3.17 Cumulative Impacts

3.17.1 Background

The West Coast has short-term and long-term supply needs for electric power. Recent long-term planning estimates by the Pacific Northwest Electric Power and Conservation Planning Council show the region will need an additional 6,000 MW of electricity over the next 10 years. Other estimates run as high as 8,000 MW. This demand for electric power has led to a number of new generating resources being proposed to meet the regional energy need. More than 24,000 MW of resources have been proposed by a variety of independent power projects. These proposals far exceed the need, which makes it difficult, if not impossible, to determine which specific projects will ultimately be constructed and operated.

Although the environmental impacts of proposed power projects are currently evaluated on an individual basis, the recent abundance of project applications has prompted EFSEC and Bonneville to consider potential cumulative effects. While the high number of power plant proposals would address regional energy shortage concerns, the cumulative impacts of constructing several energy facilities in the Pacific Northwest must be considered. This concern is magnified when several projects are proposed in close proximity to each other and/or with similar schedules (such as the Starbuck, Wallula, and Mercer Ranch projects in southeastern Washington, or the multiple projects existing or proposed in Umatilla County, Oregon).

Table 3.17-1 presents a list of more than 60 existing, permitted, and proposed power generation plants in the Pacific Northwest (including Washington, Oregon, Idaho, and Montana). Information provided includes each plant's name and location, permitting and operational status, approximate power output, approximate natural gas and water consumption, and approximate annual CO2 emissions.

Because it is unlikely that all proposed and permitted plants in the Pacific Northwest would be built (more than 40), Bonneville has identified a "Baseline Source Group" of 15 Pacific Northwest projects for the purpose of analyzing likely cumulative effects. These projects are in service, have started construction, have already been issued a Record of Decision (ROD), or are likely to receive approval and be constructed (see shaded rows in Table 3.17-1).

The geographic area that must be considered when assessing cumulative impacts differs depending on the environmental resource being considered. For example, while most (if not all) of the plants in the Pacific Northwest must be considered when evaluating the cumulative impacts of power plant emissions on the regional airshed, only the limited group of power projects (and other water-consuming entities) hydrologically linked to a common surface water body or aquifer would need to be evaluated to determine regional water supply impacts.

Because of this difference in regional scope among environmental disciplines, a brief summary of the approach taken to evaluate cumulative impacts is provided at the beginning of each section below. In some cases, it is nearly impossible to assess the cumulative impacts associated with an environmental resource without looking at specific project details and the context within which the individual power project would operate. This EIS does not attempt to do that. In such cases, general impacts are described but not quantified.

3.17.2 Air Quality

3.17.2.1 Greenhouse Gas Emissions

Recent Research into Global Warming

The issue of how emissions from human activities might affect global climate has been the subject of extensive international research over the past several decades. There is now a broad consensus among atmospheric scientists that emissions caused by humans are causing a rise in global temperatures, although there is still uncertainty about the magnitude of future impacts and the best approach to mitigate the impacts. Two sets of key research documents have recently been published.

The United Nations Intergovernmental Panel on Climate Change (IPCC) published its most recent set of 5-year progress reports summarizing worldwide research on global warming (IPCC 2001a, 2001b). These reports indicated that some level of global warming related to human activity is likely to occur and that there is a significant possibility of severe environmental impacts. Several alternative measures were evaluated to achieve the emission reductions specified by the Kyoto Protocol.

President Bush requested the National Academy of Sciences to provide a brief comprehensive review of the IPCC reports (National Academy of Sciences 2001). The review panel included atmospheric scientists with a range of opinions on future global warming. The National Academy of Sciences review was written in lay terms and focused on addressing several fundamental issues. The panel concurred with most of the findings by the IPCC.

Table 3.17-1. Cumulative Impacts Associated with Northwest Power Plants

Plant *(Location)* *(*)= Proposed*	Status	Output (MW)	Gas Consumption (million cf/day)*	Water Consumption (mgd)	Water Supply Source	Annual CO2 Emissions (Tons)
Washington						
BP Cherry Point Cogeneration Plant *(Blaine, WA) (*)*	Potential Site Study (PSS)–EFSEC Pre-Application Review: 10/01 EFSEC Application for Site Certification (ASC): 3/02 On-line: 1/04 (estimated)	750	130.1	Air-cooled facility (no cooling water needed). 0.5 gpd make-up	Nooksack River; BP refinery has right to additional 3 million gpd from Whatcom County PUD No. 1, which is supplied by Nooksack.	3,029,744
Centralia Coal-Fired Power Plant *(Centralia, WA)*	On-line	1,350	0 (Coal-fired)	N/A	Chehalis River; from Skookumchuck River drainage	12,400,000
Centralia (TransAlta) Generation LLC Big Hanaford Project *(Centralia, WA)*	On-line: 6/01	248	43.0	N/A	Chehalis River; from Skookumchuck River drainage	702,901
Chehalis Generation Facility *(Chehalis, Lewis County, WA)*	Sited by EFSEC: 1996 Construction began 5/01	520	80.0	Air-cooled facility; relatively small amount required.	City of Chehalis for make-up and potable water.	1,725,240 208,050 (#2 fuel oil)
Columbia Peaking Generation Project *(WA)*	On-line: 12/01	200	34.7	N/A	N/A	775,614
Columbia River Project *(WA)*	On-line: 5/02	220	38.2	N/A	Columbia River	1,201,718
Cowlitz Cogeneration Project *(Longview, Cowlitz County, WA)*	Sited by EFSEC: 1994, construction never started.	395	76.7	2.33	Columbia River (below Bonneville Dam) through Weyerhaeuser water right.	2,300,000
Everett Delta I *(Everett, WA)*	On-line: 9/02	248	43.0	N/A	Lower Snohomish River	973,674
Everett Delta II *(Everett, WA)*	On-line: 9/02	248	43.0	N/A	Lower Snohomish River	973,674
Ferndale *(Ferndale, WA) (*)*	On-line: 6/05	600	104.1	N/A	Groundwater	2,423,795
Fredonia Facility *(Skagit County, WA)*	Developing Permits; Consent order allows 2 engines to operate	111	19.3	N/A	N/A	920,000
Frederickson Power I *(Frederickson, WA)*	On-line: 5/02	249	43.2	N/A	N/A	1,005,875
Frederickson Power II *(Frederickson, WA) (*)*	On-line: 1/04	249	43.2	N/A	N/A	917,610
Fredrickson *(WA)*	On-line: 5/02	350	60.7	N/A	N/A	1,413,881
Goldendale Energy Project *(Goldendale, WA)*	On-line: 7/02	248	43.0	N/A	N/A	1,001,835
Goldendale (The Cliffs) *(Goldendale, WA)*	On-line: 2/02	225	39.0	N/A	N/A	977,550
Longview Power Station *(Longview, WA)*	On-line: 7/03	290	50.3	N/A	Columbia River (below Bonneville Dam)	1,126,567 265,898 (#2 fuel oil)
Mattawa *(Grant County, WA) (*)*	On-line: 6/05	1,300	225.6	N/A	N/A	5,251,556

Plant *(Location)* *(*)= Proposed*	Status	Output (MW)	Gas Consumption (million cf/day)*	Water Consumption (mgd)	Water Supply Source	Annual CO2 Emissions (Tons)
Mercer Ranch Generation Project *(Benton County, WA) (*)*	PSS: 8/01 ASC: 3/02 On-line: 11/04	850	138.8	11.1	Water from Columbia River to offset irrigation withdrawals; possible impacts to Double Canyon Creek and Dead Canyon Creek	3,231,727
Mint Farm Generation Project I *(Longview, WA) (*)*	On-line: 7/03	248	43.0	N/A	Columbia River	1,001,835
Mount Vernon *(Mount Vernon, WA) (*)*	On-line: 6/05	600	104.1	N/A	N/A	2,423,795
Pierce County Project *(Pierce County, WA)*	On-line: 1/02	320	55.5	N/A	N/A	90,084
Port of Tacoma Generation Project – Phase I Peaking Project *(Tacoma, WA)*	On-line: 6/02	175	30.4	N/A	N/A	158,625
Port of Tacoma – Phase II (5 units) *(Tacoma, WA) (*)*	On-line: 6/04	825	143.2	N/A	N/A	793,125
Satsop CT Project – Phase I *(Grays Harbor County, WA) (*)*	Sited by EFSEC: 1996 Construction started: 9/01 On-line: 1/03	650	112.8	6.1 (maximum) 5.6 (average)	Chehalis River through Ranney Well extraction.	2,042,963
Satsop CT Project – Phase II *(Grays Harbor County, WA) (*)*	Request for ASC Amendment: 11/01 On-line: 10/04	650	112.8	6.1 (maximum) 5.6 (average)	Chehalis River through Ranney Well extraction.	2,392,847
Sedro Woolley (Unnamed project) *(Sedro Woolley, WA) (*)*	In local permitting process	82.6	14.3	N/A	Skagit River (?)	317,000
Starbuck Power Project *(Starbuck, WA) (*)*	PSS: 3/01 ASC: 8/01 On-line: 10/03	1,200	201.6	0.43	Snake River (no impacts expected due to water right replenishing) at confluence with Columbia River.	3,769,997
Sumas Energy 2 Generation Facility *(Sumas, Whatcom County, WA) (*)*	ASC: 1/99 Rev ASC: 1/00 2nd Rev ASC: 1/01 On-line: 2004	660	112.0	1.2 (maximum) 0.9 (average)	Would likely reduce the discharge of groundwater to Johnson Creek; mitigated in compliance with condition the City's water right; tributary to the Fraser River (British Columbia).	2,417,744
U.S. Electric Cherry Point *(Blaine, WA) (*)*	Announced	349	0 (Coal-fired)	N/A	N/A	3,200,000
Vancouver (a) (Alcoa) *(Vancouver, WA)*	On-line: 11/01	100	17.4	N/A	Columbia River (below Bonneville Dam)	403,966
Vancouver (b) (Alcoa) *(Vancouver, WA) (*)*	On-line: 6/05	600	104.1	N/A	Columbia River (below Bonneville Dam)	2423,795
Wallula Power Project *(Wallula, WA) (*)*	PSS: 4/01 ASC: 8/01 On-line: 7/04 (Estimated)	1,300	225.6	5.9 (maximum) 4.6 (average)	Columbia River (Lake Wallula, an impoundment of Columbia River)	5,251,556
Oregon						
Boardman Coal Plant *(Marrow County, OR)*	On-line	520	0 (Coal-fired)	N/A	Carty Reservoir, a 1,450-acre pond that eliminates need for surface water discharge.	4,700,000
COB Energy Facility *(Klamath County, OR) (*)*	Notice of Intent (NOI): 12/01 Permits: 5/02 On-line: Mid 2005	1,150	199.5	10.1	Will develop deep enough well to avoid affecting surface water within the Klamath Basin.	4,400,000
Coburg Power Project *(Lane County, OR) (*)*	Project Order: 10/01 On-line: 8/03	600 (may decrease to 300 if project partner not found)	104.1	2.5	Hope to use secondary treated sewage from town of Coburg or use wastewater from nearby gravel pit with Willamette River water right. Discharge into Willamette River.	1,943,368 1,458,686 (#2 fuel oil)

