Addendum

to the

2006 Final Environmental Impact Statement

For the 2008 Seattle City Light Integrated Resource Plan

July 2008

Seattle City Light

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Summary

This document is an Addendum to the Final Environmental Impact Statement (May 2007) for Seattle City Light's 2006 Integrated Resource Plan (IRP). The 2008 IRP is substantially similar to the 2006 IRP and considers the same pool of energy resources to meet future load. The impacts fall within the range described in the 2006 IRP EIS. The goal of the EIS was to cover a broad range of alternatives and resources so that it would provide a strong base for review of future resource plans. Seattle City Light is providing additional information in this Addendum to cover the new information in the 2008 IRP.

This Addendum, along with the Draft and Final Environmental Impact Statements (September 2006 and May 2008) describe the environmental impacts of Alternatives considered in Seattle City Light's 2008 Integrated Resource Plan.

Seattle City Light prepared its 2006 Integrated Resource Plan (2006 IRP) to evaluate its customers' demand for electricity and options for meeting that demand over the period 2007-2026. A wide range of demand forecasts and energy resources, including conservation and efficiency, fossil fuels such as coal and natural gas plants, and renewable resources such as geothermal, wind, and landfill as, were considered in the 2006 IRP. The 2006 EIS covered the impacts of a wide range of resources and resource combinations, including those considered now in the 2008 process. Impacts of the Alternatives considered in the 2008 IRP fall within the range of impacts that were analyzed in the 2006 EIS.

Under Washington state law, electric utilities are required to perform analysis for Integrated Resource Planning and submit reports to the state every two years. City Light will submit its first report to the state by September 1, 2008.

The 2008 Addendum is not project-specific, and is generic in nature due to the approach taken in the IRP. As City Light pursues specific electricity sources, either owned or under contracts, environmental review will be done on the specific resources, to capture and evaluate the site and design specific impacts.

The 2008 IRP Preferred Alternative (Recommended Portfolio) is the portfolio called High Biomass, Geothermal & Wind. It includes accelerated conservation levels beginning in 2008, landfill gas in 2009, geothermal beginning in 2013, the Gorge Tunnel beginning in 2015, biomass (wood) beginning in 2018, and a wind project coming in 2024. Five other Alternatives were considered, including an Alternative under which City Light would not take any action to acquire new resources, but would rely on the power market to meet load growth and seasonal electricity needs. These Alternatives, called Portfolios in the IRP, and the analytic process are described in the 2008 IRP Report, available at http://www.seattle.gov/light/news/issues/irp/.

A notice of the Addendum's availability will be sent to all recipients of the Final EIS for the 2006 IRP. This Addendum is issued on July 28, 2008, and comments may be submitted within fifteen days of the Addendum's issuance, August 13, 2008. Send comments to: Lynn Best, Director, Environmental Affairs Division, Seattle City Light, PO Box 34023, Seattle, WA 98124-4023.

Alternatives: General Description of Portfolios

Six portfolios were analyzed as potential Alternatives (Round 2) in the IRP. They are described in detail in the 2008 Integrated Resource Plan report. A brief summary is included below.

Five of the portfolios include combinations of new electricity resources from the following list:

- Conservation - New Programs
- Capacity Purchase (also known as Call Options)
- Exchanges
- Gorge Tunnel
- Landfill Gas
- Geothermal
- Wind
- Biomass (wood)

Market Purchases and Sales are also included in each of the five portfolios.

In each of the five portfolios with new resources, there were some resources common to all, in the same amount. By the year 2027 in all five portfolios, Conservation was at 159 average megawatts (aMW), Gorge Tunnel was at 5 aMW, Landfill Gas was at 21 aMW, and Geothermal was at 125 aMW. The resources that varied among portfolios were Capacity Purchase (0 to 15 aMW), Exchanges (105 to 135 aMW), Wind (0 to 125 aMW), and Biomass (0 to 125 aMW)

A sixth portfolio, equivalent to the 'Rely on Market' Alternative in the 2006 IRP, was also evaluated in 2008. It assumes that City Light continues ownership of existing resources and that existing conservation measures and contracts continue until their expiration date and are not extended. To meet growing demand for electricity, City Light relies on the power market.

The new resources and their environmental impacts on the elements: Air Quality, Surface and Groundwater, Plants and Animals, Energy and Natural Resources, Environmental Health, Land Use, Aesthetics and Recreation, Cultural Resources, and Employment, were described in the 2006 IRP Draft Environmental Impact Statement (September 2006), Appendix C.

For the 2008 analysis, the same assumptions made in 2006 about technologies and impacts were used, with the exception of the Biomass (wood) resource. In the 2008 IRP it is assumed that the technology used in Biomass generation is Fluidized Bed Combustion, which is more efficient and has lower emissions of nitrogen oxides. These changes and any revisions to impacts on elements of the environment are included in Appendix A of this Addendum.

The Gorge Tunnel hydropower efficiency upgrade project was considered in 2006, and has moved forward as a potential engineering project at City Light. Since it is in the early stages of planning, little new information is available, but what is known at this time has been included in a revised description in Appendix A of this Addendum.

The Preferred Alternative (Recommended Portfolio) is the portfolio called High Biomass, Geothermal & Wind. It includes accelerated conservation levels beginning in 2008, landfill gas

in 2009, geothermal beginning in 2013, the Gorge Tunnel beginning in 2015, biomass (wood) beginning in 2018, and a wind project coming in 2024.

Table 1
Total New Resource Output (aMW) in 2008 IRP Alternatives– Round 2 Portfolios
By Year 2027

	1 High Biomass & Geothermal	2 High Exchange, Geothermal, & Biomass	3 High Wind, & Geothermal	4 High Exchange, Wind, & Geothermal	5 High Geothermal, Biomass & Wind	Rely on Market
Conservation	159	159	159	159	159	0
Capacity Purchase	5	15	5	0	5	0
Exchange 1	50	50	50	50	50	0
Exchange 2	55	0	55	0	55	0
Exchange 3	0	85	0	85	0	0
Gorge Tunnel II	5	5	5	5	5	0
Landfill Gas	21	21	21	21	21	0
Geothermal	125	125	125	125	125	0
Wind	0	0	125	100	85	0
Biomass	125	85	0	0	40	0

Note that Portfolio 5: High Geothermal, Biomass, and Wind, is the Recommended Alternative.

The table below shows the maximum installed capacities of each resource type in the 2008 IRP and a comparison with the 2006 IRP assumptions. The capacity is shown for both the DEIS and the FEIS analysis for the 2006 IRP. The maximum installed capacity was the largest value considered in any of the Alternative Portfolios. For example, in the 2006 IRP – DEIS, the largest amount of coal in any portfolio was 150 MW, so '150' is shown in the table under 'Coal' and '2006 IRP'. In the 2008 IRP, none of the Alternative Portfolios contained Coal, so the entry is '0'.

