AQS identifiers.

Table AC-1. DEQ Monitoring Stations, Locations, and AQS Identification Codes

Site	Address	Latitude/ Longitude	AQS Identification
Boise– ITD	311 W. State St. Boise, ID 83703	+43.634585/ -116.233919	160010019
Boise- Eastman Garage	166 N. 9th, Boise, ID 83702	+43.616379/ -116.203817	160010014
Boise– Fire Station #5	16th & Front, Boise, ID 83702	+43.618889/ -116.213611	160010009
Boise– White Pine Elementary	401 East Linden St. Boise, ID 83706	+43.577603/ -116.178156	160010017
Boise– Warm Springs	2495 W Warm Springs Ave, Boise ID 83712	+43.598833/ -116.173448	160010022
Coeur d'Alene – Lancaster Rd.	Lancaster Road, Hayden, ID 83835	+47.788908/ -116.804539	160550003
Franklin	East 4800 South Road, 83237	+42.013333/ -111.809167	160410001
Garden City	Ada County Fairgrounds, Garden City, ID 83714	+43.647819 -116.269514	160010020
Garden Valley	946 Banks Lowman Rd Garden Valley, ID 83622	+44.104498 -115.972386	160150002
Grangeville	USFS Compound Grangeville, ID 83530	+45.931389/ -116.115278	160490002
Idaho City	3851 Hwy 21 Idaho City, ID 83631	+43.823017/ -115.838557	160150001
Idaho Falls	Hickory and Sycamore St., Idaho Falls, ID 83402	+43.464700/ -112.046450	160190011
Ketchum	111 West 8th St, Ketchum, ID 83340	+43.682558/ -114.371094	160130004
Kimberly	50 Highway 50, Kimberly, 83341	+42.553325/ -114.354853	160830009
Lewiston	1200 29th St Lewiston, ID 83501	+46.404722/ -116.968889	160690012
McCall	500 N. Mission St, McCall ID 83638	+44.890197 -116.106500	160850002
Meridian– St. Luke's	Eagle Rd & I-84 Meridian, ID 83642	+43.600264/ -116.348434	160010010
Middleton – Purple Sage	15192 Purple Sage Rd. Caldwell, ID 83605	+43.735828/ -116.692967	160270009
Moscow	1025 Plant Sciences Rd Moscow, ID 83843	+46.721932/ -116.959180	160570005
Nampa	923 1st St S, Nampa, ID 83651	+43.580310/ -116.562676	160270002

Site	Address	Latitude/ Longitude	AQS Identification
Pinehurst	106 Church St. Pinehurst, ID 83850	+47.536389/ -116.236667	160790017
Pocatello– Garrett & Gould	Corner Garrett & Gould, Pocatello, ID 83204	+42.876725/ -112.460347	160050015
Pocatello–Sewage Treatment Plant	Batiste Chubbuck Rd, Pocatello, ID 83204	+42.916389/ -112.515833	160050004
Salmon – Charles St.	N Charles St. Salmon, ID 83467	+45.181893/ -113.890285	160590004
Salmon – Hwy 93	0.8 Miles South of Hwy 93/48 Intersection, Salmon ID 83468	+45.168433/ -113.888967	160590005
Sandpoint – USFS	1601 Ontario St. Sandpoint ,ID 83864	+48.267500/ -116.572222	160170005
Sandpoint – University of Idaho	U of I Research Center, 2105 N. Boyer Ave. Sandpoint, ID 83864	+48.291820/ - 116.556560	160170003
Soda Springs	5-Mile Rd., Soda Springs, ID 83276	+42.695278/ -111.593889	160290031
St. Maries	Forest Service Bldg St. Maries, ID 83666	+47.316667/ -116.570280	160050010
Twin Falls	1913 Addison Ave E, Twin Falls, ID 83301	+42.564097/ -114.446200	160830010

Table AC-2 lists the pollutants monitored, the site designation and the monitoring frequency for Idaho’s monitoring sites.

