3.0 NATURAL ENVIRONMENT

SECTION 3.1 EARTH (WAC 463-60-302)

Units 3 and 4 will be constructed on the existing Grays Harbor Energy Center site. EFSEC previously studied the project site and permitted construction and operation of the Grays Harbor Energy Center facility at this location. This section summarizes the information about the geology, soils, topography, unique physical features, and erosion presented in previous applications to EFSEC. With standard and site-specific mitigation measures, only minor impacts on the natural earth environment from the construction and operation of Units 3 and 4 are expected. No new impacts are expected at the existing site from construction or operation of the additional units, and no significant impacts are expected at the adjacent 10-acre construction laydown and access area.

3.1.1 SOILS

Naturally occurring surficial soils have been modified or removed as a result of the prior grading and construction activities at the existing 22-acre project site. The adjacent 10-acre site proposed for construction laydown and access is covered with approximately 5-acres of thinned conifers and 5-acres of grassland/agriculture that is mowed every year.

The subsurface strata and engineering properties of the Helm Creek deposits in the site area have been assessed in conjunction with work completed for nuclear project WNP-3 and the Grays Harbor Energy Center. Site-specific conditions of the project site were investigated by URS (2001). Subsurface conditions were investigated by drilling nine borings, advancing 27 electric cone penetrometer probes, and excavating five test pits. Borings were drilled to depths of 60 to 120 feet, the cone probes were pushed to depths of 40 to 133 feet, and the test pits were excavated to depths of 10 to 12 feet.

Generally, the soils encountered at the site consisted of up to approximately 75 feet of alluvial soils (interpreted as Helm Creek deposits) overlying decomposed sandstone from the Astoria Formation. The engineering properties of these strata are summarized in Table 3.1-1.

TABLE 3.1-1
SUMMARY OF SOIL CONDITIONS AND DESIGN PARAMETERS

Item	Stratum 1 Silt	Recompact Stratum 1 Silt	Stratum 2 Silty Sand Sandy Silt	Stratum 3 Gravelly Sand	Stratum 4 Silty Sand
Average Thickness (ft)	10		20	40	40+
Typical Uncorrected N-values (blows per ft)	2 to 5		3 to 10	14 to 35	20 to 40
Typical Cone Tip Resistance (tons per ft^2)	6 to 10		30 to 60	100 to 200	50 to 100
Ave. Shear Wave Velocity (ft/second)[a]	640	680	870	1,590	1,320
Ave. Compr. Wave Velocity (ft/second)[b]	1,560	1,700	1,800	3,300	2,750
Total Unit Weight (pounds per cubic ft)	110	110	110	130	120
Friction Angle (degrees)	0	0	0	40	36
Cohesion (pounds per ft^2)	900	1,200	1,200	0	50
Dynamic Elastic Modulus (kips per ft^2)[c]	3,800	4,400	7,000	27,000	17,000
Static Elastic Modulus (kips per ft^2)	300	3,20	250	800	600
Dynamic Shear Modulus (kips per ft^2)[c]	1,400	1,600	2,600	10,200	6,500
Poisson's Ratio	0.4	0.4	0.35	0.35	0.35
Active Earth Pressure Coefficient	0.36	0.36	0.31		
At-Rest Earth Pressure Coefficient	0.53	0.53	0.47		
Passive Earth Pressure Coefficient	2.7	2.7	3.2		
Soil-Concrete Friction Coefficient	0.3	0.3	0.3		
California Bearing Ratio	5	6			
Compression Index[d]	0.1	0.1	0.08		
Coefficient of Consolidation (ft^2/day)	1.5	1.5	8.5		
Permeability (cm/sec)	10^{-5}	10^{-5}	10^{-3}		
Thermal Resistivity (^{o}C·cm/W)[e]	50	50	46		

Source: URS (2001)

Values listed above generally represent average to the slightly conservative side of average values based on interpretation of available data. Natural variability of soil conditions and parameters are expected to occur throughout the site.

The water table is interpreted to be at a depth of at least 70 feet.

a. Values are measured, except for Recompacted Stratum 1

b. Values are estimated

c. Values apply to a shear strain level of approximately 10^{-4} percent

d. From a percent strain versus log of applied load curve

e. Degrees Centigrade multiplied by centimeters divided by Watts

The specific description of each soil unit, proceeding downward from the ground surface, is as follows:

- ***Gravel Surfacing.*** The site is covered with a gravel fill approximately 1.5 to 2.5 feet in thickness. The gravel is subrounded, reasonably well graded and contains some silt and sand as well as cobbles. At the base of this fill cover is a geotextile.
- ***Stratum 1 – Reddish Brown Medium Stiff to Stiff SILT.*** This soil layer is typically 5 to 12 feet thick, and medium stiff to stiff in character based on N-values, cone tip resistances, pocket penetrometer test values, and unconfined compression test values. Other laboratory tests indicate that this silt is moderately to highly plastic (liquid limit of 54) and moderately compressible. Moisture content was usually in the range of 38 to 44 percent.
- ***Stratum 2 – Yellowish Brown Silty SAND to Sandy SILT.*** This soil layer grades between a fine sand and a silt, and typically exhibits the character of a fine-grained soil. The layer is

only 4 to 10 feet thick along the western 200 feet of the site, but is typically 20 to 30 feet thick elsewhere. The soil would be characterized as stiff based on N-values and cone tip resistance values. Laboratory tests indicate that the fines content of the layer ranges from 39 to 65 percent for the samples tested. The fines appear to be non-plastic. Consolidation tests indicate that the soil is moderately compressible but drains quickly. High natural moisture contents in the range of 40 to 50 percent were measured.

- ***Stratum 3 – Multi-colored Medium Dense to Dense Gravelly SAND.*** This layer typically consists of well-graded sand with 15 to 50 percent gravel and 15 to 25 percent fines. The apparently re-worked sediments show color variations that include red, green, gray, brown and white. This layer is at least 25 feet thick, and more typically the thickness exceeds 35 feet. The N-values and cone tip resistance values suggest that the layer is medium dense to dense in character.
- ***Stratum 4 – Brown to Grayish Brown Silty SAND.*** This layer is interpreted to be a residual soil derived from the Astoria Sandstone formation. It is primarily silty sand, but contains occasional zones that are primarily silt. N-values and cone tip resistance values suggest that the soil is dense in character. The last sample collected in boring B-3, at a depth of 111 feet below ground surface (bgs), appeared to be the weathered top of the Astoria sandstone.

3.1.2 TOPOGRAPHY

3.1.2.1 Existing Conditions

The Grays Harbor Energy Center site is located on a flat terrace above the Chehalis River in a region characterized by finely dissected uplands cut by the valley of the Chehalis River. The terrace lies at an elevation of approximately 305 feet (93 meters) above mean sea level (msl), 300 feet (91 meters) above the Chehalis River. The gravel-covered ground surface slopes gently downward to the west and north, with a total topographic relief across the site of about 30 feet. The low point of the site is at approximately 284 feet above msl at the northwest corner. From the site, elevation drops 240 feet (73 meters) to the next lower river terrace in a steep, but short slope to the north. West of the site, approximately 3,000 feet (315 meters), the terrace drops to river level in a steep river cutbank.

The land surface rises to the south of the site in a finely dissected drainage pattern to a topographic high of over 1,760 feet (536 meters) above msl at Minot Peak, 6 miles (10 km) to the southeast. Fuller Creek, less than 1,500 feet (450 meters) southeast, is the nearest surface drainage. It flows northeast to the Chehalis River in a 100-foot (30-meter) deep valley.

3.1.2.2 Impacts

The finished grade of the Grays Harbor Energy Center site will be approximately 305 feet above msl. Therefore, construction of Units 3 and 4 will require some cutting and filling that will have an insignificant impact on topography. The amount of material to be removed and replaced is approximately 80,000 cubic yards.

3.1.2.3 Mitigation Measures

No mitigation measures are necessary.

3.1.3 UNIQUE PHYSICAL FEATURES

There are no unusual or unique geological or physical features in the area that could potentially be affected by the construction of Units 3 and 4.

3.1.4 EROSION/ENLARGEMENT OF LAND AREA (ACCRETION)

3.1.4.1 Existing Conditions

As part of the soil surveys of Grays Harbor County, the Washington State Department of Natural Resources (DNR) conducted a survey that evaluated the erosion potential in an area that includes both the existing 22-acre site and the adjacent 10-acre site proposed for construction laydown and access. The rating for erosion potential is based on the interaction of the following conditions:

- Soil properties, including texture, structure, and porosity
- Rainfall rate and storm intensity
- Slope

The soil property is represented in the commonly used Universal Soil Loss Equation as the K factor. The larger the K factor of a soil, the higher the potential for erosion, given that all other factors remain constant.

Rainfall rate is readily available from government agencies and slope is a function of the rise in elevation over a horizontal distance expressed as a percentage. Slopes greater than 15 percent are classified as having high potential for erosion, slopes from 5 to 15 percent have medium potential, and less than 5 percent have a low potential.

The soils underlying the proposed plant site and in the immediate vicinity of the site have been assigned K factors of between 0.15 to 0.32 at the depths expected to be disturbed during construction (USDA SCS 1986). These values correspond to a high potential for soil erosion. The slope at the project site itself has a rating of 1 (low); slopes adjacent to Fuller Creek to the east have a slope rating of 3 (high). It is anticipated that the majority of disturbance during the construction and operation of Units 3 and 4 will occur on the relatively flat bench away from the creek.

3.1.4.2 Impacts

The Certificate Holder has an EFSEC-approved Erosion Control Plan (CTP-2-01 dated November 1, 2005) for the Grays Harbor Energy Center which covers the entire site, including the area proposed for Units 3 and 4. This plan is designed to prevent and/or minimize the potential for erosion. Implementation of the plan will result in minimal, if, any erosion impacts.

3.1.4.3 Mitigation Measures

No additional mitigation measures are warranted beyond implementation of the EFSEC-approved Erosion Control Plan.

SECTION 3.2 AIR (WAC 463-60-312)

Air quality in Washington is regulated by several agencies. In the project area, the Olympic Region Clean Air Agency (ORCAA) is typically the local authority for air quality permitting of industrial sources, and permits minor sources through the Notice of Construction (NOC) permit process. The Department of Ecology (Ecology) generally retains the authority for air quality permitting of major sources in attainment areas through the Prevention of Significant Deterioration (PSD) permit process. The United States Environmental Protection Agency (USEPA) also has a role in the PSD process and in ensuring all states have plans in place to maintain compliance with ambient air quality standards.

The Energy Facility Site Evaluation Council (EFSEC) has jurisdiction over power plants capable of generating 350 megawatt (MW) or more. Because the generation capacity of the existing Grays Harbor Energy Center exceeds this threshold, EFSEC is the responsible permitting authority for this facility. EFSEC has adopted virtually all air quality regulations established by Ecology that apply to facilities such as the Grays Harbor Energy Center. Consequently, this discussion may refer to regulations established by Ecology, ORCAA, or USEPA even though EFSEC is the permitting authority for this project.

The distinction between emission rates and ambient concentrations is important in the review of air quality issues. Emission regulations limit the amount of a particular air pollutant that can be emitted from a stack or facility (e.g., ten pounds per hour [lbs/hr] of particulate matter). Emission rates and regulations are discussed in section 2.11. Ambient air quality standards limit concentrations of certain air pollutants (in parts per million [ppm] or millionths of a gram per cubic meter of air [$\mu g/m^3$]) in the outdoor (ambient) air. The impact of Unit 3 and 4 emissions on ambient air quality are discussed in this section. More detail on both topics can be found in Section 5.1.

The Air Quality Impact Analysis developed as part of the PSD permit application in Section 5.1 of this Application determined that worst-case emissions of criteria pollutants[1] from Units 3 and 4 would result in ambient concentrations far below Washington and National Ambient Air Quality Standards (WAAQS and NAAQS), and well within allowable PSD increments for Class I and Class II areas. Calculated toxic air pollutant (TAP) concentrations attributable to Units 3 and 4 also meet Washington ambient criteria.

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[1] Criteria pollutants are the six common pollutants regulated by the USEPA: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2). Because ozone is generally not directly emitted by sources, volatile organic compounds (VOCs) are used as a surrogate for ozone.

3.2.1 APPLICABLE AIR REGULATIONS

3.2.1.1 Ambient Air Quality Standards

The ambient air quality standards established by USEPA and Ecology are summarized in Table 3.2-1. Some of the pollutants are subject to both "primary" and "secondary" NAAQS. Primary standards are designed to protect human health with a margin of safety. Secondary standards are established to protect the public welfare from any known or anticipated adverse effects associated with these pollutants, such as soiling, corrosion, or damage to vegetation.

TABLE 3.2-1
AMBIENT AIR QUALITY STANDARDS AND PSD INCREMENTS

Pollutant	National Ambient Air Quality Standards		Washington	Class I PSD Increments	Class II PSD Increments
	National Primary	National Secondary			
Total Suspended Particulate (TSP)					
Annual Geo. Mean ($\mu g/m^3$)			60		
24-hour Average ($\mu g/m^3$)			150		
Inhalable Particulate (PM_{10})					
Annual Arith. Mean ($\mu g/m^3$)	note a		50	4	17
24-hour Average ($\mu g/m^3$)	150[b]	150[b]	150[b]	8	30
Fine Particulate ($PM_{2.5}$)					
Annual Arith. Mean ($\mu g/m^3$)	15[c]	15[c]			
24-hour Average ($\mu g/m^3$)	35[d]	35[d]			
Sulfur Dioxide (SO_2)					
Annual Average (ppm)	0.03		0.02	2 $\mu g/m^3$	20 $\mu g/m^3$
24-hour Average (ppm)	0.14[b]		0.10[b]	5 $\mu g/m^3$	91 $\mu g/m^3$
3-hour Average (ppm)		0.5[b]		25 $\mu g/m^3$	512 $\mu g/m^3$
1-hour Average (ppm)			0.40[b]		
Carbon Monoxide (CO)					
8-hour Average (ppm)	9[b]		9[b]		
1-hour Average (ppm)	35[b]		35[b]		
Ozone (O_3)					
8-hour Average (ppm)	0.075[e]	0.075[e]			
1-hour Average (ppm)	note f	note f	0.12[g]		
Nitrogen Dioxide (NO_2)					
Annual Average (ppm)	0.053	0.053	0.05	2.5 $\mu g/m^3$	25 $\mu g/m^3$
Lead (Pb)					
Quarterly Average ($\mu g/m^3$)	1.5	1.5			

Sources include: NAAQS (40 CFR 50), WAAQS (Chapters 173-470, 474, and 475 WAC), and PSD Increments (40 CFR 51.166).

µg/m3 = micrograms per cubic meter; ppm = parts per million

a. Federal annual PM10 standard revoked as of September 21, 2006

b. Not to be exceeded more than once per year.

c. Based on the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors

d. Based on the 3-year average of the 98th percentile of 24-hour PM2.5 concentrations at each monitor within an area.

e. Based on the 3-year average of the annual fourth-highest daily maximum 8-hour ozone concentration at each monitor.

f. Federal 1-hour ozone standard was revoked in all areas except 14 remaining nonattainment areas on June 15, 2005 but Washington has retained the standard.

g. Not to be exceeded on more than 1 day per calendar year as provided in Chapter 173-475 WAC.

3.2.1.2 Toxic Air Pollutant Regulations

Washington regulations concerning emissions of Toxic Air Pollutants (TAPs) from new and modified air pollution sources are in Chapter 173-460 of the WAC. These regulations identify Small Quality Emission Rates (SQERs) for TAPs. If the SQER is exceeded after applying the best available control technology, dispersion modeling is performed to evaluate potential ambient air quality impacts from TAP emissions.

Washington regulations also establishe outdoor exposure levels (called Acceptable Source Impact Levels, or ASILs) for more than 300 substances that are conservative in their protection of human health. Modeled ambient air quality impacts of TAPs are compared to these ASILs. If modeled concentrations are less than the ASILs, a permit can be granted. If ASILs are exceeded, the applicant must revise the project or submit a health risk assessment demonstrating that TAP emissions from the source are sufficiently low to protect human health.