Table 2
Comparison of New Resource Capacities (MW) – 2006 to 2008

	2006 IRP - DEIS	2006 IRP - FEIS	2008 IRP
Coal (PV & IGCC)	150	0	0
Natural Gas (SCCT & CCCT)	400	0	0
Conservation	140	132	159
Exchange	100	50	135
Call Option	100	30	20
Hydro Efficiency	60	23	5
Wind	750	105	391
Geothermal	25	100	132
Landfill Gas	25	25	23
Biomass	50	15	139

The capacity values reflect the amount of installed generation, in MW, that would be required to produce the output energy. The 2008 IRP assume that new generation resources have the following capacity factors (related to the percentage of time the plants and their fuel supply would be available and generating electricity): Pacific Northwest Wind projects – 32%, Geothermal – 95%, Biomass (wood) – 90%, and Landfill Gas – 90%. The Hydro Efficiency project in the 2008 IRP is the Gorge Tunnel, which would not increase the generator installed generating ability, in MW, but would allow more power to be produced, about 5 aMW during winter months, from the same amount of water. This is approximately what was considered in the 2006 IRP.

While there are increases in the maximum installed generating capacity (MW) in the 2008 portfolios compared to 2006 the overall impacts of the combinations of these resourcesin the Alternative Portfolios are much lower in 2008 than in the 2006 Alternative Portfolios. Increases are seen for conservation (up by 19 MW), Exchange (up by 5 MW), geothermal (up by 32 MW), and biomass (up by 89 MW). Conservation increases will actually have a relatively small impact, if any, and most likely will have positive impacts associated with avoiding other types of electricity generation, increasing customer satisfaction, and economic benefits. The increase in exchanges is very small, 5 MW, and since there is zero net energy received by City Light, it is essentially a transaction of energy from existing resources back and forth between seasons, there are no anticipated additional impacts due the exchanges. The increases in geothermal and biomass capacity could result in increased impacts on Soils and Geology, Surface and Groundwater, and Land Use compared to the levels of those specific resources from the 2006 analysis, however, since there is no fossil fuel in the 2008 portfolios (neither coal nor natural

gas), the overall impacts of the increase in geothermal and biomass is much lower than the impacts associated with the 2006 portfolios containing fossil fuel.

Elements of the Environment

Soils and Geology

The Alternatives considered in the 2008 IRP are similar to those in the 2006 IRP FEIS, Alternative B (named 'More Geothermal' in the FEIS). The higher levels of Wind in the 2008 Alternatives were evaluated in several of the Round 1 portfolios described in the 2006 DEIS (such as the 'Renewables' or 'Gas, Wind, 50% Block'). Geothermal levels are higher, by 25 MW installed capacity at the end of the planning period than in the 2006 portfolios. Biomass installed capacity is also larger than in the 2006 IRP portfolios. However, these increases fall well within the expected level of impacts from portfolios containing large fossil fuel-fired plants analyzed in the DEIS, which had the potential for High impacts in both Construction and Operation phases.

The expected impacts and mitigation measures for Soils and Geology for the 2008 IRP Alternative portfolios are similar to those in the 2006 DEIS and FEIS.

Air Quality

As in the EIS for the 2006 IRP, the primary source of air quality impacts are from the emissions of air pollutants directly from the generation of electricity, so those emissions are described and analyzed in this section. While there are impacts to air quality from construction of these facilities, they are relatively small, localized to the construction area, and are temporary.

One resource, Biomass (wood), has a revised heat rate in the 2008 IRP compared to the 2006 IRP, and therefore a revised emission rate for the pollutants. In the 2006 IRP, Biomass (wood) was assumed to have a heat rate of 26,686 Btu/kWh. In the 2008 IRP, this resource is assumed to have a much lower heat rate, 14,000 Btu/kWh. The technology is likely to be fluidized bed combustion of the biomass fuel. The result is higher efficiency in converting the biomass fuel into electricity, and therefore lower air emissions per unit of electricity. The change in air emissions rate and other impacts to the environment that result from the reduced heat rate are discussed in Appendix A of this Addendum.

The table below shows the change in emission rate from 2006 to 2008 for Biomass (wood).

Table 3
Biomass (wood) - 2008 Air Emission Rate Compared to 2006
(Pounds per MWh)

	Heat Rate (Btu/kWh)	SOx	NOx	Mercury	Particulates	CO2
2006 IRP	26,686	0	0.800	0	0.259	0
2008 IRP	14,000	0	0.420	0	0.136	0

Air emissions data is also presented as it was in the 2006 IRP EIS, broken out by category of new resource: generation, contracts, and market net sales/purchases. This shows more detail as to how the emissions are calculated and where the emission sources are greatest.

The tables below show the 20 year total emissions, in metric tons. The highest emissions among the alternative portfolios that were analyzed are included, to show the high end of impacts already evaluated in 2006 and how the 2008 alternative portfolios compare. Note that in the case Contracts and Net Market (Purchases – Sales), the emissions are shown as negative, indicating a reduction in overall emissions. This is due to lower emission resources (such as renewable) built to serve City Light load and meet I-937 requirements, but producing more electricity than City Light needs. This excess electricity is sold on the market, displacing higher emission Market power, which is primarily low efficiency fossil fuel plants.

Table 4
20 Year Total Emissions – New Generation Resources Only – Metric Tons

	CO2	NOX	SOX	HG	PM
2006 IRP DEIS	24,803,847	1,543	14,501	0	1,347
2006 IRP FEIS	0	992	0	0	183
2008 IRP	0	1,889	0		486

In the 2008 IRP, the sources of NOX (nitrogen oxides) and PM (particulates) is the combustion of fuel in the Biomass (wood) and Landfill (methane) facilities. As in the 2006 IRP EIS analysis, it is assumed that the CO2 created by combustion of these fuels is part of a closed loop process, and therefore is treated as having net zero increase in CO2 output. NOX output is somewhat higher in the 2008 Alternative Portfolio, High Bomass, which contains the largest amount of biomass capacity. The Recommended Alternative, however, has a smaller amount of biomass, and a 20year total of 1,377 metric tons NOX, which falls within the range evaluated in the 2006 IRP DEIS.

Table 5
20 Year Total Emissions – Contracts – Metric Tons

	CO2	NOX	SOX	HG	PM
2006 IRP DEIS	8,868,922	2,239	223	0	1,083
2006 IRP FEIS	1,753,830	-3	-62	0	-228
2008 IRP	0	0	0	0	0

Note that in 2006, City Light evaluated Market Purchases on a monthly basis, with each month having different emission factors. This monthly data was not updated in 2008 IRP, so for the 2008 air emissions analysis, the monthly data was averaged to a single annual emission factor for each pollutant. Therefore, Exchanges, which provide no net energy to City Light in the 2008 IRP, have net zero emissions. This is a change in the treatment from the 2006 process(see page 3-22 of the 2006 DEIS). The 2008 methodology is actually a more conservative approach, which assumes no positive environmental impact, compared to the small amount of positive impact that was shown in the 2006 analysis.

Table 6
20 Year Total Emissions – BPA Contract Change – Metric Tons

	CO2	NOX	SOX	HG	PM
2006 IRP DEIS	0	0	0	0	0
2006 IRP FEIS	0	0	0	0	0
2008 IRP	0	0	0	0	0

Note that in both the Final EIS for the 2006 IRP and the 2008 IRP, it was assumed in all Alternative Portfolios that City Light continues to receive approximately the same amount of power from the Bonneville Power Administration (BPA) as it does under its current contract. Many of the 2006 IRP Alternatives also assumed no change to the BPA contract. In 2008 there are no expected changes in air emissions due to BPA contract changes.

