APPENDIX A

POTENTIAL ENVIRONMENTAL IMPACTS AND PREVIOUSLY EMPLOYED MITIGATION OPTIONS FOR NATURAL GAS TRANSMISSION PIPELINES

Potential Environmental Impacts and Previously Employed Mitigation Options for Natural Gas Transmission Pipelines

Introduction

The Federal Energy Regulatory Commission (FERC) has recently prepared numerous NEPA analyses for natural gas pipeline projects in the West, and has refined its analytical methods and mitigation requirements with each succeeding project. The following summary draws from this extensive body of information in attempting to characterize the general range of impacts associated with natural gas pipeline projects. The summary represents the types of impacts likely to receive more detailed attention in a subsequent NEPA analysis for the NRPF pipeline, and identifies a reasonable array of mitigation measures that have been employed on other projects, according to the specific nature and degree of impact. Note that the following summary does not imply that all of the impacts would be present or significant for the NRPF pipeline, nor that every mitigation measure listed will or should be employed for this project. More detailed descriptions of impacts and project-specific mitigation would be developed in a subsequent NEPA analysis.

Geology

Impact:	Active Fault Crossings.
Mitigation options:	Geotechnical investigations, special design measures, such as extra-wide trench with granular backfill, increased pipe wall thickness, orienting angle of fault crossing to minimize potential stresses.
Impact:	Slope instability.
Mitigation options:	Avoidance, mechanical or vegetative stabilization, installation of line below landslide slop plane, monitoring (this may consist of visual inspection, land survey or instrumental monitoring).

Paleontology

Impact:	Direct or indirect damage or destruction of fossils.
Mitigation options:	Avoidance, scientific excavation and curation, construction monitoring.

Vegetation and Soils

Impact:	Temporary and long-term alteration/loss of vegetative cover.

Mitigation options:	Maximize use of existing corridors, clear only enough area to allow for safe construction/operation of line, scalp vegetation in areas where grading is not necessary, avoid removing mature trees where possible, restore/revegetate right-of-way, implementation of FERC's Erosion Control, Revegetation and Maintenance Plan (ECRM Plan).
Impact:	Destruction of federal or state-listed sensitive plant species.
Mitigation options:	Identify potential and actual occurrences of rare plants through agency consultation (i.e. with U.S.Fish and Wildlife Service and Washington Department of Wildlife), literature review and/or field surveys (note: Endangered Species Act requirements will be followed to address the project's potential to jeopardize any federally-listed plant species), avoid (through route realignment or exclusionary fencing) or restore identified rare plant populations.
Impact:	Soil compaction.
Mitigation options:	Compaction testing, maximization of dry season construction, halting of construction during extremely wet weather periods, ripping compacted soils during cleanup, implementation of FERC's ECRM Plan.
Impact:	Soil horizon mixing.
Mitigation options:	Topsoil separtion/replacement; implementation of FERC's ECRM Plan.
Impact:	Excess rock at or near surface.
Mitigation options:	Topsoil separation/replacement, rock-picking, removal to designated disposal sites, implementation of FERC's ECRM Plan.
Impact:	Soil erosion.
Mitigation options:	Implementation of FERC's ECRM Plan, develop site-specific plans as necessary for particularly erosion-prone, sensitive, or difficult areas.
Impact:	Crop losses.
Mitigation options:	Compensate property owners, implementation of FERC's ECRM Plan to restore right-of-way and soil productivity.

Impact:	Disruption of irrigation or drainage systems.
Mitigation options:	Determine means to minimize impacts through direct discussions with property owners (e.g., timing constraints, special construction techniques, replacement/repair of structures), compensate property owners.
Impact:	Spread of noxious weeds.
Mitigation options:	Preconstruction weed inventories, consultation with local authorities, preconstruction weed treatment, equipment washdown, right-of-way revegetation, post-construction monioring/remediation (see above for more detail)

Water Resources

Impact:	Contamination of surfact/groundwater supplies by construction fluids (e.g., diesel, motor oil, hydraulic fluid).
Mitigation options:	Development and implementation of a Spill Prevention, Containment, and Control Plan (SPCC Plan).
Impact:	Damage to wells, springs, and seeps near the right-of-way from blasting or trenching.
Mitigation options:	Preconstruction documentation of private wells and springs, repair any damages, compensate property owners, develop and implement a groundwater monitoring and mitigation plan.
Impact:	Increased turbidity and/or sedimentation during stream crossing construction.
Mitigation options:	Implement FERC's Wetland and Waterbody Construction and Mitigation Procedures, comply with Washington Department of Fisheries and Wildlife and Department of Ecology permit conditions, cross intermittent or ephemeral streams during dry season to the extent feasible, develop site-specific crossing plans for major streams.
Impact:	Withdrawal/discharge of water for hydrostatic testing.
Mitigation options:	Implementation of FERC's Wetland and Waterbody Construction and Mitigation Procedures for hydrostatic testing, obtain necessary withdrawal and discharge permits/approvals, return water to source

where feasible, reuse water in adjacent test sections, regulate withdrawal and discharge rates, use energy dissipation devices and install sediment barriers as necessary to prevent erosion during discharge.

Impact: Disturbance to wetlands.

Mitigation options: Identification and delineation of all wetlands potentially affected, avoidance of wetlands where feasible, implementation of FERC's Wetland and Waterbody Construction Mitigation Procedures, implementation of Corps of Engineers and Department of Ecology permit conditions, development of site-specific construction oand/or restoration plans where appropriate, minimization of construction area, used or specialized wetland construction techniques, restoration of wetland hydrology and vegetation, post-construction monitoring/remediation.

Fisheries and Wildlife

Impact: Fishery resources impacts from turbidity/sedimentation, acoustic shock, destruction of stream cover, introduction of water pollutants, or entrainment of fish.

Mitigation options: Identify specific aquatic resources and concerns through agency consultation, including Washington Department of Wildlife, U.S.Fish and Wildlife Service, and National Marine Fisheries Service as appropriate; conduct literature review and/or field studies; implement FERC's Wetland and Waterbody Construction and Mitigation Procedures, SPCC Plan, and hydrostatic test water intake requirements, conduct in-stream construction within designated times of the year, develop site-specific mitigation as necessary for sensitive fish species, restore/revegetate stream banks.

Impact: Taking of federal threatened and endangered species.

Mitigation options: Comply with Endangered Species Act requirements to determine potential of project to jeopardize listed species, and design mitigation as necessary. Preliminary information indicates that a portion of Middle Route 1 traverses bald eagle habitat. On past pipeline projects, potential impacts to bald eagles have been avoided by prohibiting construction within specified distances of any active nest during wintering/nesting season and until any young have fledged.

Impact: Impacts on state sensitive species and game species.

Mitigation options:	Consult with Washington Department of Wildlife and design appropriate avoidance/mitigation plans, some options of which are listed below.
Impact:	Disturbance to nesting raptors.
Mitigation options:	Conduct preconstruction surveys, restrict or avoid construction during nesting season within specified distances from active nests, monitor nests during construction.
Impact:	Disturbance or destruction of ground-nesting or denning species.
Mitigation options:	Conduct preconstruction surveys, restrict or avoid constructions during nesting/denning season, develop species-specific mitigation in consultation with Washington Department of Wildlife, restore right-of-way, follow FERC's ECRM Plan with respect to limiting vegetative maintenance on right-of-way.
Impact:	Disturbance of fawning or migrating big game.
Mitigation options:	Restrict or avoid construction during sensitive time periods, utilize trench plugs to allow passage, inspect trenches for trapped animals, monitor populations during construction.

Land Use

Impact:	Conflict with other development plans
Mitigation options:	Work closely with affected property owners and local governments to identify and resolve potential conflicts, route pipeline parallel to existing linear facilities, route pipeline along property lines to the extent feasible.
Impact:	Conflict with public use or recreation areas.
Mitigation options:	Work closely with land manager or agency to identify and resolve any concerns, develop site-specific plans as necessary, schedule construction to minimize conflicts with high recreational use periods, explore multi-use corridor concepts.
Impact:	Construction disturbance to residents.
Mitigation options:	Minimize time trench is open, restrict construction time periods, restrict construction area width, employ special techniques such as

stovepipe or drag-section construction to expedite completion in residential areas, extensive use of fencing, avoidance of tree removal where possible, avoidance of special landscaping features, preparation of site-specific construction plans.

Impact: Disruption of grazing practices.

Mitigation options: Work with property owners to minimize or avoid disruptions, install temporary fencing, gates, cattleguards, etc..

Impact: Effect on sensitive visual resources.

Mitigation options: Maximize use of existing transportation corridors/rights-of-way, feather right-of-way edges in visually sensitive forested lands, retain screening vegetation or install visual screen plantings at visually sensitive road crossings or other view points, restore preconstruction land contours, revegetate right-of-way, design above-ground facilities, such as valve lots, to blend with natural surroundings, retain trees and rock outcroppings, where feasible, develop site-specific plans, as necessary.

Impact: Disruption to road and rail transportation during construction.

Mitigation options: Acquire road and rail crossing permits, bore most state and county roads and railroads, provide single-lane access or detours for open-cut roads.

Socioeconomics

Impact: Long-term increase to local tax base, short-term increase in local payrolls and material purchases.

Mitigation options: Beneficial impacts; no mitigation.

Impact: Increased pressure on local support infrastructure caused by temporary influx of workers during construction (note: Impact is expected to be minimal for a project of this size).

Mitigation options: Work with local governments to identify and resolve any issues.

Cultural Resources

Impact: Damage to cultural resources

Mitigation options: Comply with Section 106 of the National Historic Preservation Act, identify and evaluate historic properties that could be affected

(including sites of ethnographic significance), realign pipeline or install exclusionary fencing to avoid National Register-eligible sites, where feasible, develop and implement treatment plans in consultation with involved state and federal agencies, consult with Native American groups to identify and try to resolve concerns develop and implementation of a construction monitoring plan.

Reliability and Safety

Impact: Public safety during construction.

Mitigation standards: Extensive signage, traffic control where necessary, preparation of blasting plans, implementation of speed limits for construction vehicles in congested areas, fencing of road bore pits or trench in residential areas, compliance with OSHA and other applicable safety regulations

Impact: Pipeline rupture or leakage.

Mitigation standards: Comply with Department of Transportation's Minimum Federal Safety Standards specified in 49 CFR Part 192, including inspection of materials and installation, visual and non-destructive testing of welds, and hydrostatic testing of the pipeline system prior to being put in service. Installation of cathodic protection system to prevent corrosion, regular communication with property owners to remind them to call company before excating near pipeline, implementation of one-call system to locate and mark pipeline prior to third-party excavations in pipeline's vicinity, regular aerial and ground inspections of pipeline and right-of-way, maintenance of up-to-date emergency response procedures developed in cooperation with local public safety entities, implementation of regular safety training for pipeline personnel.

Air and Noise

Impact: Fugitive dust during construction.

Mitigation options: Water exposed soil during periods of high traffic or wind.

Impact: Equipment exhaust during construction.

Mitigation options: Ensure equipment is well maintained.

Impact: Noise disturbance to residents during construction.

Mitigation options: Limit construction to daylight hours, notify residents of blasting plans.

Other Mitigation Measures Typically Employed

- Site-specific route alignment changes to address landowner or land management agency concerns
- Environmental compliance inspection during construction, with weekly or monthly status reports to the FERC.
- Training of all project personnel in the specific environmental restrictions and requirements of the job.
- FERC approval of facility location changes and ancillary areas, including access roads, borrow and rock disposal sites, pipe storage yards, and staging areas.
- Acquisition and compliance with all other required agency permits and authorizations.
- Long-term maintenance and monitoring of pipeline system and right-of-way.

APPENDIX B

STANDARD MITIGATION PLANS AND PROCEDURES FOR EROSION CONTROL/RESTORATION AND WETLAND/WATERBODY CONSTRUCTION

on all slopes within 100 feet of waterbodies and wetlands to a rate of 3 tons/acre.

c. Mulch before seeding if:

(1) final cleanup, including final grading and installation of permanent erosion control measures, is not completed in an area within 10 days after the trench in that area is backfilled; or

(2) construction or restoration activity is interrupted for extended periods, such as when seeding cannot be completed due to seeding period restrictions;

d. On all dry, sandy sites and slopes greater than 8 percent, spread mulch uniformly over the area to cover at least 75 percent of the ground surface at a rate of 2 tons/acre of straw or hay or its equivalent, unless the local soil conservation authority makes other recommendations in writing. If wood chips are used as mulch, do not use more than 1 ton/acre and add the equivalent of 11 lbs/acre available nitrogen (at least 50 percent of which is slow release).

e. If a mulch blower is used, the strands of the mulching material shall be at least 8 inches long to allow anchoring.

f. Ensure that mulch is anchored to minimize loss by wind and water.

g. When anchoring by mechanical means, use a mulch anchoring tool to properly crimp the mulch to a depth of 2 to 3 inches.

h. When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Do not use liquid mulch binders within 100 feet of wetlands or waterbodies.

i. Install erosion control fabric, such as jute thatching or bonded fiber blankets, at a minimum, on waterbody banks at the time of final bank recontouring. Anchor the erosion control fabric with staples or other appropriate devices.