Tables 2.11-4 and 5.1-15 compare TAP emission rates for Units 3 and 4 with the SQERs, and show which TAPs require modeling analysis. The results of the modeling analysis are presented in section 3.2.1.8.

3.2.1.3 Notice of Construction and Application for Approval

State law requires an NOC permit application for new air contaminant sources in Washington, which provides a description of the facility and an inventory of pollutant emissions and controls. The reviewing agency considers whether BACT has been employed to proposed emission sources and evaluates ambient concentrations resulting from the proposed emissions to ensure compliance with ambient air quality standards. Chapter 5.1 of this Application serves as a single combined NOC and PSD permit application. When both an NOC approval and PSD permit are required, the NOC approval addresses those criteria pollutants emitted in quantities less than PSD significant emissions rates and other non-criteria pollutants (i.e., TAPs) that are not subject to PSD review.

3.2.1.4 Prevention of Significant Deterioration (PSD)

The PSD regulations were established by USEPA to ensure that new or expanded sources do not cause the air quality in areas that currently meet ambient standards (i.e., attainment areas) to deteriorate significantly. These regulations set PSD Increments that limit the increases in sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and particulate matter (PM_{10}) concentrations that may be produced by a new source. Increments have been established for three land classifications. The most stringent increments apply to Class I areas, which include Wilderness Areas and National Parks. The Class I area nearest the project site is the Olympic National Park, which is located about 58 kilometers north of the project site. The area surrounding the proposed project site is designated a Class II area, where less stringent PSD increments apply. Class I and Class II increments are displayed with the ambient standards in Table 3.2-1. No Class III areas have been established in Washington.

The existing Grays Harbor Energy Center is a major source under PSD regulations because its potential emissions exceed the 100 tons per year (tpy) threshold. Once deemed a major source, modifications of the facility also trigger PSD review if the modification results in emission increases exceeding threshold values called Significant Emission Rates. Anticipated annual emissions of nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO2), volatile organic compounds (VOCs), particulate matter (PM), particulate matter with an aerodynamic diameter less than or equal to ten microns (PM_{10}) and particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$) exceed the significant emission rates that trigger evaluation in the PSD permit. Chapter 5.1 of this document provides the PSD permit application and addresses significant air pollutants associated with the Units 3 and 4.

3.2.2 EXISTING CONDITIONS

3.2.2.1 Existing Air Quality

The USEPA's AirData website (http://www.epa.gov/air/data/info.html) is a database that contains air quality data from monitoring sites across the United States and allows users to collect yearly summarized air quality data for specific monitoring sites. Air quality measurement data were collected for 2005 through 2008 for monitoring sites located in Washington. The data search was narrowed to monitoring sites in Seattle, Yelm, and Anacortes, for CO, NO2, SO2, and ozone. Data collected at Aberdeen and Oakville for $PM_{2.5}$ were obtained from Ecology's website. Previous monitoring on the Grays Harbor Energy site is used to characterize existing PM_{10} and SO_2 concentrations.

Ecology and USEPA designate regions as being "attainment" or "nonattainment" areas for particular air pollutants based on monitoring information collected over a period of years. Attainment status is therefore a measure of whether air quality in an area complies with the health-based ambient air quality standards displayed in Table 3.2-1. Grays Harbor County, where the facility is located, is in attainment for all air pollutants.

The monitoring data from the various sites can be used to characterize existing air quality at the site. A summary of these data is presented in Table 3.2-2. All observed pollutant concentrations at these monitoring sites are lower than the NAAQS and WAAQS.

TABLE 3.2-2
AMBIENT AIR QUALITY MONITORING DATA

Pollutant	Averaging Period	Data Source[a]	Maximum Concentration[b]					Ambient Standard[d]
			2005[c]	2006	2007	2008	Average	
NO_2 (ppm)	Annual	a	0.018	0.018	--	--	0.018	0.05
	Annual	b	0.008	0.006	0.008	0.011	0.008	0.05
CO (ppm)	1 Hour	a	2.7	2.0	1.4	1.2	1.8	35
	8 Hours	a	1.9	1.2	1.0	0.9	1.3	9
SO_2 (ppm)	1 Hour	a	0.042	--	0.031	0.073	0.049	0.4
	3 Hours	a	0.024	--	0.021	0.026	0.024	0.5
	24 Hours	a	0.012	--	0.007	0.011	0.010	0.1
	Annual	a	0.004	--	0.002	0.001	0.002	0.02
	1 Hour	c1	0.006	--	--	--	0.006	0.4
	3 Hours	c1	0.004	--	--	--	0.004	0.5
	24 Hours	c1	0.004	--	--	--	0.004	0.1
	Annual	c1	0.001	--	--	--	0.001	0.02
	1 Hour	c2	0.007	--	--	--	0.007	0.4
	3 Hours	c2	0.006	--	--	--	0.006	0.5
	24 Hours	c2	0.006	--	--	--	0.006	0.1
	Annual	c2	0.001	--	--	--	0.001	0.02
Ozone (ppm)	1 Hour	d	0.070	0.081	0.068	0.075	0.074	0.12[e]
	8 Hours	d	0.059	0.068	0.054	0.060	0.060	0.075[f]
PM_{10} ($\mu g/m^3$)	24 Hours	c1	22.1	--	--	--	22.1	150
	Annual	c1	9.8	--	--	--	9.8	50
	24 Hours	c2	21.6	--	--	--	21.6	150
	Annual	c2	9.0	--	--	--	9.0	50
$PM_{2.5}$[g] ($\mu g/m^3$)	24 Hours	e	--	--	18.3	15.6	17.0	35
	Annual	e	--	--	6.7	6.9	6.8	15
	24 Hours	f	--	--	19.7	14.5	17.1	35
	Annual	f	--	--	6.2	6.2	6.2	15

a. Data sources are as follows:
- a – Seattle, WA (4103 Beacon Hill S)
- b – Anacortes, WA (Casino Drive/North End Site)
- c1 – Grays Harbor Energy Center Site, Station 1, May 2002 – May 2003
- c2 – Grays Harbor Energy Center Site, Station 2, May 2002 – May 2003
- d – Yelm, WA (709 Mill Rd Se for 2005 data, 931 Northern Pacific Road for 2006-2008 data)
- e – Aberdeen, WA (359 N Division St)
- f – Oakville, WA (252 Howanut Dr)

b. From USEPA AIRS database (http://www.epa.gov/air/data/info.html) and Washington Dept. of Ecology website (https://fortress.wa.gov/ecy/enviwa/), both accessed February 2009. PM10 and some SO2 data from monitoring conducted at the Grays Harbor Energy Center site between May 2002 and May 2003.

c. The data for PM10 and some SO2 from monitoring locations c1 and c2 on the Gray Harbor Energy Center site are from the monitoring period between May 2002 and May 2003.

d. The most stringent standard from NAAQS and WAAQS.

e. Federal 1-hour ozone standard was revoked as of June 15, 2005 in all areas except 14 remaining nonattainment areas.

f. Attainment based on 3-year average of the 4th highest daily maximum 8-hour ozone concentration at each monitoring location

g. PM2.5 24-hour average is based on the 98th percentile; the annual standard is based on a three year average.

- NO_2 was monitored in Seattle and Anacortes, where the maximum annual concentrations were less than 36 and 22 percent of the NAAQS, respectively.
- CO was monitored in Seattle, where the maximum concentrations were less than 8 percent of the 1-hour average NAAQS and less than 22 percent of the 8-hour average NAAQS.

- SO_2 was monitored in Seattle for the years 2005, 2007, and 2008 and on the Grays Harbor Energy Center site for a one-year period between May of 2002 and 2003. The maximum concentrations in Seattle and at the project site were less than 20 and 6 percent of the NAAQS, respectively.
- The 4th highest maximum 8-hour ozone concentration monitored in Yelm was about 91 percent of the 8-hour NAAQS. The 2nd highest maximum hourly ozone concentration monitored in Yelm was about 68 percent of the 1-hour NAAQS. PM_{10} concentrations (usually associated with wood smoke, fugitive dust, and combustion sources) were monitored at two locations on the project site for a one-year period between May of 2002 and 2003. Average 24-hour concentrations were less than 15 percent of the NAAQS at both locations. Annual average concentrations were 18 to 20 percent of the NAAQS.
- $PM_{2.5}$ was monitored in Aberdeen and Oakville; each location is approximately 16 miles from the project site. The average of the 98th percentile 24-hour concentration over 2007 and 2008 was 49 percent of the 24-hour NAAQS at both locations. The annual averages at Aberdeen and Oakville were 45 and 41 percent of the NAAQS, respectively.[2]

3.2.2.2 Topography

The project site is located just south of the edge of the broad Chehalis River Valley at an elevation ranging from about 290 to 315 feet above msl. The area south of the plant has terrain higher than 1,200 feet above the site, while the Chehalis River Valley floor is approximately 300 feet below the site. The channeling influences of the valley floor and the larger scale topography act to give the site location a prevailing westerly wind direction. Windroses from an on-site meteorological tower are provided in the modeling protocol attached as Appendix A-3.

3.2.2.3 Climate

The climate of western Washington is dominated by two large-scale influences: the mid-latitude westerly winds and proximity of the Pacific Ocean. Temperature data available from the National Climatic Data Center, measured over a 30-year period in Elma, indicate that monthly temperatures average 51°F, with an average maximum of 67°F, and an average minimum of 34°F. Temperature extremes were recorded ranging from the high 20s°F for the minimum temperatures up to the high 90s°F as the maximum temperatures recorded. Few days below 32°F are recorded for the project area.

Precipitation totals about 60 inches annually, with the wettest months from November to April. Approximately 5 inches of snow falls annually, primarily from December to March. Mean annual mixing heights for the morning hours are approximately 600 meters, while afternoon or evening hour mixing heights are approximately 1,000 meters for the Northwest Pacific Coastal region. Relative humidity ranges from a low of about 50 percent during the summer months to a low of about 70 percent in the winter months.

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[2] These comparisons ignore temporal and annual averaging that is a consideration with the $PM_{2.5}$ standards. Consequently, existing concentrations are probably a lower percentage of the ambient standards.

3.2.2.4 Meteorology

Representative meteorological data for the project site and vicinity was obtained from a meteorological monitoring station located within the current Grays Harbor Energy Center site boundary. Specific information related to instrumentation, data collection, audits, data recovery, and data validation is provided by monitoring reports prepared by McCulley, Frick, and Gilman, Inc. These reports are included on the compact disc with dispersion modeling files. Figure 3.2-1 presents a windrose summary of wind conditions at the site.

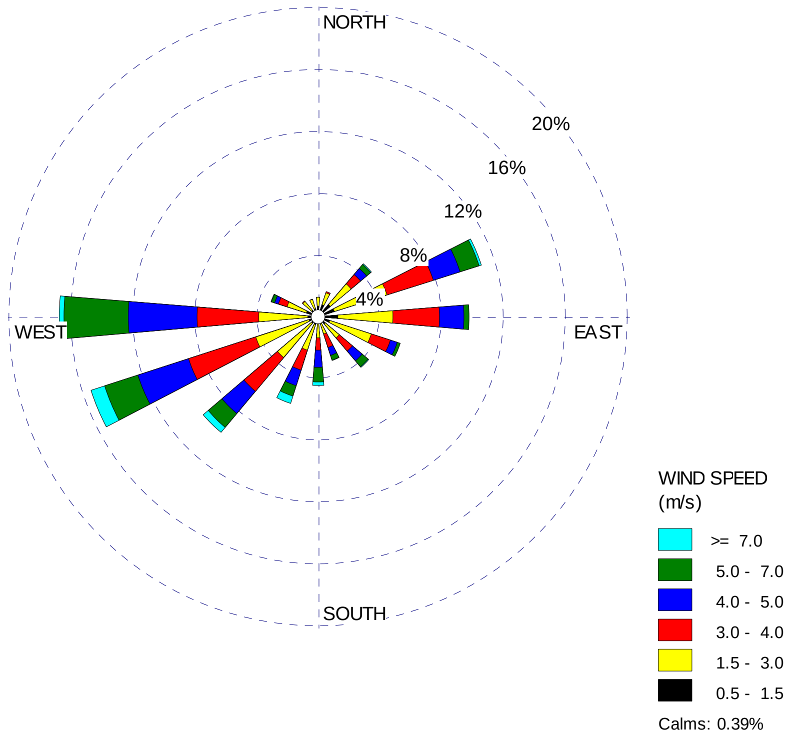


Figure 3.2-1
Windrose for Satsop, 2002 – 2003, 60 m Level

Additional meteorological parameters were obtained from Olympia and Seattle-Tacoma International Airport National Weather Service stations. The data indicate a predominant westerly wind direction (i.e., winds from the west). Calm periods were recorded for 1.5 percent of the collection period. Wind speeds averaged 3.0 meters per second (m/s), with the strongest winds 5 to 7 m/s from the east. Easterly winds were also recorded with milder wind speeds of 3 to 5 m/s.

3.2.3 IMPACTS

An Air Quality Impact Assessment was conducted for the project based on the emission rates described in Section 2.11 and 5.1 of this Application using a year of meteorological data from the project site. Computer-based dispersion modeling techniques were applied to simulate the dispersion of criteria pollutant and TAP emissions from the facility to assess compliance with NAAQS, WAAQS, ASILs, and Class I and Class II PSD increments. The dispersion modeling techniques that were employed in the analysis follow USEPA regulatory guidelines (40 CFR Part 51, Appendix W) and, more specifically, a modeling protocol approved by EFSEC and the Federal Land Managers. Please refer to Sections 5.1.3 and 5.1.4 for additional detail regarding the modeling approach and results for Class II and Class I areas, respectively.

Table 3.2-3 compares maximum model-predicted concentrations with the applicable Significant Monitoring Concentrations (SMCs) and the Significant Impact Levels (SILs) established in WAC 173-400-113(3). SMCs are thresholds that indicate whether pre-construction monitoring of background air quality is appropriate. The SILs represent incremental, project-specific impact levels that the State of Washington and USEPA accept as insignificant with respect to maintaining compliance with the NAAQS, WAAQS, and PSD increments. When predicted concentrations are less than the SILs, consideration of cumulative concentrations are not required because the project contribution is deemed insignificant.

TABLE 3.2-3
MAXIMUM PREDICTED CRITERIA POLLUTANT CONCENTRATIONS ATTRIBUTABLE TO GHE UNITS 3 AND 4
(μg/m^3)

Pollutant	Averaging Period	Maximum Concentration[a]	SIL[b]	Over the SIL?
NO_2	Annual	0.0889	1	No
CO	1-Hour	365	2,000	No
	8-Hour	18.1	500	No
SO_2	1-Hour	29.9	30	No
	3-Hour	9.99	25	No
	24-Hour	1.38	5	No
	Annual	0.0311	1	No
PM_{10}	24-Hour	2.71	5	No
	Annual	0.127	1	No
$PM_{2.5}$ (Filterable)	24-Hour	0.836	NA[c]	NA
	Annual	0.0485	NA[c]	NA
$PM_{2.5}$ (Total)	24-Hour	2.71	NA[c]	NA
	Annual	0.127	NA[c]	NA

a. Maximum from all operating scenarios, ambient conditions, and turbine types provided by GE Energy.
b. SIL = Significant Impact Level, from WAC 173-400-113(3) except as noted.
c. SMCs and SILs for $PM_{2.5}$ have been proposed but have not been promulgated

As shown in Table 3.2-3, all predicted concentrations are less than the monitoring thresholds and established PSD SILs.

Although not required by the air permitting regulations, predicted concentrations attributable to the Units 3 and 4 may also be added to measured background concentrations for comparison with NAAQS and WAAQS. Compliance with the ambient air quality standards may be conservatively assessed by summing the highest modeled concentrations attributable to facility and maximum measured (existing) concentrations to represent other sources of emissions. This comparison is presented in Table 3.2-4. It indicates that when the maximum predicted concentrations are added to the highest monitored values, total concentrations are less than the WAAQS or NAAQS.