Table 7
20 Year Total Emissions – Net Market (Purchases Minus Sales) – Metric Tons
Compared to the Rely on Market Portfolio

	CO2	NOX	SOX	HG	PM
2006 IRP DEIS	-12,433,773	-3,295	-128	0	84
2006 IRP FEIS	-14,911,998	-5,083	-495	0	-906
2008 IRP	-2,421,748	-110	-962	0	-195

For the purposes of comparison with the 2006 IRP analysis, the table above shows the estimated reduction in air emissions that result from the net sale of electricity into the power market. This excess electricity results, as described above, from City Light acquiring enough new resources to meet load growth and I-937 requirements. The load is seasonal in nature, so there are times in the year when City Light's owned hydropower, plus existing and new resource contracts or ownership, is far greater than what is needed for the service territory. Over any year in the planning period, City Light sells many more MWhs of electricity than it buys, therefore displacing market resources that are most likely low efficiency fossil fuel plants. The 2008 Alternative Portfolios include more seasonal Exchanges, with the goal of reducing this surplus to a more reasonable level to reduce risk of market sales income not covering cost of new generation.

Table 8
20 Year Emissions – Sum of New Generation, Contracts, Net Market

	CO2	NOX	SOX	HG	PM
2006 IRP DEIS	39,318	5,526	13,329	0	-2,452
2006 IRP FEIS	-13,158,168	-4,095	-557	0	-952
2008 IRP	-2,421,748	-110	-188	0	-69

The sum of emissions and estimated reductions from market net sales show a net reduction in emissions. Even without the net sales reductions, the overall air quality impacts of operational emissions are low, and significantly below the levels evaluated in the 2006 DEIS for portfolios containing coal and natural gas power plants.

Surface and Groundwater

The 2008 Alternatives are similar to those in the FEIS for the 2006 IRP, as described in the Soils and Geology section above. For Surface and Groundwater, impacts from Geothermal resources have the potential to be High during operation, but the actual impacts will be very site specific. By avoiding fossil fuel resources, the 2008 Alternatives have much lower potential of Surface and Groundwater impacts than Alternatives in 2006 that included coal or natural gas plants. The impacts and mitigation measures fall within the scope considered in the 2006 IRP FEIS. Potential mitigation measures for High impacts include evaluating hydrology issues prior to construction and avoid activities that would disturb existing surface and groundwater systems, and monitoring water quality and quantity in waters near the plant site.

Plants and Animals

Impacts to Plants and Animals could be High during construction of the resources in the Alternatives, since Geothermal development is most likely to occur in less accessible, environmentally sensitive locations and all of the Alternatives include Geothermal. During operation, impacts could be Moderate, largely depending on the source of wood for the biomass facility, for example whether it would be a dedicated crop with transportation required to the plant, or a facility located near an existing manufacturing facility that provides waste wood. Impacts and mitigation fall within the range considered in the 2006 IRP EIS. Mitigation for High impacts includes conducting adequate surveys for plants and animals, avoid siting projects where they could impacts sensitive plant and animal species, and developing restoration plans for disturbed plant and animal habitat.

Energy and Natural Resources

The Alternatives considered in the 2008 IRP are made up of renewable resources (Geothermal, Biomass, Landfill Gas, Wind, increased hydropower output from Gorge Tunnel) and Conservation. During operation and construction, small amount of fossil fuels may be used, but the levels are very low compared to direct fossil-fuel fired plants.

These resources will have a low overall impact by increasing energy supply with minimal impact compared to fossil fuel resources. Mitigation is not likely to be required, except for small amount of greenhouse gas emissions that may be created during construction or operation. The impacts fall within those considered for the 2006 IRP FEIS.

Environmental Health

The potential impacts to Environmental Health of the 2008 IRP Alternatives are expected to be low. Renewable resource development would have to comply with all applicable safety and health regulations. Slight increases in conservation measures could impact environmental health in terms of projects that reduce air infiltration into and out of buildings, but these impacts will be mitigated through the application of building codes for adequate ventilation and the reduction in the use of fossil fuel and its associated air emissions. The impacts fall within those considered in the 2006 IRP FEIS, and similar mitigation measures would apply.

Land Use

The impacts of the 2008 IRP Alternatives are associated primarily with the construction and operation of new renewable resources: Geothermal, Biomass (wood), Wind, and Landfill Gas. Landfill Gas has the least potential for impacts, since it is usually sited at an existing landfill and requires very little additional land and infrastructure. The impacts of the other resources depends largely on their location, and are very site specific. The potential for land use impacts from Biomass, on a per unit of energy basis, are expected to be lower due to the assumption that a more efficient technology is used, reducing the amount of fuel required for each unit of energy. Therefore, while the amount of biomass energy is increased compared to the FEIS Alternatives, the overall impacts are mitigated by increased efficiency of biomass generation, and are less than in Alternatives considered in the DEIS that contained fossil fuel plants.

Aesthetics and Recreation

The resources in the Alternative Portfolios in the 2008 IRP that are most likely to have impacts on aesthetics and recreation are those that are generally sited on public lands or areas seen from public lands and roads. Wind and Geothermal projects fall into this category, and the fuel source for Biomass may as well, if it is a dedicated fuel crop. Siting is the key determinant in impacts and mitigation options. Impacts will fall within the range considered in the 2006 IRP FEIS, and could be High during operation. Mitigation measures include siting and design to reduce or avoid viewer impacts, minimize disturbance during operations, and provide screening with vegetation.

Cultural Resources

As with many of the elements of the environment, siting plays a key role in the impacts on Cultural Resources. In the 2008 Alternatives, renewable resources have the potential for moderate impacts during construction and operation. Proper siting and monitoring during construction can help reduce impacts. The magnitude of the resources in the 2008 IRP is unlikely to cause an increase in the potential for impacts compared to those evaluated in the FEIS for the 2006 IRP, and mitigation measures are similar.

Employment

The Alternatives in the 2008 IRP contain new renewable generation resources and conservation, which in the 2006 analysis were considered to have moderately positive impacts on employment. No mitigation is expected to be required.

Summary of Impacts

The impacts to each element of the environment are summarized in the table below. They are very similar to the impacts assigned to Option B; More Geothermal Alternative from the 2006 IRP, which was the Preferred Alternative from that process.