VI. RESTORATION

A. CLEANUP

1. Make every effort to complete final cleanup of an area (including final grading and installation of permanent erosion control structures) within 10 days after backfilling the trench in that area. If this schedule cannot be met, final cleanup must be completed as soon as possible. In no case shall final cleanup be delayed beyond the end of the next recommended seeding season.

2. A travel lane may be left open temporarily to allow access by construction traffic if the temporary erosion control structures are installed as specified in section V.F. and inspected and maintained as specified in sections III.B.11 through 13. When access is no longer required the travel lane must be removed and the right-of-way restored.

3. Excess rock, including blast rock may be used to backfill the trench to the top of the existing bedrock profile.

4. Remove excess rock from at least the top 12 inches of soil to the extent practicable in all rotated and permanent cropland, hayfields, pastures, residential areas, and other areas at the landowner's request. The size, density, and distribution of rock on the construction work area should be similar to adjacent areas not disturbed by construction. Make diligent efforts to remove stones greater than 4 inches if the off right-of-way areas do not contain stones greater than 4 inches. The landowner may approve other rock size provisions in writing.

5. Remove construction debris from the right-of-way and grade the right-of-way to leave the soil in the proper condition for planting.

B. PERMANENT EROSION CONTROL DEVICES

1. Trench Breakers

   a. Trench breakers are intended to slow the flow of subsurface water along the trench. Trench breakers may be constructed of materials such as sand bags or polyurethane foam. Do not use topsoil in trench breakers.

   b. An engineer or similarly qualified professional shall determine the need for and spacing of trench breakers. Otherwise, trench breakers shall be installed at the same spacing as and upslope of permanent slope breakers.

   c. In agricultural fields and residential areas where slope breakers are not typically required, install trench breakers at the same spacing as if permanent slope breakers were required.

   d. Install trench breakers at the base of slopes adjacent to waterbodies and wetlands and where needed to avoid draining of a wetland.

2. Permanent Slope Breakers

   a. Permanent slope breakers are intended to reduce runoff velocity and divert water off the construction right-of-way. Permanent slope breakers may be constructed of materials such as soil and sand bags.

b. Construct and maintain permanent slope breakers in all areas, except cultivated areas and lawns, using the spacing recommendations obtained from the local soil conservation authority. In the absence of written recommendations, use the spacing for temporary slope breakers provided in section V.F.1.b.

c. Construct slope breakers with a 2 to 8 percent outslope to divert surface flow to a stable area. In the absence of a stable area, construct appropriate energy-dissipating devices off the construction right-of-way. Where slope breakers extend beyond the edge of the construction right-of-way to direct runoff into stabilized areas, they are subject to compliance with all applicable survey requirements.

C. SOIL COMPACTION MITIGATION

1. Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Conduct tests on the same soil type under similar moisture conditions in undisturbed areas to identify approximate preconstruction conditions. Use U.S. Army Corps of Engineers-style cone penetrometers or other appropriate devices to conduct tests.

2. Plow severely compacted agricultural areas with a paraplow or other deep tillage implement. In areas where topsoil has been segregated, plow the subsoil before replacing the segregated topsoil. Alternatively, make arrangements with the landowner to plant and plow under a "green manure" crop, such as alfalfa, to decrease soil bulk density and improve soil structure. If subsequent construction and cleanup activities result in further compaction, conduct additional tilling.

3. Perform appropriate soil compaction mitigation in severely compacted residential areas.

D. REVEGETATION

1. General

a. The project sponsor is responsible for ensuring successful revegetation of soils disturbed by project-related activities, except as noted in section VI.D.1.b.

b. Restore all turf, ornamental shrubs, and specialized landscaping in accordance with the landowner's request, or compensate the landowner. Restoration work must be performed by personnel familiar with local horticultural and turf establishment practices.

2. Soil Additives

Fertilize and add soil pH modifiers in accordance with written recommendations obtained from the local soil conservation authority or land management agencies. Incorporate recommended soil pH modifier and fertilizer into the top 2 inches of soil as soon as possible after application.

3. Seeding Requirements

a. Prepare a seedbed in disturbed areas to a depth of 3 to 4 inches using appropriate equipment to provide a firm seedbed. When hydroseeding, scarify the seedbed to facilitate lodging and germination of seed.

b. Seed disturbed areas in accordance with written recommendations for seed mixes, rates, and dates obtained from the local soil conservation authority or land management agencies, except in upland areas where landowners request alternative seed mixes. Seeding and mulching in cultivated cropland shall conform with the adjacent off right-of-way area unless otherwise requested by the landowner in writing.

c. Perform seeding of permanent vegetation within the recommended seeding dates. If seeding cannot be done within those dates, use appropriate temporary erosion control measures discussed in section V.F. and perform seeding of permanent vegetation at the beginning of the next recommended seeding season. Lawns may be seeded on a schedule established with the landowner.

d. Seed slopes steeper than 33 percent immediately after final grading, weather permitting, subject to the specifications in section VI.D.3.a-c.

e. Seed all disturbed soils within 6 working days of final grading, weather and soil conditions permitting, subject to the specifications in section VI.D.3.a-c.

f. Base seeding rates on Pure Live Seed. Use seed within 12 months of seed testing.

g. Treat legume seed with an inoculant specific to the species. For conventional seeding, use 4 times the manufacturer's recommended rate of inoculant. For hydroseeding, use 10 times the recommended rate of inoculant.

h. Uniformly apply and cover seed in accordance with the written recommendations of the local soil conservation authorities or land management agencies.

i. In the absence of recommendations referred to in section VI.D.3.h. above, a seed drill equipped with a cultipacker is preferred for application, but broadcast or hydroseeding can be used at double the recommended seeding rates. Where seed is broadcast, firm the seedbed with a cultipacker or roller after seeding.

VII. OFF-ROAD VEHICLE CONTROL

To each owner or manager of forested lands offer to install and maintain measures to control unauthorized vehicle access to the right-of-way. These measures may include:

- signs;
- fences with locking gates;
- slash and timber barriers, pipe barriers, or a line of boulders across the right-of-way; and
- conifers or other appropriate trees or shrubs across the right-of-way.

VIII. POST-CONSTRUCTION ACTIVITIES

A. MONITORING AND MAINTENANCE

1. Conduct follow-up inspections of all disturbed areas after the first and second growing seasons to determine the success of revegetation.

2. Monitor crops for at least 2 years to determine the need for additional restoration.

3. Revegetation shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation (or crops in cultivated cropland) are similar in density and cover to adjacent undisturbed lands. If vegetative cover and density are not similar or there are excessive noxious weeds after two full growing seasons, a professional agronomist shall determine the need for additional restoration measures (such as fertilizing or reseeding). Implement the measures recommended by the agronomist.

4. Monitor and correct problems with drainage and irrigation systems resulting from pipeline construction in active agricultural areas.

5. Routine vegetation maintenance clearing shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be maintained annually in a herbaceous state. In no case shall routine vegetation maintenance clearing occur between April 15 and August 1 of any year.

6. Restoration shall be considered successful if the right-of-way surface condition is similar to adjacent undisturbed lands, revegetation is successful, and all temporary erosion control devices are removed.

7. Efforts to control unauthorized off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Maintain signs, gates, and vehicle trails as necessary.

B. REPORTING

1. The project sponsor shall maintain records that identify by milepost:

   a. method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;

   b. acreage treated;

   c. dates of backfilling and seeding; and

   d. names of landowners requesting special seeding treatment and a description of the follow-up actions.

2. The project sponsor shall file with the Secretary quarterly activity reports documenting problems, including those identified by the landowner, and corrective actions taken for at least 2 years following construction.

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

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WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES (PROCEDURES)

I. APPLICABILITY

A. These Procedures apply to all natural gas construction projects where they are imposed by the Commission or agreed to by project sponsors and shall be used for all wetlands and waterbodies affected by a project. Deviations that involve measures different from those contained in these Procedures will only be permitted as certificated by the Commission or by written approval of the Director of the Office of Pipeline Regulation (OPR), or his/her designee, unless specifically required in writing by another Federal, state, or Native American land management agency for the portion of the project on its land. The project sponsor shall file other agency requirements with the Secretary of the Commission (Secretary) before construction.

B. The intent of these Procedures is to minimize the extent and duration of project-related disturbance of wetlands and waterbodies. Any project-related ground disturbance (including erosion) inside or outside of the certificated areas is subject to compliance with all applicable survey and mitigation requirements.

C. DEFINITIONS

1. "waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

   a. "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of construction;

   b. "intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of construction;

   c. "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of construction.

2. "wetland" includes any area that satisfies the requirements of the current Federal methodology for identifying and delineating wetlands.

II. PRECONSTRUCTION FILING

A. Project sponsors shall file with the Secretary before construction the hydrostatic testing information specified in section VII.B.3. and a wetland delineation report as described in section VI.B.1., if applicable.

B. Project sponsors shall file with the Secretary site-specific construction plans prepared to comply with sections V.B.2.c., V.B.6.c., V.B.9.b., VI.B.4., and VI.C.1.b. for review and written approval by the Director of OPR before construction.

C. Before construction begins on a project that will disturb more than 5 acres of land, the project sponsor shall file with the Secretary a copy of its Stormwater Pollution Prevention Plan prepared for compliance with the U.S. Environmental Protection Agency's (EPA) National Stormwater Program General Permit requirements. This plan must be available in the field on each construction spread and shall include a Spill Prevention, Containment, and Countermeasure Plan (see section IV.A.).

D. The project sponsor shall prepare a schedule identifying when trenching or blasting would occur within each waterbody greater than 10 feet wide, or within any coldwater fishery. The project sponsor shall file the schedule with the Secretary within 30 days of the acceptance of the certificate and revise it as necessary to provide at least 14 days advance notice. Changes within this last 14-day period must provide for at least 48 hours advance notice.

III. ENVIRONMENTAL INSPECTORS

A. At least one Environmental Inspector having knowledge of the wetland and waterbody conditions in the project area is required for each construction spread.

B. The Environmental Inspector's responsibilities are outlined in the Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

IV. PRECONSTRUCTION PLANNING

A. SPILL PREVENTION, CONTAINMENT, AND COUNTERMEASURE (SPCC) PLAN

Prepare a SPCC Plan that, at a minimum:

1. Identifies typical fuel, lubricants, and hazardous materials stored or used in the project area, and the location, quantity, and method of storage;

2. Describes the preventive and mitigative measures to avoid or minimize impacts of spills of fuel, lubricants, or hazardous materials, especially within any municipal watershed area or within 100 feet of any waterbody or wetland;

3. Requires fueling and lubricating to be done in areas designated for such purposes and specifies measures to avoid or minimize spills when construction equipment (such as pontoon-mounted backhoes and pumps) will be refueled in or within 100 feet of any waterbody or wetland;

4. Identifies emergency notification procedures in the event of a spill;

5. Requires each construction crew to have sufficient supplies of absorbent and barrier materials on-hand to allow the rapid containment and recovery of any spills;

6. Includes procedures for collection and disposal of waste generated during spill cleanup or equipment maintenance;

7. Includes procedures regarding excavation and disposal of any soil or materials contaminated by a spill; and

8. Identifies names and telephone numbers of all state agencies and individuals that will be contacted in the event of a spill.

B. AGENCY COORDINATION

Coordinate with the appropriate agencies as specified in sections V.A., VI.A., VI.D.4., VI.D.5.c., VI.D.7., and VII.A.

V. WATERBODY CROSSINGS

A. NOTIFICATION PROCEDURES AND PERMITS

1. Provide written notification to the U.S. Army Corps of Engineers (COE) of the proposed construction activities.

2. Provide written notification to authorities responsible for potable surface water supply intakes located within 3 miles downstream of the crossing at least 1 week before beginning work in the waterbody.

3. Apply for state-issued waterbody crossing permits and obtain individual or generic section 401 water quality certification or waiver.

4. Notify state authorities that request such notification at least 48 hours before beginning trenching or blasting within the waterbody.

B. INSTALLATION

1. Time Window for Construction

Unless expressly permitted or further restricted by the appropriate state agency in writing on a site-specific basis, crossings must be constructed during the following time windows:

a. Coldwater Fisheries - June 1 through September 30; and

b. Coolwater and Warmwater Fisheries - June 1 through November 30.

2. Extra Work Areas

a. Access roads across a waterbody must use an equipment bridge as specified in section V.B.5.

b. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from waterbody boundaries, where topographic conditions permit. If topographic conditions do not permit a 50-foot setback, these areas must be located at least 10 feet from the water's edge.

c. The project sponsor shall file with the Secretary for review and written approval by the Director of OPR before construction site-specific construction plans for those extra work areas with a less than 50-foot setback from waterbody boundaries and a site-specific explanation of the conditions that will not permit a 50-foot setback.

d. Limit clearing of vegetation between extra work areas and the edge of the waterbody to the certificated construction right-of-way.

e. Limit the size of extra work areas to the minimum needed to construct the waterbody crossing.