TABLE 3.2-4
COMPARISON OF CUMULATIVE CONCENTRATIONS TO AMBIENT AIR QUALITY STANDARDS ($\mu g/m^3$)

Pollutant	Averaging Period	Maximum Modeled Concentration[a]	Measured Background Concentration[b]	Maximum Total Concentration	NAAQS	WAAQS
NO_2	Annual	0.0889	34	34.1	100	100
CO	1-hour	365	2,100	2,465	40,000	40,000
	8-hour	18.1	1,500	1,518	10,000	10,000
SO_2	1-hour	29.9	18	47.9	-	1,050
	3-hour	9.99	16	26.0	1,300	-
	24-hour	1.38	16	17.4	365	262
	Annual	0.0311	2.6	2.63	80	52
PM_{10}	24-hour	2.71	22	24.7	150	150
	Annual	0.127	9.8	9.93	50	50
$PM_{2.5}$[c]	24-hour	0.836	17	17.8	35	-
	Annual	0.0485	6.8	6.85	15	-

a. From Table 3.2-3.
b. Maximum background concentrations from Table 3.2-2, converted from ppm to $\mu g/m^3$ where necessary.
c. The modeled 24-hour average $PM_{2.5}$ concentration is the highest 8th high concentration (which is the 98th percentile over a year). The 24-hour average $PM_{2.5}$ background value is based on the 98th percentile, and the annual average background value is based on a three year average

Chapter 173-460 of the WAC requires NOC applications to include dispersion modeling of TAP emissions if anticipated emissions exceed SQERs. Model predictions are compared with TAP-specific ASILs. If calculated concentrations are less than the ASILs, a permit can be granted without further analysis. Otherwise, the applicant must revise the project or submit a health risk assessment demonstrating that toxic emissions from the project are sufficiently low to protect human health. For carcinogenic pollutants, the risk of an additional cancer case can not exceed one in 100,000. Concentrations below the ASILs indicate insignificant potential for adverse health effects from these chemicals.

The dispersion modeling analysis of TAPs emitted at rates exceeding the SQERs was conducted in the same manner as for the criteria pollutants. Depending on the chemical, either the maximum predicted 1-hour, 24-hour, or annual concentrations were compared with the ASILs. TAP emissions estimates are discussed in section 2.11 and 5.1.2 of this Application

Maximum 24-hour and annual TAP concentrations attributable to the Units 3 and 4 (and associated support units) are compared with Ecology ASILs in Table 3.2-5. Predicted maximum concentrations are less than the Ecology ASILs for all TAPs that are emitted in concentrations that exceed the SQER.

TABLE 3.2-5
MAXIMUM PREDICTED TAP CONCENTRATIONS
ATTRIBUTABLE TO UNITS 3 AND 4
($\mu g/m^3$)

Compound	CAS #	Averaging Period	ASIL[a]	Maximum Predicted[b]	Over ASIL?
Acetaldehyde	75-07-0	Annual	0.37	0.000349	No
Acrolein	107-02-8	24-hr	0.06	0.00138	No
Ammonia	7664-41-7	24-hr	70.8	2.11	No
Arsenic	7440-38-2	Annual	0.000303	0.00000074	No
Benzene	71-43-2	Annual	0.0345	0.000111	No
Benzo(a)pyrene	50-32-8	Annual	0.000909	0.0000192	No
Beryllium	7440-41-7	Annual	0.000417	0.00000004	No
1,3-Butadiene	106-99-0	Annual	0.00588	0.00000377	No
Cadmium	7440-43-9	Annual	0.000238	0.00000408	No
Chromium (hexavalent)	18540-29-9	Annual	0.00000667	0.00000021	No
Diesel Engine Particulate	DEP	Annual	0.00333	0.00325	No
7,12-Dimethylbenz(a)anthracene	57-97-6	Annual	0.0000141	0.00000006	No
Ethyl benzene	100-41-4	Annual	0.4	0.000279	No
Formaldehyde	50-00-0	Annual	0.167	0.00114	No
Manganese	7439-96-5	24-hr	0.04	0.00002	No
Naphthalene	91-20-3	Annual	0.0294	0.0000131	No
Nitrogen Dioxide	10102-44-0	1-hr	470	402	No
Propylene Oxide	75-56-9	Annual	0.27	0.000253	No
Sulfur Dioxide	7446-09-5	1-hr	660	29.9	No
Sulfuric acid	7664-93-9	24-hr	1	0.823	No
Vanadium	7440-62-2	24-hr	0.2	0.00015	No

a. ASIL = Acceptable Source Impact Level, from WAC 173-460-150.
b. Maximum from all operating scenarios.

3.2.3.1 Ozone

40 CFR 52.21(i)(5)(i) requires any net emissions increase of 100 tpy or more of VOC or NO_x subject to PSD to perform an ambient ozone impact analysis. Because potential annual emissions of NO_x attributable to Units 3 and 4 exceed 100 tpy, an ozone impact analysis that includes all post-project emissions was conducted. A summary of that analysis is presented in Appendix A-4.

ENVIRON acquired the relevant input data and control files and replicated the MM5/SMOKE/CMAQ runs performed by Washington State University for the Puget Sound Clean Air Agency and Oregon Department of Environmental Quality in support of the various ozone studies conducted by those organizations. The scenarios in question simulate the July 26-28, 1998 ozone episode, which was meteorologically more severe than the 1996 case used in previous ozone assessments. ENVIRON examined a "base case" scenario that closely resembled those of the PSCAA and Portland SIP studies, and a "PTE scenario," which was comprised of all base case scenario emissions plus the maximum post-project emissions from the entire Grays Harbor Energy Center.

The maximum change to 8-hour average ozone concentrations between the PTE and base case scenarios is an increase of 2.25 parts per billion (ppb) in the cell adjacent to the facility. The spatial variation of the difference between the two scenarios during the period with the maximum difference is quite localized, falling to less than 0.33 ppb within about 20 km of the facility.

The largest increase in 8-hour ozone concentration near a Class I area is about 0.01 ppb near Mount Hood Wilderness Area. This is less than 1 percent of the relevant NAAQS, indicating that the facility will not cause or significantly contribute to degradation of natural wild areas. The largest increase in 8-hour ozone concentration near the Enumclaw (Mud Mountain) observation site is less than 0.0004 ppb.

3.2.3.2 Odor

Construction of the Units 3 and 4 would include some activities that would generate odors. If oil based paints are applied to structures or equipment at the site, paint odors may be perceptible nearby. Some of the site would be paved with asphalt, and asphalt fumes may be perceptible for a short period during the paving operation. These impacts are anticipated to be slight and of short duration.

Operation of the facility would not generate odors that are perceptible off-site. The threshold of perceptibility for ammonia is approximately 0.5 ppm, or about 350 $\mu g/m^3$ (National Academy of Sciences 1979). Up to 37 pounds of ammonia could "slip" through the NO_x control equipment (i.e., SCR) and be emitted from the two HRSGs each hour. Based on the dispersion modeling results (see Table 3.2-5), this maximum emission rate would result in a ground-level hourly average concentration of approximately 1.8 $\mu g/m^3$. Therefore, ammonia attributable to Units 3 and 4 would not be perceptible off-site.

3.2.3.3 Climate, Visible Plumes, Fogging, Misting, Icing

The Units 3 and 4 design includes a 10-cell cooling tower. These cells would produce water vapor clouds that vary in size depending on meteorology and operational factors during periods of elevated relative humidity. However, such condensed plumes would usually occur during conditions of already poor or obscured visibility (i.e., fog or precipitation). A visible moisture plume from the HRSG stacks may also occur during periods with higher relatively humidity.

3.2.3.4 Dust

Because the site is flat, there would be relatively little excavation or grading prior to construction. Therefore, dust generated by excavation and grading would be short term. Dust from access roads would be controlled by applying gravel or paving the access road and watering as necessary.

After the Units 3 and 4 are completed and operational, virtually no dust would be generated on site.

3.2.4 MITIGATION

- To control dust during construction, water would be applied as necessary, access roads would be graveled or paved.
- BACT would be incorporated into the Units 3 and 4 design to reduce air pollution emissions.
- Greenhouse gas emissions would be mitigated pursuant to RCW chapter 80.70. Grays Harbor Energy LLC has chosen the “monetary path” outlined in RCW 80.70.020(5) for mitigation. At the current rate of $1.60 per metric ton of carbon dioxide, the required payment is approximately $11.75 million. Grays Harbor Energy LLC currently plans to provide EFSEC with proof of payment to a qualifying organization of the total sum, no later than one hundred twenty days after the start of commercial operation.

SECTION 3.3 WATER (WAC 463-60-322)

3.3.1 EXISTING CONDITIONS

This section summarizes existing information on surface water and groundwater resources in the vicinity of the proposed plant site and describes the proposed water supply sources for the proposed project.

3.3.1.1 Surface Water

The Grays Harbor Energy Center site is located in the lower Chehalis River Valley near Elma, Washington (Figure 3.3-1). The site is situated along the southern bank of the Chehalis River with Fuller Creek approximately 0.5 mile to the east and Workman Creek two miles to the east. Both Fuller and Workman Creeks drain to the southern side of the Chehalis River. Fuller Creek’s drainage basin faces northeast and covers approximately two square miles. The Workman Creek drainage basin, which drains into the Chehalis River east of the plant site, faces northeast and covers approximately 16 square miles. The Satsop River near Satsop (USGS Station 12035000) has a drainage basin area of approximately 299 square miles. The Chehalis River, approximately 2.5 miles downstream from the site, faces south and has a drainage area of approximately 1760 square miles (USGS Station 12035002). A small drainage basin between Workman Creek and Fuller Creek is drained by Purgatory Creek.

Mean annual precipitation near Satsop is approximately 67.5 inches (Western Regional Climate Center Elma COOP Station 452531 Updated 07-29-2009). The Chehalis River system is principally fed by rainfall. Annual precipitation quantities recorded at Elma, Satsop, and Aberdeen for 1993 through 2008 are listed in Table 3.3-1. The collection of data on precipitation quantities at the Grays Harbor Energy Center site was discontinued in 2000.

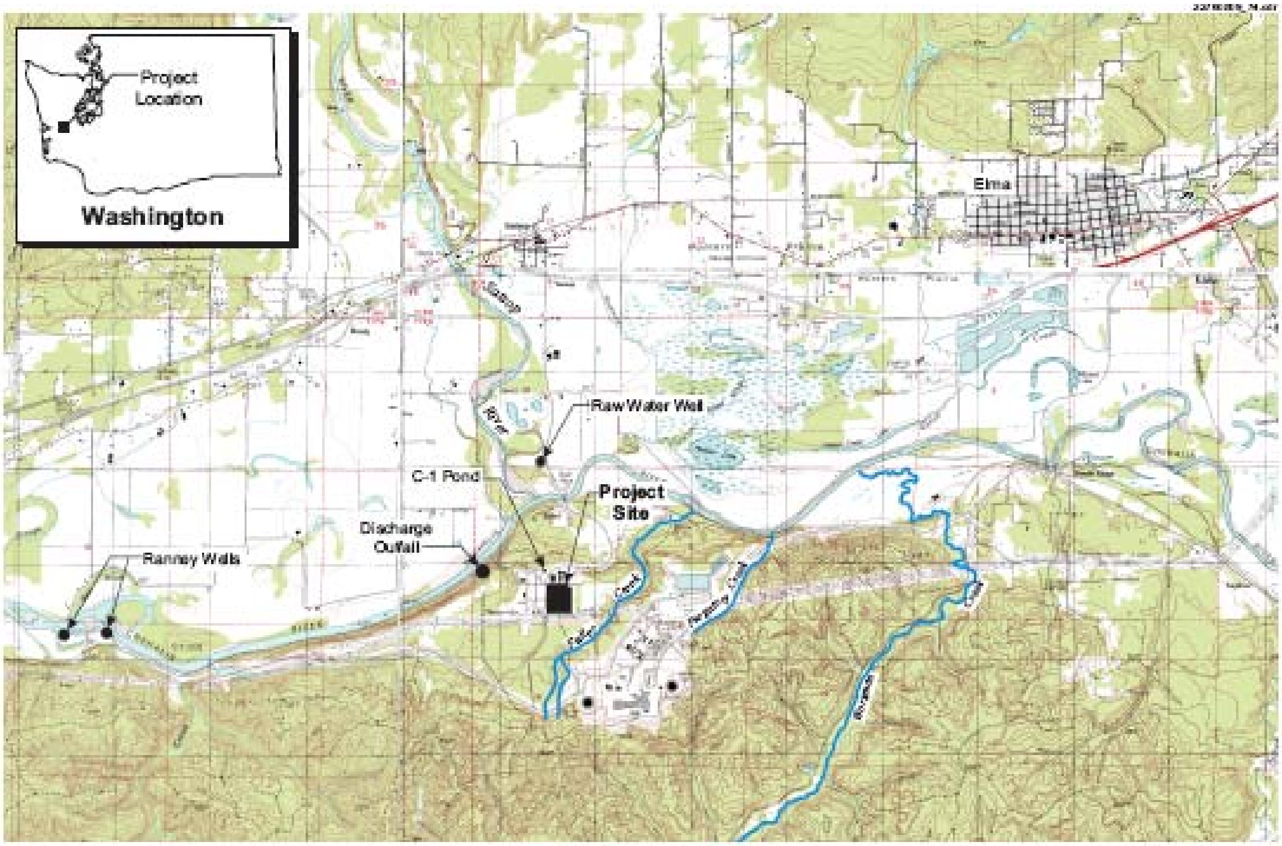


Figure 3.3-1
Area Map

Stream Flow

In accordance with WAC Chapter 173-522 and general Ecology rules, the base flows for the Grays Harbor Energy Center were established at monitoring station 12.0350.02, located at the outfall for the project. On those days not specifically identified in Table 3.3-2, Ecology plots a straight-line graph between the dates and flows shown in the table to determine base flow. The flow rate at Station 12.0350.02 is calculated as 1.5 times (Chehalis River Flow at Station 12.0275.00 + Satsop River Flow at Station 12.0350.00), per EFSEC Resolution 309.

Figure 3.3-2 shows Ecology's exceedance hydrographs for the Chehalis River at Porter. The base flows for monitoring station 12.0350.02 also are depicted. A review of the data shows that low flow conditions in the Chehalis River at Satsop typically occur from July to October, but also may occur at any time of the year. Annual peak discharge typically occurs in December through April. This annual peak discharge is a result of winter storms, which produce excess rainfalls. During periods when flows are below the base flow requirement, some withdrawals are restricted by Ecology, including withdrawal of water by the Grays Harbor Energy Center pursuant to the water authorization in the SCA. However, water rights issued prior to 1973, including those held by the Grays Harbor Public Development Authority (PDA) for the Satsop Development Park (20 cfs), and those held by the City of Aberdeen (145 cfs per Mike Randich from the City of Aberdeen Public Works Department, 8/18/09)), are not subject to flow restrictions.