Table 9
Summary of Environmental Impacts of IRP Preferred Alternatives

Elements of the Environment	1: High Biomass & Geothermal	2: High Exchange, Geothermal, & Biomass	3: High Wind, & Geothermal	4: High Exchange, Wind, & Geothermal	5: High Geothermal, Biomass & Wind
Soils and Geology					
Construction	H	H	H	H	H
Operation	H	H	H	H	H
Air Quality					
Construction	L	L	L	L	L
Operation	L	L	L	L	L
Surface/Groundwater					
Construction	L	L	L	L	L
Operation	H	H	H	H	H
Plants/Animals					
Construction	H	H	H	H	H
Operation	M	M	M	M	M
Energy/Natural Resources	L	L	L	L	L
Construction	L	L	L	L	L
Operation					
Environmental Health	M	M	M	M	M
Construction	M	M	M	M	M
Operation					
Land Use					
Construction	M	M	M	M	M
Operation	H	H	H	H	H
Aesthetics/Recreation					
Construction	M	M	M	M	M
Operation	H	H	H	H	H
Cultural Resources					
Construction	M	M	M	M	M
Operation	M	M	M	M	M
Employment					
Construction	M (positive)	M (positive)	M (positive)	M (positive)	M (positive)
Operation	M (positive)	M (positive)	M (positive)	M (positive)	M (positive)

APPENDIX A

Revisions to "Appendix C: Environmental Analysis of Resources"

from the

2006 Integrated Resource Plan Draft Environmental Impact Statement

Biomass (wood)
and
Gorge Tunnel

Note: New information is underlined.

7.0 Biomass (Wood)

7.1 General Description

The wood biomass plants evaluated in the IRP produce electricity by directly combusting wood. The heat of combustion is used to turn water into steam in boilers, and the steam then drives a turbine, which turns a generator that converts the power into electricity. A water source for producing steam would be required that can supply 23,000 to 55,000 gallons per MWh for a once-through system (350 to 900 gallons per MWh for a system where water is recirculated).

For the 2008 IRP, a high-efficiency process called fluidized bed combustion (FBC) is assumed for the biomass plant. This technology represents an improved process that has evolved from research efforts to develop a technology that would control pollutant emissions without external emission controls. Under the fluidized bed combustion (FBC) technology using biomass as fuel, both the bubbling fluidized bed (BFB), and the circulating fluidized bed (CFB) operate at a low temperature, with the primary benefit being reduced emissions of thermal nitrogen oxides.

Wood fuel sources could include logging residues, mill residues, the clean woody fraction of municipal solid waste (urban wood waste and construction debris), and dedicated wood crops. Nearly 50 million tons of logging residues greater than 4 inches in diameter remain on the ground annually in the U.S. (Grantham and Howard, no date). The energy potential of this residue is equivalent to 100 million barrels of oil. Though timber production and logging and mill residues have declined in the Northwest over the past two decades, stabilization and possible expansion of the timber supply and logging and mill residues can be expected as forest recovery occurs. In addition, the supply of forest thinnings could increase from more intensive commercial forest management, forest health restoration efforts, and wildfire control. The woody fraction of municipal solid waste is expected to increase in quantity with economic and population growth. Conventional steam-electric plants with or without cogeneration are likely to remain the chief technology for electricity generation using wood residues. The cost of generation using wood residue is less expensive than some forms of new generation provided the fuel is very low cost. To the extent fuel must be purchased and/or transported, costs are higher than other alternatives. The use of FBC would reduce the amount of wood fuel required to produce a unit of electricity, compared to the assumptions used in the 2006 IRP.

For biomass-fueled power plants, reliance on variable supplies of forest and agricultural residues means that a continuous supply of fuel may be uncertain. Generation of electric power requires large quantities of biomass. Fuel transportation, storage, and handling costs are a significant part of the costs of biomass energy production. For example, logging residues require additional processing due to their variable size and greater transportation costs when compared to mill residues. Designing the facility to use multiple fuel types can mitigate uncertain fuel supplies.

Fuel competition and transportation costs virtually preclude the construction of power plants of greater than 50 MW. Most future biomass plants are likely to be in the range of 15 to 30 MW. There is considerable uncertainty associated with the availability and cost of a firm fuel supply for biomass projects. The likely proximity to load ameliorates those costs and risks because new long transmission lines would not be required as they would for more remote resources.

7.2 Environmental Impacts and Mitigating Measures

7.2.1 Soils and Geology

7.2.1.1 Construction Impacts

Construction would involve a variety of land-disturbing activities such as clearing and grading to build access roads, construction pads, and fuel storage areas and excavating for turbine foundations and the power collection system. These activities would result in surface and sub-surface disturbance that can expose soils to erosion by wind and water. Heavy equipment operation causes compaction of native soils. If geologic hazards are present within the project area, those hazards could be activated by the construction disturbance. Project construction also requires consumption of geologic materials such as sand and gravel for use in concrete, road surfaces and bases, and as backfill.

Construction impacts on geology and soils can be minimized by careful planning and design, and through development and implementation of a surface water pollution prevention plan (SWPPP), which will in turn require a variety of best management practices (BMPs) to minimize erosion and control runoff and sedimentation (NWCC, 2002). Planning and design measures to reduce impacts include locating project facilities to avoid geologic hazards and erosion-prone areas, conducting site-specific evaluations of geotechnical conditions, and designing project facilities to meet the conditions encountered. Also, construction impact would be lessened if the facility is located on already developed land near wood processing facilities. With implementation of appropriate mitigation, impacts are expected to be low.

7.2.1.2 Operation Impacts

Operation impacts at the facility site would be negligible. Impacts on geology and soils could result from vibration associated with operation of turbines. However, planning and design measures to reduce operation impacts include locating project facilities to avoid geologic hazards and erosion-prone areas, conducting site-specific evaluations of geotechnical conditions, and designing project facilities to meet the conditions encountered. In addition, if the wood is waste, there would be no incremental impact to soils and geology, and perhaps a reduction in impacts since that wood material would otherwise need to be disposed of in a landfill. The greatest impacts would occur if the wood is residue from logging operations since its removal from steep fragile soils could lead to excessive soil disturbance and soil compaction where soils are wet. Further, if too much logging residue is removed, it can result in interruption to nutrient cycling.

If the wood were from a dedicated crop, there also would be disturbance to soils in the planting and harvesting process. These disturbances would include digging holes to plant; creating and maintaining access roads to plant, harvest, and remove the timber; and erosion that could result from these activities. Some of these impacts would be unavoidable. The incremental impacts could be reduced by growing wood on land that has already been disturbed for timber production or agricultural use. Additional soil disturbance could occur if the ash from wood combustion has to be disposed of in a landfill, though this is likely to be a small impact relative to other waste sources or, in the case of waste wood, less than if the waste wood itself was disposed. Overall,

operation impacts are likely to be low to moderate depending upon the source of the wood. Operational impacts would be lower using the FBC technology, since less fuel is required.

7.2.1.3 Mitigation

- Minimize the extent of ground disturbance required, such as by using existing roads to the extent possible. Locate new access roads to follow the local topography, and minimize sidehill cuts.
- Cover and stabilize exposed areas consistent with applicable standards, salvage removed topsoils and reclaim disturbed areas as soon as possible.
- Identify and avoid unstable slopes and other geologic hazards, and avoid creating excessive slopes during construction; use special construction techniques where applicable.
- Develop and implement a temporary stormwater management system to control runoff, erosion and sedimentation, including use of SWPPP and BMPs during construction.

7.2.2 Air Quality

7.2.2.1 Construction Impacts

Equipment exhaust and fugitive dust generation would be the principal potential sources of air pollutants during construction. Construction equipment, vehicles transporting construction materials and facility components to the site, and construction workers' vehicles would all produce exhaust emissions. Air pollutants in these emissions can include CO, NO_x, VOCs, SO_2, and particulates. Emissions from these sources would be short-term, would likely be low, and are not likely to cause significant air quality impacts or have a measurable effect on ambient air quality near a site.