3. General Crossing Procedures

a. Comply with section 404 nationwide permit program terms and conditions (33 CFR Part 330).

b. Construct crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.

c. If the pipeline parallels a waterbody, attempt to maintain at least 15 feet of undisturbed vegetation between the waterbody and the right-of-way except at the crossing location.

d. Where waterbodies meander or have multiple channels, route the pipeline to minimize the number of waterbody crossings.

e. Maintain adequate flow rates to protect aquatic life, and prevent the interruption of existing downstream uses.

f. Do not store hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities within 100 feet of any waterbody or within any designated municipal watershed area (except at locations designated for these purposes by an appropriate governmental authority).

g. Attempt to refuel all construction equipment at least 100 feet from any waterbody. If construction equipment must be refueled within 100 feet of a waterbody, follow the procedures outlined in the project-specific SPCC Plan. See section IV.A.

4. Spoil Pile Placement and Control

   a. All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas as described in section V.B.2.b.

   b. Use sediment barriers to prevent the flow of spoil into any waterbody.

5. Equipment Bridges

   a. Only clearing equipment may cross waterbodies before installation of equipment bridges. Limit the number of such crossings of each waterbody to one per piece of equipment.

   b. Construct equipment bridges using one of the following methods:

      (1) equipment pads and culvert(s);
      (2) clean rockfill and culvert(s); or
      (3) flexi-float or portable bridges.

      Do not use soil to construct or stabilize equipment bridges.

   c. Design and maintain each equipment bridge to withstand and pass the highest flow that would occur while the bridge is in place.

   d. Maintain equipment bridges to prevent soil from entering the waterbody.

   e. Remove equipment bridges as soon as possible after permanent seeding unless the COE authorizes it as a permanent bridge.

   f. If there will be more than 1 month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the right-of-way is available, remove equipment bridges as soon as possible after final cleanup.

6. Dam and Pump

   a. The dam-and-pump method may be used without prior approval for crossings of minor waterbodies where fluming is not required by these Procedures.

   b. Prior written approval from the Director of OPR is required to dam and pump where:

      (1) fluming is required by these Procedures; or
      (2) the waterbody is greater than 10 feet wide.

c. To request approval to use the dam-and-pump method, the project sponsor shall file with the Secretary a project-specific plan for review and written approval by the Director of OPR before construction. This plan must list all waterbodies where the dam-and-pump method would be used and describe all measures that would be used to maintain downstream flows, including:

(1) number and capacity of active pumps;
(2) number and capacity of backup pumps;
(3) the types of dams to be used up- and downstream of the crossing;
(4) how streambed scour would be prevented at the pump discharge; and
(5) how the operation would be monitored if the crossing is prolonged beyond one normal construction day.

7. Crossings of Minor Waterbodies

a. For crossings of all state-designated fisheries, all construction equipment must cross the waterbody on an equipment bridge as specified in section V.B.5.

b. Equipment bridges are not required at minor waterbodies that do not have a state-designated fishery classification (for example, agricultural or intermittent drainage ditches). However, if an equipment bridge is used it must be constructed as described in section V.B.5.

c. For crossings of all coldwater fisheries, and all coolwater and warmwater fisheries considered significant by the state, route waterbody flow across the trench using a flume pipe, and install the pipeline using all of the following "dry-ditch" techniques:

(1) install flume pipe after blasting, but before trenching;
(2) use sand bag or sand bag and plastic sheeting diversion structure, or equivalent;
(3) properly align flume pipe;
(4) do not remove flume pipe during trenching, pipelaying, or backfilling activities; and
(5) remove all flume pipes and dams that are not also part of the equipment bridge after final cleanup but before permanent seeding.

d. For minor waterbody crossings not covered by section V.7.c., complete construction in the waterbody (not including blasting) within 24 hours. Limit use of equipment operating in the waterbody to that needed to construct the crossing.

8. Crossings of Intermediate Waterbodies

a. Limit use of equipment operating in the waterbody to that needed to construct the crossing.

b. All other construction equipment must cross on an equipment bridge as specified in section V.B.5.

c. Attempt to complete trenching and backfill work within the waterbody (not including blasting) within 48 hours, unless site-specific conditions make completion within 48 hours infeasible.

9. Crossings of Major Waterbodies

a. All major waterbody crossings must be constructed in accordance with the measures contained in these Procedures to the maximum extent practicable.

b. The project sponsor shall develop and file with the Secretary detailed, site-specific construction procedures (including scaled drawings identifying all areas to be disturbed by construction) for each major waterbody crossing, as defined in section I.C.1.c. for review and written approval by the Director of OPR before construction. This requirement does not apply to offshore pipeline construction.

10. Temporary Erosion and Sediment Control

Install sediment barriers (as defined in section V.F.2.a. of the Plan) immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan.

a. Install sediment barriers across the entire construction right-of-way at all waterbody crossings.

b. Where waterbodies are adjacent to the construction right-of-way, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the right-of-way.

c. Use trench plugs at all non-flumed waterbody crossings to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody. Trench plugs must be of sufficient size to withstand upslope water pressure.

11. Trench Dewatering

Dewater trench in such a manner that no heavily silt-laden water flows into any waterbody.

C. RESTORATION

1. Use clean gravel or native cobbles for the upper 1 foot of trench backfill in all waterbodies that contain coldwater fisheries.

2. Stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing the crossing. For dry ditch crossings, complete bank stabilization before returning flow to the waterbody channel.

3. Return all waterbody banks to preconstruction contours.

4. Application of riprap must comply with section 404 nationwide permit program terms and conditions (33 CFR Part 330).

5. Unless otherwise specified by state permit, limit the use of riprap to areas where flow conditions preclude effective vegetative stabilization techniques such as seeded erosion control fabric.

6. Revegetate disturbed riparian areas with conservation grasses and legumes or native plant species, preferably woody species.

7. Remove all temporary sediment barriers when restoration of adjacent upland areas is successful as specified in section VIII.A.6. of the Plan.

8. For each waterbody crossed, install a permanent slope breaker and a trench breaker at the base of slopes near the waterbody. Locate the trench breaker immediately upslope of the slope breaker.

9. Sections V.C.2. through V.C.7. above also apply to any streams mapped (as perennial or intermittent) on U.S. Geological Survey 7.5-minute topographic quadrangles but not flowing at the time of construction.

D. POST-CONSTRUCTION MAINTENANCE

1. Limit vegetation maintenance adjacent to waterbodies to allow a riparian strip at least 25 feet wide, as measured from the waterbody's mean high water mark, to permanently revegetate with native plant species across the entire right-of-way. However, to facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be maintained in a herbaceous state. In addition, trees that are located within 15 feet of the pipeline that are greater than 15 feet in height may be cut and removed from the right-of-way.

2. Do not use herbicides or pesticides in or within 100 feet of a waterbody except as specified by the appropriate land management or state agency.

VI. WETLAND CROSSINGS

A. NOTIFICATION PROCEDURES AND PERMITS

1. Provide written notification to the COE concerning the proposed construction activities.

2. Apply for state-issued wetland crossing permit(s) and obtain individual or generic section 401 water quality certification or waiver.

B. GENERAL

1. The project sponsor shall conduct a wetland delineation using the current Federal methodology and file a wetland delineation report with the Secretary before construction. This report shall identify:

   a. by milepost all federally delineated wetlands that would be affected;

   b. the National Wetlands Inventory (NWI) classification for each wetland;

   c. the crossing length of each wetland in feet; and

   d. the area of permanent and temporary disturbance that would occur in each NWI classification type.

2. Route the pipeline to avoid wetland areas to the maximum extent possible. If a wetland cannot be avoided or crossed by following an existing right-of-way, route the new pipeline in a manner that minimizes disturbance to wetlands. Where looping an existing pipeline, overlap the existing pipeline right-of-way with the new construction right-of-way. In addition, locate the loop line no more than 25 feet away from the existing pipeline unless site-specific constraints would adversely affect the stability of the existing pipeline.

3. Limit the width of the construction right-of-way to 75 feet or less.

4. Implement the provisions of sections V. and VI. in the event a waterbody crossing is located within or adjacent to a wetland crossing. If all provisions of sections V. and VI. cannot be met, the project sponsor must file with the Secretary a site-specific crossing plan for review and written approval by the Director of OPR before construction. This crossing plan shall address at a minimum:

   a. spoil control;

b. equipment bridges;

c. restoration of waterbody banks and wetland hydrology;

d. timing of the waterbody crossing;

e. method of crossing; and

f. size and location of all extra work areas.

5. Do not locate aboveground facilities in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

C. INSTALLATION

1. Extra Work Areas and Access Roads

a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from wetland boundaries, where topographic conditions permit. If topographic conditions do not permit a 50-foot setback, these areas must be located at least 10 feet from the wetland's edge.

b. The project sponsor shall file with the Secretary for review and written approval by the Director of OPR before construction site-specific construction plans for those extra work areas with a less than 50-foot setback from wetland boundaries and a site-specific explanation of the conditions that will not permit a 50-foot setback.

c. Limit clearing of vegetation between extra work areas and the edge of the wetland to the certificated construction right-of-way.

d. Limit the size of extra work areas to the minimum needed to construct the wetland crossing.

e. The only access roads, other than the construction right-of-way, that can be used in wetlands are those existing roads that can be used with no modification and no impact on the wetland.

2. Crossing Procedures

a. Comply with section 404 nationwide permit program terms and conditions (33 CFR Part 330).

b. Assemble the pipeline in an upland area and use "push-pull" or "float" techniques to place pipe in trench where water and other site conditions allow.

c. Minimize the duration of construction-related disturbance within wetlands.

d. Limit construction equipment operating in wetland areas to that needed to clear the right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the right-of-way. All other construction equipment shall use access roads located in upland areas to the maximum extent practicable. Where access roads in upland areas do not provide reasonable access, limit all other construction equipment to one pass through the wetland using the right-of-way.

e. Cut vegetation off at ground level, leaving existing root systems in place, and remove it from the wetland for disposal.

f. Limit pulling of tree stumps and grading activities to directly over the trenchline. Do not grade or remove stumps or root systems from the rest of the right-of-way in wetlands unless the Chief Inspector and Environmental Inspector determine that safety-related construction constraints require removal of tree stumps from under the working side of the right-of-way.

g. Segregate the top 1 foot of topsoil from the area disturbed by trenching, except in areas where standing water or saturated soils are present. After backfilling is complete, restore the segregated topsoil to its original location.

h. Do not store hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities in a wetland, or within 100 feet of any wetland boundary.

i. Attempt to refuel all construction equipment in an upland area at least 100 feet from a wetland boundary. If construction equipment must be refueled in a wetland or within 100 feet of any wetland boundary, follow the procedures outlined in the project-specific SPCC Plan. See section IV.A.

j. Do not use rock (except as allowed by item k. below), soil imported from outside the wetland, tree stumps, or brush riprap to stabilize the right-of-way.

k. If standing water or saturated soils are present, use low-ground-weight construction equipment, or operate normal equipment on timber riprap, prefabricated equipment mats, or geotextile fabric overlain with gravel. Geotextile fabric used for this purpose must be strong enough to allow removal of all gravel and fabric from the wetland.

l. Do not cut trees outside of the construction right-of-way to obtain timber for riprap or equipment mats.

m. Attempt to use no more than two layers of timber riprap to stabilize the right-of-way.

n. Remove all timber riprap, prefabricated equipment mats, geotextile fabric, and overlying gravel upon completion of construction.

3. Temporary Sediment Control

Install sediment barriers (as defined in section V.F.2.a. of the Plan) immediately after initial disturbance of the wetland or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench). Except as noted below in section VI.3.c., maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan.

a. Install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all wetland crossings, as necessary to prevent sediment flow into the wetland.

b. Where wetlands are adjacent to the construction right-of-way, install sediment barriers along the edge of the construction right-of-way as necessary to prevent sediment flow into the wetland.

c. Install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the right-of-way. Remove these sediment barriers during right-of-way cleanup.

4. Trench Dewatering

Dewater trench in such a manner that no heavily silt-laden water flows into any wetland or waterbody.

D. RESTORATION

1. Where the pipeline trench may drain a wetland, construct trench breakers and/or seal the trench bottom as necessary to maintain the original wetland hydrology.

2. For each wetland crossed, install a permanent slope breaker and a trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. Locate the trench breaker immediately upslope of the slope breaker.

3. Do not use fertilizer, lime, or mulch unless required in writing by the appropriate land management or state agency.

4. Consult with the appropriate land management or state agency and develop plans for active revegetation of wetlands affected by construction. The revegetation plans should include specifications for the planting of native wetland species. Provide these plans to the FERC staff upon request. In the absence of detailed revegetation plans or until the appropriate seeding season for permanent wetland vegetation, temporarily revegetate the right-of-way with annual ryegrass at a rate of 40 pounds/acre, unless standing water is present.