Table AC-2. Pollutants/Monitor Designation/Sampling Frequency

Site	Pollutant Monitored**	Monitor Designation**	Monitoring Frequency
Boise- Eastman Garage	CO	SLAMS	Continuous
Boise- Fire Station #5	PM_{10}	SLAMS	Continuous
Boise - Idaho Transportation Dept.	O_3	SLAMS	Continuous
Boise- White Pine Elementary	O_3	SLAMS	Continuous
Boise- Warm Springs	10-meter meteorology	SPM	Continuous
Coeur d’Alene – Lancaster Rd.	$PM_{2.5}$ - TEOM O_3 NO_x 10-meter meteorology	SPM SLAMS SPM SPM	Continuous Continuous Continuous Continuous
Franklin	$PM_{2.5}$ - FRM $PM_{2.5}$ – BAM	SLAMS SPM	Every sixth day (1/6) Continuous
Garden City	10-meter meteorology	SLAMS	Continuous
Garden Valley	$PM_{2.5}$– TEOM	SPM	Continuous

Site	Pollutant Monitored**	Monitor Designation**	Monitoring Frequency
Grangeville	$PM_{2.5}$ - TEOM 10-meter meteorology	SLAMS SPM	Continuous Continuous
Idaho City	$PM_{2.5}$ – TEOM	SLAMS	Continuous
Idaho Falls	$PM_{2.5}$ – TEOM	SLAMS	Continuous
Ketchum	$PM_{2.5}$ – TEOM	SLAMS	Continuous
Kimberly	10-meter meteorology	SPM	Continuous
Lewiston	$PM_{2.5}$ - TEOM 10-meter meteorology	SLAMS SPM	Continuous Continuous
McCall	$PM_{2.5}$ – TEOM	SLAMS	Continuous
Meridian St. Luke's	$PM_{2.5}$ - FRM $PM_{2.5}$ - TEOM $PM_{2.5}$ - BAM $PM_{2.5}$ Chemical Speciation O_3 SO_2 NO_2 NO_Y CO 10-meter meteorology	NCore NCore NCore NCore NCore NCore NCore NCore NCore NCore	Every third day (1/3) Continuous Continuous Every third day (1/3) Continuous Continuous Continuous Continuous Continuous Continuous
Middleton – Purple Sage	$PM_{2.5}$- TEOM 10-meter meteorology	SPM SPM	Continuous Continuous
Moscow	$PM_{2.5}$ - TEOM 10-meter meteorology	SLAMS SPM	Continuous Continuous
Nampa	PM_{10} - TEOM $PM_{2.5}$ - FRM $PM_{2.5}$ - TEOM $PM_{2.5}$ – BAM	SLAMS SLAMS SLAMS SPM	Continuous Every third day (1/3) Continuous Continuous
Pinehurst	$PM_{2.5}$ – FRM $PM_{2.5}$ – FRM Precision $PM_{2.5}$ – TEOM/FDMS $PM_{2.5}$ - BAM PM_{10} - TEOM 10-meter meteorology	SLAMS SLAMS SLAMS SPM SLAMS SPM	Every day (1/1) Every sixth day (1/6) Continuous Continuous Continuous Continuous
Pocatello	$PM_{2.5}$ - TEOM PM_{10} - TEOM 10-meter meteorology	SLAMS SLAMS SPM	Continuous Continuous Continuous
Pocatello- Sewage Treatment Plant	SO_2	SLAMS	Continuous
Salmon – Charles St.	$PM_{2.5}$ - FRM $PM_{2.5}$ – BAM	SLAMS SPM	Every sixth day (1/6) Continuous
Salmon – Hwy 93	10-meter meteorology	SPM	Continuous
Sandpoint – University of Idaho	10-meter meteorology	SPM	Continuous

Site	Pollutant Monitored**	Monitor Designation**	Monitoring Frequency
Sandpoint – U.S. Forest Service	PM_{10} – TEOM $PM_{2.5}$ – TEOM	SLAMS SLAMS	Continuous Continuous
Soda Springs	SO_2	SLAMS	Continuous
St. Maries	$PM_{2.5}$ – FRM $PM_{2.5}$ - TEOM $PM_{2.5}$ – BAM	SLAMS SLAMS SPM	Every sixth day (1/6) Continuous Continuous
Twin Falls	$PM_{2.5}$ – TEOM	SLAMS	Continuous

** Abbreviations: PM_{10} – particulate matter less than 10 microns in diameter; $PM_{2.5}$ – particulate matter less than 2.5 microns in diameter; TEOM – tapered element oscillating microbalance; O_3 – ozone; NO_2 – nitrogen dioxide; FRM – federal reference method; FDMS – filter dynamics measurement system; BAM – beta attenuation monitor; SO_2 – sulfur dioxide; NO_y – total reactive nitrogen; CO – carbon monoxide

APPENDIX D.
INDEX OF HEALTH STUDIES AND PUBLICATIONS BASED ON ASSOCIATED AMBIENT AIR MONITORING DATA

Public Health Consultations published by ATSDR
Available at: http://www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=ID