Plant *(Location)* *(*)= Proposed*	Status	Output (MW)	Gas Consumption (million cf/day)*	Water Consumption (mgd)	Water Supply Source	Annual CO2 Emissions (Tons)
Coyote Springs Cogeneration Project I *(Morrow County, OR)*	On-line	280	48.6	2-3	Port of Morrow, hydrologically connected to Columbia River.	1,000,783 82,520 (#2 fuel oil)
Coyote Springs II *(Morrow County, OR)*	On-line. 6/02	280	48.6	2-3	Port of Morrow, hydrologically connected to Columbia River.	920,939
Grizzly Power Generation Project *(Jefferson County, OR)*	Permits: 11/01 On-line: 7/04	980	170.0	6.25	Will use groundwater, which is hydraulically connected to all surface water in Deschutes Basin (Crooked and Deschutes Rivers). Concern expressed by ODFW that this may tax local water supply.	3,530,662
Hermiston Generating Project *(Umatilla County, OR)*	On-line	468	81.2	4-5	Port of Umatilla regional water supply pipeline. Mainstream to Columbia River.	1,800,000
Hermiston Power Project *(Umatilla County, OR)*	On-line: Spring 2002	546	94.7	4-5	Port of Umatilla regional water supply pipeline. Mainstream to Columbia River.	2,205,654
Klamath Cogeneration Project *(Klamath County, OR)*	On-line	484	84.0	Single CT: 1.7 Two CT: 3.4	Reuse treated effluent from Klamath Falls' Spring Street Wastewater Treatment Plant	11.5 million short tons CO2 offset.
Klamath Generation Facility *(Klamath County, OR) (*)*	Expedited review granted: 12/01	500	86.8	4-5	Unresolved. Would like to copy Klamath Cogeneration Project..	1,900,000
Morrow Generation Project *(Morrow County, OR) (*)*	NOI: 9/01 On-line: 1/05	620	107.6	4-5	Port of Morrow (buying water), hydrologically connected to Columbia River.	2,077,749
Port Westward Generating Project *(Columbia County, OR)*	Permits: 8/01 Amended proj. order: 11/01 On-line: 12/03	650	112.8	4-5	Municipal water from Port of St. Helens; hydrologically linked to Columbia River.	2,480,718
Springfield Utility-Industrial Energy Center *(Lane County, OR)*	Developed last winter but likely never operated.	51.2	0 (Primarily biomass-fired)	Relatively small amount.	N/A	650,000
Summit/Westward Energy Project *(Columbia County, OR) (*)*	Permits: 8/01 Expedited review allowed.	520	90.2	4-5 million gpd	Municipal water right from Port of St. Helens; hydraulically linked to Columbia River.	1,857,120
Turner Energy Project *(Turner, Marion County, OR) (*)*	Expedited review allowed: 7/01	620	107.6	44,640 gpd (air-cooled, very small amount of water needed)	Obtained from City of Turner (in turn served by City of Salem). No water right transfer needed.	2,370,000
Umatilla Generating Project (Hermiston II) *(Umatilla County, OR)*	Permits approved. On-line: 11/03	620	107.6	3.31 million gpd	Port of Umatilla regional water supply pipeline (currently extends to Hermiston Generating Project).	2,077,749
Umatilla Tribal Generation Project ("Wanapa Plant") *(Umatilla County, OR) (*)*	On-line: 7/03	1,000	173.5	N/A	N/A	4,814,671
Idaho						
Garnet Energy Facility *(Middleton, ID) (*)*	Submitted Permits to DEQ	535	92.8	N/A	N/A	2,040,000
Kootenai Power (Rathdrum) *(Rathdrum, ID) (*)*	On-line: 6/05	1,300	225.6	N/A	Spokane Valley/Rathdrum Prairie Aquifer (recharges Spokane River)	5,009,177
Mountain Home *(Mountain Home, ID) (*)*	Submitted Permits to DEQ	90	15.6	N/A	N/A	340,000
Mountain Home *(Mountain Home, ID) (*)*	Submitted Permits to DEQ	80	13.9	N/A	N/A	300,000
Northern Idaho Power *(Rathdrum, ID) (*)*	On-line: 12/04	810	140.6	N/A	N/A	3,272,124
Rathdrum Power, LLC *(Rathdrum, ID)*	On-line: 8/01	270	35.9	N/A	Spokane Valley/Rathdrum Prairie Aquifer (recharges Spokane River)	1,090,708

Plant ***(Location)*** ***(*)= Proposed***	**Status**	**Output (MW)**	**Gas Consumption (million cf/day)***	**Water Consumption (mgd)**	**Water Supply Source**	**Annual CO2 Emissions (Tons)**
Montana						
Basin Creek *(Butte, MT) (*)*	Applied for permits	100	17.4	N/A	N/A	380,000
BMP Power Plant Proposal *(Roundup, MT) (*)*	Proposed	700	0 (Coal-fired)	N/A	N/A	6,400,000
Camanche Park *(Broadview, MT) (*)*	Proposed; On-line 2004	200	0 (Coal-fired)	N/A	N/A	1,800,000
Montana First Megawatts *(Great Falls, MT)*	Construction began 2001	240	41.6	N/A	N/A	917,000
Rocky Mountain Power Project *(Hardin, MT) (*)*	Contract signed with Montana Power; under commission review	100	0 (Coal-fired)	N/A	N/A	920,000
Silver Bow *(Butte, MT) (*)*	Applied for permits	500	86.8	N/A	N/A	1,900,000

* Unless specifically identified in project documents or through personal interviews, the following equation was used to determine approximate gas consumption:
Fuel Usage = 7,230 ($feet^3$/MW-hr)

CO numbers from "Phase I Results Regional Air Quality Modeling Study; Bonneville Power Administration" August 1, 2001; Table titled "Regional Air Quality Impacts Study Carbon Dioxide Emissions from Proposed Power Plants (08/01/2001)" or derived through calculations.

Greenhouse Gas Emissions from Wallula Power Plant

For purposes of evaluating greenhouse gas emissions, the combustion efficiency of the proposal is quantified by the carbon dioxide (CO2) emission factor, with units of pounds of CO2 emitted per kilowatt-hour of electricity produced. Table 3.17-2 lists the CO2 emission factors for typical fossil-fueled generating stations operating today. As shown in the table, combined cycle combustion turbines emit much less CO2 than other types of fossil-fuel power plants. The estimated overall CO2 emission factor for the Wallula power plant is 0.873 pound per kilowatt-hour.

Table 3.17-2. Typical CO2 Emission Factors for Electrical Generating Stations

Generating Station Fuel Type	CO2 Emission Factor (lbs CO2 per kw-hr)
Wallula Power Plant, natural gas fired combined cycle combustion turbine	0.873
Natural gas fuel, conventional gas-fired boiler	1.2
Fuel oil, conventional oil-fired boiler	1.9
Coal, conventional coal-fired boiler	2.1
Other solid fuel generating stations	2.95
Nationwide average for electric utility generating stations (1998)	1.35
Sources: Application for Site Certification (Wallula Generation 2001); DOE 1999.	

The CO2 emissions during each operating condition were estimated based on the manufacturer's estimated emission factors. Assuming a 100% capacity factor for the plant, the estimated annual CO2 emissions from the power plant stacks would be 4.27 millions tons per year. Other power plant developers currently undergoing EFSEC permitting have estimated actual future load factors of 80% to 85%, so an assumed 100% load factor is conservatively high.