5. For all forested wetlands affected:

   a. plant native trees to ultimately restore the temporary right-of-way and the non-maintained portion of the permanent right-of-way to its preconstruction state;

   b. plant native shrub and herbaceous species to revegetate the 30-foot-wide portion of the permanent right-of-way selectively maintained as described in section VI.E.1.; and

   c. consult with the U.S. Fish and Wildlife Service, the EPA, the COE, and the appropriate state agency to determine the density for planting the native trees and shrubs.

6. Ensure that all disturbed areas permanently revegetate with native wetland herbaceous and/or woody plant species.

7. Develop specific procedures in coordination with the appropriate land management or state agency, where necessary, to prevent the invasion or spread of undesirable exotic vegetation (such as purple loosestrife and phragmites).

8. Remove temporary sediment barriers located at the boundary between wetland and adjacent upland areas after upland revegetation and stabilization of adjacent upland areas are judged to be successful as specified in section VIII.A.6. of the Plan.

E. POST-CONSTRUCTION MAINTENANCE

1. Do not conduct vegetation maintenance over the full width of the permanent right-of-way in wetlands. However, to facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be maintained in a herbaceous state. In addition, trees within 15 feet of the pipeline that are greater than 15 feet in height may be selectively cut and removed from the right-of-way.

2. Do not use herbicides or pesticides in or within 100 feet of a wetland, except as specified by the appropriate land management agency or state agency.

3. Monitor the success of wetland revegetation annually for the first 3 to 5 years after construction. Revegetation should be considered successful if the cover of native herbaceous and/or woody species is at least 80 percent of the total area, and the diversity of native species is at least 50 percent of the diversity originally found in the wetland. If revegetation is not successful at the end of 3 years, develop and implement (in consultation with a professional wetland ecologist) a remedial revegetation plan to actively revegetate the wetland with native wetland herbaceous and woody plant species. Continue revegetation efforts until wetland revegetation is successful.

VII. HYDROSTATIC TESTING

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply for state-issued withdrawal permits, as required.

2. Apply for National Pollutant Discharge Elimination System (NPDES) or state-issued discharge permits, as required.

3. Notify appropriate state agencies of intent to use specific sources at least 48 hours before testing activities unless they waive this requirement in writing.

B. GENERAL

1. Perform 100 percent radiographic inspection of all pipeline section welds or hydrotest the pipeline sections, before installation under waterbodies or wetlands.

2. If pumps used for hydrostatic testing are within 100 feet of any waterbody or wetlands, address the operation and refueling of these pumps in the SPCC Plan prepared as described in section IV.A.

3. The project sponsor shall file with the Secretary before construction a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location.

C. INTAKE SOURCE AND RATE

1. Screen the intake hose to prevent entrainment of fish.

2. Do not use state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate Federal, state, and/or local permitting agencies grant written permission.

3. Maintain adequate flow rates to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

APPENDIX C

FINAL NOISE TECHNICAL REPORT

CH2MHILL

Final Noise Technical Report
for the

NORTHWEST REGIONAL POWER FACILITY

Creston, Washington

Prepared for
ENSR Consulting and Engineering
CSW Energy, Inc.
KVA Resources, Inc.

November 1994
(Revised May 1995)
(Revised September 1995)

EXHIBIT
RW-2

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Introduction

This technical report summarizes the results of the noise analysis conducted by CH2M HILL to determine the impacts that a natural gas powered generating facility would have on the noise environment in Creston, Washington, and surrounding areas. This study includes a review of applicable noise regulations, measurement of existing noise levels near the two proposed sites (including nearby residential areas), and projection of the potential noise level increase.

Noise Measurement Methodology

Noise level measurements and projections in this study are based on a methodology that simulates noise as perceived by the human ear. Because the human ear is more sensitive to midrange frequencies than to higher and lower frequencies, environmental noise is measured using the A-weighted sound level scale. The A-weighted scale uses units of decibels, denoted as dBA. Noise levels stated in dBA approximate the response of the human ear by filtering out the high and low frequencies in a manner similar to that occurring in the human ear.

A 10-dBA change in noise levels is judged by most people to be approximately a twofold change in loudness (e.g., an increase from 50 dBA to 60 dBA causes the perceived loudness to double). A 3-dBA increase is barely perceptible. Increases in average or cumulative noise levels of 5 dBA or more are clearly noticeable. Table 1 presents sound levels for some common noise sources. A technical summary of characteristics of noise and definitions of various noise levels descriptors are included in Appendix B titled "Background Noise Information." A complete listing of references used in this report is located in Appendix A.

Health Effects of Noise

Noise may have a variety of consequences for the physical health of human beings. Auditory effects of noise include hearing loss and interference with communication. Non-auditory effects include physiological reactions and interference with sleep.

Hearing loss may be either temporary or permanent. Temporary loss, attributable to fatigue of the inner ear, can occur after brief exposure to high noise levels, or after longer exposure to more moderate levels. Often this temporary decrease in hearing loss is accompanied by ringing or buzzing sensations in the ears. Continued exposure to levels sufficient to cause temporary hearing impairment can, over a period of time, result in damage to the inner ear that is permanent. Permanent hearing loss cannot be restored, either through medical treatment or hearing aids.

Hearing loss resulting from noise is referred to as a "noise-induced threshold shift." It usually first affects those frequencies necessary to hear and understand speech communication. Noise-induced permanent threshold shift is related to the intensity, duration, and frequency content of

Table 1

Sound Levels and Relative Loudness of Typical Noises in Indoor and Outdoor Environments

Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (human judgment of different sound levels)
Jet aircraft takeoff from carrier (50 ft)	140	Threshold of pain	64 times as loud
50 hp siren (100 ft)	130		32 times as loud
Jet takeoff (200 ft)	120	Uncomfortably loud	16 times as loud
Riveting machine	110		8 times as loud
Jet takeoff (2000 ft)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 ft)	90		2 times as loud
Pneumatic drill (50 ft), garbage disposal, or food blender	80	Moderately loud	Reference loudness
Vacuum cleaner (10 ft) or passenger car at 65 mph (25 ft)	70		1/2 as loud
Large store air conditioning unit (20 ft)	60		1/4 as loud
Light auto traffic (100 ft)	50	Quiet	1/8 as loud
Bedroom/living room or bird calls	40		1/16 as loud
Library, soft whisper (15 ft)	30	Very quiet	
Broadcasting studio	20		
	10	Just audible	
	0	Threshold of hearing	

Source: Noise and Vibration Control, Leo L. Beranek, 1988.

noise exposure. From extensive studies of industrial noise, it has been found that 8-hour exposure to continuous noise levels below approximately 80 dB does not cause significant permanent threshold shift.

Communication interference is one of the primary concerns in environmental noise problems. Communication interference includes speech interference and activities such as watching television. Normal conversational speech is in the range of 60 to 65 dBA and any noise in this range or louder may interfere with speech.

In addition to auditory effects, a number of other physiological responses to noise have been documented. These physiological responses are those measurable effects of noise on people which are realized as changes in the pulse rate, blood pressure, etc. and are usually termed "stress" reactions. While such effects can be induced and observed, the extent is not known to which these cause harm or are a sign of harm. Generally, physiological responses are a reaction to a loud short term noise such as a rifle shot or a very loud jet overflight.

Stress reactions have not been observed at noise levels below that at which hearing loss can occur; the threshold of this stress effect seems to be 70-80 dBA. Therefore, if people are protected from noise exposures capable of causing hearing loss, it is believed they will also be protected from the experience of any noise-induced non-auditory disease.

It is evident that noise interferes with sleep. In addition to awakening a person, or preventing the person from falling asleep, noise can shift the stage of sleep from a deep, restful stage to a lighter one. In laboratory tests this is observed as a change in brain-wave pattern of a sleeping subject. The significance of these shifts in stage of sleep to a person's long term well-being has not been established.

A number of factors influence the degree to which noise may interfere with sleep. Impulsive or fluctuating noise is more disruptive than steady-state noise. Familiarity with the noise may reduce its ability to awaken, but there is no clear evidence that the quality of sleep is unaffected. Noise which has some information value is more likely to wake a person. In addition, the ability of noise to disrupt sleep is related to age. Elderly persons are much more easily awakened by noise than younger groups, and once awakened find it more difficult to return to sleep.

Proposed Generating Station Operations

The proposed plant will be a natural gas-fired combined-cycle generation facility located near Creston, Washington. Two alternative site locations are being considered: (1) the Northwest Regional Power Facility (NRPF) and (2) the Sinking Creek Site. (See Figure 1: Site Location Map). The project is designed as a standard block consisting of four General Electric Company (GE) MS7221FA combustion turbines, four heat recovery steam generators (HRSG), and two steam turbine generators.