TABLE 3.3-1
ANNUAL PRECIPITATION

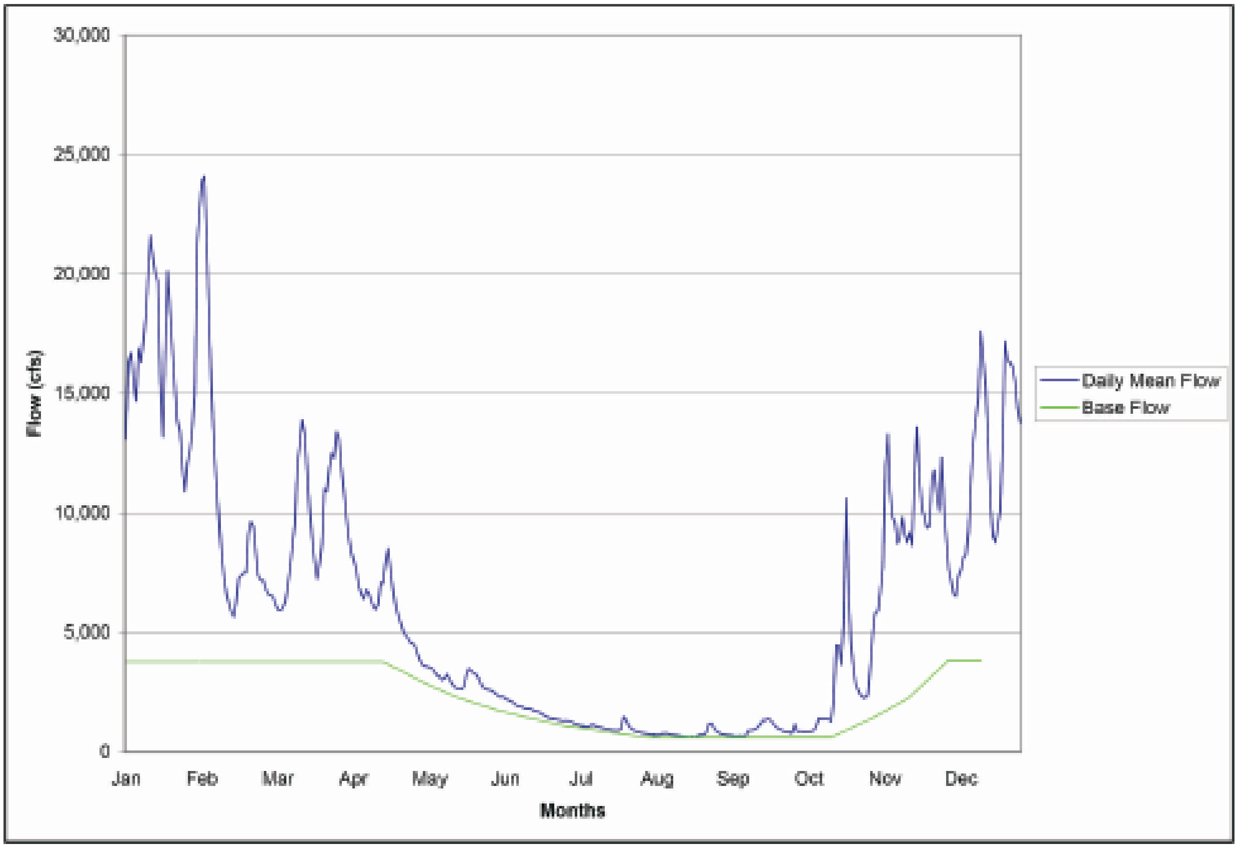
Year	Elma, Washington Station 452531 (inches)	Satsop Site (inches)	Aberdeen, Washington Station 450008 (inches)
2008	60.91		70.70
2007	71.76		81.44
2006	82.49		100.52
2005	64.25		76.57
2004	57.26		68.40
2003	77.21		92.94
2002	56.37		73.75
2001	62.56		83.54
2000	45.11	55.83	54.24
1999	86.33	95.68	111.13
1998	77.43	82.12	94.89
1997	93.24	92.63	106.73
1996	87.83	90.05	96.67
1995	75.23	79.38	98.93
1994	74.37	86.64	71.27
1993	48.12	55.11	61.34

Source: Western Regional Climate Center; last updated 07-29-2009

TABLE 3.3-2
BASE FLOW FOR MONITORING STATION 12.0350.02
ON THE CHEHALIS RIVER JUST BELOW CONFLUENCE WITH SATSOP RIVER

Month	Day	Base flow (cfs)	Month	Day	Base flow (cfs)
January	1	3800	July	1	1085
January	15	3800	July	15	860
February	1	3800	August	1	680
February	15	3800	August	15	550
March	1	3800	September	1	550
March	15	3800	September	15	550
April	1	3800	October	1	640
April	15	3800	October	15	750
May	1	2910	November	1	1305
May	15	2300	November	15	2220
June	1	1750	December	1	3800
June	15	1360	December	15	3800

Source: WAC Chapter 173-522-020; last updated June 9, 1988



Source: USGS 2008

Figure 3.3-2
Chehalis River Daily Mean Flow at Porter Station
2002 - 2007

Water Quality in the Site Vicinity

General water quality and flow data for the Chehalis River at the Porter station upstream from the site are presented in Table 3.3-3. This station is the closest station to the site to have analytical water quality testing for general chemistry parameters and study of water flow. Most of the parameters vary seasonally. Concentrations of suspended solids, turbidity, and dissolved oxygen levels are highest during high flow periods and lowest during low flow periods. Seasonal water temperature data for the Porter station are presented in Table 3.3-4. River water temperature ranged from 0.6°C on January 8, 1973 to slightly over 25.4°C on July 24, 2006. Average seasonal river water temperature ranged between 4.0°C and 22°C annually.

River water quality in the Chehalis River is considered Class A in the vicinity of the site (WAC Chapter 173-201A). Water quality of this class must meet requirements for many uses, including water supply, stock watering, fish and shellfish existence, wildlife habitat, recreation, commerce, and navigation. Water quality requirements for Class A waters include limits on fecal coliform organisms, dissolved oxygen, total dissolved gas, temperature, pH, toxic substances, and impacts to aesthetic values.

TABLE 3.3-3
CHEHALIS RIVER WATER QUALITY DATA AND FLOW RATE

	2006			2007			2008		
	Mean	**Range**	**n[b]**	**Mean**	**Range**	**n[b]**	**Mean**	**Range**	**n[b]**
Flow (cfs)	3005	320-8130	12	3931	314-19900	12	2382	425-5640	12
Specific Conductivity (µmhos/cm)	99	73-131	12	93	68-115	12	99	79-115	12
pH (pH)	7.4	6.82-7.8	12	7.47	6.77-8.04	11	7.38	7.08-7.87	11
Temperature (°C)	12.6	4.1-25.4	12	12	5-16.3	12	11.3	2.8-20.4	11
Turbidity (NTU)	6.3	0.08-15	12	5.6	1.4-22	12	12	1.1-80	12
Dissolved Oxygen (mg/l)	10.39	8.52-12.03	12	7.5	8.37-11.6	12	11.1	9.0-12.6	12
Ammonia Nitrogen (mg/l)	0.013	0.01-0.02	12	0.015	0.01-0.024	12	0.012	0.01-0.02	12
Total Phosphorus (mg/l)	0.026	0.013-0.0391	12	0.028	0.166-0.0422	12	0.037	0.018-0.117	12
Total Suspended Solids (mg/l)	13	2-34	12	10	2-31	12	10	2-34	12
Nitrites and Nitrates (mg/l)	0.643	0.558-0.899	12	0.562	0.355-0.746	12	0.512	0.330-0.695	12
Fecal Coliform (colonies/100 ml)	15	4-46	12	15	6-29	12	24.3	4-160	12

Data are for Chehalis River at Porter Station WRIA 23A070 from www.ecy.wa.gov/apps/watersheds/riv

b. n = Total number of data values

TABLE 3.3-4
CHEHALIS RIVER TEMPERATURE DATA FROM PORTER STATION

Date	Temperature (°C)	Date	Temperature (°C)
1/24/2000	5.7	3/29/2005	8.2
2/21/2000	4.3	4/19/2005	9.2
3/27/2000	6.9	5/24/2005	12.1
4/24/2000	9.7	6/14/2005	15.7
5/22/2000	12.3	7/19/2005	20.5
6/26/2000	15.5	8/16/2005	21.1
7/24/2000	16.4	9/19/2005	16
8/28/2000	17.2	10/19/2005	14
9/25/2000	13.2	11/14/2005	8.6
10/23/2000	9.3	12/12/2005	4.1
11/27/2000	4.4	1/25/2006	7.2
12/11/2000	2.9	2/13/2006	7
1/29/2001	4.6	3/13/2006	6
2/19/2001	5.1	4/17/2006	8.6
3/26/2001	9.3	5/15/2006	16.2
4/23/2001	10.6	6/19/2006	17.3
5/28/2001	16.2	7/24/2006	25.4
6/25/2001	15.5	8/21/2006	20.1
7/23/2001	17.7	9/25/2006	16.3
8/27/2001	17.7	10/18/2006	12.3
9/24/2001	17.3	11/15/2006	8.3
10/29/2001	8.6	12/20/2006	5
11/26/2001	7.4	1/24/2007	5.9
12/10/2001	6.2	2/14/2007	7.4
1/28/2002	4.4	3/21/2007	8.6
2/18/2002	6.8	4/25/2007	11.8
3/25/2002	9.6	5/23/2007	14.5
4/15/2002	8.9	6/13/2007	16.3

Date	Temperature (°C)	Date	Temperature (°C)
5/27/2002	15.4	7/18/2007	20
6/24/2002	18.6	8/21/2007	19
7/29/2002	18.7	9/25/2007	15.4
8/26/2002	19.7	10/30/2007	
9/23/2002	15.1	11/27/2007	4.6
10/28/2002	10.2	12/17/2007	6
11/18/2002	8.5	1/28/2008	2.8
12/9/2002	5.4	2/27/2008	7.7
1/27/2003	9.8	3/18/2008	7.4
2/24/2003	6	4/22/2008	7.9
3/17/2003	8.7	5/20/2008	17.4
4/21/2003	10.7	6/17/2008	15.3
5/19/2003	12.2	7/22/2008	19.2
6/16/2003	17.9	8/19/2008	20.4
7/21/2003	22.5	9/23/2008	15.7
8/18/2003	20.6		
9/22/2003	15.9		
10/20/2003	13.3		
11/17/2003	7.6		
12/15/2003	6.4		
1/26/2004	5.8		
2/23/2004	7.5		
3/23/2004	10.3		
4/20/2004	10.9		
5/18/2004	16.1		
6/22/2004	20.5		
7/20/2004	21.4		
8/16/2004	23.7		
9/21/2004	12.8		
10/19/2004	12		
11/16/2004	9.4		
12/14/2004	7.6		
1/25/2005	8.9		
2/15/2005	5.1		

Source: USGS (1970 - 2007) and www.ecy.wa.gov , Chehalis River @Porter Station 23A070

3.3.1.2 Groundwater

Groundwater Occurrence

Significant groundwater aquifers in the plant site vicinity occur in the alluvial valleys of the Chehalis River, Satsop River, and tributary rivers, as well as in smaller perched aquifers in the marginal terrace deposits. Little useable water occurs in the underlying Tertiary bedrock (WPPSS 1982). The alluvial deposits are approximately 100 feet thick north of the site vicinity, and extend to depths of as much as 200 feet in the lower Chehalis River valley. The alluvial aquifer under the Grays Harbor Energy Center site consists of alluvial sediments including sand, gravel, and silt and is confined by a thin layer of silt flood deposits, approximately 11 feet thick.

Groundwater flow in the alluvial aquifer is likely to generally parallel the flow of the Chehalis River, toward the west. During periods of low river flow, the flow direction in the aquifer would likely be skewed toward the river, where it would discharge. During high river flow periods, flow direction would be skewed toward the valley walls due to aquifer recharge from the river. According to aquifer tests performed prior to installation of the Ranney collector system, the gradient of the potentiometric surface is estimated to be approximately 15 feet per mile in a down-valley direction (WPPSS 1974). The alluvial aquifer extends north approximately two miles across the Chehalis River Valley, about 14 miles downstream to Grays Harbor, and about 15 miles upstream to the eastern limit of Grays Harbor County. The northern, southern, and basal boundaries of the alluvial aquifer are formed by a Tertiary sandstone formation that occurs at the southern portion of the site, and contains little groundwater.

Groundwater depths in the alluvium may range from near-surface in slough and wetland areas to greater than 20 feet bgs. Reported groundwater withdrawal rates from wells in the eastern Grays Harbor County area range from 5 gpm for domestic supplies to over 900 gpm for irrigation purposes (Ecology 2001). Wells screened at depths of less than 100 feet typically yield lower quantities whereas those screened below 100 feet potentially yield up to 3,000 gpm. The interconnection between shallow and deep groundwater in the alluvial aquifer and surface water sources such as the Chehalis River is known to be high. Groundwater wells screened in the alluvium typically draw upon both groundwater and surface water sources. Recharge to the alluvial aquifer is from direct precipitation as well as from surface water sources (e.g., Chehalis River).

As a part of investigations related to the nuclear projects, a pumping test of the aquifer was performed in anticipation of installing the Ranney wells in alluvial deposits at the confluence of the Satsop and Chehalis Rivers (the current raw water well location). Test results indicated that average transmissivity of the aquifer is 1,242,000 gallons per day (gpd) per foot and the aquifer is hydraulically connected with the Satsop River (WPPSS 1974). Pumping tests after the installation of the Ranney wells in 1980 yielded an aquifer transmissivity of approximately 560,000 gpd per foot. Natural groundwater flow conditions are governed by the transmissivity and gradient of the aquifer. Based on the pumping test data from the Ranney collector system, the calculated natural underflow in the alluvial aquifer is approximately 8 to 18 million gallons per day per mile of aquifer width. More accurate calculation of this value is difficult due to the Ranney wells' interaction with both the aquifer and surface water systems and limitations in separating the ground and surface water components of the flow.

Smaller, discontinuous perched aquifers, which occur in the unconsolidated terrace deposits on the Grays Harbor Energy Center and surrounding Satsop Development Park properties, lie above the alluvial valley (WPPSS 1982). The groundwater level in the terrace deposits beneath the property varies from 15 to 50 feet bgs. The flow of water through the perched aquifers is locally controlled by topography. Flow will likely tend toward the Chehalis river valley, where it will join the regional groundwater system. Recharge to the terrace deposits is by direct infiltration.

Limited groundwater quality analyses for samples taken at the Ranney collector system have been previously provided to EFSEC (see Application 94-1, Appendix D, Ranney Well Information). Groundwater and surface water quality are compared in Section 3.3.1.3.

Groundwater Wells in the Site Vicinity

There are no groundwater wells on the Grays Harbor Energy Center site. Groundwater wells on Satsop Development Park property include a groundwater collection system referred to as the Ranney collector system (makeup water well), the raw (potable and construction) water well, and a small domestic well. Other domestic wells occur in the area (within several miles of the site), and are generally located west of the site or on the north side of the river. Three domestic wells are known to be screened in the terrace deposits.

The Ranney wells consist of two vertically placed caissons that penetrate beneath the Chehalis River bed within the alluvial gravel beneath the river. The caissons are connected to a tier of horizontal collector laterals that extend in a radial pattern from the caisson. Each caisson potentially yields 26 million gallons per day (mgd), or 40 cfs (WPPSS 1984). Pump tests completed in 1982 in the collector system indicated that the wells draw surface water from the Chehalis River as well as groundwater in the alluvium. It was determined that the Ranney wells derive up to 88 percent of their supply from the Chehalis River via infiltration, with the remaining 12 percent drawn from the surrounding alluvial aquifer (WPPSS 1982). Drawdown effects resulting from pumping 20,833 gpm were estimated to lower water levels in surrounding farm and irrigation wells 1 to 2.5 feet. Maximum withdrawals for the Grays Harbor Energy Center with all four units operating will be 16.0 cfs or 7180 gpm and will be substantially less than those projected for the nuclear plants, and therefore the impact to surrounding farm and irrigation wells is expected to be negligible.

3.3.1.3 Comparison of Surface and Groundwater Quality

As described above, it was determined that the Ranney wells derive up to 88 percent of their supply from the Chehalis River via infiltration, with the remaining 12 percent drawn from the surrounding alluvial aquifer (WPPSS 1982). It is unknown as to whether these percentages will remain the same with lower flows anticipated for the Grays Harbor Energy Center and the Satsop Development Park (non-low flow maximum of 36 cfs based on 20 cfs for the Grays Harbor PDA, and 16 cfs for the Grays Harbor Energy Center, and a maximum of 26.5 cfs during low flow conditions).

The Chehalis River water quality from five different locations upstream and downstream of the Ranney wells was detailed in the Receiving Water Study (Energy Northwest 2004). A summary of the results is shown in Table 3.3-5, Chehalis River Water Quality Data.

For a comparison between surface water quality and groundwater quality, water quality data from the Chehalis River collected during the receiving water study of 2004 (Table 3.3-5) may be compared to the data collected from the Ranney Wells on August 5, 2009, which are summarized in Table 3.3-6.