Exposed surfaces can generate fugitive dust. To the extent that exposed soils are not wetted or otherwise stabilized, they could generate windblown dust and cause dust deposition in the surrounding area. Fugitive dust deposition is generally not considered to be a health issue; however, excess dust deposition is considered a nuisance as it can increase the soiling of surfaces. Fugitive dust resulting from construction of a biomass energy project is not anticipated to produce any measurable effect on the overall ambient air quality in the area surrounding a site. Overall, impacts would be low.

7.2.2.2 Operation Impacts

The principal air pollutants of concern from burning wood are oxides of nitrogen (NOx) and particulates. NOx can affect air quality both directly and indirectly. The direct effect of breathing NOx is irritation of lungs that can lead to coughing, lung damage, and difficulty breathing in both animals and humans. Indirectly, NOx combines with precipitation to form an acid solution, causing damage to plants and acidifying water bodies, resulting in damage to aquatic life. NOx also combines with other chemicals in the air to form ground level ozone (smog), which causes breathing difficulty and impairs visibility. Some biomass power plants have a relatively high NOx emission rate compared to other combustion technologies (Power Scorecard, 2005), and rates vary widely with plant design and operational conditions. The

estimated emission rate for NOx is 0.03 lbs per million Btu. Using FBC technology is expected to reduce NOx both because less fuel is used per unit of electricity, and due to a reduction in thermal NOx formation. Information on thermal NOx formation reduction is limited, so the 2008 IRP assumes a reduction in emissions that only scales with reduction in fuel use, a conservative assumption.

Particulates are small particles, less than 10 micrometers in diameter (PM_{10}), that are often emitted by combustion energy sources. A subcategory of these particles, those smaller than 2.5 micrometers in diameter ($PM_{2.5}$) is considered to be especially damaging to the lung and heart functions because they can be breathed in and lodged deep in the lungs. Particulates can result in breathing difficulty, bronchitis, asthma, and damage to heart and lung functions. Particulates also reduce visibility, which can be a safety concern in some situations, as well as an aesthetic problem. Without controls, particulate emissions would be substantial for a wood-burning facility. Conventional control technology would be employed to substantially reduce emissions of large particulates, which comprise most of the particulate emissions. Few plants use advanced control technology. Further, if logging residues are the fuel source, an overall reduction in particulate emissions would occur if the residue would otherwise have been burned in a slash burn. Using FBC would also reduce PM emissions due to reduced fuel consumption.

Other pollutants from a biomass plant are carbon dioxide (CO_2), a primary greenhouse gas, and carbon monoxide (CO). For CO_2, there would be little or no net gain in atmospheric CO_2 if the cycle of growing the fuel is sustained. The IRP analysis assumes that the wood used as fuel is from a source that will be replanted and therefore biomass is considered to have zero greenhouse gas emissions. Also, if wood waste is diverted from landfills, this would reduce the production and atmospheric release of methane, a much more potent greenhouse gas than carbon dioxide. CO is sometimes emitted at levels higher than those for coal plants. Finally, substantial quantities of ash would be produced that would need to be disposed of at an approved landfill. Overall, impacts would be moderate.

7.2.2.3 Mitigation

- Wet exposed soils during construction to reduce fugitive dust emissions.
- Use best available control technology to reduce particulate emissions.

7.2.3 Surface and Groundwater

7.2.3.1 Construction Impacts

Construction of plant facilities and access roads can alter surface and groundwater flow patterns, cause discharges to existing water sources, and consume water during the construction process. Surface disturbance of the project area can alter the surface drainage patterns and create areas of impervious surfaces, which would lead to greater levels of runoff. If uncontrolled, runoff can produce temporary increases in soil erosion, resulting in elevated turbidity in runoff water and sedimentation in stream channels. However, the construction process would include implementation of a temporary on-site stormwater management system to control site drainage and minimize temporary impacts to water quality. Therefore, impacts on water quality and drainage conditions during construction would likely be low.

Ground water could be adversely affected by releases of hazardous fluids (fuel and hydraulic oils, etc.) during construction. Typically, there would be a spill prevention control and countermeasure plan (SPCC) that would minimize impacts on ground water. Also, excavations that penetrate a shallow aquifer could adversely affect water quality and productivity of the aquifer.

Construction would consume water for several activities, including dust suppression, vehicle washdown, and potable water supply for the construction crew. No measurable effect on the availability of local water supplies would be expected.

7.2.3.2 Operation Impacts

A wood-fired plant will require a water source to produce steam. The amount of water required for operations for a wood steam plant is roughly equal to the amount required for other steam-based generation, such as traditional coal plants: 23,000 to 55,000 gallons of water per MWh of electricity produced. For a small plant (20 MW), that could equal 55 million gallons per year (California Energy Commission, 2005).

In addition, if the wood source is a dedicated crop, it may require water from surface or ground sources in the planting and early growing stages. Using less fuel with FBC would reduce fuel needs, thus reducing impacts.

Long-term effects on surface water quantity and quality would be limited to any permanent changes in drainage patterns and the runoff from the area of impervious surfaces created by the permanent project facilities. Similar to construction, a permanent stormwater management system that contains best management practices for pollution prevention would need to be provided to accommodate a site's surface water runoff. Based on the requirements for such a system and the limited runoff volume to be managed, prevailing water quality standards would be met and impacts on surface water quantity and quality are likely to be low.

If groundwater is a source of water for the facility, withdrawals could lead to water table depression, effects on neighboring wells, and reduced in-stream flows. Water rights would need to be obtained. Warming of local ground water could occur if plant cooling water percolates into groundwater, Impacts on groundwater are expected to be moderate.

7.2.3.3 Mitigation

- Develop temporary and permanent stormwater management systems that incorporate BMPs for pollution prevention.
- Characterize the surface and groundwater hydrology prior to construction, develop an understanding of discharge and recharge relationships, and avoid creating new hydrologic connections through grading and related activities.
- Monitor water quantity and quality conditions if construction activity is to occur near aquifer recharge areas.
- Implement BMPs for use, handling, and storage of fuels, pesticides and other hazardous materials during both construction and operation.

- Implement a SPCC.
- Implement planning and design measures to reduce operation impacts including locating project facilities to avoid areas of shallow ground water conditions.
- Implement a groundwater monitoring plan if groundwater withdrawals and discharges are planned.

7.2.4 Plants and Animals

7.2.4.1 Construction Impacts

Direct effects during construction commonly include removal of vegetation and the habitat it provides for wildlife, and mortality or injury to animal species that inhabit the site at the time of construction. A 40-MW wood-fired plant can occupy a site of about 30 acres for the plant itself and fuel storage. Construction requires clearing of existing vegetation around areas to be occupied by roads, boiler and generator, fuel storage, substations and other project facilities. This area represents a permanent loss of vegetation and habitat on a previously undeveloped site. Mobile wildlife or aquatic species present on a project site are likely to be displaced during construction, while those that are less mobile can be killed or injured as a result of construction activity within the area of disturbance.