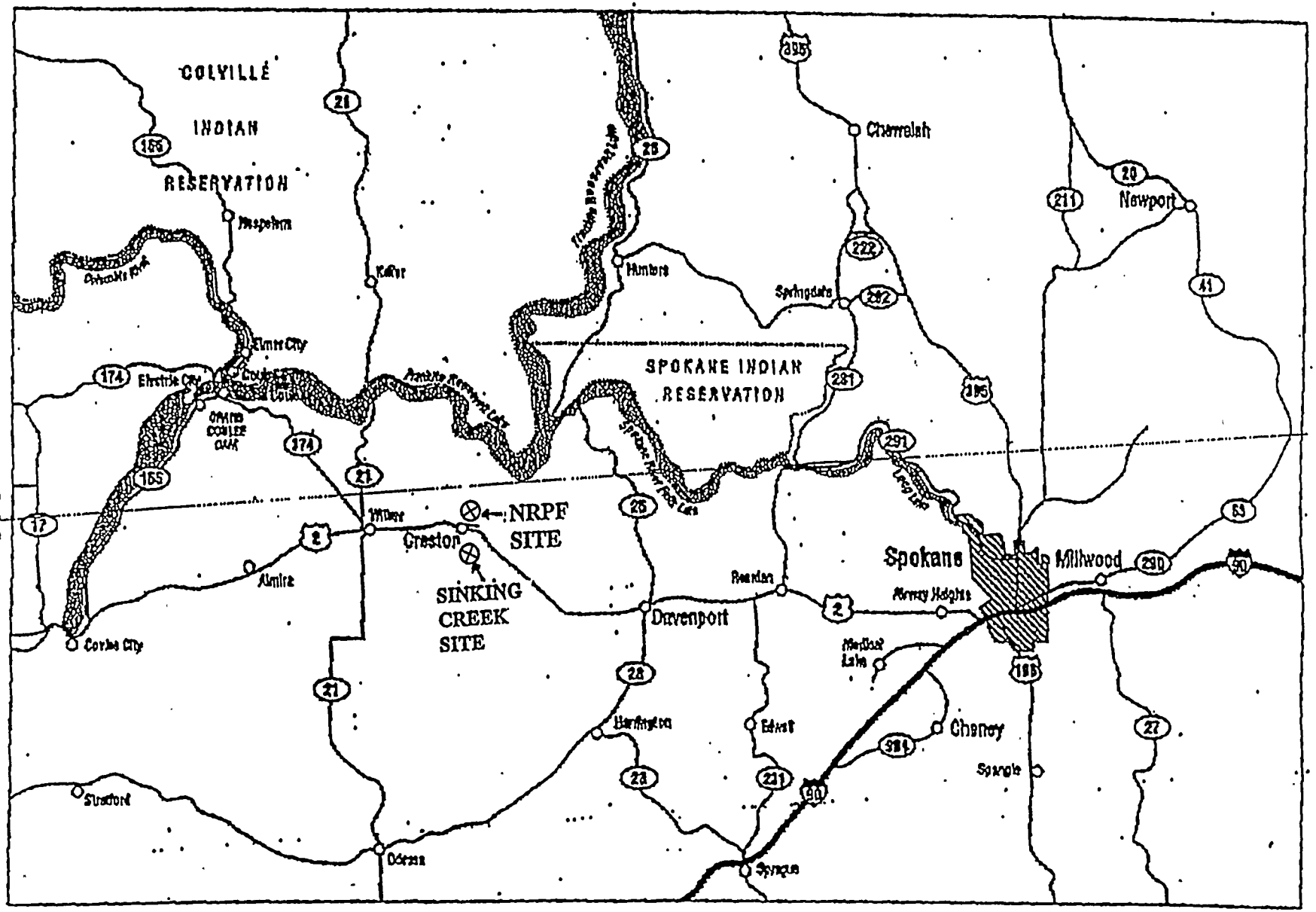


FIGURE 1
SITE LOCATION MAP
CH2MHILL

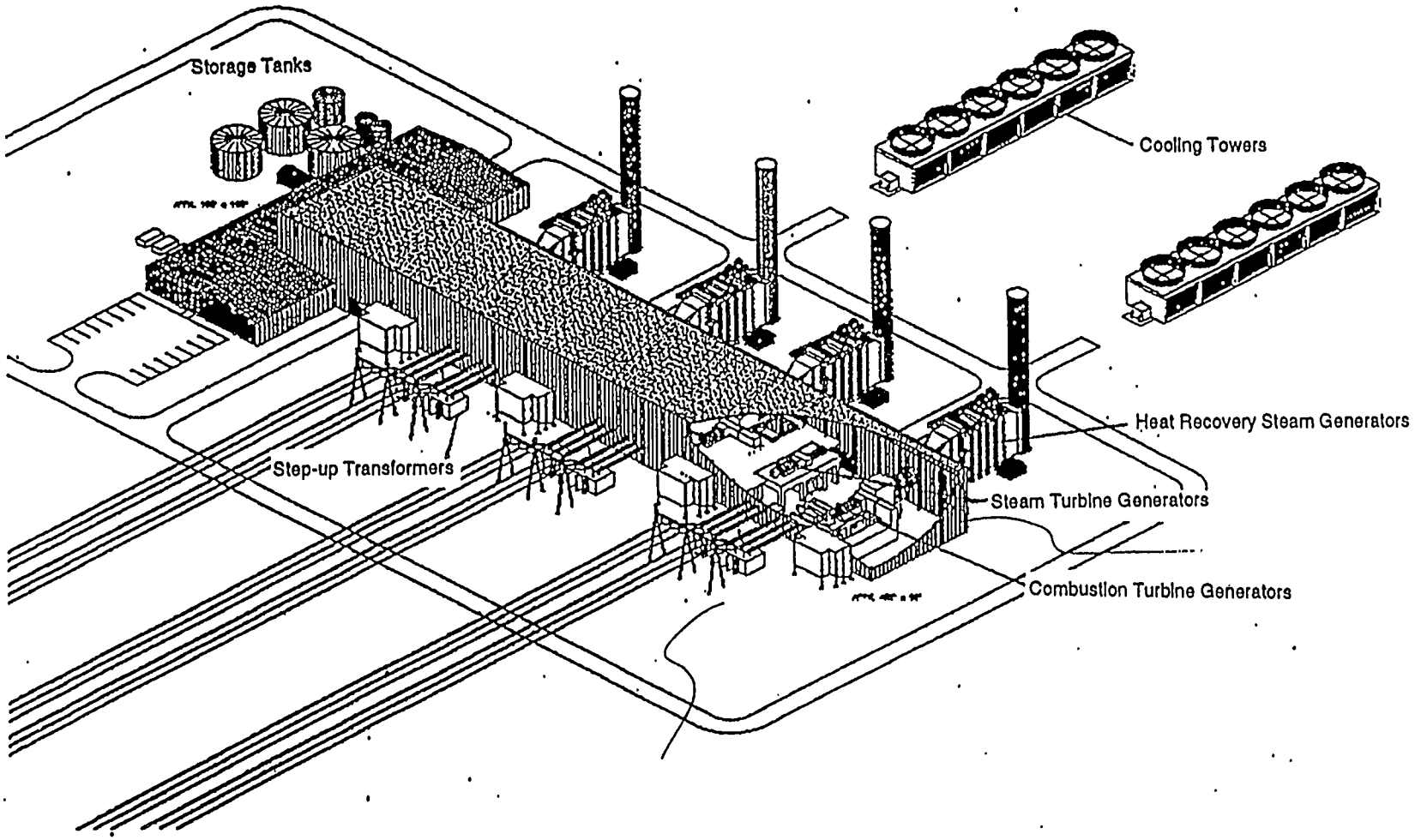


FIGURE 2
THREE DIMENSIONAL SITE LAYOUT

CH2MHILL

A general arrangement drawing for the conceptual 838 MW plant is shown in Figure 2. The major facilities and structures that will be provided include a main equipment building, a switching station, two aircooled condenser units, and several fenced evaporation ponds. Of primary concern with regard to noise is the main equipment building, which will include the Turbine-Generator/Control Building and the two aircooled condenser units. The Turbine-Generator/Control Building will be a multi-story structure that will house the turbine-generators and auxiliary equipment, control room, control equipment room, electrical switchgear, battery and uninterruptable power supply (UPS) equipment. The upper floor will include the major equipment operating level and the main control room. The lower floor will house auxiliary mechanical systems and electrical equipment, including switchgear, secondary unit substations, motor control centers, battery and battery chargers, inverter, and panels.

Applicable Regulations

Noise level criteria that would apply to this project are described in this subsection.

Construction and Operation Noise Regulations

Washington Administrative Code

Noise sources and their impacts in Lincoln County and the City of Creston are governed by Chapter 173-60 of the Washington Administrative Code (WAC), which sets maximum permissible environmental noise levels that cannot be exceeded in any 1-hour period. The maximum noise levels are different for the various classifications of receiving property (e.g., residential) and the noise source (e.g., industrial). The classification system is called the Environmental Designation for Noise Abatement (EDNA) and is generally based on a property's use. The maximum noise source in each EDNA in relation to a receiving property of each EDNA is shown in Table 2. Noise limits apply at the property line.

Table 2
Noise Limitations

EDNA of Noise Source	EDNA of Receiving Property		
	Class A	**Class B**	**Class C**
Class A (residential)	55 dBA	57 dBA	60 dBA
Class B (commercial)	57 dBA	60 dBA	65 dBA
Class C (industrial)	60 dBA	65 dBA	70 dBA

Source: WAC 173-60

Between 10 p.m. and 7 a.m., the noise limitations in Table 2 are reduced by 10 dBA for the receiving properties that are Class A EDNA. The WAC noise regulations allow the maximum permissible sound levels to be exceeded during any sound that is of short duration. The noise levels indicated in Table 2, including the nighttime restrictions, may be exceeded for any receiving property during any 1-hour period by 15 dBA for a total of 1.5 minutes, by 10 dBA for a total of 5 minutes, and by 5 dBA for a total of 15 minutes.

The noise limitations shown in Table 2, along with the exceedance limitations, can be interpreted in terms of statistical noise descriptors. The noise levels that are exceeded 1.5, 5, and 15 minutes in an hour are designated as $L_{2.5}$, $L_{8.3}$, and L_{25} statistical levels, respectively. The L_x refers to the percentage of time the noise level is exceeded. For example, if noise levels are 60 dBA or higher for 15 minutes (25 percent of 1 hour), the noise conditions would be characterized as having an L_{25} equal to 60 dBA. Table 3 summarizes the exceedance limitations in terms of statistical noise descriptors for a Class C EDNA (industrial) with impacts on a Class A EDNA (residential). These limits are of particular interest for evaluating the noise impacts of the NRPF (Class C) on nearby residential receptors (Class A).

Table 3
Exceedence Limitations
Class C EDNA with Impacts on a Class A EDNA

EDNA of Noise Source	Class A EDNA of Receiving Property		
	L_{25}	$L_{8.3}$	$L_{2.5}$
Class C (industrial)	65 dBA	70 dBA	75 dBA
Source: WAC 173-60			

On site construction generated noise is exempt from 7 a.m. to 10 p.m. for Class A EDNA and at all times for Class B and C EDNA. If project construction occurs at night, noise levels measured from nearby residential receivers must meet the WAC nighttime noise regulations set forth in the preceding paragraphs.

Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) describes its recommendations for noise levels in *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (March 1974). On the basis of available evidence, the EPA has concluded that a 24-hour Energy Equivalent Sound Level (L_{eq}) of 70 dBA is the maximum exposure consistent with long-term protection against significant hearing loss at a frequency of 4,000 Hz. Since this frequency is within the most sensitive range of the ear, protection at 4,000 Hz insures that the entire frequency spectrum of human hearing would be protected from significant hearing loss. For normal conversation in a residential area, an outdoor L_{eq} of 55 dBA has been identified with an indoor L_{eq} of 45 dBA.

Because of the number of variables involved, it has been difficult to establish a quantitative relationship between noise exposure and sleep interference. This seems to be largely dependent on the type of noise. A constant noise source with no substantially higher instantaneous peak noise levels is much more conducive to sleep that a lower noise level with occasional piercing noise. In light of present knowledge, however, researchers recommend that noise levels inside dwellings not exceed 30-47 dBA for satisfactory sleeping conditions.

By EPA standards, changes of less than 5 dBA to a noise level are generally not considered to be noticeable. A standard reduction of 15 dBA is applied to outdoor sound levels to arrive at the interior sound level. This is due to attenuation of noise by the typical structure.

Traffic Noise Regulations

Motor vehicles are required to comply with the EPA and WAC limitations for individual vehicles. Traffic noise generated within the project site boundaries would be required to comply with the WAC noise regulations. However, motor vehicle noise on public roadways is exempt from the maximum noise level regulations.

Existing Noise Conditions

Existing noise levels were recorded at nine sites, designated M1 through M9 on Figure 3, near the two alternative project locations. The sites were monitored using a Bruel and Kjaer 2231 Type 1 Sound Level Meter and 4230 Bruel and Kjaer Calibrator. As shown in Figure 1, the preferred site (NRPF) is located north of Creston, while the other (Sinking Creek Site) is located south of Creston. Photographs of each monitoring location are shown in Appendix C and descriptions of the monitoring locations are listed below. Measurement procedures complied with the American National Standards Institute (ANSI) S1.13-1971.

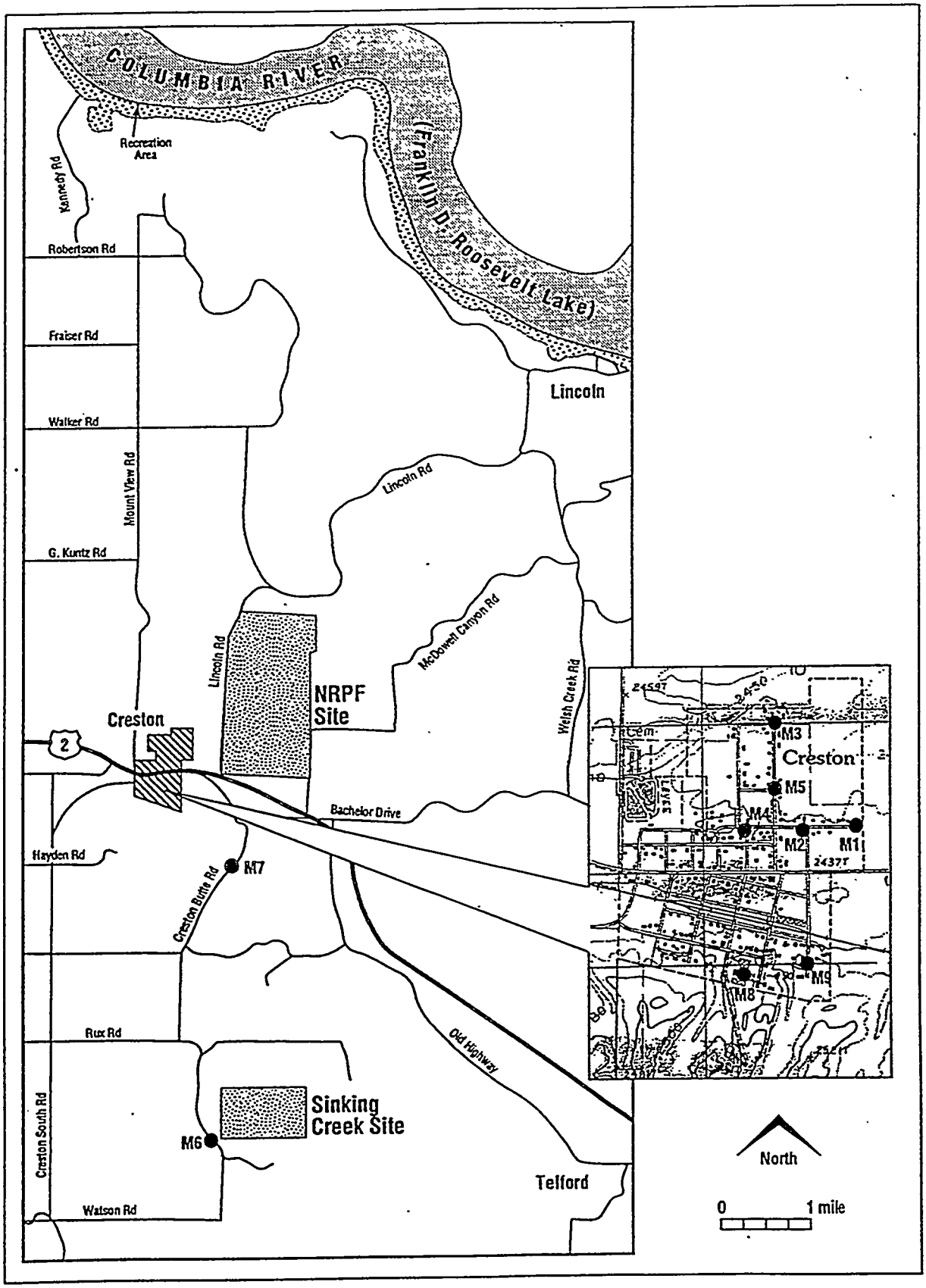
- Site M1 is at the east end of Foster Street near a residential home, approximately 5,280 feet (1 mile) from the proposed NRPF facility north of the City of Creston.