TABLE 3.3-5
CHEHALIS RIVER WATER QUALITY DATA

Samples Taken at Five Stations[a]	Stations 1 & 2 (Upstream)	Station 3 (Discharge Area)	Stations 4 & 5 (Downstream)
Ammonia (mg/l)	0.026-0.028	0.026	0.024-0.025
Total Cadmium (µg/l)	0.025-0.031	0.182	0.025-0.032
Total Chromium (µg/l)	1.154-1.172	1.042	0.955-0.998
Total Copper (µg/l)	2.079-2.342	1.863	1.645-1.695
Dissolved Oxygen (mg/l)	8.59-8.66	8.57	8.48-8.54
Hardness (mg/l)	31	30	32-33
Total Lead (µg/l)	0.163-0.177	0.110	0.105-0.166
Total Mercury (µg/L)	0.0015 – 0.0025	0.0017	0.0015
pH (pH)	7.34	7.43	7.52-7.62
Total Selenium (µg/L)	0.1410-0.2425	0.1450	0.1610-0.1615
Temperature (°C)	12.69-12.43	12.44	12.82-13.00
Total Suspended Solids (mg/L)	18.7-30.4	15.1	9.8-11.0
Total Zinc (µg/L)	1.986-2.283	2.413	1.329-1.363

Source: Energy Northwest (2004)

a. Station results are averages taken over a 6-month period. Samples taken at two upstream stations, two downstream stations, and the Discharge Area

TABLE 3.3-6
RANNEY WELL WATER QUALITY DATA

Parameter[a]	Ranney Well Water Quality Data[a]
Ammonia (mg/l)	NAv
Total Cadmium (µg/l)	ND
Total Chromium (µg/l)	0.00026
Total Copper (µg/l)	0.00039
Dissolved Oxygen (mg/l)	NAv
Hardness (mg/l)	NAv
Total Lead (µg/l)	0.00044
Total Mercury (µg/L)	ND
pH (pH)	7.68
Total Selenium (µg/L)	0.00027
Temperature (°C)	NAv
Total Suspended Solids (mg/L)	NAv
Total Zinc (µg/L)	ND

a. Dragon Analytical Laboratory Results from two samples collected on August 5, 2009.

3.3.1.4 Existing Water Appropriations

Existing surface water right appropriations in the Chehalis Basin include water for domestic, municipal, irrigation/agricultural, power, commercial, and fish propagation purposes. Critical periods for potential impacts of water withdrawals to the environment and to existing surface water rights occur during low flow periods, typically from July through October.

A water right provides legal authorization to use a certain amount of surface water or groundwater for specific beneficial purposes. Diversion of surface or groundwater requires a water right except for minimal diversions. The proposed water use must satisfy statutory requirements in order for Ecology to issue a water right permit. Statutes require: beneficial use of the water; the use must not cause impairment of existing rights; water is available for appropriation; and issuance of the water right must not be deemed detrimental to the public interest.

A review of current surface and groundwater appropriations filed with Ecology indicates that industry is the largest appropriator in the basin (42 percent of the total consumptive use appropriations) followed by municipal (44 percent), irrigation (1.2 percent), and domestic use (1.1 percent). Municipal supply uses both surface and groundwater resources. In-stream flows are necessary to maintain anadromous fish populations, which attract sport and commercial fishing interests. In-stream flow appropriations also are pursued for subsistence fishing and aesthetic concerns.

Ecology has established a water resources program for the Chehalis River basin in order to establish base flow, provide protection for future allocations, establish a priority scheme for future rights during water shortage periods, and identify streams closed to further consumptive appropriations (WAC 173-522). The only downstream river that has been closed to consumptive appropriations is the Wynoochee River which has had seasonal closures since March 9, 1962 between May 1 and October 31 (WAC 173-522-050). Base flow requirements for the Chehalis River below the confluence with the Satsop River (Station 12.0350.02) have been developed by Ecology for maintenance of in-stream flows (Table 3.3-2).

The Chehalis River basin is divided into two Water Resources Inventory Areas (WRIAs): an upper basin (WRIA-23) and lower basin (WRIA-22). The site is located in the lower basin. Specific water resource management goals are assigned to each WRIA, including base flow regulations. Base flows are in-stream flow limits which allow “preservation of wildlife, fish, scenic, aesthetic, and other environmental values, and navigational values” (Ecology 1975). While existing water right permits are not affected by base flow restrictions, future water right permits and certificates will not allow appropriation of surface water from the Chehalis River and its tributaries below the base flow levels specified by regulation. In addition, future groundwater appropriations will be affected by base flow provisions if the groundwater in question is determined to be in hydraulic continuity with the affected stream section.

Several surface water and groundwater users have been identified in the area of the Ranney wells. The intended use is for domestic, stockwater, and irrigation purposes. Ecology’s listing of water right permits for the Ranney well area includes withdrawal quantities ranging from 300 to 800 gpm.

3.3.2 IMPACTS

This section addresses potential impacts to surface water and groundwater due to construction and operation of the Units 3 and 4. Surface water runoff controls during operation are presented below and in the approved Erosion Control Plan.

3.3.2.1 Surface Water

Runoff from the site will be routed to the C-1 erosion control pond, located on Satsop Development Park property west of the site. The C-1 pond is designed and maintained to store runoff from the 100-year rainfall event. As a result of implementation of this plan, surface water impacts due to construction of the plant will be temporary and minor.

3.3.2.2 Groundwater

The Grays Harbor Energy Center site is situated on terrace deposits with smaller, discontinuous perched aquifers that may contribute little recharge to adjacent surface water bodies. In addition, the gravel fill currently on the site is underlain by a liner that restricts water infiltration. As a result, construction of Units 3 and 4 will not have a significant impact on groundwater resources.

3.3.2.3 Impacts of Process Water Withdrawal

Process water will continue to be supplied from the existing Ranney wells and transported through the existing make-up water line to the Grays Harbor Energy Center (Figure 2.3-4, Process Water Conceptual Flow Diagram). The make-up water line was originally designed and constructed for the nuclear plants, and is capable of carrying 80 cfs of water. The existing Grays Harbor Energy Center is authorized to use 9.2 cfs from the Ranney wells (per EFSEC Resolution 309), and the Grays Harbor PDA has a permitted water right to withdraw an additional 20 cfs from the Ranney wells. The Certificate Holder is proposing to obtain up to an additional 6.5 cfs of water from an existing water rights' holder, such as the Grays Harbor PDA or the City of Aberdeen, and is in the process of negotiating an agreement to obtain water. If water is leased from an existing right held by other than the PDA, the holder of that right would apply to Ecology to transfer the point of intake to the Ranney wells. This could potentially increase the water withdrawal to a maximum of 36 cfs (20 cfs for the PDA and 16 cfs total for Grays Harbor Energy), which is still less than half of the amount the existing wells and water line were designed to carry. Therefore, the capacity of the Ranney wells and make-up water line are more than sufficient for the permitted uses.

The Ranney wells are located on the southern bank of the Chehalis River, approximately four miles downriver of the plant site near the river's confluence with Elizabeth Creek. The wells penetrate to a depth of approximately 120 feet into the alluvial aquifer associated with the Chehalis River. The estimated radius of groundwater influence for the Ranney wells is 2,000 feet after 30 days of pumping. Ecology well records do not show groundwater wells within 2,000 feet of either Ranney well. However, if a groundwater well in the alluvial deposits was within 2,000 feet of the Ranney wells, it would experience some drawdown in water level due to the pumping at the Ranney wells. Because Units 3 and 4 are intended to operate using an existing permitted water right, the Grays Harbor Energy Center will not draw additional groundwater from the alluvial aquifer system beyond that already anticipated by existing water rights and authorizations. The additional 6.5 cfs that will be withdrawn for the Grays Harbor Energy Center should not change the temperature or the water quality of the Chehalis River since the amount withdrawn is about 1 to 2% of the flow in the river.

3.3.2.4 Potable Water Supply Withdrawal

Potable water is provided to the Grays Harbor Energy Center by the Grays Harbor PDA under an existing agreement. The agreement covers the existing facility and would also apply to Units 3 and 4.

3.3.2.5 Process Water Discharge Summary

The Grays Harbor Energy Center has been designed to minimize wastewater discharges. Like the existing facility, the design for Units 3 and 4 includes waste streams that will be treated as necessary and co-mingled prior to discharge. These waste streams consist of cooling tower blowdown, oil/water-separator decant, and metal cleaning waste. The co-mingled waste streams will be discharged to the Satsop Development Park's blowdown line in accordance with the NPDES permit for the Grays Harbor Energy Center (Permit No. WA-002496-1; see Section 2.8.2). As shown on Figure 2.3-4, the outfall discharges to the Chehalis River. Discharge of total process water (from all Units 1-4) to the river will be at a maximum rate of approximately 2.84 cfs (1,320 gpm) when operating with duct firing.

The temperature of the cooling tower blowdown at the point of discharge from the Grays Harbor Energy Center to the blowdown line will be below the limit of 16^{o}C, the temperature limitation in the existing NPDES Permit, as required by the SCA.

Based on preliminary water balances for the project with all four turbines operating, evaporative losses and other flow reduction losses from the combustion turbine process range from 2,104 to 3,230 gpm for Units 3 and 4.

3.3.2.6 Sanitary Water Discharge

Sanitary water effluent will be released to an existing on-site septic system. The system has been designed to Grays Harbor County standards to accommodate up to 3,500 gpd sanitary waste. Conservatively estimating the number of people on site (staff and visitors) per day, and using a sanitary waste flow typical for an operating plant, the flow to the on-site system would be less than 3,500 gpd.

3.3.3 MITIGATION MEASURES

3.3.3.1 Surface Water

To minimize impacts on surface water, contractors will use BMPs for erosion and sediment control during construction of Units 3 and 4 and will implement a plan that complies with the requirements of the existing Erosion and Sedimentation Control Plan. BMPs will include limiting certain construction activities and installing temporary control structures such as sediment traps, silt fences, and diversion ditches.

To meet the temperature requirements of the discharge, heat exchangers will be used to control the temperature of the cooling water discharge.

3.3.3.2 Groundwater

Process water is discharged via a diffuser to the Chehalis River, and stormwater is directed to the C-1 pond for treatment and discharged via surface drainage to the Chehalis River. The septic drain field is the only water that could reach groundwater. The design of the existing on-site septic system included a professional engineer's report on site conditions, schedule for development, water balance analysis, overall effects of the proposed system on the surrounding area, and any local zoning requirements. The placement and design of the system allows infiltration of effluent but inhibits its direct release to surface and/or groundwater bodies.

Additionally, the project is situated on terrace deposits with smaller, discontinuous perched aquifers and the site is built on gravel fill, which is underlain by a liner that restricts water infiltration. As a result, plant construction will not have an impact on groundwater quality. Therefore, no significant impacts to groundwater quantity or quality are likely to occur.

SECTION 3.4 PLANTS AND ANIMALS (WAC 463-60-332)

EFSEC has previously evaluated the plants and animals associated with the 22-acre project site, and authorized construction of the Gray Harbor Energy Center on the site. Units 3 and 4 will be constructed on the same site. An additional 10 acres of adjacent property will be used for construction laydown and site access.

This section summarizes information provided in the previous application addressing the vegetation, fish, and wildlife studies concerning the original project site, and provides additional information regarding the 10-acre construction laydown and access area.

Vegetation studies were conducted by Dames & Moore biologists during May and June 1994. These surveys of the study area consisted of reviewing and assessing aerial photographs, National Wetland Inventory Maps, and county soil surveys. Surveys completed in 1994 were for the 22-acre Grays Harbor Energy Center, as well as the pipeline corridor, and the transmission line corridor. The 10-acre construction laydown and access area to the east was surveyed in 1994 as part of the pipeline corridor and the conditions field verified on June 19, 2008 by a URS biologist.

3.4.1 HABITAT AND VEGETATION

3.4.1.1 Existing Conditions

The 22-acre site was previously used as a construction laydown area for the Satsop nuclear facilities. The site has been graded several times, most recently as part of the Grays Harbor Energy Center construction. The site is scarcely vegetated and covered in gravel.

The area immediately surrounding the site is a mix of developed and undeveloped areas. The area north of the site is industrial with some conifers to the northeast. The area south of the site consists of the transmission line corridor and is mostly shrubs, followed by conifers further south. To the west of the site is Keys Road. The proposed 10-acre construction laydown and access area is adjacent to and east of the existing site and consists of approximately 5 acres of thinned conifers managed as a mature forest, and 5 acres of grassland/agriculture. The grasslands continue to the east and are mowed every year.

The original nuclear power plant site comprised 1,600 acres, of which 400 acres were developed and 1,200 acres were left undeveloped. Developed areas include land that is essentially cleared of all vegetation, such as roads, industrial parks, and other buildings and facilities. Planted grasses, forbs, shrubs, and trees typically dominate these areas. These areas also have a higher proportion of ornamentals.

The surrounding area consists of developed land, coniferous forest, regenerated coniferous forest, grassland/agriculture, and shrubland.

Developed Areas. Although there are varying levels of development, these areas generally provide low-quality habitat because of the lack of native vegetation and the level of human disturbance. Species observed in developed areas during field reconnaissance in 1994 included European starlings, rock doves, American crows, house sparrows, and opossums, all of which are highly adapted to human-modified environments.

Coniferous Forest. Forest habitat consists of areas dominated by coniferous and/or deciduous tree cover, and associated forest understory vegetation. Coniferous forest is the predominant habitat in the areas around the study area to the northeast, south past the transmission lines, and in five acres of the construction laydown and access area. Deciduous and mixed forest occurs in smaller patches, generally interspersed with coniferous forest stands.

The quality of forest habitat for wildlife varies depending on the age or successional stage of the stand, the presence of several vegetative layers (i.e., shrub/midstory and herbaceous/understory vegetation), the presence of snags and downed logs, and the size of the stand.

Wildlife occurring in forest habitat in the study area is typical of wildlife occurring in second-growth forest stands throughout western Washington. Common forest songbirds observed in the 1994 surveys throughout the study area included Pacific slope flycatchers, Steller’s jays, chestnut-backed chickadees, red-breasted nuthatches, brown creepers, winter wrens, golden-crowned kinglets, varied thrushes, solitary vireos, Townsend’s warblers, Wilson’s warblers, western tanagers, and black-headed grosbeaks. Sign of black-tailed deer, mountain beaver, and Douglas’ squirrel also was observed in many forested areas.

Regenerating Coniferous Forest. Regenerating coniferous forest is defined as areas that were clearcut up to 20 years ago and where successional advancement is moving rapidly toward forest development. For the first few years after clearcutting, these stands are dominated by a mix of forbs, ferns, and shrubs, such as salal, Oregon grape, trailing blackberry, vine maple, sword fern, bracken fern, and red alder. The diversity of plant species is higher in regenerating stands than during later stages of forest succession because the open space following clearcutting allows many plant species to invade. Within 5 to 10 years after clearcutting, the conifer seedlings (primarily Douglas fir) become the dominant vegetation. Herbs, ferns, and shrubs become overtopped by young trees and often die under the taller growing species. By age 20, the stands have developed closed canopies and are classified as forest habitat. Regenerating forest is interspersed with forest habitat in the study area.

Many wildlife species are found in regenerating forest stands since the variety of plants and seeds provide an abundance and diversity of food. The young plants are fairly palatable, are accessible to ground-foraging animals (i.e., deer), and provide hiding cover for songbirds and other wildlife. Wildlife commonly observed in regenerating coniferous forest during the 1994 field surveys included ruffed grouse, mourning doves, rufous hummingbirds, Swainson's thrushes, orange-crowned warblers, MacGillivray's warblers, Wilson's warblers, rufous-sided towhees, song sparrows, white-crowned sparrows, dark-eyed juncos, and American goldfinches. Red-tailed hawks occasionally were observed circling over the open stands. Sign of coyote, black-tailed deer, and elk was observed within regenerating forest habitat and on logging roads through the regenerating stands. Garter snakes were common along the edges of logging roads. Mountain beaver sign also was prevalent throughout many of the stands.

Grassland/Agricultural Areas. Grasslands and agricultural areas include pastures, croplands, orchards, hayfields, and untended fields. Open areas also provide foraging habitat for raptors. Red-tailed hawks and northern harriers occur year-round in open agricultural areas. American kestrels occur in open areas in the study area during winter. Songbirds occurring in this habitat type include violet-green swallows, savannah sparrows, and American robins.

Shrubland. Shrub habitat is the primary habitat type in existing rights-of-way for the BPA transmission line south of the project site. Shrub habitat is not a forest successional stage. Shrub habitat is dominated primarily by Scotch broom, but also includes trailing blackberry, Himalayan blackberry, salmonberry, thimbleberry, and young red alder.