Indirect effects can stem from a number of disturbance mechanisms that can interfere with normal animal behaviors or introduce adverse changes to their habitat. Remaining vegetation and habitat quality for wildlife can be diminished indirectly through dust generated by construction, erosion and runoff, and increased opportunities for invasive species. Similarly, aquatic habitat can be degraded by runoff, dust and exposure to contaminants through spills. Noise, the presence of humans and vehicles, and similar aspects of construction activity can modify the behavior of wildlife remaining on the site and in adjacent areas. Overall, impacts would likely be moderate depending upon site location and the quality and sensitivity of habitat.

7.2.4.2 Operation Impacts

In general, there would be no impacts at the plant site during operation because additional disturbance would not occur. With respect to fuel production, there would be no incremental impacts if the fuel is mill residues or other wood waste. Minor impacts would be associated with logging residues; although the areas involved will have been already disturbed, yarding and related activities may cause additional disturbance to terrestrial and aquatic habitats. Use of FBC reduce those impacts.

If the wood is from a newly dedicated crop, then the land used for the crop must be cleared of any existing vegetation, which could adversely affect some animal species and habitat. Application of herbicides and fertilizers would also impact plants and animals. It is possible that the wood crop would provide habitat for some of the same animals that used the land before, or for new animals that find the wood crop better suited to their needs. The impacts will vary with the site and its previous use, with the highest impacts in areas that were in their natural state and the least impacts on sites that were already in agricultural or commercial use. Minimizing the use of herbicides and fertilizers can reduce the impacts from those materials on plants and animals.

If groundwater or surface water withdrawals or discharges occur, streams, wetlands, and the aquatic species they support could be affected by changes in water quality and flow. Noise during operation could affect some sensitive wildlife species. Overall, potential incremental impacts on plants and wildlife from operation would be moderate.

7.2.4.3 Mitigation

Mitigation measures for plants and animals from the construction and operation of biomass facilities would be similar to those identified for other energy facilities, including:

- Conduct adequate surveys of plant and animal resources.
- Avoid siting facilities and dedicated crops in areas that support unique or sensitive plants or wildlife habitat.
- Where possible, use existing roads and disturbed areas for project development, and minimize the area disturbed for project construction.
- If logging residues are used as fuel, minimize disturbance in yarding and collecting residues.
- Design necessary stream crossings to minimize disturbance and maintain aquatic habitat conditions.
- Develop and implement a restoration plan to restore disturbed plant and animal habitat.
- Purchase or reserve areas to replace habitat values lost through project development.
- Implement measures to minimize establishment of invasive species.
- Landscape site buffer areas with native plant species
- Establish a monitoring program to assess impacts on the area's plants and animal species.
- Implement a water quality and quantity monitoring program.
- Provide a cooling system that does not release water with elevated temperatures.

7.2.5 Energy and Natural Resources

7.2.5.1 Construction Impacts

Small quantities of energy and natural resources would be consumed during construction of plant facilities; impacts would be low.

7.2.5.2 Operation Impacts

Wood for fuel, whether mill or logging residue, waste wood, or dedicated crop, is generally considered to be a renewable energy resource, provided that the source from which the wood fuel is derived is properly replanted, maintained, and harvested to ensure that it can be sustained as a source of fuel, and that the source does not involve old-growth forests, wetlands, wilderness areas, or other scarce natural resource areas. For dedicated crops, the fuel cropland could be reclaimed for growing natural vegetation once the crop use was discontinued.

Energy and natural resources would be consumed in transporting wood fuels and in other aspects of the operation; impacts would be low. Impacts are reduced even further if FBC is used, since less fuel energy is required.

7.2.5.3 Mitigation

No mitigation would be required as long as a waste product is being used. If a natural area is converted to cropland, it may be necessary to restore a site elsewhere or provide other mitigation.

7.2.6 Environmental Health

7.2.6.1 Construction Impacts

Construction of a wood-fired power plant would primarily affect environmental health concerns regarding occupational safety for workers. Adherence to occupational health and safety regulations, in addition to health and safety plans used by contractors, would reduce the level of such impacts.

Construction of the facilities would produce noise that is audible beyond the boundaries of the construction site. Noise sources would include heavy equipment operation, construction of the structures and ancillary facilities, and truck traffic. Because of their short-term duration, construction activities are typically exempt from noise regulations established in state and local regulatory standards, though they are usually confined to normal daytime hours. Impacts could be low to moderate.

7.2.6.2 Operation Impacts

Principal noise-producing sources would be operation of the boiler and generator, handling of wood fuels in the storage area, and fuel conveyance. Depending upon site location, noise could be incompatible with surrounding land uses. The facility can likely be planned and laid out so that noise levels at the site boundary do not exceed permissible levels of local noise codes. If dedicated crops or logging residues are used as fuel, there would be noise associated with harvesting, collecting/yarding, and hauling fuels. Such noise would likely be typical for the areas in which these activities would occur (e.g., noise from yarding of forest residues would be similar to noise associated with logging). Overall, noise impacts would be low to moderate.

7.2.6.3 Mitigation

- Restrict construction activities to daylight hours.
- Lay out plant facilities so that noise standards are not exceeded at the site boundaries.

7.2.7 Land Use

7.2.7.1 Construction Impacts

Development of a wood-burning facility would require long-term displacement and conversion of the existing uses within the plant site and, in the case of dedicated crops, a large area for tree crop production. A plant site (including fuel storage) would require about 30 acres for a 40 MW

plant. If the fuel source is wood waste and the plant is co-located with the waste generator (e.g., sawmill), land area requirements would likely be smaller. Also, compatibility with surrounding land uses would be greater with co-location. For other fuel sources, potential impacts would be highly dependent on the project location, and would vary considerably from site to site. It is plausible that sites could be in either developed industrial areas (low impact) or rural areas (greater impact). Location decisions would need to consider the cost trade-offs between fuel transport and need for transmission lines. Transmission lines would cause additional land use impacts. Overall, impacts would likely range from low to moderate.

7.2.7.2 Operation Impacts

Operation of a wood-fired biomass project could result in some proximity-related impacts associated with noise, traffic, and the physical presence of the facilities, which would vary with site location. Impacts would likely be low to moderate.

If the fuel source is from a dedicated crop, land use impacts would vary by the type of crop and location. If it is grown on land that is already used for agriculture or timber production, there could be small incremental impacts. If the crop is grown on land that was previously covered with native plants, then the impacts could be greater. The amount of land required for a dedicated crop would vary with the type of crop. Impacts could range from low to high. Using FBC would reduce impacts.

7.2.7.3 Mitigation

- Evaluate the project site before construction to make sure it conforms with local planning and zoning requirements and avoids compatibility issues with nearby uses.
- Co-locate facilities when possible.
- Locate any new transmission facilities parallel to existing rights-of-way and avoid bisecting existing land uses.
- Develop construction management plans that avoid or minimize disruptions to adjacent existing uses.

7.2.8 Aesthetics and Recreation

7.2.8.1 Construction Impacts

Changes in visual quality of the setting would occur during construction. The effect of these changes would depend upon the sensitivity of the setting and the proximity and number of viewers. It is assumed that the plant facilities can be located to avoid recreation areas and conflicts with recreationists. Overall, impacts would likely be low to moderate.