- Site M2 is a residential home at 250 NE on Foster Street, approximately 5,591 feet (1.06 miles) from the proposed NRPF facility north of the City of Creston.

- Site M3 is at the north end of E Street near a residential home, approximately 4,969 feet (0.94 miles) from the proposed NRPF site north of the City of Creston.

- Site M4 is near the northeast corner of the Creston Community Church at the corner of Creston Avenue and Foster Street, approximately 6,005 feet (1.14 miles) from the proposed NRPF site north of the City of Creston. This location is partially shielded by two homes on E Street, but a direct line-of-sight exists between the proposed NRPF and the Creston Community Church between the two homes.

- Site M5 is located on E Street between two residential homes, 540 NE and 410 NE, approximately 5,487 feet (1.04 miles) from the proposed NRPF facility north of the City of Creston.



NPE96089.NB • Noise Monitoring Locations

FIGURE 3
Noise Monitoring Locations

- Site M6 is located near the south side of the proposed Sinking Creek facility south of the City of Creston approximately 3,624 (0.7 miles) feet from the proposed Sinking Creek facility.

- Site M7 is located near a residential home (the Rosman residence), which is near Green Lake and outside the City of Creston, approximately 12,113 feet (2.3 miles) from the proposed Sinking Creek facility south of the City of Creston.

- Site M8 is located near the southwest corner of Creston School on a gravel parking area with a line-of-sight blocked by rolling hills but in the direction of the proposed Sinking Creek facility south of the City of Creston, approximately 17,794 feet (3.37 miles) from the Sinking Creek facility.

- Site M9 is located near several residential homes at the corner of S. First Street and F Street, approximately 17,477 feet (3.31 miles) from the proposed Sinking Creek facility south of the City of Creston.

Noise levels were recorded at Sites M1 through M9 between 7 a.m. and 10 p.m., as well as between 10 p.m. and 7 a.m. The current noise environment in the City of Creston and surrounding areas includes vehicular traffic on Highway 2, local traffic, domestic dogs, and birds. The majority of the noise is generated by Highway 2 which divides the town in half. A railroad line also travels through the town, but no trains passbys were observed during the measurement periods. Table 4 gives the results of the noise level monitoring. L_{90} is used for determining background noise levels at the site.

All existing ambient noise levels were below the maximum noise limits set forth in Chapter 173-60 of the WAC.

Impacts

The projected noise levels are based on the proposed building design, the site layout, and a preliminary list of equipment expected to be incorporated into the facility. The most significant steady noise sources are the four proposed General Electric (GE) model 7FA combustion turbines, the two steam turbine-generator units, and the two aircooled condensers units. Substantial noise levels may also be generated during two, infrequent plant processes: (1) combustion turbine startup, and (2) steam turbine trip (the venting of large amounts of steam).

Steady Noise Sources

The facility would operate 24-hours per day, 7 days per week. Noise source characteristics for the combustion turbines were collected from the GE America's Commercial Support Team in Schenectady, New York. Appended to this report is the letter from GE proposal manager, David W. Johnson, which outlines the data used in this analysis (Appendix D). Information on other noise

Table 4
Noise Monitoring Results (dBA)
August 16-17, 1994

Site	Start Time	End Time	L_{eq}	L_{90}	L_{25}	$L_{8.3}$	$L_{2.5}$	WAC EDNA Limits	Dominant Noise Source(s) During Measurement Period[1]
NRPF Facility Receiver Locations									
M1	10:08 a.m.	10:23 a.m.	43	35	44	47	50	60	Traffic on Highway 2, local activity (e.g., birds, children, dogs, etc.)
	3:12 a.m.	3:22 a.m.	33	29	35	36	38	50	Almost no traffic on Highway 2
M2[2]	10:40 a.m.	10:55 a.m.	43	38	44	47	49	60	Traffic on Highway 2, local activity (e.g., birds, children, dogs, etc.)
M3	11:31 a.m.	11:46 a.m.	46	37	43	50	55	60	Traffic on Highway 2, rainbow sprinkler, local activity (e.g., birds, children, dogs, etc.)
	4:08 a.m.	4:13 a.m.	35	29	35	39	42	50	Almost no traffic on Highway 2, rainbow sprinkler
M4	12:05 p.m.	12:20 p.m.	44	37	45	47	49	60	Traffic on Highway 2, rotating sprinkler, local activity (e.g., birds, children, dogs, etc.)
	4:23 a.m.	4:28 a.m.	37	31	39	41	43	50	No traffic on Highway 2, rotating sprinkler
M5	12:43 p.m.	12:58 p.m.	45	37	44	47	51	60	Traffic on Highway 2, leaves rustling, local activity (e.g., birds, children, dogs, etc.)
	4:36 a.m.	4:41 a.m.	31	28	32	34	37	50	Almost no traffic on Highway 2
Sinking Creek Facility Receiver Locations									
M6[2]	3:42 p.m.	3:57 p.m.	41		41	46	49	60	Background country noise
M7	4:40 p.m.	4:50 p.m.	44	33	45	49	51	60	Background country noise
	11:25 p.m.	11:35 p.m.	25	22	25	27	29	50	Crickets
M8	5:05 p.m.	5:10 p.m.	44	33	43	47	51	60	Traffic on Highway 2, wind in the fields
	11:50 p.m.	12:00 a.m.	33	27	34	36	38	50	One car on a residential street at low speeds
M9	5:52 p.m.	6:02 p.m.	42	36	43	46	48	60	Traffic on Highway 2, leaves rustling, local activity (e.g., birds, children, dogs, etc.)
	12:12 a.m.	12:22 a.m.	37	32	38	40	42	50	Leaves rustling

[1] Noise sources are listed in descending order of dominance.
[2] No nighttime measurements available for this Monitoring Location.

sources was obtained from standard acoustical engineering references and technical literature.

Noise levels were predicted for the receiver locations by the methods listed below:

1. Predicting the noise level due to each piece of equipment at the interior of the building wall. This included the effect of any noise mitigation techniques used inside the building, such as adding noise absorptive material to the walls and ceiling.

2. Determining the noise transmission loss through the building walls.

3. Estimating the reduction of level as the noise traveled from the exterior of the wall to the receivers.

4. Calculating the noise levels at the inlet and exhaust locations; included were the effects of silencing and other mitigation. The noise level at the receivers was then determined through estimation of the reduction level as the noise traveled to the receiver.

Appended to this report are eleven computer spreadsheets that give the results of the calculations (Appendix E). Table 5 summarizes the results of the calculations. The existing noise levels listed in Table 5 are the day and night measurements recorded at each receiver. These two levels are indicative of the noise level range that could be expected at each location. The noise levels listed in the Total Projected Noise Level column reflect the sum of the existing and plant noise levels. Projected noise levels from the NPRF facility range from 10 to 13 dBA-L_{eq} below the WAC noise level limits and from 5 to 8 dBA-L_{eq} below EPA limits. For indoor levels 15 dBA is subtracted from the outdoor level (see Table 6). These levels are within the EPA recommendation of 30-47 dBA for nighttime sleeping conditions and the noise source is not disruptive due to its constant nature. Therefore, no adverse noise impact is expected from the operation of the proposed NRPF. Projected noise levels from the Sinking Creek facility range from 9 to 25 dBA-L_{eq} below the WAC noise level limits and from 4 to 20 dBA-L_{eq} below EPA limits. Sinking Creek facility levels are below the EPA recommendation of 30-47 dBA for nighttime sleeping conditions and the noise source is not disruptive due to its constant nature. Therefore, no adverse noise impact is expected from the operation of the Sinking Creek facility.

The facility generated noise level at the nearest NRPF site boundary, approximately 185 feet from the main equipment building, is estimated to be 70 dBA. Therefore, the 70 dBA WAC limit at the site boundary would be met. Facility noise levels at the property boundary of the Sinking Creek site is 67 dBA which also meets the 70 dBA WAC limit.

Other potential noise sources from the proposed power facility include in-well pumps at the well field site and an enclosed pump station along the Redwine Canyon Water Pipeline Corridor route (a pump station would not be required for the Cross-Country Water Pipeline Corridor). The in-well pumps will be underground and, therefore, no transmission of noise to sensitive areas is expected. The pump station noise will be mitigated by an enclosing structure. In sum, neither are expected to noticeably contribute to the surrounding noise level.

Monitoring Location	Exis			WAC EDNA Noise Limits[2]			
	L_{eq}	L_{25}		L_{eq}	L_{25}	$L_{8.3}$	$L_{2.5}$
1	33-43	35-44		60	65	70	75
2[3]	43	44		60	65	70	75
3	35-46	35-43		60	65	70	75
4	37-44	36-45		60	65	70	75
5	31-45	32-44		60	65	70	75
6[3]	41	41		60	65	70	75
7	25-44	25-45		60	65	70	75
8	33-44	34-43		60	65	70	75
9	37-42	38-43		60	65	70	75

[1] Constant noise source contributes equally to the
[2] A 10 dBA reduction is applied to residential noi
[3] No nightime measurement available for Monitor

Table 6
Projected Nighttime Noise Levels
(dBA-L_{eq})

Monitoring Location	Total Projected Nighttime Outdoor Noise Level	Total Project Nighttime Indoor Noise Level[1]	EPA Recommended Noise Level for Sleeping
NRPF Facility Receiver Locations			
1	47	32	30 - 47
2[2]	--	--	30 - 47
3	48	33	30 - 47
4	47	32	30 - 47
5	47	32	30 - 47
Sinking Creek Facility Receiver Locations			
6[2]	--	--	30 - 47
7	35	20	30 - 47
8	35	20	30 - 47
9	38	23	30 - 47

[1] EPA attributes a decrease of 15 dBA to outdoor noise levels due to attenuation from the house structure.
[2] No nighttime noise measurement was available at this Monitoring Location.

Infrequent Noise Sources

The combustion turbine start-up would likely occur several times during the initial startup of plant operations and then become very infrequent as the plant attains normal operating conditions. The combustion turbine startup process occurs over a 20-minute to 30-minute period, and the sound pressure levels (SPLs) near the combustion turbines are in the 100+ dBA range. Table 7 gives the estimated noise levels generated by the startup of the combustion turbines.

The steam turbine trip venting is expected to occur a maximum of two to three times per year and would last 20 to 30 minutes. Maximum SPLs are estimated to reach 100 dBA near the steam vent. Table 7 shows the estimated SPLs at each receiver created during the activation of the steam turbine trip venting.

The worst-case scenario for the infrequent noise sources would be when the steam turbine trip venting and combustion turbine startup occur simultaneously. Table 7 lists the combined sources that reflect this scenario. Under this scenario, maximum noise levels are expected to reach 41 dBA at Receiver No. 6. Because these infrequent noise sources are likely to occur only a few times per year and because the maximum noise levels are 19 dBA less than the WAC maximum noise level limit (L_{max} of 60 dBA) no adverse impact is expected from the identified infrequent noise sources associated with the NRPF.

Table 7
Estimated Noise Levels Generated by the Most Significant Infrequent Noise Sources (dBA)

Receiver No.	SPL for Start-up of Combustion Turbine[1]	SPL for Steam Turbine Trip[2]	SPL for Combined Events[3]
NRPF Facility Receiver Locations			
1	35	35	38
2	34	34	37
3	35	35	38
4	33	33	36
5	34	34	37
Sinking Creek Facility Receiver Locations			
6	38	38	41
7	28	28	31
8	25	25	28
9	25	25	28

[1] Assumes 100 dBA at 3 feet during start-up period.
[2] Assumes 100 dBA at 3 feet for 20-30 minutes, 2-3 times per year for venting of steam.
[3] In the event that start-up of combustion turbine and steam turbine trip occur at the same time.

Mitigation

Nighttime outdoor L_{eq} levels are estimated to range from 47 - 48 dBA at the nearest residential locations with the operation of the proposed NPRF power facility. According to the EPA, these levels are reduced by 15 dBA to obtain the indoor noise levels which would range from 32 - 33 dBA. With this reduction, the indoor noise level would be well within the EPA recommendation for levels consistent with sleep, 30 - 47 dBA. The noise source from the proposed power facility would also be a constant noise source which is less disruptive than a fluctuating noise source. Because the levels would be well below the EPA's recommended range and the WAC limits would also be met, no mitigation is recommended at this time. Similarly, the projected noise levels from the Sinking Creek facility satisfy both EPA and WAC requirements and, thus, no mitigation is recommended at this time.

To eliminate the potential for any increase in noise levels at nearby receivers, additional noise attenuation equipment could be added to the combustion turbine inlet and exhaust points. To satisfy the near field Occupational Safety and Health Act noise limits (i.e., worker noise level exposure inside the Turbine-Generator/Control Building), the General Electric (GE) MS7221FA 85 dBA near field package is recommended.