Regional Conditions. The study area is located within the Puget Trough Province (Franklin and Dyrness 1988). Relief is moderate, with elevations seldom exceeding 525 feet. The majority of the soils were formed in glacial materials under the influence of coniferous forest vegetation.

The study area also is within the Western hemlock (*Tsuga heterophylla*) Zone (Franklin and Dyrness 1988). This zone is the most extensive zone in western Washington and is named for the potential climax species (Western hemlock). This zone has a wet, mild, maritime climate, although climatic variation is widespread. The greatest amount of precipitation occurs in the winter, with only six to nine percent of the total precipitation during the summer. The climatic variation and precipitation patterns create moisture stresses that result in distinct community patterns along moisture gradients.

Plant Site. Prior to the construction of the Grays Harbor Energy Center, most of the 22-acre site had been filled and graded with several feet of compacted gravel (Parametrix 1993), lacked vegetation, and a portion of the site was covered with asphalt. The site was used as a construction laydown area and had stockpiles of concrete forms, steel reinforcing bars, and other materials remaining from construction of the nuclear facilities located on the Satsop Power Plant property. The entire site was re-graded for the construction of the Grays Harbor Energy Center, including the portion of the site that would be used for the construction of Units 3 and 4.

Construction Laydown and Access Area. The 10-acre construction laydown area consists of approximately 5 acres of thinned conifers managed as a coniferous forest and 5 acres of grassland/agriculture that is mowed every year. Table 3.4-1 lists vegetation observed in the construction laydown area during the June 2008 site visit.

TABLE 3.4-1
PLANT SPECIES OBSERVED ON CONSTRUCTION LAYDOWN AREA

Scientific Name	Common Name	Native or Introduced
Trees		
Acer circinatum	vine maple	N
Alnus rubra	red alder	N
Fraxinus latifolia	Oregon ash	N
Malus sp.	apple	I
Rhamnus purshiana	cascara	N
Populus balsamifera	black cottonwood	N
Pseudotsuga menziesii	Douglas-fir	N
Tsuga heterophylla	Western hemlock	N
Shrubs		
Berberis aquifolium	tall Oregongrape	N
Cytisus scoparius	Scot's broom	I
Gaultheria shallon	salal	N
Hedera helix	English ivy	I
Ilex aquifolium	English holly	I
Oemleria cerasiformis	osoberry	N
Oplopanax horridus	devil’s club	N
Ribes sanguineum	red-flowering currant	N
Rosa nutkana	Nootka rose	N
Rubus armeniacus	Himalayan blackberry	I
Rubus spectabilis	salmonberry	N
Rubus ursinus	trailing blackberry	N
Sambucus racemosa	red elderberry	N
Symphoricarpos albus	snowberry	N
Vaccinium parvifolium	red huckleberry	N
Herbs		
Achlys triphylla	Vanilla-leaf	N
Bellis perennis	English daisy	I
Cerastium sp.	chickweed	I
Circaea alpina	Enchanter’s nightshade	N
Cirsium vulgare	bull thistle	I
Claytonia sibirica	Siberian miner’s-lettuce	N
Daucus carota	Queen Anne's lace	I
Dicentra Formosa	Pacific bleeding heart	N
Digitalis pupurea	foxglove	I
Epilobium angustifolium	fireweed	N
Galium aparine	cleavers	N
Lotus corniculatus	birds-foot trefoil	I
Maianthemum dilatatum	false lily-of-the-valley	N
Plantago lanceolata	English plantain	I
Ranunculus repens	creeping buttercup	I
Rhinanthus minor	yellow rattle	N

Scientific Name	Common Name	Native or Introduced
Rumex acetosella	sheep sorrel	I
Rumex obtusifolius	bitter dock	I
Smilacina racemosa	False solomons seal	N
Solidago canadensis	Canada goldenrod	N
Solanum dulcamara	bittersweet nightshade	I
Stachys sp.	hedgenettle	I
Taraxacum officinale	common dandelion	I
Trifolium repens	white clover	I
Trifolium dubium	Small hop-clover	I
Trillium ovatum	Western trillium	N
Vicia sp.	vetch	N
Grasses, Sedges, Rushes		
Agrostis capillaris	colonial bentgrass	I
Anthoxanthum odoratum	sweet vernalgrass	I
Dactylis glomerata	orchardgrass	I
Elytrigia repens	quackgrass	I
Festuca arundinacea	tall fescue	I
Holcus lanatus	velvetgrass	I
Juncus effusus	soft rush	N
Lolium perenne	perennial ryegrass	I
Phalaris arundinacea	reed canarygrass	I
Poa annua		I
Poa sp.	bluegrass	I
Ferns and Allies		
Blechnum spicant	deer fern	N
Polystichum munitum	sword fern	N
Pteridium aquilinum	bracken fern	N

3.4.1.2 Impacts

Plant Site

Since the area of the existing site proposed for Units 3 and 4 is not vegetated, there will not be any impacts to upland vegetation due to construction or operation of the additional two units. The forested and pasture areas surrounding the site will not be impacted by construction.

Construction Laydown and Access Area

There would be a permanent impact to the forest and mown pasture habitat on the construction laydown and access area due to the removal of the trees and pasture.

3.4.2 FISH

Like the existing Grays Harbor Energy Center facility, Units 3 and 4 would use water from the existing Ranney wells for cooling, and discharge water to the Chehalis River through the existing outfall. Previous applications have addressed the fish and aquatic resources in the area, and addressed the potential impacts associated with the existing facility. The aquatic area studied previously included the Chehalis River within 2,000 feet of the Ranney wells located at approximately river mile (RM) 17 and in the vicinity of the discharge outfall at approximately RM 19.6.

Currently, a maximum of 29.2 cfs is authorized to be withdrawn from the Ranney wells based on 20 cfs for the Grays Harbor PDA and an additional 9.2 cfs for the Grays Harbor Energy Center. Operation of Units 3 and 4 would use up to an additional 6.5 cfs of water from the Ranney wells. This water could come from the Grays Harbor PDA's 20 cfs authorization, or alternatively be obtained from another water rights holder such as the City of Aberdeen. If obtained from an entity other than the PDA, the potential withdrawal could be a maximum of 36 cfs when the river is above base flow, or 26.5 cfs during low flow conditions. The operations of Units 3 and 4 would increase the discharge of water at the diffuser outfall by as much as 3 cfs. The temperature of the discharge water will be below the existing NPDES permit limit of 16ºC. The results of mixing zone modeling indicate that all modeled constituents of the discharge water would be diluted to below water quality standards and permit limits within the regulated mixing zone. Approximately 88 percent of the water in the well comes from the Chehalis River, for a total reduction in river flow below the outfall of 5.7 cfs (88 percent of 6.5 cfs). This section describes the fisheries and aquatic resources important to the Grays Harbor Energy Center study area, which includes portions of the Chehalis River Basin.

Data sources reviewed in the preparation of this section include the US Fish and Wildlife Service (USFWS 2008), National Marine Fisheries Service (NMFS 2008), Washington Department of Fish and Wildlife (WDFW 2008a, 2008b, 2008c), Washington Department of Fisheries (WDF 1975), and Washington Department of Wildlife (WDW 1992). Maps from the then-named Washington Department of Fisheries stream catalog were used to obtain information about the locations of cascades and falls (WDF 1975). Maps from various sources were used to delineate stream use by fish (WDF 1975; WDW 1992; WDFW 2000, 2002, 2004, 2008b and 2008c; and Smith and Wenger 2001). Additional data was reviewed to determine fish species presence in the Chehalis River (Baker 2008, Henning 2004, Jeanes et al. 2003, Kelley 1997, McPhail 1969, USFWS 2004, WDF 1971, Wydoski and Whitney 2003, and Mongillo and Hallock 1995, 1997, and 1999).

3.4.2.1 Existing Conditions

Chehalis River

Outside of the Columbia River system, the Chehalis River is the largest watershed in the state of Washington (Seiler 1989). The Chehalis River is classified as Class A (excellent), as are most of the water bodies of the Chehalis Basin. Beneficial uses of Class AA and Class A waters include water supply, fish spawning and rearing, recreation, and navigation (LCCD 1992a and 1992b). The Chehalis River flows into Grays Harbor, the fourth largest estuary in the western United States.

The Chehalis River in the aquatic study area has a low gradient with deciduous vegetation along its banks. The Chehalis River in the aquatic study area provides a fairly uniform habitat for fish. The river channel ranges from 60 to 80 yards in width with a number of slow-moving pools followed by relatively short riffle sections. The bottom is composed primarily of gravel and rubble (WDF 1975).

Limiting factors affecting fisheries resources may include seasonal low flows resulting in degradation of spawning and rearing areas and water quality (WDF 1975). A major limiting factor in the Chehalis basin is degraded water quality. The Chehalis River basin is reportedly degraded by fecal bacterial and unknown agents from sources including industrial, municipal, and pasture land uses, and from timber harvesting, residential wastewater, and other unknown sources (LCCD 1992a).

The Chehalis River from its mouth upstream to the Newaukum River confluence at RM 75.4 is reportedly impaired by fecal bacteria and low dissolved oxygen (LCCD 1992a). From its confluence with the Satsop River upstream to the city of Chehalis, the river has a history of fish kills associated with high temperatures and low dissolved oxygen levels. Elevated temperatures (in excess of 18°C) have been measured throughout the Chehalis River system in most years, resulting in water quality problems that restrict anadromous fisheries in this basin (LCCD 1992a and 1992b). Elevated temperatures and depressed dissolved oxygen levels typically occur during the summer season (LCCD 1992a). Despite the limiting factors associated with water quality in the lower Chehalis River, better fisheries habitat is found in the area downstream of the confluence of the Black River at RM 47.0, as compared to the upper Chehalis basin (Seiler 1989).

High occurrences of the diagenic fluke *Nanophyetus salmincola* are present in lower areas of the Chehalis River. Adult coho salmon migrating through the lower reaches become heavily infested with this parasite that places physiological burdens on the fish and increases their vulnerability to additional stress, and may increase mortality (WDF 1992).

It appears that degraded water quality and heavy parasite infestation cause exceptionally high mortality in the Chehalis River coho salmon smolts. Another factor that limits salmon production is the presence of a robust population of squawfish, known predators of juvenile salmonids, in the lower Chehalis River (WDF 1992).

Groundwater helps sustain stream flow during low flow (basal flow) conditions, which typically occur during the summer months. Groundwater problem areas are evident in Grays Harbor County near Elma. Typical causes of groundwater contamination include septic systems, agricultural waste (manure and pesticides), automotive waste, landfills, and industrial waste (LCCD 1992a). Contaminated groundwater is probably a contributing factor in water quality impairment in the lower Chehalis River basin.

Fish

Table 3.4-2 lists all fish species that occur within the study area. Six species of anadromous salmonids, Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), chum salmon (*O. keta*), steelhead trout (*O. mykiss*), coastal cutthroat trout (*O. clarki clarki*), and bull trout (*Salvelinus confluentus*), use the Chehalis River mainstem within the study area. Healthy populations of spring- and fall-run Chinook, coho, and chum salmon migrate through the aquatic study area, along with three stocks of winter-run steelhead and one stock of summer-run steelhead. A summer-run population of Chinook salmon is depressed (WDFW 2002 and 2008c).

TABLE 3.4-2
FISH SPECIES LIKELY TO OCCUR IN THE VICINITY OF THE STUDY AREA

Common Name[a]	Scientific Name
Anadromous Fishes	
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*O. kisutch*
Chum salmon	*O. keta*
Steelhead trout	*O. mykiss*
Coastal cutthroat trout	*O. clarki clarki*
Bull trout	*Salvelinus confluentus*
Pacific lamprey	*Entosphenus tridentatus*
River lamprey	*Lampetra ayresi*
White sturgeon	*Acipenser transmontanus*
American shad (I)	*Alosa sapidissima*
Resident Fishes	
Mountain whitefish	*Prosopium williamsoni*
Prickly sculpin	*Cottus asper*
Coastrange sculpin	*Cottus aleuticus*
Riffle sculpin	*Cottus gulosus*
Reticulate sculpin	*Cottus perplexus*
Torrent sculpin	*Cottus rhotheus*
Three-spine stickleback	*Gasterosteus aculeatus*
Olympic mudminnow	*Novumbra hubbsi*
Northern pikeminnow	*Ptychocheilus oregonensis*
Peamouth	*Mylocheilus caurinus*
Speckled dace	*Rhinichthys osculus*
Nooksack dace	*Rhinichthys cataractae ssp.*
Redside shiner	*Richardsonius balteatus*
Common carp (I)	*Cyprinus carpio*
Largescale sucker	*Catostomus macrocheilus*
Western brook lamprey	*Lampetra richardsoni*
Largemouth bass (I)	*Micropterus salmoides*
Black crappie (I)	*Pomoxis nigromaculatus*
Bluegill (I)	*Lepomis macrochirus*
Pumpkinseed (I)	*L. gibbosus*
Warmouth bass (I)	*L. gulosis*
Rock bass (I)	*Ambloplites rupestris*
Yellow perch (I)	*Perca flavescens*
Brown bullhead (I)	*Ameiurus nebulosus*

a. I=Introduced species
The study area is defined as the within 2,000 feet the Ranney wells and 300 feet downstream of the discharge outfall.
Sources: Baker (2008), Henning (2004), Jeanes et al. (2003), Kelley (1997), McPhail (1969), USFWS (2004), WDF (1971), Wydoski and Whitney (2003), Mongillo and Hallock (1995, 1997, and 1999).

The Satsop and Skookumchuck/Newaukum stocks of winter-run steelhead are depressed while the Chehalis River stock of winter-run steelhead is healthy and the Chehalis River summer-run steelhead stock has an unknown status. Historically, summer-run steelhead have returned to the Chehalis in low numbers due to a lack of suitable habitat (WDFW 2002, WDW 1992). Coastal cutthroat trout are present and relatively common throughout the Chehalis River basin (WDFW 2000). Juvenile Chinook, coho, chum, steelhead, and coastal cutthroat are documented to rear in the aquatic study area, while chum salmon have been documented to spawn in the study area (WDFW 2008c). Chinook spawn in the headwaters of the Chehalis upstream of the aquatic study area and in larger tributaries, while chum, steelhead, and coho spawn primarily in medium-sized tributaries and the mainstem rivers. Coastal cutthroat primarily spawn in small tributaries. Bull trout have not been documented to reproduce in the Chehalis River basin, but small numbers of large adult anadromous bull trout from known coastal natal rivers north of Grays Harbor have been documented to enter the lower Chehalis River basin (Jeanes et al. 2003, USFWS 2004, WDFW 2004).

Other anadromous fish that have been documented as occurring in the Chehalis River in the vicinity of the aquatic study area are white sturgeon (*Acipenser transmontanus*), introduced American shad (*Alosa sapidissima*), Pacific lamprey (*Entosphenus tridentatus*), and river lamprey (*Lampetra ayresi*). Lamprey and shad spawn in the Chehalis River, while white sturgeon do not reproduce in the Chehalis River basin and are primarily produced in the lower Columbia River and perhaps other coastal rivers to the south of the Columbia River, such as the Sacramento River (Wydoski and Whitney 2003). In addition to the ten anadromous fish species documented to occur in the vicinity of the aquatic study area, eulachon (*Thaleichthys pacificus*) and longfin smelt (*Spirinchus thaleichthys*) have been documented to spawn in the Chehalis River, but it is unknown if they run upstream as far as the project vicinity. Green sturgeon (*Acipenser medirostris*) summer over in Grays Harbor between the months of May and October, but are not known to enter the Chehalis River or to spawn in the Chehalis basin (Moser and Lindley 2007).

Native resident fishes occurring in the aquatic study area (Table 3.4-2) include mountain whitefish (*Prosopium williamsoni*), five species of sculpin (*Cottus* spp.), three-spine stickleback (*Gasterosteus aculeatus*), Olympic mudminnow (*Novumbra hubbsi*), northern pikeminnow (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus caurinus*), speckled dace (*Rhinichthys osculus*), the Nooksack form of the longnose dace (*R. cataractae* ssp.), western brook lamprey (*Lampetra richardsoni*), largescale sucker (*Catostomus macrocheilus*), and redside shiner (*Richardsonius balteatus*). Both resident and sea-run life histories of coastal cutthroat trout are present in the aquatic study area. There are also nine species of introduced fish, including carp as well as members of the sunfish, catfish, and perch families (Table 3.4-2).