Fugitive leaks of natural gas from the pipeline system serving the power plant are estimated to emit methane equivalent to 12% of the plant's stack emissions of greenhouse gas (DOE 2000). The estimated greenhouse gas emissions generated by leaks from the supply pipelines serving the Wallula Power Project would be 24,000 tons of methane per year.

Comparison with Worldwide Greenhouse Gas Emissions

Global warming is a worldwide problem caused by the combined greenhouse gas emissions throughout the planet. Carbon dioxide emitted from an industrial facility persists in the atmosphere for over 100 years before it is eventually metabolized by plants or absorbed into the oceans (ICPP 2001a). During that 100-year lifetime, a parcel of emissions generated anywhere on the planet will disperse throughout the world and affect climate change everywhere. Thus, climate change in Washington would be affected as much by emissions from power plants in China, for example, as by emissions from the Wallula Power Project.

To provide perspective on the potential direct impacts of emissions from the proposed Wallula Power Project, it is necessary to consider worldwide emissions. Table 3.17-3 lists greenhouse gas emissions worldwide, and from the United States, the State of Washington, and the proposed Wallula Power Project. The table also lists the total estimated future greenhouse gas emissions from the new gas-fired power plants forecast to be built in the Pacific Northwest (Bonneville 2001a).

Table 3.17-3. Comparison of Worldwide vs. Local Greenhouse Gas Emissions

Item	Annual Greenhouse Gas Emissions (MMTCE per year)		
	CO_2	Compounds Other than CO_2	Total
Worldwide emissions (including. U.S.) (1998)	5,660	2,430	8,090
United States emissions (1998)	1,494	340	1,834
Washington State emissions (1995)	21	4	25
Anticipated future gas-fired power plants in Washington and Oregon (28 plants, 11,000 MW)	11	1.3	12.3
Proposed Wallula Plant emissions	1.07	0.12	1.19
MMTCE – million metric tons of carbon equivalent Sources: IPCC (2001); EPA (2000); CTED (1999); Bonneville (2001).			

Many air pollutants compose "greenhouse gases," each of which exhibits a different chemical tendency to affect global warming. The two most common greenhouse gases associated with gas-fired power plants are CO_2 emitted from the exhaust stacks and methane emitted as fugitive leaks of natural gas along the pipeline system. Emissions of various greenhouse gas chemicals are commonly standardized as "carbon equivalents." The emission rates listed in Table 3.17-3 are standardized as million metric tons of "carbon equivalents" (MMTCE) per year, to account for the different global warming potential of each greenhouse gas. For comparison, 1 million tons of CO_2 equals 0.25 MMTCE, and 1 million tons of methane equals 5.2 MMTCE.

As listed in the table, most of the worldwide greenhouse gas emissions are in the form of CO_2, while a smaller fraction of the emissions are in the form of other gases such as methane or nitrous oxide. The total annual greenhouse gas emissions associated with the Wallula Power Project (including fugitive leaks of natural gas from the pipeline system serving the plant) would be 1.19 MMTCE. Based on the data listed in Table 3.17-3, this is 4.8% of the greenhouse gas presently emitted from all sources in Washington State and 9.6% of the amount anticipated to be issued from all proposed future power plants in the Northwest. The greenhouse gas emissions from the Wallula Power Project would be approximately 0.06% of the United States emissions. The actual effect on global warming caused solely by emissions from the Wallula plant is unknown.

3.17.2.2 Cumulative Impacts on Regional Class I Areas (Acid Deposition and Regional Haze)

Objective of Phase I and Phase II Studies

Air quality at many of the region's Class I areas (typically wilderness and national parks) is acknowledged to be currently impaired due to regional population growth and industrial activity. Since the majority of the proposed power projects are combustion turbines that would be operated near Class I areas, there is a regional concern over further degradation of air quality. Thus, Bonneville initiated the Phase I and Phase II Regional Air Quality Modeling Studies to better understand, under worst-case conditions, the interaction of the site-specific effects (Bonneville 2001a, 2001b, 2001c).

Phase I examined three scenarios regarding the number of future power plants to be operated in the region:

- a worst-case scenario in which a total of 45 new power plants were built and operated for a total of more than 24,000 MW;
- a second scenario with 28 new power plants, totaling a little over 11,000 MW operated simultaneously; and
- a third scenario with 15 new power plants totaling 7,000 MW, which is the most likely scenario in the next 10 years based on projection of need for new generation.

Phase II attempted to model the individual contribution of each new plant to the overall cumulative impact. The Phase II analysis for the Wallula Power Project is essentially the same as the 7,000 MW scenario from Phase I.

The impacts caused by the emissions solely from the new power plants were modeled at all of the Class I areas in Washington, Oregon, and Idaho. Existing background concentrations at the Class I areas were compared to the future impacts caused solely by the new power plants. The Phase I study did not attempt to model future impacts caused by population growth or industrial activity other than the new power plants.

Descriptors to Quantify Regional Haze

Regional haze is usually quantified using two related indicators. The "visual range" is the distance at which a dark mountain is just perceptible against the sky. The visual range decreases if the air is polluted. The "light extinction coefficient" (b_{ext}) has units of Mm^{-1} and is another indicator to quantify how pollutants in the atmosphere reduce visual range. Increased b_{ext} results in reduced visual range. For example b_{ext} coefficients of 18.1 Mm^{-1} and 20 Mm^{-1} correspond to visual ranges of 216 km and 196 km, respectively. If the background b_{ext} is 18.1 Mm^{-1}, then an increase of 1.9 Mm^{-1} (caused by emissions from a new source) would decrease the visual range by about 10%.

According to the federal land mangers (FLMs) responsible for protecting air quality in the Class I areas, a 5% change in extinction can be used to indicate a "just perceptible" change to a landscape and a 10% change in extinction coefficient from the "natural" background is considered a significant incremental impact. Restoration of "natural background" visibility is the long-range goal of existing federal regulations (EPA's Regional Haze Rule) as well as the FLMs. "Natural background" b_{ext} coefficients for each Class I area in the Pacific Northwest are listed in recent federal guidelines published by the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) in its Phase One Report, published by the U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service in December 2001.

However, Bonneville did not compare the future air quality impacts of new power plants to the natural background. Instead, Bonneville compared the future impacts to the measured cleanest 20th percentile of the existing Year 2001 b_{ext} coefficients at each Class I area. Because existing air quality at the Class I areas is already degraded, the Year 2001 background b_{ext} values used in the Bonneville study are considerably higher than the natural background b_{ext} values published by the FLMs. Therefore, the "percent increase above background" values calculated in the Bonneville report are lower than they would have been if Bonneville had followed the FLM's protocols.

Modeling Methodology

Features of the model simulations included the following.

Emission Scenarios

The study examined these three scenarios:

- air impacts that would occur if all 45 projects were built as planned and operated simultaneously at their rated capacity using their primary fuel,
- air impact that would accrue if 28 of the projects were built and energized by 2004, and
- air impacts that would accrue if 15 of the projects were built and energized by 2004.

Table 3.17-4 lists all 45 projects considered in the Phase I study and their assumed emission rates.

Predictive Model

The CALPUFF dispersion model was applied in the simulations. CALPUFF is the EPA's preferred model for long-range transport assessments. CALPUFF treats plumes as a series of puffs that move and disperse according to local conditions that vary in time and space. CALPUFF estimates processes for wet and dry deposition, aerosol chemistry, and regional haze.

Meteorological Data

Three-dimensional wind fields used by the CALPUFF model were based on the University of Washington's simulations of Pacific Northwest weather. The study area included all of Washington and portions of Oregon, Idaho, and British Columbia. Meteorological, terrain, and land use data in the model were based on a horizontal grid of 12 km. Maximum concentrations may be underestimated by CALPUFF because the 12z km grid cannot estimate plume collision with local elevated terrain.

Class I Areas

The study evaluated impacts to 16 Class I/Scenic/Wilderness Areas (3 National Parks, the Spokane Indian Reservation, and 12 Wilderness Areas), the Columbia River Gorge National Scenic Area (CRGNSA), and the Mt. Baker Wilderness.

Background Conditions

Assumed Year 2001 background b_{ext} values represent visibility on the clearest 5% of the days in the Class I/Scenic/Wilderness Areas and the best 20% of days in the CRGNSA and the Spokane Indian Reservation. These Year 2001 background values are considerably higher than the natural background b_{ext} values published by the FLMs

(FLAG, 2001). Background ozone and ammonia concentrations, nitrogen deposition, and sulfur deposition data were based on generally conservative assumptions.