APPENDIX E

NOISE LEVEL PROJECTIONS

Receiver No. 1

NRPF SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 1

Noise Level Calculations 4780 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

NRPF SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 1

Noise Level Calculations 4780 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	4780	4780	4780	4780	4780	4780	4780	4780	4780	
Distance from Turbine Generator Building to Receiver (meters)	1457	1457	1457	1457	1457	1457	1457	1457	1457	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.7	4.1	7.3	14.6	40.8	40.8	
Package SPL of four GE 7FAs at Receiver	22	31	24	17	5	2	-4	-41	-40	
A-weighted Package SPL of four GE 7FAs at Receiver	-17	5	8	8	2	2	-3	-40	-41	13
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	4780	4780	4780	4780	4780	4780	4780	4780	4780	
Distance from turbine inlets to Receiver (meters)	1457	1457	1457	1457	1457	1457	1457	1457	1457	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.7	4.1	7.3	14.6	40.8	40.8	
Inlet SPL of four GE 7FAs at Receiver	35	34	27	28	23	14	5	-23	-28	
A-weighted Inlet SPL of four GE 7FAs at Receiver	-4	8	11	19	20	14	6	-22	-29	24
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	4780	4780	4780	4780	4780	4780	4780	4780	4780	
Distance from Exhaust to Receiver (meters)	1457	1457	1457	1457	1457	1457	1457	1457	1457	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.7	4.1	7.3	14.6	40.8	40.8	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	60	60	53	46	34	31	11	-36	-46	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	17	23	14	11	-13	-17	-32	-72	-69	25

NRPF SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 1

Noise Level Calculations 4780 Feet From Turbine Generator Building

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	60	60	53	46	35	31	12	-23	-28	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	17	23	16	20	20	14	7	-22	-29	27
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	4780	4780	4780	4780	4780	4780	4780	4780	4780	
Distance from Turbine Generator Building to Receiver (meters)	1457	1457	1457	1457	1457	1457	1457	1457	1457	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.7	4.1	7.3	14.6	40.8	40.8	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	27	33	30	20	7	-1	-16	-58	-53	
A-weighted SPL of two steam turbine-generator units at Receiver	-13	6	14	12	4	-1	-15	-57	-54	17

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 1

Noise Level Calculations 4780 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	4780	4780	4780	4780	4780	4780	4780	4780	4780	
Distance from ACCs to Receiver (meters)	1457	1457	1457	1457	1457	1457	1457	1457	1457	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.7	4.1	7.3	14.6	40.8	40.8	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	53	53	55	51	45	39	32	-4	-11	
A-weighted SPL of two ACCs at Receiver	14	27	39	43	42	39	34	-3	-12	47
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**19**	**29**	**39**	**43**	**42**	**39**	**34**	**-3**	**-12**	**47**

Receiver No. 2

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 2

Noise Level Calculations 5091 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_n	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 2

Noise Level Calculations 5091 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	5091	5091	5091	5091	5091	5091	5091	5091	5091	
Distance from Turbine Generator Building to Receiver (meters)	1552	1552	1552	1552	1552	1552	1552	1552	1552	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.9	4.3	7.8	15.5	43.5	43.5	
Package SPL of four GE 7FAs at Receiver	21	30	24	16	5	1	-6	-44	-43	
A-weighted Package SPL of four GE 7FAs at Receiver	-18	4	8	7	1	1	-4	-43	-45	12
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	5091	5091	5091	5091	5091	5091	5091	5091	5091	
Distance from turbine inlets to Receiver (meters)	1552	1552	1552	1552	1552	1552	1552	1552	1552	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.9	4.3	7.8	15.5	43.5	43.5	
Inlet SPL of four GE 7FAs at Receiver	35	34	26	27	23	13	3	-27	-32	
A-weighted Inlet SPL of four GE 7FAs at Receiver	-4	8	10	18	19	13	5	-26	-33	23
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	5091	5091	5091	5091	5091	5091	5091	5091	5091	
Distance from Exhaust to Receiver (meters)	1552	1552	1552	1552	1552	1552	1552	1552	1552	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.9	4.3	7.8	15.5	43.5	43.5	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	60	60	52	45	34	30	9	-40	-50	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	17	23	13	10	-14	-18	-33	-76	-73	24

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	60	60	52	45	34	30	10	-26	-31	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	**17**	**23**	**16**	**19**	**19**	**13**	**5**	**-25**	**-32**	**27**
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_n	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	5091	5091	5091	5091	5091	5091	5091	5091	5091	
Distance from Turbine Generator Building to Receiver (meters)	1552	1552	1552	1552	1552	1552	1552	1552	1552	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.9	4.3	7.8	15.5	43.5	43.5	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	26	32	30	20	6	-2	-18	-61	-56	
A-weighted SPL of two steam turbine-generator units at Receiver	**-13**	**6**	**13**	**11**	**3**	**-2**	**-17**	**-60**	**-57**	**16**

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 2

Noise Level Calculations 5091 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	5091	5091	5091	5091	5091	5091	5091	5091	5091	
Distance from ACCs to Receiver (meters)	1552	1552	1552	1552	1552	1552	1552	1552	1552	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.9	4.3	7.8	15.5	43.5	43.5	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	52	52	55	51	44	38	31	-7	-14	
A-weighted SPL of two ACCs at Receiver	13	26	39	42	41	38	32	-6	-16	46
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**18**	**28**	**39**	**42**	**41**	**38**	**32**	**-6**	**-15**	**46**

Receiver No. 3

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 3

Noise Level Calculations 4469 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 3

Noise Level Calculations 4469 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	4469	4469	4469	4469	4469	4469	4469	4469	4469	
Distance from Turbine Generator Building to Receiver (meters)	1363	1363	1363	1363	1363	1363	1363	1363	1363	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.5	1.6	3.8	6.8	13.6	38.2	38.2	
Package SPL of four GE 7FAs at Receiver	23	32	25	17	6	3	-3	-38	-37	
A-weighted Package SPL of four GE 7FAs at Receiver	-17	5	9	9	3	3	-1	-37	-38	14
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	4469	4469	4469	4469	4469	4469	4469	4469	4469	
Distance from turbine inlets to Receiver (meters)	1363	1363	1363	1363	1363	1363	1363	1363	1363	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.5	1.6	3.8	6.8	13.6	38.2	38.2	
Inlet SPL of four GE 7FAs at Receiver	36	35	28	28	24	15	6	-20	-25	
A-weighted Inlet SPL of four GE 7FAs at Receiver	-3	9	11	20	21	15	8	-19	-26	25
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	4469	4469	4469	4469	4469	4469	4469	4469	4469	
Distance from Exhaust to Receiver (meters)	1363	1363	1363	1363	1363	1363	1363	1363	1363	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.5	1.6	3.8	6.8	13.6	38.2	38.2	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	61	61	54	46	35	32	12	-33	-43	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	18	24	14	12	-12	-16	-30	-69	-66	25

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 3

Noise Level Calculations 4469 Feet From Turbine Generator Building

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	61	61	54	46	36	32	14	-20	-25	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	**18**	**24**	**17**	**21**	**21**	**16**	**8**	**-19**	**-26**	**28**
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	-5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	4469	4469	4469	4469	4469	4469	4469	4469	4469	
Distance from Turbine Generator Building to Receiver (meters)	1363	1363	1363	1363	1363	1363	1363	1363	1363	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.5	1.6	3.8	6.8	13.6	38.2	38.2	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	27	33	31	21	8	0	-15	-54	-49	
A-weighted SPL of two steam turbine-generator units at Receiver	**-12**	**7**	**15**	**13**	**5**	**0**	**-14**	**-53**	**-50**	**18**

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 3

Noise Level Calculations 4469 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	4469	4469	4469	4469	4469	4469	4469	4469	4469	
Distance from ACCs to Receiver (meters)	1363	1363	1363	1363	1363	1363	1363	1363	1363	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.5	1.6	3.8	6.8	13.6	38.2	38.2	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	54	54	56	52	46	40	34	-1	-8	
A-weighted SPL of two ACCs at Receiver	14	27	40	43	43	40	35	0	-9	48
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**19**	**29**	**40**	**43**	**43**	**40**	**35**	**0**	**-9**	**48**

Receiver No. 4

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 4

Noise Level Calculations 5505 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 4

Noise Level Calculations 5505 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	5505	5505	5505	5505	5505	5505	5505	5505	5505	
Distance from Turbine Generator Building to Receiver (meters)	1678	1678	1678	1678	1678	1678	1678	1678	1678	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.7	2.0	4.7	8.4	16.8	47.0	47.0	
Package SPL of four GE 7FAs at Receiver	21	30	23	15	4	0	-7	-49	-48	
A-weighted Package SPL of four GE 7FAs at Receiver	-19	4	7	7	0	0	-6	-48	-49	12
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	5505	5505	5505	5505	5505	5505	5505	5505	5505	
Distance from turbine inlets to Receiver (meters)	1678	1678	1678	1678	1678	1678	1678	1678	1678	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.7	2.0	4.7	8.4	16.8	47.0	47.0	
Inlet SPL of four GE 7FAs at Receiver	34	33	26	26	22	12	1	-31	-36	
A-weighted Inlet SPL of four GE 7FAs at Receiver	-5	7	9	18	18	12	3	-30	-37	22
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	5505	5505	5505	5505	5505	5505	5505	5505	5505	
Distance from Exhaust to Receiver (meters)	1678	1678	1678	1678	1678	1678	1678	1678	1678	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.7	2.0	4.7	8.4	16.8	47.0	47.0	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	59	59	52	44	33	29	7	-44	-54	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	16	22	12	10	-15	-19	-35	-80	-77	24

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	59	59	52	44	33	29	9	-30	-35	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	16	22	15	19	18	12	3	-30	-37	26
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_n	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft High (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	5505	5505	5505	5505	5505	5505	5505	5505	5505	
Distance from Turbine Generator Building to Receiver (meters)	1678	1678	1678	1678	1678	1678	1678	1678	1678	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.7	2.0	4.7	8.4	16.8	47.0	47.0	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	25	31	29	19	5	-3	-20	-65	-60	
A-weighted SPL of two steam turbine-generator units at Receiver	-14	5	13	10	2	-3	-19	-64	-61	15

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 4

Noise Level Calculations 5505 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	5505	5505	5505	5505	5505	5505	5505	5505	5505	
Distance from ACCs to Receiver (meters)	1678	1678	1678	1678	1678	1678	1678	1678	1678	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.7	2.0	4.7	8.4	16.8	47.0	47.0	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	52	52	54	50	43	36	29	-12	-19	
A-weighted SPL of two ACCs at Receiver	12	26	38	41	40	36	30	-11	-20	45
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**18**	**27**	**38**	**41**	**40**	**36**	**30**	**-11**	**-20**	**46**

Receiver No. 5

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 5

Noise Level Calculations 4987 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 5

Noise Level Calculations 4987 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	**91**
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	4987	4987	4987	4987	4987	4987	4987	4987	4987	
Distance from Turbine Generator Building to Receiver (meters)	1520	1520	1520	1520	1520	1520	1520	1520	1520	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.8	4.3	7.6	15.2	42.6	42.6	
Package SPL of four GE 7FAs at Receiver	22	31	24	16	5	2	-5	-43	-42	
A-weighted Package SPL of four GE 7FAs at Receiver	-18	4	8	8	2	2	-4	-42	-44	**13**
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	**44**
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	**50**
Distance from turbine inlets to Receiver (feet)	4987	4987	4987	4987	4987	4987	4987	4987	4987	
Distance from turbine inlets to Receiver (meters)	1520	1520	1520	1520	1520	1520	1520	1520	1520	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.8	4.3	7.6	15.2	42.6	42.6	
Inlet SPL of four GE 7FAs at Receiver	35	34	27	27	23	14	4	-25	-30	
A-weighted Inlet SPL of four GE 7FAs at Receiver	4	8	10	19	20	14	5	-24	-32	**23**
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	**62**
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	**68**
Distance from Exhaust to Receiver (feet)	4987	4987	4987	4987	4987	4987	4987	4987	4987	
Distance from Exhaust to Receiver (meters)	1520	1520	1520	1520	1520	1520	1520	1520	1520	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.8	4.3	7.6	15.2	42.6	42.6	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	60	60	53	45	34	31	10	-38	-48	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	17	23	13	11	-13	-17	-33	-74	-72	**24**

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 5

Noise Level Calculations 4987 Feet From Turbine Generator Building

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	60	60	53	45	34	31	11	-25	-30	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	17	23	16	20	20	14	6	-24	-31	27
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_n	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	4987	4987	4987	4987	4987	4987	4987	4987	4987	
Distance from Turbine Generator Building to Receiver (meters)	1520	1520	1520	1520	1520	1520	1520	1520	1520	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.8	4.3	7.6	15.2	42.6	42.6	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	26	32	30	20	7	-2	-17	-60	-55	
A-weighted SPL of two steam turbine-generator units at Receiver	-13	6	14	11	3	-2	-16	-59	-56	16

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Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 5