Threatened and Endangered Species

Table 3.4-3 lists special status fish likely to occur in the vicinity of the aquatic study area. The bull trout is the only federally listed fish present in the aquatic study area. Bull trout have not been documented to reproduce in the Chehalis River basin, but small numbers of large adult anadromous bull trout from known coastal natal rivers north of Grays Harbor (the Quinault, Queets, and Hoh Rivers) have been documented to enter the lower Chehalis River and its major tributary rivers as far upstream as RM 47 between late April and mid-June (Jeanes et al. 2003, USFWS 2004, WDFW 2004). The entry of anadromous bull trout into the lower Chehalis River during the spring months, which is likely a foraging migration, coincides with the out-migration timing of Pacific salmon. Starting at age 3, coastal anadromous bull trout have been documented to leave their natal streams and enter the marine environment from December to March and return to their natal streams from April to July (Brenkman and Corbett 2005, Brenkman et al. 2007). During their marine migration, coastal bull trout have been documented to enter coastal estuaries and non-natal streams to overwinter and forage on out-migrating salmonid smolts (Brenkman and Corbett 2005, Brenkman et al. 2007). It is possible that anadromous bull trout occasionally overwinter in the Chehalis River basin, but high summer water temperatures likely force foraging bull trout to exit the Chehalis River basin by late June and not return to the basin until the winter out-migration from their natal streams to the marine environment.

TABLE 3.4-3
THREATENED, ENDANGERED, SENSITIVE, AND CANDIDATE FISH SPECIES AND SPECIES OF CONCERN LIKELY TO OCCUR IN THE STUDY AREA VICINITY

Common Name	Scientific Name	Federal Status	State Status
Bull trout	*Salvelinus confluentus*	T	C
Pacific lamprey	*Entosphenus tridentatus*	SOC	NA[b]
River lamprey	*Lampetra ayresi*	SOC	C
Olympic mudminnow	*Novumbra hubbsi*	NA[a]	S

Sources: USFWS (2008), NMFS (2008), WDFW (2008a and 2008b).
The *study area* is defined as the within 2,000 feet the Ranney wells and 300 feet downstream of the discharge outfall.
T – Threatened: A species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range
SOC – Federal Species of Concern
C – State Candidate: A species that is under state review for possible listing as endangered, threatened, or sensitive.
a. NA – Not applicable: A species that has no federal status
b. N/A – Not applicable: Species has not yet been added to the state list

Pacific lamprey and river lamprey are federal species of concern and their status in the Chehalis River basin is undocumented. Olympic mudminnow are found throughout low gradient side channels and floodplain ponds and wetlands of the Chehalis River (Mongillo and Hallock 1999). Their state sensitive status is due to their limited distribution, which is in low elevation floodplain habitat that is frequently filled for development or agriculture. The native range of the Olympic mudminnow is confined to coastal lowlands of the western Olympic Peninsula, from Lake Ozette south to Grays Harbor and up the north side of the Chehalis River valley to the Skookumchuck and Black Rivers with occasional headwater transfers from the Black to the Deschutes River (Wydoski and Whitney 2003).

3.4.2.2 Impacts

Construction Impacts

Although there are no aquatic resources on the project site, or on the area proposed for construction laydown and access, the Certificate Holder will implement the already-approved erosion and sediment control plan to avoid sediment releases into nearby streams. Discharges from the Grays Harbor Energy Center will use the existing outfall structure, and therefore construction of a new outfall will not be necessary. Thus, there will not be a significant adverse impact due to construction of the power plant.

Operational Impacts

As with Units 1 and 2, water for Units 3 and 4 will be withdrawn from existing Ranney wells and transported to the site through an existing pipeline infrastructure system (see Section 3.3, Water, WAC 463-60-322, and Section 2.5, Water Supply System, WAC 463-60-165). Process water will continue to be delivered through the existing connection to the existing outflow line. The Grays Harbor Energy Center will continue to send its effluent back to the blowdown line via the existing connection downstream of the project intake. Effluent will continue to be discharged through the existing outfall in the Chehalis River. The discharge will meet the limitations of the existing NPDES Permit.

The Chehalis River in the vicinity of the project site is classified as "core summer salmonid habitat" (June 15 to September 15) with a 7-day average daily maximum temperature (7-DADMax) criterion for aquatic life use of 16ºC (WAC 173-201A-200). This criterion applies to Pacific salmon and trout spawning, juvenile emergence from spawning gravel, and adult holding; or foraging by adult or sub-adult bull trout that occurs during the summer season. A review of a long-term temperature monitoring station at Porter (RM 33.3) reveals temperature recordings exceeding 18ºC almost every day between June 26 and September 16 during the summer of 2001 with a high water temperature exceeding 20ºC on 33 days during that period (Chehalis Basin Partnership 2003). The maximum water temperature (7-DADMax) did not exceed the criterion of 16ºC during when bull trout are present in the Chehalis River basin (March through June), but frequently exceeded the temperature criterion during the late spring and summer months when other salmonids, such as coho and Chinook salmon and steelhead, are present in the Chehalis River mainstem in the vicinity of the project site.

The lowest recorded daily mean flow for the Chehalis River at Porter, WA was 166 cfs and the lowest daily mean flow for the Satsop River at Satsop, WA was 147 cfs (USGS 1999). A conservative lowest mean daily flow for the Chehalis River in the vicinity of the project site would be the total of these two low flows, or 313 cfs. The seven consecutive day low flow at the Porter gauge during the period 1953–1993 averaged 308 cfs (Smith and Wenger 2001).

If the 6.5 cfs of additional water is purchased or leased from an entity other than the PDA, the potential maximum withdrawal at the Ranney wells would increase from 29.2 cfs to 35.7 cfs, or from 20 cfs to 26.5 cfs during low flow conditions. Leasing 6.5 cfs of additional water from an entity other than the PDA could require transferring the water withdrawal upstream from the current withdrawal location as much as 4 miles. The reduction of 5.7 cfs (88 percent of 6.5 cfs) at the Ranney wells and the discharge of as much as 3 cfs of water above the Ranney wells at a temperature below 16ºC would not create a measurable change in river flow, depth, wetted area, or water temperature in the main stem of the Chehalis River at or below the vicinity of the project site where the lowest regulatory minimum base flow is 550 cfs (WAC 173-522-020) and the lowest recorded flows are greater than 300 cfs.

Anadromous adult or sub-adult individuals of the federally listed bull trout (threatened) occasionally forage in the Chehalis River mainstem between the March and June and also may over winter in the Chehalis River basin. Bull trout would only be present in the Chehalis River basin outside of the low flow period when average river water temperature is at or below the 7-

DADMax 16ºC thermal maximum (WAC 173-201A-200) for foraging adult and sub-adult bull trout.

The increased water withdrawal from the Ranney wells and discharge of stormwater and process effluent into the Chehalis River will not significantly impact water temperature or available aquatic habitat for resident and anadromous fishes or other aquatic life in the Chehalis River.

No significant impacts to aquatic resources from the use of this well are anticipated.

3.4.3 WILDLIFE

Wildlife investigations were conducted for the Grays Harbor Energy Center, including the pipeline corridor and the transmission line corridor. This information was used as a baseline, and updated information was collected in June 2008 for the construction laydown and access area. Presence and distribution information related to special status species was obtained from the US Fish and Wildlife Service and the Washington Department of Fish and Wildlife (USFWS 2008, WDFW 2008b). Additional data was reviewed to determine probable occurrence of wildlife species in the terrestrial study area (Henning 2004, Wahl et al. 2005, Smith et al. 1997, Johnson and Cassidy 1997, and Dvornich et al. 1997).

3.4.3.1 Existing Conditions

Plant Site and Laydown Area

The terrestrial study area is defined as the existing 22-acre site and the 10-acre laydown and access area, and the area 500 feet around the combined 32-acre site. There will be no construction or disturbance to the aquatic study area described in Section 3.4.2 and, as a result, the aquatic study area is not included in the wildlife analysis.

The existing site has been graded several times, is scarcely vegetated, and is covered in gravel. The 10-acre construction laydown area consists of roughly 50% grassland/agriculture and 50% coniferous forest habitat. All trees and grassland in the laydown area will be removed during construction.

Wildlife

Table 3.4-4 lists wildlife species likely to occur within the terrestrial study area.

TABLE 3.4-4
WILDLIFE SPECIES LIKELY TO OCCUR IN THE VICINITY OF THE STUDY AREA

Common Name	Scientific Name
Birds[a]	
Ring-necked pheasant (I)	*Phasianus colchicus*
Ruffed grouse	*Bonasa umbellus*
Sooty blue grouse	*Dendragapus fuliginosus*
Great blue heron	*Ardea herodias*
Turkey vulture	*Cathartes aura*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
Northern goshawk	*Acipiter gentilis*
American kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine falcon	*Falco peregrinus*
Red-tailed hawk	*Buteo jamaicensis*
Rock Dove (I)	*Columba livia*
Band-tailed pigeon	*Patagioena fasciata*
Morning dove	*Zenaida macroura*
Barn Owl	*Tyto alba*
Western screech-owl	*Megascops kennicottii*
Great horned owl	*Bubo virginianus*
Northern pygmy-owl	*Glaucidium gnoma*
Spotted owl	*Strix occidentalis*
Barred owl	*Strix varia*
Short-eared owl	*Asio flammeus*
Northern saw-whet owl	*Aegolius acadicus*
Killdeer	*Charadrius vociferus*
Common nighthawk	*Chordeiles minor*
Vaux’s swift	*Chaetura vauxi*
Rufous hummingbird	*Selasphorus rufus*
Hairy woodpecker	*Picoides villosus*
Downy woodpecker	*Picoides pubescens*
Northern flicker	*Colaptes auratus*
Red breasted sapsucker	*Sphyrapicus ruber*
Pileated woodpecker	*Dryocopus pileatus*
Olive-sided flycatcher	*Contopus borelis*
Willow flycatcher	*Empidonax traillii*
Hammond's flycatcher	*Empidonax hammondii*
Northern shrike	*Lanius excubitor*
Hutton's Vireo	*Vireo huttoni*
Warbling Vireo	*Vireo gilvus*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Violet-green swallow	*Tachycineta thalassina*
Tree swallow	*T. bicolor*
Cliff swallow	*Pterochelidon pyrrhonota*
Barn swallow	*Hirundo rustica*
Purple martin	*Progne subis*
Gray jay	*Perisoreus canadensis*

Common Name	Scientific Name
Stellar's jay	*Cyanocitta stelleri*
American Crow	*Corvus brachyrhynchos*
Common raven	*Corvus corax*
Black-capped chickadee	*Parus atricapillus*
Chestnut-backed chickadee	*Poecile rufescens*
Bushtit	*Psaltriparus minimus*
Red-breasted nuthatch	*Sitta canadensis*
Brown creeper	*Certhia americana*
Bewick's wren	*Thryomanes bewickii*
Winter wren	*Troglodytes troglodytes*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet	*R. caledula*
Varied thrush	*Ixoreux naevius*
American robin	*Turdus migratorius*
Swainson's thrush	*Catharus ustulatus*
European starling (I)	*Sturnus vulgaris*
Cedar waxwing	*Bombycilla cedrorum*
Yellow warbler	*Dendroica petechia*
Yellow-rumped warbler	*D. coronata*
Black-throated gray warbler	*D. nigrescens*
Townsend's warbler	*D. townsendi*
MacGillivray's warbler	*Oporornis tolmei*
Orange-crowned warbler	*Vermivora celata*
Wilson's warbler	*Wilsonia pusilla*
Common yellowthroat	*Geothlypis trichas*
Western tanager	*Pirnga ludoviciana*
Black-headed grosbeak	*Pheucticus melanocephalus*
Spotted towee	*Pipilo maculatus*
Savannah sparrow	*Passerculus sandwichensis*
Fox sparrow	*Passerella iliaca*
Song sparrow	*Melospiza melodia*
Lincoln's sparrow	*M. lincolni*
White-crowned sparrow	*Zonotrichia leucophrys*
White-throated sparrow	*Z. albicollis*
Golden-crowned sparrow	*Z. atricappilla*
Dark-eyed junco	*Junco hyemalis*
Western meadowlark	*Sturnella neglecta*
Brewer's blackbird	*Euphagus cyanocephalus*
Brown-headed cowbird	*Molothrus ater*
House finch	*Carpodacus mexicanus*
Purple finch	*C. purpureus*
Red crossbill	*Loxia curvirostra*
Pine siskin	*Carduelis pinus*
American goldfinch	*Carduelis tristis*
Evening grosbeak	*Coccothraustes vespertinus*
House sparrow (I)	*Passer domesticus*
Mammals[b]	
American opossum	*Didelphis virginiana*
Montane shrew	*Sorex monticolus*

Common Name	Scientific Name
Trowbridge's shrew	*S. trowbridgii*
Vagrant shrew	*S. vagrans*
Shrew-mole	*Neurotrichus gibbsii*
Coast mole	*Scapanus orarius*
Townsend's mole	*S. townsendii*
California myotis	*Myotis californicus*
long-eared myotis	*M. evotis*
Long-legged myotis	*M. volans*
Yuma myotis	*M. yumanensis*
Little brown myotis	*M. lucifugus*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasirus cinereus*
Silver-haired bat	*Lasionycteris noctivagans*
Townsend's big-eared bat	*Coryhorhinus townsendii*
Snowshoe hare	*Lepus americanus*
Mountain beaver	*Aplodontia rufa*
Townsend's chipmunk	*Tamias townsendii*
Douglas' squirrel	*Tamiasciurus douglaasii*
Northern flying squirrel	*Glaucomys sabrinus*
Bushy-tailed wood rat	*Neotoma cinerea*
Forest deer mouse	*Peromyscus keeni*
Deer mouse	*P. maniculatus*
Gapper's red-back vole	*Clethrionomys gapperi*
Long-tailed vole	*Microtus longicaudus*
Creeping vole	*M. oregoni*
Townsend's vole	*M. townsendii*
Pacific jumping mouse	*Zapus trinotatus*
Porcupine	*Erethizon dorsatum*
House mouse	*Mus musculus*
Norway rat	*Rattus norvegicus*
Coyote	*Canis latrans*
red fox	*Vulpes vulpes*
Raccoon	*Procyon lotor*
Black bear	*Ursus americanus*
Striped skunk	*Mephitis mephitis*
Spotted skunk	*Spilogale gracilis*
Ermine	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*
Bobcat	*Lynx rufus*
Columbia black-tailed deer	*Odocoileus hemionus columbianus*
Roosevelt Elk	*Cervus canadensis roosevelti*
Amphibians[c]	
Pacific treefrog	*Pseudacris regilla*
Northern red-legged frog	*Rana aurora*
Western toad	*Bufo boreas*
Rough-skinned newt	*Taricha granulosa*
Northwestern salamander	*Ambystoma gracile*
Long-toed salamander	*Ambystoma macrodactylum*
Western red-backed salamander	*Plethodon vehiculum*

Common Name	Scientific Name
Ensatina	*Ensatina eschscholtzii*
Reptiles[d]	
Common garter snake	*Thamnophis sirtalis*
Northwestern garter snake	*T. ordinoides*
Western terrestrial garter snake	*T. elegans*
Rubber boa	*Charin bottae*
Northern Alligator lizard	*Elgaria coerulea*

The study area is defined as the combined 32-acre site and 500 feet surrounding it.
I=Introduced species
a. Source: Wahl et al. (2005), Smith et al. (1997)
b. Source: Johnson and Cassidy (1997)
c. Source: Dvornich et al. (1997), Henning (2004)
d. Source: Dvornich et al. (1997)

Threatened and Endangered Species

Table 3.4-5 lists special status wildlife likely to occur in the vicinity of the terrestrial study area. The northern spotted owl (*Strix occidentalis*) is the only federally listed (threatened) wildlife species likely to occur in the terrestrial study area. This species depends on large stands of mature and old-growth forest. Surveys for the northern spotted owl were conducted in mature forest habitat at the Satsop Development Park in 1993 and 1994 by qualified biologists from the Washington State DNR. The surveys were designed to meet US Fish and Wildlife Service protocol. No spotted owls were detected during these surveys (Welker 1993, Schinnell 1994).