Table 3.17-4. Peak Emissions with Primary Fuel, All Sources in Phase I Study

					Peak Emissions (lb/hr)		
	Project Name	**Owner**	**(MW)**	**Date**	**SO2**	**NO_x**	**PM10**
	TranAlta Centralia Generation LLC Big Hanaford Project	Transalta	248	Jun-01	6.6	21.1	16.2
	Fredonia Facility	PSE	111	Jul-01	102.4	46.4	24.3
	Rathdrum Power, LLC	Cogentrix	270	Aug-01	2.7	29.8	21.4
	Vancouver a (Alcoa)	Calpine	100	Nov-01	0.7	16.0	5.0
	Columbia Peaking Generation Project	Avista	200	Dec-01	2.8	13.6	11.2
	Mcnary B	Calpine	200	Dec-01	1.3	32.0	10.0
	Sumas Energy 2	NESCO	660	Jan-02	15.8	33.0	47.6
	Goldendale (The Cliffs)	Summit	225	Feb-02	1.0	38.3	15.0
	Columbia River Project	AES Columbia	220	May-02	7.3	25.3	17.2
	Frederickson	Calpine	350	May-02	1.5	17.1	18.0
	Frederickson Power	West Coast	249	May-02	10.2	19.7	16.9
	Coyote Springs 2	Avista	280	Jun-02	1.1	30.0	4.5
	Port of Tacoma Generation Project Phase 1 Peaking Project	SW Power	175	Jun-02	2.6	61.0	18.0
	Goldendale Energy Project	Calpine	248	Jul-02	1.0	14.9	11.8
	Hermitston Power Project	Calpine	546	Sep-02	2.5	71.7	38.1
	Everett Delta I	FPL	248	Sep-02	11.0	25.0	18.0
	Everett Delta II	FPL	248	Sep-02	11.0	25.0	18.0
	Pierce County Project	Duke	320	Jan-03	44.0	148.0	44.0
	Satsop CT Project- Phase I	Duke	650	Jan-03	2.7	43.5	50.6
	Mint Farm Generation Project I	Avista	248	Jul-03	2.7	25.0	18.8
	Umatilla Tribal Generation Project	Confed. Tribes	1000	Jul-03	5.6	122.4	109.6
	Longview Energy	Enron	290	Jul-03	1.4	25.0	19.9
	Coburg Power	Frontier	600	Aug-03	1.5	54.7	15.8
	Starbuck	NW Power Ent.	1200	Oct-03	17.7	106.4	82.8
	Umatilla Generating Project	PG&E	620	Nov-03	9.8	40.4	48.0
	Summit/Westward (Clatskanie)	Summit	520	Nov-03	8.0	54.0	48.0
	Chehalis Generating Facility	Tractebel	520	Nov-03	20.8	40.9	31.6
	Port Westward	PGE	650	Dec-03	12.7	43.8	26.8
	Cherry Point	BP	750	Jan-04	3.0	45.1	35.7
	Frederickson Power II	West Coast	249	Jan-04	10.2	13.6	15.6
	Mcnary A	Calpine	600	Jun-04	3.0	34.2	36.0
	Salem (Bethel PGE)	Calpine	600	Jun-04	3.0	34.2	36.0
	Port of Tacoma Phase II (5 units)	SW Power	825	Jun-04	13.0	101.5	90.0
	Grizzly Power	Cogentrix	980	Jul-04	52.8	114.4	105.6
	Wallula Power Project	Newport Generation	1300	Jul-04	9.5	108.2	72.8
	Mercer Ranch Generation Project	Cogentrix	800	Oct-04	42.7	92.4	85.3
	Satsop CT Project- Phase II	Duke	650	Oct-04	2.7	43.5	50.6
	Satsop CT Project- Phase III	Duke	650	Oct-04	2.7	43.5	50.6
	Northern Idaho Power	Cogentrix	810	Dec-04	34.5	83.5	70.5
	Morrow Generating Project	PG&E	620	Jan-05	9.8	40.4	48.0
	Ferndale	Calpine	600	Jun-05	3.0	34.2	36.0
	Mount Vernon	Calpine	600	Jun-05	3.0	34.2	36.0
	Vancouver b (Alcoa)	Calpine	600	Jun-05	3.0	34.2	36.0
	Mattawa (Grant Co)	Grant Co. LLC	1300	Jun-05	9.5	108.2	72.8
	Kootenal Power (Rathdrum)	Kootenal Generation	1300	Jun-05	4.4	87.6	94.4

Overview of Phase I Results

The Phase I study considered 45 new power plants in the region and modeled the following parameters at each Class I area.

Increase in Ambient Concentrations of SO2, NOx, and PM10

The increases in ambient concentrations caused solely by the new power plants were compared to the allowable ambient air quality standards and PSD Class I increments. As listed in Table 3.17-5, the modeled concentrations for all three scenarios were much lower than the allowable PSD Class I increments, and in nearly all cases were below the Significant Impact Levels. This indicated that, even for the worst-case scenario, new power plants in the region would probably not cause concentrations exceeding regulatory limits at any Class I area.

The Bonneville study did not attempt to estimate air pollutant concentrations in Class II areas near each individual power plant. The impacts near each plant are evaluated based on detailed air quality modeling required under each plant's air quality permit application. Each individual permit application is reviewed by the appropriate regulatory agency to ensure that the power plant does not contribute to exceedances of the Ambient Air Quality Standards.

For example, the Wallula Power Project would be located in an existing PM10 nonattainment area. As described in Section 3.2 of this EIS, the Wallula project is required to install LAER emissions controls and to procure off-site ERCs to ensure the project would not contribute to the existing PM10 exceedances.

Table 3.17-5. Maximum Concentration Predictions (ug/m3)*

	Annual Average			24-hour		3-hour
Area	**NO_x**	**PM10**	**SO2**	**PM10**	**SO2**	**SO2**
Diamond Peak Wilderness	0.003	0.014	0.002	0.15	0.02	0.06
Three Sisters Wilderness	0.007	0.025	0.004	0.31	0.08	0.21
Mt. Jefferson Wilderness	0.007	0.031	0.004	0.37	0.08	0.25
Strawberry Mtn. Wilderness	0.003	0.019	0.002	0.18	0.02	0.12
Mt. Hood Wilderness	0.014	0.051	0.005	0.71	0.07	0.12
CRGNSA	0.047	0.094	0.010	1.54	0.18	0.33
Eagle Cap Wilderness	0.007	0.028	0.003	0.24	0.02	0.08
Hells Canyon Wilderness	0.006	0.022	0.002	0.18	0.01	0.04
Mt. Adams Wilderness	0.010	0.036	0.004	0.41	0.03	0.17
Goat Rocks Wilderness	0.010	0.034	0.004	0.24	0.03	0.11
Mt. Rainier National Park	0.022	0.055	0.010	0.52	0.08	0.35
Olympic National Park	0.019	0.035	0.003	0.43	0.10	0.23
Alpine Lakes Wilderness	0.040	0.077	0.016	0.49	0.11	0.31
Glacier Peak Wilderness	0.020	0.047	0.012	0.28	0.14	0.63
North Cascades National Park	0.022	0.043	0.016	0.32	0.19	0.63
Pasayton Wilderness	0.009	0.020	0.005	0.11	0.06	0.22
Mt. Baker Wilderness	0.041	0.075	0.031	0.38	0.27	1.42
Spokane Indian Res.	0.021	0.055	0.006	0.66	0.07	0.32
EPA Proposed Class I SIL	0.100	0.200	0.100	0.30	0.20	1.00

* Includes all sources.
Note: PM10 includes sulfates and nitrates.

Increase in Sulfur and Nitrogen Deposition

Increases in acid deposition at the Class I areas caused solely by the new power plants were compared to existing background values and recognized impact thresholds. Table 3.17-6 shows the assumed background values and modeled worst-case deposition rates. In most of the Class I areas the existing background deposition rates are much higher than impact thresholds established by the U.S. Forest Service and the National Park Service, indicating that existing air quality is already significantly impaired. As shown in the table the modeled worst-case increases caused solely by new power plants would be a small fraction of the existing background values.

Table 3.17-6. Maximum Annual Deposition (Wet + Dry) Flux*

	Annual Sulfur Deposition (kg/ha/yr)				Annual Nitrogen Deposition (kg/ha/yr)			
Area	**Background**	**Sources**	**Total**	**Change (%)**	**Background**	**Sources**	**Total**	**Change (%)**
Diamond Peak Wilderness	4.000	0.003	4.003	0.640	2.200	0.005	2.205	0.231
Three Sisters Wilderness	5.600	0.006	5.606	0.101	3.600	0.011	3.611	0.100
Mt. Jefferson Wilderness	4.000	0.006	4.006	0.148	1.800	0.012	1.812	0.644
Strawberry Mtn. Wilderness	1.400	0.003	1.403	0.194	1.200	0.005	1.205	0.406
Mt. Hood Wilderness	8.600	0.006	8.606	0.070	5.400	0.013	5.413	0.240
CRGNSA	12.000	0.009	12.009	0.075	10.000	0.021	10.021	0.214
Eagle Cap Wilderness	1.600	0.004	1.604	0.250	1.600	0.010	16.100	0.595
Hells Canyon Wilderness	1.400	0.004	1.404	0.256	1.200	0.009	1.209	0.760
Mt. Adams Wilderness	10.800	0.006	10.806	0.053	9.000	0.011	9.011	0.126
Goat Rocks Wilderness	11.800	0.006	11.806	0.049	9.000	0.010	9.010	0.113
Mt. Rainier National Park	3.100	0.011	3.111	0.354	2.400	0.017	2.417	0.706
Olympic National Park	5.600	0.007	5.607	0.119	2.000	0.015	2.015	0.758
Alpine Lakes Wilderness	7.200	0.024	7.224	0.327	5.200	0.031	5.234	0.654
Glacier Peak Wilderness	8.000	0.020	8.020	0.250	5.800	0.023	5.823	0.401
North Cascades National Park	3.500	0.029	3.529	0.812	5.200	0.025	5.225	0.483
Pasayton Wilderness	7.200	0.011	7.211	0.146	5.200	0.012	5.212	0.222
Mt. Baker Wilderness	No Data	0.052			No Data	0.040		
Spokane Indian Res.	No Data	0.008			No Data	0.019		
USFS Criteria	-	-	3.000	-	-	-	5.000	-

* Includes all sources.
Note: Nitrogen deposition includes ammonium ion.