1. Evaluation of Air Exposure Potlatch Pulp Mill; September 19, 2003
2. Evaluation of Benzene Air Contamination in Lewiston Area, Idaho; February 16, 2005
3. Evaluation of Air Contaminants in the Treasure Valley Area Ada and Canyon Counties, Idaho; September 30, 2006
4. Portneuf Valley Air Toxics Ambient Air Data Evaluation & Health Assessment; August 21, 2007
5. Evaluation of Potential Health Effects from Air Toxics Lewiston Air Toxics Monitoring 2006-2007; February 18, 2009; Revised: September 3, 2009

Non-published studies

1. Particulate Matter and Health Effects in North Idaho: An Evaluation of Air Monitoring and Health Insurance Data. Jim Vannoy, Chris Johnson, Joe Pollard, Kara Stevens
2. Correlation between adverse air quality and short-term human health effects, Treasure Valley, Idaho, USA 2002-2004; Lee Hannah, DVM, MS, MPH; Peter Curran, MD; and Dale Stephenson, Boise State University; Chris Johnson, MPH, Idaho Cancer Data Registry; Jim Vannoy and Joe Pollard, Idaho Dept. of Health and Welfare
3. Treasure Valley Air Monitoring 2007-2008, Evaluation of the Potential Health Effects from Air Toxics; Jim Vannoy, Idaho Dept. of Health and Welfare.

Published in Journals

1. Koracin, D.; Podnar, D.; Chow, J.C.; Isakov, V.; Dong, Y.; Miller, A.; and McGown, M. (2000). *PM_{10} dispersion modeling for Treasure Valley, Idaho*. J. AIR & WASTE MANAGE. ASSOC., 50(8):1335-1344.
2. Kuhns, H., V. Bohdan, C. Chow, V. Etyemezian, M. Green, D. Herlocker, S. Kohl, M. McGown, J. Ramsdell, W. Stockwell, M. Toole, and J. Watson, 2002: *The Treasure Valley Secondary Aerosol Study I: Measurements and Equilibrium Modeling of Inorganic Secondary Aerosols and Precursors in Southwestern Idaho.* Atmos. Environ., 37 (4), 511-524.
3. Stockwell, W.R., H. Kuhns, V. Etyemezian, M.C. Green, J.C. Chow, and J.G. Watson, 2002: The Treasure Valley Secondary Aerosol Study II: Modeling of the Formation of Inorganic Secondary Aerosols and Precursors for Southwestern Idaho. Atmos. Environ. 37 (4), 525-534.

4. Etyemezian, V., H. Kuhns, J. Gillies, J. Chow, K. Hendrickson, M. McGown, and M. Pitchford. Vehicle based road dust emissions measurement (III): Effect of speed, traffic volume, location, and season on PM_{10} road dust emissions. Atmospheric Environment 36:4583-4593 (2002).
5. Kuhns, H., V. Etyemezian, M. Green, Karin Hendrickson, Michael McGown, Kevin Barton, and Marc Pitchford. Vehicle-based road dust emissions measurement (II): Effect of precipitation, wintertime road sanding, and street sweepers on PM_{10} fugitive dust emissions from paved and unpaved roads. Atmospheric Environment 36:4572-4582 (2003).

Annual Reports

1. AMERICAN LUNG ASSOCIATION STATE OF THE AIR 2010
American Lung Association National Headquarters; 1301 Pennsylvania Ave NW, Suite 800, Washington, DC 20004-1725. http//:www.lungusa.org.

Air Quality Monitoring Data Summary; Idaho Department of Environmental Quality; http://www.deq.idaho.gov/air/data_reports/publications.cfm.

DEQ Special Studies

Ozone and its precursors in the Treasure Valley, Idaho. Final Report, May 2008;
Ilias G. Kavouras, David W. DuBois, Vicken Etyemezian and George Nikolich; Division of Atmospheric Sciences, Desert Research Institute
http://www.deq.idaho.gov/air/data_reports/reports/ada_co/ozone_treasure_valley_report.pdf

Precursors and sources of fine particulate matter ($PM_{2.5}$) in the Treasure Valley, Idaho Airshed. Final Report, December 2009. Ilias G. Kavouras, David W. DuBois, Vicken Etyemezian and George Nikolich; Division of Atmospheric Sciences, Desert Research Institute.

Rathdrum Prairie Ozone Precursor Study. Final Report, June 2009; Laboratory for Atmospheric Research; Washington State University.
http://www.deq.idaho.gov/air/data_reports/reports/north_idaho/rathdrum_prairie_ozone_precursor_study.pdf.