7.2.8.2 Operation Impacts

Potential impacts from operation would be similar to those experienced during construction, although over a longer time frame. The significance of such impacts would again be dependent on the quality of the setting and the number and type of exposed viewers and their sensitivity to landscape change. Plant facilities co-located with a mill would produce only minor impacts. If

the fuel is wood waste there would be no incremental impacts. If the fuel is from a dedicated crop, aesthetic impacts and recreational conflicts could occur by clearing native vegetation, planting, and harvesting the crop. Impacts may be reduced by using native vegetation as the crop, or by using a crop that fits within the other uses of the site area (for example, growing a crop that is similar to other crops in an agricultural area, or growing trees in a forested area.) Overall, impacts could be low to high. Reducing fuel used through using higher efficiency FBC would lower impacts.

7.2.8.3 Mitigation

- When possible, locate biomass facilities in areas with less viewer exposure and away from popular recreation areas.
- Integrate design and configuration of structures into the surrounding landscape.
- Provide vegetative screening to obstruct views of the facility from surrounding areas.

7.2.9 Cultural Resources

7.2.9.1 Construction Impacts

Known cultural resource sites would be avoided in locating a plant site. However, resources could be discovered or disturbed during construction activities. The level of impact would depend upon the importance of the resource and the degree of disturbance. If resources are discovered, mitigation would need to be negotiated. Impacts are expected to be low to moderate.

7.2.9.2 Operation Impacts

There would be no impacts if mill waste is used, and probably no impacts if logging residues are used for fuel. If a wood crop is used the impacts would vary by site. Otherwise, there would be no impacts during operation.

7.2.9.3 Mitigation

- Consult with the State Historic Preservation Officer (SHPO) in the state where the resource is to be located and area tribes to determine the likelihood of any cultural resources within or near the project area.
- Conduct an archaeological and cultural resource survey of the area to identify and assess resources that may be present.
- If cultural resources are present and impacts cannot be avoided, implement a cultural resources mitigation and management plan in consultation with appropriate authorities to accomplish data recovery from the affected sites.
- If unanticipated resources are discovered during construction, halt work, notify SHPO immediately, develop an appropriate mitigation program, and negotiate next steps.

7.2.10 Employment

7.2.10.1 Construction Impacts

There would be substantial beneficial impacts during construction. A 40 MW wood-fired plant would require an average of 70 workers over a 2-year period with a peak of 300 workers (Washington Water Power, no date). In addition to the employment gains, the local economy would benefit from spending by workers as well as by the facility for materials, equipment, and supplies.

7.2.10.2 Operation Impacts

Beneficial impacts during operation would be smaller but longer term. Permanent employment for a wood-fired plant would require an estimated 20 workers (Washington Water Power, no date). The operations employment levels would likely be higher than for other power plant facilities due to the higher need for fuel handling and maintenance, including ash handling. If the fuel source is mill waste, there would likely be little additional employment (besides the plant operations). If logging residues are the fuel source, there would be some additional employment associated with collecting and transporting the residue. If a dedicated crop is used for fuel, employment will increase to plant, maintain, and harvest the crop. The amount of employment would vary with site and crop type, and may be seasonal, temporary, and not high-wage.

7.2.10.3 Mitigation

No mitigation would be needed.

7.3 References

Grantham, John B. and Jack O. Howard. No date. Logging Residue as an Energy Source. U.S. Forest Service, Seattle, WA.

Yan, Jinyne, Lars Eidensten and Gunnar Svedberg. October 1997. "A Future for biomass". Mechanical Engineering.

PACE University. 2005. Power Scorecard: Electricity from Biomass. www.powerscorecard.org.

California Energy Commission. 2005. Environmental Performance Report of California's Electrical Generation System, June 2005, page 110.

Washington Water Power. No date. Proposed Washington Water Power Co. Wood Waste Electric Generating Plant.

8.0 Hydro Efficiency Upgrade (Gorge Tunnel)

8.1 General Description

Gorge powerhouse is a hydroelectric plant that is part of the Skagit Project owned and operated by Seattle City Light. The powerhouse is supplied with water from Gorge Reservoir through a single tunnel. The project would involve installing a second companion tunnel that would decrease flow velocities, reduce energy lost to turbulence when water flows at high velocity, and reduce the frictional losses that occur between the water and the tunnel wall, thereby increasing the effective hydraulic head. This would result in greater power production for the same amount of water. This efficiency improvement would add 18 MW of capacity and increase annual generation by 45,000 MWh. The energy captured through this hydro efficiency upgrade translates to a reduction in carbon dioxide emissions of nearly 39,000 metric tons annually.

The second tunnel would branch off the existing tunnel below the existing reservoir intake, continue underground and parallel to the existing tunnel, and then reconnect with the existing tunnel above and just north of the powerhouse near the existing surge tank. A new intake would not be required and there would be no change in water diversion amounts, flow, or plant operations. The tunnel would be approximately 11,000 feet long and 18 feet in diameter.

A FERC license amendment and other permits would be necessary. The primary environmental issues for the project involve conformance with the Endangered Species Act and Clean Water Act (Section 401) Water Quality Certification. A planning team has been assembled, with preliminary engineering scheduled to begin in 2008. The project will be presented to decision-makers in the 2009-1010 CIP. The project would be completed within about eight years, with the first three years for the FERC license amendment. It is anticipated that a tunnel-boring machine would be used for construction of the tunnel, instead of the traditional drilling and blasting. It is also anticipated that waste rock and soil would be transported off-site and used for beneficial construction purposes elsewhere. Fuel extraction impacts do not apply to this technology.

8.2 Environmental Impacts and Mitigation

8.2.1 Soils and Geology

8.2.1.1 <u>Construction Impacts</u>

Soils and rock would be removed and geologic structures would be disturbed to build the tunnel. Approximately 79,000 cubic yards of soil and rock would be removed. The soil and rock that would be disturbed would be primarily underground. Excavation and disposal of the soil and rock could lead to soil erosion and impacts from transporting the soil and rock. However, using debris in a project where clean soil was needed would reduce impacts. The feasibility of this option depends on the proximity of nearby construction projects. Overall, it is expected that impacts would be moderate.

8.2.1.2 Operation Impacts

No operation impacts are anticipated.

8.2.1.3 Mitigation

- Minimize the extent of ground disturbance required, such as by using existing roads to the extent possible. Locate new access roads to follow the local topography, and minimize sidehill cuts.
- Cover and stabilize exposed areas consistent with applicable standards, salvage removed topsoils, and reclaim disturbed areas as soon as possible.
- Identify and avoid unstable slopes and other geologic hazards, and avoid creating excessive slopes during construction; use special construction techniques where applicable.

8.2.2 Air Quality

8.2.2.1 Construction Impacts

There would be small amounts of air pollutants released during construction, from drilling, excavation, and vehicles used to build the tunnel. Construction equipment, vehicles transporting construction materials and facility components to the site, and construction workers' vehicles would all produce exhaust emissions. Air pollutants in these emissions can include CO, NO_x, VOCs, SO_2, and particulates. Emissions from these sources would be short-term, would likely be low, and are not likely to cause significant air quality impacts or have a measurable effect on ambient air quality near the site. There would be small amounts of greenhouse gases released during construction from drilling, excavation, and equipment used to build the tunnel.