Impacts to Regional Haze

Increases in the light extinction coefficient b_{ext} (related to regional haze and visual range) caused solely by the new power plants were compared to the cleanest background values and recognized impact thresholds. Monitoring data from the U.S. Forest Service and National Park Service indicate the Class I areas are already significantly impaired, and even minor increases in regional haze (5% to 10% increase in b_{ext} above background) are considered a significant impact.

Table 3.17-7 shows the number of days per year that 45 new power plants were modeled to cause b_{ext} increases exceeding 5%. The two Class I areas that would be impacted by the Wallula Power Project are the CRGNSA and Mt. Hood Wilderness. The worst-case modeling indicated those two areas could experience 31 to 57 days per year of significant regional haze impact as a result of the 45 new plants.

Table 3.17-7. Number of Days with Greater than 5% Change to Background Extinction*

Area	Spring	Fall	Summer	Winter	Total
Diamond Peak Wilderness	0	0	0	0	0
Three Sisters Wilderness	6	9	5	2	22
Mt. Jefferson Wilderness	2	5	0	3	10
Strawberry Mtn. Wilderness	0	0	0	2	2
Mt. Hood Wilderness	5	17	3	6	31
CRGNSA	10	19	17	11	57
Eagle Cap Wilderness	1	2	0	3	6
Hells Canyon Wilderness	0	0	0	0	0
Mt. Adams Wilderness	1	8	0	7	16
Goat Rocks Wilderness	2	6	0	2	10
Mt. Rainier National Park	18	11	9	8	46
Olympic National Park	8	14	1	16	39
Alpine Lakes Wilderness	28	19	16	22	85
Glacier Peak Wilderness	12	12	12	12	48
North Cascades National Park	6	6	6	7	25
Pasayton Wilderness	1	2	0	4	7
Mt. Baker Wilderness	18	20	18	17	73
Spokane Indian Res.	0	9	2	13	24

* Includes all sources.
Note: Background extinction based on aerosol concentrations on days with the best visibility. For the CRGNSA and Spokane Indian Reservation based on top 20 percent, for all other areas based on average of the top 5 percent.

The Phase I modeling suggested that operation of between 28 to 45 new power plants in the region could significantly impact regional haze at many Class I areas. However, as described previously, it is expected that only a fraction of those power plants would actually be constructed. The third scenario of 7,000 MW produced by 15 new power plants, the number of plants that has the most reasonable likelihood of being constructed, is essentially the same as the Phase II study to evaluate the individual contribution of the Wallula Power Project to overall cumulative impact. The Phase II modeling results are described below.

Results of Phase II Study (7,000 MW Including Wallula Project)

The following modeling results were developed by Bonneville in the Phase II study for the Wallula Power Project (Bonneville 2001b) and for the generic "7,000 MW Baseline Source Group" that included the Wallula project (Bonneville 2001c).

Table 3.17-8 lists the power plants that were included in the 7,000 MW Baseline Group. Figure 3.17-1 shows the locations of the power plants relative to the Class I areas. Peak emissions from the 15 projects within the 7,000 MW Baseline Source Group are listed in Table 3.17-8. Emissions are shown both for the primary and secondary fuels. The Phase II analysis assumed all plants in Table 3.17-8 operate simultaneously at peak load with their primary fuel for the entire simulation period. An oil-firing scenario was also considered, where sources permitted to fire with fuel oil were assumed to operate in this manner over the winter season.

Table 3.17-8. 7000 MW Baseline Source Group: Peak Emissions with Primary Fuel

Num	Project Name	Owner	MW	Peak Emissions (lb/hr)		
				SO2	NOx	PM10
1	Fredonia Facility	PSE	108	3.5	23.2	6.8
2	Rathdrum Power, LLC	Cogentrix	270	2.7	29.8	21.4
3	Frederickson Power	West Coast	249	10.2	19.7	16.9
4	Coyote Springs 2	Avista	280	1.1	30.0	4.5
5	Goldendale Energy Project	Calpine	248	1.0	14.9	11.8
6	Hermiston Power Project	Calpine	546	2.5	71.7	38.1
7	Chehalis Generation Facility	Tractebel	520	20.8	40.9	31.6
8	Longview Energy	Enron	290	1.4	25.0	19.9
9	Goldendale (The Cliffs)	GNA Energy	225	1.0	38.3	15.0
10	Big Hanaford Project	TransAlta	267	6.5	23.1	14.3
11	Umatilla Generating Project	PG&E	620	9.8	40.4	48.0
12	Mint Farm Generation	Mirant	319	4.0	25.1	23.1
13	Wallula Power Project	Newport	1300	12.4	89.2	81.3
14	Starbuck Power Project	NW Power Ent.	1200	17.7	106.4	82.8
15	SCTP (Phase I)	Duke Energy	650	2.7	43.5	50.6
		Total	**7092**	**97**	**921**	**466**
Peak Emissions with Secondary Fuel						
1	Fredonia Facility (Oil-Fired)	PSE	104	51.2	23.2	12.2
7	Chehalis (Oil-Fired)	Tractebel	520	238.0	211.5	40.0
8	Longview Energy (Oil-Fired)	Enron	290	3.2	54.0	34.0
The Fredonia Facility has requested fuel oil firing for all hours of the year as a secondary fuel. The Longview Energy Facility and the Chehalis Generating Facility have requested fuel oil firing for 1,650 and 720 hours per year, respectively.						

The assumption of simultaneous operation at peak load likely overestimated impacts, and with the exception of the Fredonia Facility, the projects are not allowed to fire with fuel oil for an entire winter season. In practice, virtually all proponents state they intend to burn gas except in times of significant shortage. However, the surge in gas prices during 2000-2001 led to widespread efforts to re-permit a number of existing gas-fired boilers to allow the use of oil firing. This suggests power plant operators may also be inclined to burn oil during periods of high gas prices. Thus, it is conceivable the power plants that are permitted to burn oil would, in fact, burn oil as much as they are allowed, particularly as more power plants come online.

The oil-burning scenario is a compromise solution to a potentially complex assessment. The present analysis likely overstates potential impacts attributable to the Chehalis Generating Facility and Longview Energy Facility because they cannot burn oil every day of the winter. The meteorology on the winter days producing the highest impacts may also not occur concurrently with the economic conditions likely to cause these power plants to burn oil. On the other hand, the impacts attributable to the Fredonia Facility (if they are allowed to burn oil every day) may be underpredicted because the analysis limits their oil-fired emissions to winter months.

The results of the Phase II study were as follows.

Regional Haze Impacts During Natural Gas Firing

Figure 3.17-2 shows the maximum 24-hour increases in regional haze caused by the 7,000 MW Baseline Group firing primary fuel (mainly natural gas). Relatively higher 24-hour maximum extinction coefficients are predicted for the lowland areas of western Washington, in northern Oregon just south of the Columbia River, and in the lower Columbia River Basin. The meteorological conditions conducive to formation of secondary aerosols from the power projects include high relative humidity, light winds, and cooler temperatures that generally occur during fair weather in the spring, fall, and winter. During such conditions, plumes from the power projects are primarily confined to the lower elevations within the study domain.

Regional Haze Impacts Under the Oil-Fired Scenario

Figure 3.17-3 shows the predicted maximum 24-hour extinction coefficients for the winter oil-fired case. This scenario assumes sources within the 7,000 MW Baseline Group permitted for oil firing would use this fuel for the entire winter period. Since the hours of fuel oil firing are restricted for most of the facilities, the model likely overpredicted impacts. Due to relatively high SO2, PM10, and NOx emissions, the maximum b_{ext} values for the oil-fired case are potentially much higher than for the gas-fired case, especially in the western Washington airsheds influenced by the Fredonia Facility, Chehalis Generation Facility, and Longview Energy Facility. The impacts in eastern Washington are similar for the oil-fired and gas-fired scenarios, because few of the plants in eastern Washington would be permitted for significant amounts of oil-fired operation.

Modeled Regional Haze Impacts Caused Solely by Wallula Project

Table 3.17-9 lists the modeled increases in b_{ext} at each Class I area caused solely by the Wallula project. Impacts are limited mainly to the CRGNSA and Mt. Hood Wilderness. Emissions from the Wallula project, by itself, would not cause a 5% increase in b_{ext} at any Class I area. The highest impact would be a 3.5% increase at the CRGNSA.

Table 3.17-9. Contribution of the Wallula Power Project (By Itself) to Regional Haze Firing by Primary Fuel

Area of Interest	Wallula Power Maximum Extinction (1/Mm)	Wallula Power Maximum Change to Year 2001 Background Extinction (%)	Number of Days When Wallula Power Contribution > 0.4%	
			And Cumulative Change to Year 2001 Extinction > 5%	And Cumulative Change to Year 2001 Extinction > 10%
CRGNSA	1.48	3.5	3	0
Mt. Hood Wilderness	0.83	3.5	3	1
Spokane Indian Reservation	0.58	1.8	0	0
Three Sisters Wilderness	0.16	1.18	0	0
Mt. Adams Wilderness	0.42	2.13	0	0
Alpine Lakes Wilderness	0.21	1.40	0	0
Diamond Peak Wilderness	0.04	0.25	0	0
Eagle Cap Wilderness	0.34	2.21	0	0
Glacier Peak Wilderness	0.33	1.82	0	0
Goat Rocks Wilderness	0.26	1.31	0	0
Hells Canyon Wilderness	0.22	1.21	0	0
Mt. Jefferson Wilderness	0.29	1.72	0	0
Mt. Baker Wilderness	0.15	0.68	0	0
North Cascades National Park	0.15	0.84	0	0
Olympic National Park	0.16	0.65	0	0
Pasayten Wilderness	0.11	0.57	0	0
Mt. Rainier National Park	0.12	0.88	0	0
Strawberry Mtn. Wilderness	0.10	0.63	0	0

Notes:
For the Wallula Power Project peak 24-hour gas-fired emissions were assumed for all days of the year. Cumulative predictions include emissions from the power projects listed in Table 3.17-8 fired by their primary fuel.