TABLE 3.4-5
THREATENED, ENDANGERED, SENSITIVE, CANDIDATE WILDLIFE SPECIES AND SPECIES OF CONCERN LIKELY TO OCCUR IN THE STUDY AREA VICINITY

Common Name	Scientific Name	Federal Status	State Status
Long-eared myotis	*Myotis evotis*	SOC	NA[b]
Long-legged myotis	*Myotis volans*	SOC	NA[b]
Townsend's big-eared bat	*Coryhorhinus townsendii*	SOC	C
Oregon vesper sparrow	*Pooectetes gramineus affinis*	SOC	C
Bald eagle	*Haliaeetus leucocephalus*	SOC	S
Northern goshawk	*Accipiter gentiles*	SOC	C
Northern Spotted owl	*Strix occidentalis*	FT	E
Vaux's swift	*Chaetura vauxi*	NA[a]	C
Pileated woodpecker	*Dryocopus pileatus*	NA[a]	C
Olive-sided flycatcher	*Contopus cooperi*	SOC	NA[b]
Purple martin	*Progne subis*	NA[a]	C
Western toad	*Bufo boreas*	SOC	C

The study area is defined as the proposed plant and 500 feet around it.
Sources: Data from Natural Heritage Data Systems, WDFW (2008a and 2008b), USFWS (2008)
C – State Candidate: A species that is under review for possible listing as endangered, threatened, or sensitive.
E – State Endangered: A species, native to the state of Washington, that is likely seriously threatened with extirpation throughout all or a significant portion of its range.
FT – Federal Threatened Species
S – State Sensitive: A species native to the state of Washington that is vulnerable or declining and likely to become endangered or threatened throughout a significant portion of its range within the state without cooperative management or removal of threats.
SOC – Federal Species of Concern
a. N/A – Not applicable - A species that has no federal status
b. N/A– Not applicable - A species that is has not yet been added to the state list.

There is habitat in the vicinity of the terrestrial study area that would support foraging spotted owls; however, there is insufficient evidence to establish territory. The edge of a spotted owl management circle is approximately 0.75 mile east of the project site. No spotted owls have been observed in the project vicinity. The patches of coniferous forest within the laydown area are large enough for thinning and limited harvest, but do not constitute a mature, old-growth coniferous forest with the complex structure necessary for northern spotted owl nesting, roosting, and foraging. Therefore, other than individual owls occasionally dispersing through the area to establish territories elsewhere, northern spotted owls are unlikely to occur in the terrestrial study area.

Although there is a federally listed (threatened) marbled murrelet (*Brachyramphus marmoratus*) buffer a little more than 1 mile northwest of the project site, no marbled murrelets have been observed in the project vicinity. Unlike the spotted owl, marbled murrelets would not forage within the terrestrial study area, confining their foraging activities to coastal marine waters. None of the trees within the terrestrial study area are large enough to provide suitable nesting for either species.

There are eight federal species of concern that may occur in the vicinity of the terrestrial study area. Of these, three species of bats may forage over the terrestrial study area, but suitable roosting, nursery, or hibernation sites are not available in the project vicinity for Townsend's big-eared bat (*Coryhorhinus townsendii*). The long-eared myotis (*Myotis evotis*) and long-legged myotis (*M. volans*) may make limited use of conifer trees as roost sites. Only the Townsend's big-eared bat (state candidate) has special state status. The bald eagle (*Haliaeetus leucocephalus*) is a state sensitive species, with the closest mapped nest approximately 1.5 miles northeast of the study area. It has been confirmed that there are no bald eagle nests, roosts, or perch trees in the terrestrial study area or vicinity (M. Zahn, personal communication). Hence, eagle use of the project vicinity is limited to opportunistic foraging by bald eagles flying over the project site. The Oregon vesper sparrow (*Pooectetes gramineus affinis*), northern goshawk (*Accipiter gentiles*), and western toad (*Bufo boreas*) are state candidate species that may occur within the vicinity of the study area. The final federal species of concern is the Olive-sided flycatcher (*Contopus cooperi*), which does not have any special state status.

Finally, three state candidate species, Vaux's swift (*Chaetura vauxi*), Pileated woodpecker (*Dryocopus pileatus*), and purple martin (*Progne subis*), that have no federal status may occur in the vicinity of the terrestrial study area. Signs of pileated woodpecker foraging activity was observed in forested stands near Fuller Creek, to the east of the terrestrial study area.

3.4.3.2 Impacts

Construction

Approximately 5 acres of coniferous forest habitat and 5 acres of grassland/agriculture would be removed within the laydown area and would disturb wildlife in the laydown area. Because of its proximity to the existing Grays Harbor Energy Center and its separation from other forest land by the BPA right-of-way on the south, the annually mown grassland to the east, and a roadway to the north, this loss of 5 acres of habitat is considered a minor impact. Human activity and noise generated from construction of Units 3 and 4 will be temporary and result in temporary disturbance of wildlife in immediately surrounding habitat areas. Wildlife tends to habituate, so only minor impacts are expected to occur.

Operation

Baseline noise level for forested habitat is 40 A-weighted decibels (dBA) (WSDOT 2008). Nesting birds are the most likely wildlife to be affected by operational noise in the vicinity of the project site. Based on a study of 17 species of birds, the average threshold level where a sound increase is detectable but no reaction occurs is 4 dB above baseline noise level. The threshold level where birds show apparent interest (alert) by turning the head or extending the neck is 17 dB above baseline and the threshold level where birds show avoidance of the sound by hiding, defending themselves, moving their wings or body, or postponing a feeding (disturbance) is 30 dB. Adding the baseline level of 50 dBA to the threshold increases yields a detection level of 44 dBA, alert level of 57 dBA, and disturbance level of 70 dBA. The threshold of injury level, where a bird is actually injured by flushing from the nest or the young missing a feeding, is defined as 92 dBA, regardless of the baseline noise level.

Based on the information presented in Section 4.1, Environmental Health, WAC 463-60-352, operational noise will alert nesting birds in the area immediately surrounding the project site. Noise will only reach the threshold of the disturbance level within the property boundaries. The threshold of injury will not be reached within the project area. Nesting birds within the area outside the property line that exceeds the threshold 57 dBA will be affected, but not disturbed or injured by operational noise. Small mammals and deer may have similar levels of noise related impacts.

There were no bald eagle nests found near the study area, therefore no buffers or timing restrictions are needed.

No special wildlife use areas, such as fawning areas, seasonal congregation areas, or critical seasonal use habitats have been reported adjacent to the study area, and none were noted during fieldwork. It is possible that fawning areas may exist and are unknown.

Construction and maintenance vehicle traffic may cause mortality among some individual animals as they cross the access roads. These impacts generally will affect a very small percentage of the existing animal populations, and therefore the impacts will not be significant.

No spotted owls have been detected during surveys in mature forest habitat of the Satsop Development Park property. No other stands of mature or old-growth forest are located in the study area.

There are no wetlands or water bodies on the project site. Therefore, there would be no impacts to species relying on those habitats. The previously graded 22 acres of the project site has minimal vegetation and marginal if any current habitat value. There would be a permanent impact from the removal of the 5 acres of forest habitat and 5 acres of grassland/agriculture habitat on the construction laydown and access area. The state listed wildlife in the vicinity of the study area may be temporarily displaced due to either the construction or operational noise.

Signs of pileated woodpecker foraging activity was observed in forested stands near Fuller Creek, but no long-term impacts are anticipated with either the construction or operation of the plant. None of the remaining listed wildlife have been documented on site or within the study area by Washington Department of Fish and Wildlife.

3.4.4 MITIGATION MEASURES

No significant impacts to habitat, fish, or wildlife are anticipated to occur from the construction and operation of Units 3 and 4, or in combination with the operation of the existing Units 1 and 2, and no mitigation measures are required.

SECTION 3.5 WETLANDS (WAC 463-60-333)

Biologists surveyed the vegetation, focusing primarily on the areas potentially affected by construction activities. A wetland reconnaissance was conducted in conjunction with vegetation surveys.

3.5.1 EXISTING CONDITIONS

On June 19, 2008, URS biologists conducted a wetland reconnaissance and vegetation survey on the 10-acre construction laydown and access area to the east of the existing 22-acre site.

3.5.1.1 Regional Conditions

The study area is located within the Puget Trough Province (Franklin and Dyrness 1988). Relief is moderate, with elevations seldom exceeding 525 feet above msl. The majority of the soils were formed in glacial materials under the influence of coniferous forest vegetation.

3.5.1.2 Plant Site

Prior to the construction of the Grays Harbor Energy Center, most of the 22-acre project site had been filled and graded with several feet of compacted gravel (Parametrix 1993), lacked vegetation, and a portion of the site was covered with asphalt. The site was used as a construction laydown area and had stockpiles of concrete forms, steel reinforcing bars, and other materials remaining from construction of the nuclear facilities located on the Satsop Power Plant property. The site was completely regraded for the Grays Harbor Energy Center, including the portion of the site that would be used for the construction and operation of Units 3 and 4.

The area immediately surrounding the plant site is a mix of developed and undeveloped areas. The area north of the site is industrial with some conifers to the northeast. The area south of the project site consists of the transmission line corridor and is mostly brush, followed by conifers further south. Keys Road lies immediately west of the project site. The 10-acre construction laydown and access area east of the existing project site consists of approximately 5 acres of thinned conifers managed as a mature forest, and approximately 5 acres of grassland/agriculture that is mowed every year. Further to the east is a continuation of the grassland area that is mowed every year.

No wetlands were found on the existing 22-acre site or the construction laydown and access area to the east.

3.5.2 IMPACTS

Construction and operation of Units 3 and 4 will not affect wetlands because there are no wetlands on the existing site or in the area proposed for construction laydown and access.

3.5.3 MITIGATION MEASURES

No impacts to wetlands will occur and no mitigation measures are required.

SECTION 3.6 ENERGY AND NATURAL RESOURCES (WAC 463-60-342)

3.6.1 INTRODUCTION

Energy and natural resources are consumed during construction and operation of any facility. Because the proposed Units 3 and 4 will generate electricity, it will produce many times more energy than is invested in its materials or is used to construct them. Thus, the focus of this section is on the operational aspect of the facility expansion.

3.6.2 ENERGY REQUIRED

3.6.2.1 Construction

Cranes, trucks, mobile equipment, and power tools will all consume energy during project construction. Similarly, energy is used during manufacturing of the combined cycle equipment and materials necessary for constructing the new units. For example, the steel used in much of the equipment requires energy input during the foundry, rolling mill, and fabrication processes. Until the project's detailed design has been completed, estimates of materials content and manufacturing energy use cannot be made; however, the purpose of the combustion turbine facility will be to produce electrical and steam energy over a planned project lifetime of at least 30 years. During this time the Grays Harbor Energy Center will produce approximately 171 million MW-hours of electricity, an amount far in excess of the energy required for production of the materials used in the manufacture and fabrication of the equipment used in the project.

3.6.2.2 Operation

The Grays Harbor Energy Center will continue to be fueled by natural gas. A small amount of diesel fuel (#2 distillate) will be on site for the backup generators and fire-water pump.

Natural gas will continue to be delivered to the project by the existing natural gas pipeline installed for Units 1 and 2. Natural gas will continue to flow from the pipeline through a metering/pressure-regulating station located on the northern boundary of the project site.

The expanded Grays Harbor Energy Center will require a maximum of 103,048 pounds per hour of natural gas to fuel each combustion turbine and duct burner, for a total maximum consumption of 412,192 pounds per hour. Annually, a maximum of 3.6 billion pounds of natural gas will be used to fuel the expanded project, assuming 8,760 hours of operation per unit. The auxiliary boilers will use a maximum of 1,254 pounds per hour of natural gas. Annually, a maximum of 6.3 million pounds of natural gas will be used to fuel the auxiliary boilers assuming 2,500 hours of operation per boiler. Assuming a 30 -year project life, the Grays Harbor Energy Center will require a maximum of 108 billion pounds of natural gas to generate a maximum of 342 million MW-hours of electricity.

Distillate fuel oil will be used to operate the emergency backup diesel generators. Each diesel generator uses 40.4 gallons of distillate fuel per hour of operation, resulting in a maximum annual consumption rate to operate the diesel generators of 2,101 gallons of fuel oil per year, based on 26 hours of operation for each diesel generator.

3.6.3 SOURCE AND AVAILABILITY OF ENERGY AND NATURAL RESOURCES

The project's fuel will continue to be natural gas that will be supplied by the pipeline constructed as part of the original project. A final determination of the fuel source will be made after final commitment for construction, is likely to be drawn from both domestic and Canadian sources. The suppliers have sufficient gas available to provide for the needs of the project and other customers over the 30-year life of the project.

3.6.4 NONRENEWABLE RESOURCES

3.6.4.1 Construction

Construction of Units 3 and 4 will require use a variety of natural resources, although in relatively small amounts. The largest quantities will be of steel (from iron ore) and concrete (from aggregate, sand and cement). Diesel fuel and electrical power also will be consumed during construction.

3.6.4.2 Operation

The main resource consumed by operation of Units 3 and 4 will be natural gas.

In addition, operation of Units 3 and 4 will entail consumption of minor amounts of other materials, such as metals, petroleum-based lubricants, paints, and various chemicals used in the process of operation and normal maintenance of the plants.

3.6.5 CONSERVATION AND RENEWABLE RESOURCES

Compared with many other sources of electricity, the Grays Harbor Energy Center will conserve energy. The facility is expected to operate at approximately 54 to 54.5 percent efficiency across the ambient temperature range, compared to 30 to 45 percent efficiency for other types of thermal plants. A discussion of water reuse can be found in Section 2.8, Wastewater Treatment, WAC 463-60-195.

Large combined cycle gas-fired power plants also provide the benefit of integrating large amounts of variable, intermittent wind generation resources by providing a firm backup resource in times when wind speeds are less than optimal for energy generation.

3.6.6 SCENIC RESOURCES

Impacts to scenic resources are described in Section 4.2, Land and Shoreline Use, WAC 463-60-362.

As shown on Figure 5.1-4 *Locations of Class I Areas and the CRGNSA within the AQRV Modeling Domain* in Section 5.1 PSD Application, four Class I areas are located within 160 kilometers (100 miles) of the project site: Mt. Rainier National Park, Goat Rocks Wilderness Area, Alpine Lakes Wilderness Area, and Olympic National Park. The Class I area closest to the proposed Grays Harbor Energy Center is Olympic National Park, located approximately 58 kilometers (35 miles) to the northeast. Other Class I areas considered in the modeling analysis are Pasayten Wilderness, Glacier Peak Wilderness, Mt. Adams Wilderness, and the Mt. Hood Wilderness. At the request of the US Forest Service, the analysis also considers impacts to the Mt. Baker Wilderness and the Columbia River Gorge National Scenic Area. Results of the CALPUFF dispersion modeling performed for the proposed project show that concentrations of pollutants from all four units are below the Class I allowable increment for the nearest Class I area and thus are not expected to have a significant impact upon these scenic resources. Additionally, the regional haze analyses show minimal impact from the project.

Visual impacts of Units 3 and 4 upon the existing regional landscape are not expected to be significant. A small portion of the emission stacks may be visible from some viewpoints in the Chehalis River Valley. If visible, the presence of small portions of the project's emission stacks will be an additional, but minor, element to the west of the existing and taller cooling towers of WNP-3 and WNP-5, and the existing stacks of Units 1 and 2. Depending on the time of year and weather conditions, attention to the stacks could be more pronounced when a vapor plume is present.

The impact to local residents adjacent to the site is expected to be slightly negative but not significant, due to the overall visual compatibility with the existing conditions. Even though the emission stacks and the higher plant structures will be visible, Units 3 and 4 will be an addition to the existing Grays Harbor Energy Center. The vegetated screening berm and turbine equipment enclosures also will reduce visual impacts.