Exposing excavated spoils on the ground surface and transporting it can generate fugitive dust. To the extent that exposed spoils are not wetted or otherwise stabilized, they could generate windblown dust and cause dust deposition in the surrounding area. Fugitive dust deposition is generally not considered to be a health issue; however, excess dust deposition is considered a nuisance as it can increase the soiling of surfaces. Fugitive dust is not anticipated to produce any measurable effect on the overall ambient air quality in the area surrounding a site. Impacts would be low.

8.2.2.2 Operation Impacts

During operation of the new tunnel, no air emissions are expected other than very small amounts potentially emitted by vehicles used during maintenance. Impacts would be low.

8.2.2.3 Mitigation

No mitigation would be required.

8.2.3 Surface and Groundwater

8.2.3.1 Construction Impacts

Groundwater could be affected during construction of the new tunnel if an aquifer is breached by excavation and groundwater pathways are disrupted, in which case it would probably dewater. There is the potential that the existing reservoir could be disturbed by construction, but a new intake is not planned, since the new tunnel would divert from the existing one below the existing intake. Excavation and disposal of excavated material could have short-term impacts on surface water quality because of increased turbidity and siltation.

8.2.3.2 Operation Impacts

No operations impacts would occur; the new tunnel would not result in more water being taken from the existing reservoir. However, the new tunnel could create a preferential pathway for groundwater flow along the tunnel.

8.2.3.3 Mitigation

- Develop temporary and permanent stormwater management systems that incorporate BMPs for pollution prevention.
- Characterize the surface and groundwater hydrology prior to construction, develop an understanding of discharge and recharge relationships, and avoid creating new hydrologic connections through grading and related activities.
- Monitor water quantity and quality conditions if construction activity is to occur near aquifer recharge areas.
-
- Implement BMPs for use, handling, and storage of fuels, pesticides and other hazardous materials during both construction and operation.

8.2.4 Plants and Animals

8.2.4.1 Construction Impacts

There would be negligible impacts on plants and animals other than those associated with construction (noise, vehicle traffic, soil removal), since most of the work would be done below ground and there would be no change in the way water is removed from the reservoir. Construction impacts that affect ground and surface water could ultimately have adverse effects on aquatic species. Overall, minor habitat disturbance and human activity in the project area would result in low impacts

8.2.4.2 Operation Impacts

No operations impacts are expected.

8.2.4.3 Mitigation

- Where possible, use existing roads and disturbed areas for project development, and minimize the area disturbed for project construction.
- Develop and implement a restoration plan to restore disturbed plant and animal habitat.
- Implement measures to minimize establishment of invasive species.
- Landscape site buffer areas with native plant species

8.2.5 Energy and Natural Resources

8.2.5.1 Construction Impacts

The vehicles and boring equipment used in the construction process would consume relatively small amounts of non-renewable fossil fuels.

8.2.5.2 Operation Impacts

The operation of the project would not use fossil fuel and would not increase the amount of water consumed to produce electricity. The increased output of electricity would reduce the need for other, non-renewable electricity sources to meet City Light load growth.

8.2.5.3 Mitigation

No mitigation would be required.

8.2.6 Environmental Health

8.2.6.1 Construction Impacts

During construction, noise levels would increase due to vehicles and use of boring equipment. No additional corona or electrical-magnetic field effects (EMF) are anticipated during construction.

8.2.6.2 Operation Impacts

During operation, no additional noise, corona, or EMF impacts are anticipated.

8.2.6.3 Mitigation

No mitigation would be required.

8.2.7 Land Use

8.2.7.1 Construction Impacts

Construction impacts would be limited to potential interference with recreation uses or hydropower facility operations, the two primary land uses in the area. Impacts would likely be in the form of increased vehicle traffic for construction staff and materials that could delay traffic flow or limit access to certain areas (thus limiting land use for other purposes). These impacts would be temporary, and would likely be low during most stages of construction.

8.2.7.2 Operation Impacts

Project operation would be compatible with the site's existing use as a hydroelectric project and would not permanently change the use of surface land. The area is within the Ross Lake National Recreation Area; however, there would be no incremental changes in potential impacts on recreation compared to the present. The existing project operates under a federal license that includes requirements for minimizing and mitigating impacts of the hydroelectric plant operations on the National Recreation Area. City Light works closely with the National Park Service in implementing license requirements.

8.2.7.3 Mitigation

- Buffer areas of construction activity from areas frequented by recreationists, if possible.

8.2.8 Aesthetics and Recreation

8.2.8.1 Construction Impacts

Construction activity including vehicle and equipment use and ground disturbance could create contrasts with the existing visual environment and adversely affect the visual experience of motorists. As noted in the *Land Use* section, work will take place in the Ross Lake National Recreation Area, which is part of the North Cascades National Park Complex. The project would be in close proximity to State Route 20, the highway used by all travelers through the area. The area is used for recreation, and increased construction traffic and noise could adversely affect the recreation experience of hikers and others. These impacts would be temporary. They could be mitigated by scheduling construction during periods of low recreation use, but that would primarily be during winter months, increasing risks of other impacts such as increased erosion due to rain. Overall, impacts would be low to moderate.

8.2.8.2 Operation Impacts

Operation would have almost no impacts on aesthetics and recreation, since the new tunnel facilities would be underground and require little routine maintenance.

8.2.8.3 Mitigation

- Schedule construction during periods of low recreation use.
- If possible, provide vegetative or landscape screening to obstruct views of the construction activity from surrounding areas.

8.2.9 Cultural Resources

8.2.9.1 Construction Impacts

The tunnel is not itself listed on the National Register. However, Gorge Powerhouse, the old railroad bridge over the Skagit River between SR20 and the powerhouse, and Ladder Creek Gardens behind the powerhouse are listed on the National Register of Historic Places. Work would have to be planned to avoid impacts to those resources. It is possible but highly unlikely that other resources could be discovered or disturbed during construction activities. The level of impact would depend on the importance of the resource and the degree of disturbance. It is assumed that if resources are discovered, mitigation would be implemented to recover information represented by the cultural resource. Impacts are expected to be low.

8.2.9.2 Operation Impacts

No operations impacts are expected.

8.2.9.3 Mitigation

- Consult with the appropriate State Historic Preservation Officer (SHPO) and area tribes to determine the likelihood of any cultural resources within or near the project area.
- Conduct a cultural resource survey of the area to identify and assess resources that may be present.
- If cultural resources are present and impacts cannot be avoided, prepare a cultural resources mitigation and management plan in consultation with appropriate authorities and negotiate next steps.
- If unanticipated resources are discovered during construction, halt work, notify SHPO immediately, and develop an appropriate mitigation program.

8.2.10 Employment

8.2.10.1 Construction Impacts

There would be a temporary increase in employment during construction and benefits from spending by workers and by the facility for materials, equipment, and supplies.

8.2.10.2 Operation Impacts

There would be a small increase in employment during operation as a result of increased maintenance requirements for the new tunnel.

8.2.10.3 Mitigation

No mitigation would be required.