Background extinction coefficients are based on aerosol concentrations during days with the top five percent best visibility for all areas except the CRGNSA and the Spokane Indian Reservation. The CRGNSA and Spokane Indian Reservation background extinction is based on the average for the top twenty percent at the Wishram monitoring site.

Number of Days of Significant Regional Haze Impact (Eastern Washington)

Tables 3.17-10 and 3.17-11 list the predicted number of days per year for which the 7,000 MW Baseline Group would cause greater than 5% and 10% b_{ext} increases, respectively (compared to Year 2001 background). For both the natural gas and oil-fired scenarios, the 7,000 MW Baseline Group could potentially cause a "just perceptible" 5% b_{ext} increase on a few days per year at several Class I areas. The following areas near the Wallula project would experience cumulative impacts exceeding a 5% b_{ext} increase:

- CRGNSA (4 days per year),
- Mt. Hood Wilderness (3 days per year); and
- Spokane Indian Reservation (3 days per year).

The 7,000 MW Baseline Group exceeds the 10% significance criterion on only 1 day in the Mt. Hood Wilderness when these sources are fired by natural gas, due mainly to the power projects at the east end of the CRGNSA, in the Umatilla area, the Wallula Power Project, and the Starbuck Power Project.

Table 3.17-10. Number of Days with Greater than 5% Change to Year 2001 Background Extinction: Cumulative Impact of Entire 7000 MW Baseline Source Group

Area	Natural Gas-Fired					Oil-Fired
	Spring	Fall	Summer	Winter	Total	Winter
CRGNSA	0	2	0	2	4	4
Mt. Hood Wilderness	0	1	0	2	3	3
Spokane Indian Reservation	0	1	0	1	2	3
Diamond Peak Wilderness	0	0	0	0	0	0
Three Sisters Wilderness	0	0	0	0	0	0
Mt. Jefferson Wilderness	0	0	0	0	0	0
Strawberry Mtn. Wilderness	0	0	0	0	0	0
Eagle Cap Wilderness	0	0	0	0	0	0
Hells Canyon Wilderness	0	0	0	0	0	0
Mt. Adams Wilderness	0	0	0	2	2	3
Goat Rocks Wilderness	0	0	0	0	0	2
Mt. Rainier National Park	1	0	0	0	1	20
Olympic National Park	0	0	0	0	0	4
Alpine Lakes Wilderness	0	0	0	0	0	6
Glacier Peak Wilderness	0	0	0	0	0	2
North Cascades National Park	0	0	0	0	0	1
Pasayten Wilderness	0	0	0	0	0	0
Mt. Baker Wilderness	0	0	0	0	0	4

Background extinction based on aerosol concentrations on days with the best visibility. For the CRGNSA and Spokane Indian Reservation based on top 20%, for all other areas based on the average of the top 5%

The Oil-fired case assumes the Fredonia Facility, Chehalis Generating Facility, and Longview Energy Facility would all be using oil for all hours of a winter season.

Table 3.17-11. Number of Days with Greater than 10% Change to Year 2001 Background Extinction Cumulative Impact of Entire 7000 MW Baseline Source Group

Area	Natural Gas-Fired					Oil-Fired
	Spring	Fall	Summer	Winter	Total	Winter
CRGNSA	0	0	0	0	0	0
Mt. Hood Wilderness	0	0	0	1	1	1
Spokane Indian Reservation	0	0	0	0	0	0
Diamond Peak Wilderness	0	0	0	0	0	0
Three Sisters Wilderness	0	0	0	0	0	0
Mt. Jefferson Wilderness	0	0	0	0	0	0
Strawberry Mtn. Wilderness	0	0	0	0	0	0
Eagle Cap Wilderness	0	0	0	0	0	0
Hells Canyon Wilderness	0	0	0	0	0	0
Mt. Adams Wilderness	0	0	0	0	0	0
Goat Rocks Wilderness	0	0	0	0	0	0
Mt. Rainier National Park	0	0	0	0	0	7
Olympic National Park	0	0	0	0	0	0
Alpine Lakes Wilderness	0	0	0	0	0	0
Glacier Peak Wilderness	0	0	0	0	0	0
North Cascades National Park	0	0	0	0	0	0
Pasayten Wilderness	0	0	0	0	0	0
Mt. Baker Wilderness	0	0	0	0	0	0

Background extinction based on aerosol concentrations on days with the best visibility. For the CRGNSA and Spokane Indian Reservation based on top 20%, for all other areas based on the average of the top 5%.

The Oil-fired case assumes the Fredonia Facility, Chehalis Generating Facility, and Longview Energy Facility would all be using oil for all hours of a winter season.

Western Washington Regional Haze Impacts

Western Washington areas that would be impacted by power plants other than the Wallula project are the Alpine Lakes Wilderness, Mt. Rainier National Park, and Mt. Baker Wilderness. In Mt. Rainier National Park the predicted change to background extinction for the winter oil-fired case exceeds the FLM 10% significance criterion on 7 days.

Uncertainty Analysis

The above analysis is subject to both overprediction and underprediction for the reasons described below.

Overprediction

The above analysis probably overpredicts the number of days of regional haze impact, because it assumes a background condition consisting of exceptionally clear weather for 365 days per year. In reality, several of the modeled worst-case meteorological episodes occurred during the winter with fog, drizzle, and overcast conditions. For example, the modeled 1-day episode affecting the Mt. Hood Wilderness occurred on a day with easterly flow during the winter. Under these conditions the turbine plumes are embedded in cold moist air, promoting the formation of nitrate particles that would exacerbate downwind regional haze if the weather was clear. However, concurrent weather observations at Pasco, Pendleton, and The Dalles indicate fog and poor existing visibility sometimes accompanied these episodes. During such cold air outbreak episodes, high winds occur in the western end of the CRGNSA. Background aerosol concentrations will likely be higher due to the resulting fog, low clouds, precipitation and other obscuring weather. Thus, in some cases the modeled impacts predicted in this analysis would not actually be perceptible.

The modeling of wintertime impacts resulting from use of secondary oil firing probably overpredicts the impacts because it assumes each plant that is permitted to use oil as a backup fuel does so continuously for 90 days during the winter. This is a conservative assumption. For example, the Chehalis Generating Facility is permitted to burn oil for only 30 days per year, so the assumption that the plant uses oil for 90 days during the winter probably results in an overprediction of the number of days that plant would impact Mt. Rainier National Park.

Underprediction

Bonneville's Phase I and Phase II studies did not consider future cumulative impacts related to population growth and industrial expansion other than new utility power plants. Given the expected population growth in Washington and Oregon, it is likely that the actual future air quality degradation at the Class I areas could be substantially higher than modeled in Bonneville's limited studies.

The Bonneville study calculated the increase in b_{ext} above background using the degraded Year 2001 conditions as the background, rather than using natural background values as prescribed by the FLM's protocol (FLAG 2001). Use of the degraded Year 2001 conditions resulted in an underestimate of the number of days the future power plants would cause either a "just perceptible" 5% increase or an unacceptable 10% increase in b_{ext} above natural background.

3.17.3 Water Resources

Cumulative impacts on water resources depend upon the proximity of proposed generation plants to other water-consuming projects (power generating and otherwise) and the characteristics of the common surface water bodies and aquifers to which the projects would be hydrologically linked. These concerns have been compounded in recent years by the listings of regional salmon and trout species as endangered and threatened, requiring special attention to water levels in Pacific Northwest rivers.

Cumulative water resource impacts can result from single projects in sensitive water resource areas, or where groups of projects would collectively tax an otherwise plentiful water source. Reducing local water supplies could lead to detrimental effects on water quality and fish habitat. For example, the Oregon Department of Fish and Wildlife believes that the amount of water required by the Grizzly Power Generating Project may impact local water supplies due to the hydrologic link to local surface water bodies, including the Deschutes River.

Similarly, six power projects exist or have been permitted or proposed in the Chehalis River Basin (including the Centralia Coal-Fired Power Plant, the Big Hanaford Project, the Chehalis Generation Facility, and two phases of the Satsop CT Project). While basins like the Chehalis can support large projects, siting several highly water-consumptive power plants in the same region could create water supply impacts that may not be anticipated through individual project evaluations. Actual impacts would occur only if facilities are constructed, now or in the future. Cumulative effects on individual watersheds and stream reaches are not evaluated in this EIS because impact analyses would need to be informed by project-specific details and site-specific hydrologic data.

Water consumption issues are not confined to state boundaries, as can be seen in the proposal by North Idaho Power, LLC. The applicant, who is proposing to bring an 810 MW plant online in late 2004, is requesting a permit to withdraw water from the Spokane Valley-Rathdrum Prairie aquifer. This aquifer, shared by both Washington and Idaho (Spokane and Kootenai Counties, respectively), recharges the Spokane River and is the sole source of drinking water for nearly 400,000 people in northern Idaho and eastern Washington. (Associated Press 2002)

On a larger scale (and most relevant to the Wallula Power Project), many existing and proposed plants in Washington and Oregon consume, or plan to consume, water from the Columbia River (through direct withdrawals or through aquifers that recharge the river). Table 3.17-12 (excerpted from Table 3.17-1) lists existing and proposed plants with water supplies that are (or would be) hydrologically linked to the Columbia River. While it is unlikely that all of these plants will be constructed, the fact that so many have been proposed along the Columbia River indicates that cumulative impacts may occur.

Table 3.17-12. Proposed and Existing Power Plants with Water Supplies Hydrologically Linked to the Columbia River above the Bonneville Dam

Plant	Water Consumption (million gal/day)	Surface Water Source
Coyote Springs Cogeneration Project I	2-3	Port of Morrow, hydrologically connected to Columbia River
Coyote Springs Cogeneration Project II	2-3	Port of Morrow, hydrologically connected to Columbia River
Hermiston Generating Project	4-5	Port of Umatilla regional water supply pipeline; mainstream right to Columbia River
Hermiston Power Project	4-5	Port of Umatilla regional water supply pipeline; mainstream right to Columbia River
Mercer Ranch Generation Project	11.1	Columbia River
Morrow Generation Project	4-5	Port of Morrow, hydrologically connected to Columbia River
Port Westward Generating Project	4-5	Municipal water from Port of St. Helens; hydrologically linked to Columbia River
Summit Westward Energy Project	4-5	Municipal water from Port of St. Helens; hydrologically linked to Columbia River
Umatilla Generating Project	3.3	Port of Umatilla regional water supply pipeline; mainstream right to Columbia River
Wallula Power Project	4.6 (average)	Local wells with hydrologic connection to Lake Wallula, an impoundment of the Columbia River.*
Total	43.0 to 50.0	
* The Wallula Power Project is an example of a power facility that would purchase and transfer water rights for the majority of its water needs. Please see Section 3.3.		

Table 3.17-12 provides information on the cumulative water resource impacts that would occur above Bonneville Dam, because assessing flow rate impacts at the mouth of the Columbia River would result in an artificially low impact (i.e., several large tributaries feed the Columbia River below the Bonneville Dam, additional water resources that would not alleviate water resource impacts occurring above the Bonneville Dam). Projects located along the Columbia River below Bonneville Dam include the Cowlitz Generation Project, Longview Power Station, Mint Farm Generation Project, and Vancouver (a) and (b). In some instances, the water consumption shown from the Columbia River is an existing water right currently used for another purpose such as agricultural irrigation, and the water consumption shown is a change in user and not a net increase in consumption.

The average daily flow from the Bonneville Dam is 2,609 mgd (Bonneville 2002). Thus the maximum total daily water consumption of all existing, permitted, and proposed plants above the Bonneville Dam (50.0 mgd) represents approximately 1.9% of the Columbia River's daily flow at that point. Similarly, cumulative water consumption from the Chehalis River for existing and proposed energy projects (excepting the Centralia Coal-Fired Power Plant) would equal approximately 1.7% of the total river flow as measured at Porter, Washington (approximately 10 miles upstream of the Satsop River confluence).[1]

[1] Calculation based upon estimated water consumption from the Satsop CT Projects [Phase I and II], Centralia Big Hanaford Project, and Chehalis Generating Facility as compared with Chehalis River flow

This does not take into account localized water supply impacts along specific river reaches, where concentrated water withdrawals could result in more pronounced water resource effects. Such impacts are more appropriately evaluated in the water resources impacts sections for specific projects. Furthermore, seasonal fluctuations in water quantities could also result in more pronounced effects on local water resources (i.e., an average rate of water withdrawal during a drought could more adversely effect local environmental resources than the same level of withdrawal when water quantities were normal).

As a result of water supply concerns, some applicants are considering a variety of options to mitigate for individual and cumulative water supply impacts. For example, some applicants have altered or are considering altering their configurations to accommodate air-cooled systems, which would require far less water than a wet-cooled system. Other projects, like the COB Energy Facility in Klamath County, Oregon, plan to develop a deep enough water well to avoid affecting surface water within the local water basin. In some cases, the permitting agency is requiring offset of water usage as a means of mitigating local water supply impacts.

3.17.4 Gas Supply

Natural gas consumption in the Pacific Northwest (Washington, Oregon, and Idaho) was approximately 1.59 billion cubic feet per day (cf/day) in 2000 (Energy Information Administration 2000). In comparison, Canada's extensive transmission system has the capacity to deliver 3 billion cf/day of natural gas to the Pacific Northwest (NGA undated). This transmission system, composed of approximately 7,000 miles of pipeline owned by GTN, Westcoast Energy Pipeline, and Williams Gas Pipeline-West, supplies about 80% of the natural gas used in Washington, Oregon, and Idaho (NGA undated). (Approximately 20% of natural gas supplied to the Northwest is obtained from other sources in Southwest and Plains states.) Although Canadian natural gas supplies exceed current needs in the Pacific Northwest by approximately 47%, most of this excess production would be consumed if many of the proposed gas-fired plants were built.

Comparing current Canadian natural gas supply capacity with projected needs in the Pacific Northwest indicates that supply would nearly meet demand if only existing facilities and Bonneville's Baseline Source Group were considered. If all power plants listed in Table 3.17-1 were built and concurrently operating at maximum capacity, the Pacific Northwest (including Idaho and Montana) would require 4.94 billion cf/day of natural gas (approximately 65% more gas than Canada could currently deliver per day). However, a more realistic and conservatively high needs estimate (which would include the combined requirements of Bonneville's 15 Baseline Source Group facilities, existing facilities, and smaller facilities that research indicates could currently be online) would be approximately 1.58 billion cf/day of natural gas (approximately 53% of Canada's delivery capacity of 3 billion cf/day). Thus, future natural gas needs would potentially exceed *current* Canadian supply capacity by approximately 6% (i.e., current use [53% of

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rates provided in the Satsop CT Project Phase II Application for Amendment 4 to the Site Certification Agreement.

current supply] plus future need [53% of current supply] totals 106% [6% more than current supply]).

As stated by the National Gas Association, "the 7,000 average megawatts of gas-fired electric resources that could be built in the next 20 years [Bonneville's Baseline Source Group] would nearly double current natural gas consumption. To meet this need, western Canadian production needs to be increased by only 16%." This projected increase in production (16%) likely exceeds the estimated need calculated above (6%) due to anticipated increases in natural gas demand in other sectors. The National Gas Association affirms that advances in technology and the large portion of British Columbia that remains unexplored imply that important additional gas discoveries are occurring throughout North America and are adding gas reserves at a sustainable rate. (NGA undated)

Regardless of current supply and demand, the use of gas, its cost, and the potential for new gas reserve development (or alternatives to it) are determined by market forces not evaluated in this EIS.

3.17.5 Electrical Transmission Lines

In June 1995, Bonneville issued a Business Plan Final EIS that addressed the environmental impacts of the agency's business strategies for participation in the electric utility market. As a part of this analysis, Bonneville described in broad terms the impacts associated with further development of the electrical transmission system in the Pacific Northwest. See the Business Plan Final EIS Chapter 4.3 (Generic Environmental Impacts) for a detailed discussion of Bonneville's findings. Several of the most relevant points are summarized below.

The cumulative environmental impacts related to transmission line improvement projects can be quantified, in part, based on the size of the required transmission line right-of-way. Expanding the electric transmission system may also lead to further development of industrial sites based on improved access to power lines. Such impacts would need to be assessed on a project-by-project basis. Table 3.17-14 presents information about the typical right-of-way widths of Bonneville transmission lines.

Table 3.17-14. Typical Right-of-Way Widths of BPA Transmission Lines

Voltage	Structure Type	Right-of-Way Width (meters/feet)
115-kV	Single pole wood	21/70
	H-frame wood	24-32/80-105
230-kV	H-frame wood	35-37/115-120
	Steel	32-35/105-115
500-kV	Steel	37-52/120-170
Source: Bonneville (1995).		

Bonneville has identified several highly probable transmission line projects, called the "G-9" projects, to be located throughout the Pacific Northwest. The G-9 projects, described in Table 3.17-15, are all scheduled for completion by or before the end of 2005.

Table 3.17-15. G-9 Transmission Line Infrastructure Projects

Project Name	Voltage (kV)	Length (miles)	Approximate Right-of-Way Area (acres)	Energization Date
Kangley-Echo Lake	500	9	131 to 185	November 2002
Schultz-Wautoma	500	59	858 to 1,216	October 2004
McNary-John Day	500	70	1,018 to 1,442	October 2004
Lower-Mon.-Starbuck	500	15	218 to 309	October 2004
McNary-Wallula/ Generation-Wallula	500	28/ 5	436 to 618/ 73 to 103	October 2005
Schultz Series Cap Additions (Project yet to be defined)	N/A	N/A	N/A	November 2003
Celilo Mercury Arc Replacement (Transmission line improvements)	N/A	N/A	N/A	December 2003
Monroe-Echo Lake	500	30	436 to 618	October 2005
Grand Coulee-Bell	500	84	1,222 to 1,731	October 2004
Source: Bonneville (2001d).				

An example of potential cumulative impacts related to transmission lines could occur where multiple new lines would converge on the same substation. For example, several new lines (including the McNary-John Day Project, new lines from the Umatilla Generation Project and the Wanapa Generation Project, a 230 kV line to Brownlee, and an additional McNary-John Day line on the south side of the Columbia River) are all proposed to interconnect at the McNary Substation. If all projects were to be built, transmission line congestion around the McNary Substation could worsen.

3.17.5.1 Land Use

Land uses can be directly affected by the amount of new and existing rights-of-way needed to establish transmission line corridors. Constructing new transmission lines (and widening existing rights-of-way) can affect residential, commercial, agricultural, and forest land because new line segments and access roads intrude on existing land uses and can eliminate some land uses. For example, the Wallula Power Project would potentially remove some farmland from production, and transmission line structures could interfere with nearby crop circle irrigation systems.

Land use impacts of transmission lines vary according to several factors, including voltage, insulation design, conductor tension, right-of-way width, span lengths, structures, and conductor configurations. Table 3.17-15 provides rough land area estimates associated with the G-9 projects that would be converted to transmission line rights-of-way. The land use types and impacts would be specific to the particular routes being evaluated.

3.17.5.2 Wildlife and Vegetation Impacts

Removal of vegetation to create and maintain transmission line rights-of-way could gradually alter the composition of vegetation (particularly in forested areas where tall trees must be removed). Furthermore, maintenance activities, such as herbicide use and the clearing of tall trees, would leave only low-growing vegetation. Reseeding right-of-way construction corridors with native vegetation has met with mixed success.

Creating and maintaining transmission line rights-of-way could also negatively affect wildlife species. Construction-related impacts such as noise and vegetation clearing could impact local wildlife species, particularly during breeding, calving, and other critical seasons. Operation impacts could also include bird strikes on towers or other tall structures at night or in foggy weather. Maintaining rights-of-way also increases access for hunters, and could result in habitat fragmentation and reduce habitat effectiveness and integrity for some species.

3.17.5.3 Electric and Magnetic Fields (EMF) Impacts

As described in Bonneville's Business Plan Final EIS, hundreds of EMF studies have been conducted, but overall evidence is too weak to establish a causal relationship between EMF and harmful health effects. While there are no national EMF standards, Bonneville has taken the following steps to address public health concerns:

- developing guidelines on EMF,
- discouraging intensive uses of rights-of-way that would increase human exposure to EMF, and
- limiting public and employee exposure to EMF where practical alternatives exist.

See Bonneville's publication Electrical and Biological Effects of Transmission Lines: A Review (DOE/BP-945) for further information about EMF impacts.

3.17.6 Natural Gas Pipelines

Impacts associated with natural gas transmission line routes would be similar (though slightly less intensive) than those associated with transmission line impacts. It is impossible to quantify the total length of pipeline construction projects anticipated in the Pacific Northwest over the next few years, although it is assumed that applicants would consider proximity to natural gas pipelines as an important consideration when selecting a project site, thus limiting the length and cost of natural gas pipeline extensions. Furthermore, applicants would consider natural gas availability on a project-specific basis (i.e., if obtaining the necessary gas supply were not feasible, the project applicant would likely select a different location). Although pipeline impacts cannot be quantified, general impacts associated with pipeline extensions are discussed below.

3.17.6.1 Land Use Impacts

To prepare for pipeline construction, the easements where a pipeline would be located would be cleared of crops, fencing, and other obstacles (natural gas pipeline companies, such as Westcoast, compensate landowners for the removal of any crops or trees). Oftentimes, construction crews also must negotiate with landowners for the right to use temporary workspace outside of the pipeline easement. On agricultural lands, topsoil is generally stripped and stored away from working areas (separate from subsoil), and explosives are sometimes needed to blast through hard rock (blasting is avoided unless deemed absolutely necessary). Once a trench is dug, the pipeline would be laid and subsoil and topsoil backfilled. Directional drilling, a relatively new process, is sometimes used to minimize impacts on the environment, especially to avoid sensitive areas or geographical barriers (rivers, wetlands, etc.).

After completion of pipeline construction, disturbed areas would be cleaned and restored. Easements in agricultural areas would be restored to their original condition or improved so that cultivation and/or grazing could resume (the pipeline would be placed far enough below the surface to avoid interference with agricultural activities). Temporary fencing would be removed, permanent fencing restored, and markers and signs installed to mark the pipeline's location. (Orca Natural Gas Pipeline 2000)

The only land use that would be lost due to the construction of a natural gas pipeline would be residential uses, as regulations prohibit homes and apartments above or within a certain distance to the line for public health and safety reasons.

3.17.6.2 Wildlife and Vegetation Impacts

Wildlife and vegetation impacts associated with gas pipeline construction would be similar to those described in conjunction with electrical transmission lines. Within the pipeline easement, vegetation would need to be cleared (including crops and trees). During construction, wildlife species could experience impacts associated with noise (particularly if explosives were used). Wildlife species would be particularly sensitive to noise during breeding, calving, and other critical seasons. While revegetation of the pipeline easement would be allowed once construction was complete, habitat could be slightly modified (e.g., large trees would be permanently removed). Potential habitat fragmentation and loss of integrity could occur.

3.17.7 Transportation, Population, and Housing

Cumulative impacts to transportation, population, and housing must be considered when two or more large projects (power generating or otherwise) are proposed in the same general area with similar construction schedules. For example, if built at the same time, the construction workforce for the Wallula, Starbuck, and Mercer Ranch Power Projects would be drawn from similar local labor pools, partially fill common temporary housing areas, and potentially use common roads to commute to job sites.

Cumulative transportation, population, and housing impacts would be limited to a small area relative to other environmental resources. In other words, while cumulative air quality impacts would take into account the entire Pacific Northwest airshed, cumulative transportation, population, and housing impacts could reasonably be limited to a project radius of approximately 75 miles (as a general rule of thumb, it is considered unlikely that construction workers would commute more than 75 miles to work, thus limiting impacts to that radius). Furthermore, due to the relatively small area of potential effect, and the differing contexts within which projects would be built, cumulative impacts would need to be evaluated on a project-specific basis.

3.17.7.1 Transportation

Evaluating cumulative transportation impacts requires an estimation of the strain that a large construction workforce would place on local roads in combination with other factors. If two or more large projects were constructed in close proximity and on similar schedules (such as the Wallula and Starbuck Power Projects), construction workers commuting to both project sites could contribute to added congestion on the same local streets and highways. The Wallula and Starbuck sites are approximately 70 miles apart by surface roads, indicating that construction workers at both sites could be using common routes (although likely traveling in different directions).

Planned transportation improvement projects could also reduce capacity on local roads, making the burden of additional commuter traffic difficult to absorb. For example, the proposed renovation and reconstruction of U.S. Highway 12 (which borders the Wallula Power Project site) would occur during the same time period as construction of the power project. Some temporary cumulative impacts on local transportation resources would result from the combined construction activities.

3.17.7.2 Population and Housing

The majority of cumulative population and housing impacts would be temporary and would occur during construction. Again using the Wallula and Starbuck Power Projects as examples, it is likely that some construction workers for both projects would choose to live in housing located in common cities. For example, workers at both sites might choose to live in Walla Walla, a reasonable commuting distance to either site (30 miles from Wallula, 40 miles from Starbuck). While a project-specific analysis of the Wallula Power Project's impacts to population and housing indicates that accommodations exist to support the peak workforce, a more accurate analysis would need to include the fact that construction workers for the Starbuck Power Project would be competing for common housing and other resources.

The workforce analysis conducted for the Wallula Power Project suggests that there is a sufficient labor supply available to complete both the Wallula and Starbuck Power Projects within the same time frame. If an additional project (or projects) were to be constructed simultaneously (i.e., Mercer Ranch, other transmission lines, etc.), the local workforce supply might be strained. This would likely require more workers from outside of the project area to relocate to the project vicinity, thus potentially affecting local population and housing.

3.17.8 Cultural Resources

Constructing power project components such as generation plants, water pipelines, natural gas pipelines, electrical transmission lines, and so forth requires the disturbance of earth to create foundations, trenches, rights-of-way, and staging areas. Every time native soil is disturbed for these activities, the likelihood increases that cultural resources will be uncovered.

Power project operation could also impact cultural resources. Water withdrawal from reservoirs behind dams could reveal sensitive historic tribal areas, and discharge of warm wastewater could threaten the integrity of cultural resources. Furthermore, cumulative air quality degradation from power plant emissions and other sources could lead to acid deposition, resulting in corrosion of historic structures and resources (e.g., the corrosion of petroglyphs in the Columbia River Gorge).

Cumulative cultural resource impacts would need to be quantified on a project- and area-specific basis. However, incorporating appropriate mitigation measures in each individual project should help to limit project-specific impacts, thus reducing cumulative cultural resource impacts overall.

For example, proper Section 106 procedures must be implemented for each project. Interested Tribes should be consulted early in the planning process to ensure that complete information is obtained about resources in the area, and to ensure cooperation among interested agencies and Tribes. Construction monitors should be present throughout a project's duration, and mechanisms should be in place prior to groundbreaking that would detail the procedures to follow if cultural resources were uncovered. This is often accomplished by establishing a memorandum of agreement (MOA) between the applicant and appropriate state agencies as part of the project EIS. If possible, the use of common or previously disturbed corridors for pipelines and transmission lines is recommended to minimize the disturbance of native soil, thus limiting potential impacts on cultural resources.