Noise Level Calculations 4987 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	4987	4987	4987	4987	4987	4987	4987	4987	4987	
Distance from ACCs to Receiver (meters)	1520	1520	1520	1520	1520	1520	1520	1520	1520	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.6	1.8	4.3	7.6	15.2	42.6	42.6	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	53	53	55	51	44	38	31	-6	-13	
A-weighted SPL of two ACCs at Receiver	13	26	39	42	41	38	33	-5	-15	47
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**18**	**28**	**39**	**42**	**41**	**38**	**33**	**-5**	**-14**	**47**

Receiver No. 6

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 6

Noise Level Calculations 3624 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
L										
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building										
Assuming Reverberant Field in Building.										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	63	63	55	49	38	35	18	-11	-16	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	20	26	19	23	24	19	13	-10	-17	30
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_o	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	3624	3624	3624	3624	3624	3624	3624	3624	3624	
Distance from Turbine Generator Building to Receiver (meters)	1105	1105	1105	1105	1105	1105	1105	1105	1105	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.4	1.3	3.1	5.5	11.0	30.9	30.9	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	29	35	33	23	10	3	-10	-45	-40	
A-weighted SPL of two steam turbine-generator units at Receiver	-10	9	17	15	7	3	-9	-44	-41	20

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 6

Noise Level Calculations 3624 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	3624	3624	3624	3624	3624	3624	3624	3624	3624	
Distance from ACCs to Receiver (meters)	1105	1105	1105	1105	1105	1105	1105	1105	1105	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.4	1.3	3.1	5.5	11.0	30.9	30.9	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	55	55	58	54	48	43	38	8	1	
A-weighted SPL of two ACCs at Receiver	16	29	42	46	45	43	40	9	0	51
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**21**	**31**	**42**	**46**	**45**	**43**	**40**	**9**	**0**	**51**

Receiver No. 7

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 7

Noise Level Calculations 12113 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 7

Noise Level Calculations 12113 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	12113	12113	12113	12113	12113	12113	12113	12113	12113	
Distance from Turbine Generator Building to Receiver (meters)	3693	3693	3693	3693	3693	3693	3693	3693	3693	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	1.5	4.4	10.3	18.5	36.9	103.4	103.4	
Package SPL of four GE 7FAs at Receiver	14	23	15	6	-9	-17	-34	-112	-111	
A-weighted Package SPL of four GE 7FAs at Receiver	-26	-3	-1	-3	-12	-17	-33	-111	-112	3
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	12113	12113	12113	12113	12113	12113	12113	12113	12113	
Distance from turbine inlets to Receiver (meters)	3693	3693	3693	3693	3693	3693	3693	3693	3693	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	1.5	4.4	10.3	18.5	36.9	103.4	103.4	
Inlet SPL of four GE 7FAs at Receiver	27	26	18	17	9	-5	-26	-94	-99	
A-weighted Inlet SPL of four GE 7FAs at Receiver	-12	0	2	8	6	-5	-24	-93	-100	11
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	12113	12113	12113	12113	12113	12113	12113	12113	12113	
Distance from Exhaust to Receiver (meters)	3693	3693	3693	3693	3693	3693	3693	3693	3693	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	1.5	4.4	10.3	18.5	36.9	103.4	103.4	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	52	52	44	35	20	12	-20	-107	-117	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	9	15	5	0	-27	-36	-62	-143	-140	17

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 7

Noise Level Calculations 12113 Feet From Turbine Generator Building

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	52	52	44	35	20	12	-18	-94	-99	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	9	15	7	9	6	-5	-24	-93	-100	18
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	12113	12113	12113	12113	12113	12113	12113	12113	12113	
Distance from Turbine Generator Building to Receiver (meters)	3693	3693	3693	3693	3693	3693	3693	3693	3693	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	1.5	4.4	10.3	18.5	36.9	103.4	103.4	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	19	25	21	10	-7	-20	-47	-128	-123	
A-weighted SPL of two steam turbine-generator units at Receiver	-21	-2	5	1	-10	-20	-46	-127	-124	7

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 7

Noise Level Calculations 12113 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	12113	12113	12113	12113	12113	12113	12113	12113	12113	
Distance from ACCs to Receiver (meters)	3693	3693	3693	3693	3693	3693	3693	3693	3693	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	1.5	4.4	10.3	18.5	36.9	103.4	103.4	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	45	45	46	41	31	19	2	-75	-82	
A-weighted SPL of two ACCs at Receiver	6	19	30	32	27	19	3	-74	-83	35
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**11**	**20**	**30**	**32**	**27**	**20**	**3**	**-74**	**-83**	**35**

Receiver No. 8

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 8

Noise Level Calculations 17794 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA (source: General Electric 9/21/94)										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_n	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 8

Nnise Level Calculations 17794 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	17794	17794	17794	17794	17794	17794	17794	17794	17794	
Distance from Turbine Generator Building to Receiver (meters)	5425	5425	5425	5425	5425	5425	5425	5425	5425	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.2	6.5	15.2	27.1	54.3	151.9	151.9	
Package SPL of four GE 7FAs at Receiver	11	20	11	1	-17	-29	-55	-164	-163	
A-weighted Package SPL of four GE 7FAs at Receiver	-29	-7	-5	-8	-20	-29	-54	-163	-164	-1
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	17794	17794	17794	17794	17794	17794	17794	17794	17794	
Distance from turbine inlets to Receiver (meters)	5425	5425	5425	5425	5425	5425	5425	5425	5425	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.2	6.5	15.2	27.1	54.3	151.9	151.9	
Inlet SPL of four GE 7FAs at Receiver	24	23	14	12	1	-17	-46	-146	-151	
A-weighted Inlet SPL of four GE 7FAs at Receiver	-15	-3	-2	3	-2	-17	-45	-145	-152	6
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	17794	17794	17794	17794	17794	17794	17794	17794	17794	
Distance from Exhaust to Receiver (meters)	5425	5425	5425	5425	5425	5425	5425	5425	5425	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.2	6.5	15.2	27.1	54.3	151.9	151.9	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	49	49	40	30	12	0	-40	-159	-169	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	6	12	1	-5	-35	-48	-83	-195	-192	13

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 8

Noise Level Calculations 17794 Feet From Turbine Generator Building

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	49	49	40	30	12	0	-39	-146	-151	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	6	12	3	4	-2	-17	-44	-145	-152	14
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	17794	17794	17794	17794	17794	17794	17794	17794	17794	
Distance from Turbine Generator Building to Receiver (meters)	5425	5425	5425	5425	5425	5425	5425	5425	5425	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.2	6.5	15.2	27.1	54.3	151.9	151.9	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	15	21	17	4	-15	-32	-67	-180	-175	
A-weighted SPL of two steam turbine-generator units at Receiver	-24	-5	1	-4	-19	-32	-66	-179	-176	3

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 8

Noise Level Calculations 17794 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	17794	17794	17794	17794	17794	17794	17794	17794	17794	
Distance from ACCs to Receiver (meters)	5425	5425	5425	5425	5425	5425	5425	5425	5425	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.2	6.5	15.2	27.1	54.3	151.9	151.9	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	42	42	42	35	22	7	-19	-127	-134	
A-weighted SPL of two ACCs at Receiver	2	15	26	27	19	7	-17	-126	-135	30
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**7**	**17**	**26**	**27**	**19**	**8**	**-17**	**-126**	**-135**	**30**

Receiver No. 9

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 9

Noise Level Calculations 17477 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_n	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 9

Noise Level Calculations 17477 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	17477	17477	17477	17477	17477	17477	17477	17477	17477	
Distance from Turbine Generator Building to Receiver (meters)	5328	5328	5328	5328	5328	5328	5328	5328	5328	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.1	6.4	14.9	26.6	53.3	149.2	149.2	
Package SPL of four GE 7FAs at Receiver	11	20	12	1	-17	-28	-54	-161	-160	
A-weighted Package SPL of four GE 7FAs at Receiver	-29	-6	-5	-8	-20	-28	-53	-160	-161	-1
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	17477	17477	17477	17477	17477	17477	17477	17477	17477	
Distance from turbine inlets to Receiver (meters)	5328	5328	5328	5328	5328	5328	5328	5328	5328	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.1	6.4	14.9	26.6	53.3	149.2	149.2	
Inlet SPL of four GE 7FAs at Receiver	24	23	14	12	1	-16	-45	-143	-148	
A-weighted Inlet SPL of four GE 7FAs at Receiver	-15	-3	-2	3	-2	-16	-44	-142	-149	6
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	17477	17477	17477	17477	17477	17477	17477	17477	17477	
Distance from Exhaust to Receiver (meters)	5328	5328	5328	5328	5328	5328	5328	5328	5328	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.1	6.4	14.9	26.6	53.3	149.2	149.2	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	49	49	40	30	12	1	-39	-156	-166	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	6	12	1	-5	-35	-47	-82	-192	-189	13

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	49	49	40	30	13	1	-38	-143	-148	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	6	12	3	4	-2	-16	-43	-142	-149	14
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	17477	17477	17477	17477	17477	17477	17477	17477	17477	
Distance from Turbine Generator Building to Receiver (meters)	5328	5328	5328	5328	5328	5328	5328	5328	5328	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.1	6.4	14.9	26.6	53.3	149.2	149.2	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	15	21	17	5	-15	-32	-66	-177	-172	
A-weighted SPL of two steam turbine-generator units at Receiver	-24	-5	1	-4	-18	-32	-65	-176	-173	3

SINKING CREEK SITE

Noise Level Estimate for Northwest Regional Power Facility at Receiver No. 9

Noise Level Calculations 17477 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	17477	17477	17477	17477	17477	17477	17477	17477	17477	
Distance from ACCs to Receiver (meters)	5328	5328	5328	5328	5328	5328	5328	5328	5328	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	2.1	6.4	14.9	26.6	53.3	149.2	149.2	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	42	42	43	35	23	8	-18	-124	-131	
A-weighted SPL of two ACCs at Receiver	2	16	27	27	20	8	-16	-123	-132	30
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**7**	**17**	**27**	**27**	**20**	**8**	**-16**	**-123**	**-132**	**30**

NRPF Property Boundary

NRPF SITE: PROPERTY BOUNDARY

Noise Level Estimate for Northwest Regional Power Facility at the Property Boundary

Noise Level Calculations 185 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

NRPF SITE: PROPERTY BOUNDARY

Noise Level Estimate for Northwest Regional Power Facility at the Property Boundary

Noise Level Calculations 185 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	185	185	185	185	185	185	185	185	185	
Distance from Turbine Generator Building to Receiver (meters)	56	56	56	56	56	56	56	56	56	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.0	0.1	0.2	0.3	0.6	1.6	1.6	
Package SPL of four GE 7FAs at Receiver	50	59	53	47	38	37	38	26	27	
A-weighted Package SPL of four GE 7FAs at Receiver	11	33	37	38	34	37	39	27	26	45
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	185	185	185	185	185	185	185	185	185	
Distance from turbine inlets to Receiver (meters)	56	56	56	56	56	56	56	56	56	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.0	0.1	0.2	0.3	0.6	1.6	1.6	
Inlet SPL of four GE 7FAs at Receiver	64	63	56	58	56	49	47	44	39	
A-weighted Inlet SPL of four GE 7FAs at Receiver	24	37	40	49	52	49	48	45	38	57
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	185	185	185	185	185	185	185	185	185	
Distance from Exhaust to Receiver (meters)	56	56	56	56	56	56	56	56	56	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.0	0.1	0.2	0.3	0.6	1.6	1.6	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	89	89	82	76	67	66	53	31	21	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	45	52	43	41	19	18	10	-5	-2	53

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	89	89	82	76	67	67	54	44	39	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	45	52	45	50	52	50	49	45	38	58
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	185	185	185	185	185	185	185	185	185	
Distance from Turbine Generator Building to Receiver (meters)	56	56	56	56	56	56	56	56	56	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.0	0.1	0.2	0.3	0.6	1.6	1.6	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	55	61	59	50	39	34	26	10	15	
A-weighted SPL of two steam turbine-generator units at Receiver	16	35	43	42	36	34	27	11	14	46

NRPF SITE: PROPERTY BOUNDARY

Noise Level Estimate for Northwest Regional Power Facility at the Property Boundary

Noise Level Calculations 185' Feet From Turbine Generator Building

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C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. March 1, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]

A-weighted noise level measured at 800 feet from one (1) Air cooled condenser unit	64
A-weighted noise level from two (2) ACCs at 800 feet based on measurement	67

To estimate aircooled condenser noise levels at the nearby property line (540 feet), the manufacturer's noise level measurements taken at 800 feet were used. This method should provide more accurate estimates at distances close to the units.

Composite Noise Levels from two air cooled condensers at Receiver

A-weighted noise level from two (2) ACCs at property line located 540 feet from center of air cooled condensers (based on measurement)	70

Noise Level Estimate for Northwest Regional Power Facility at Receiver	45	52	47	51	53	50	49	45	38	70

These levels do not include aircooled condensers...but this final calculation does

Sinking Creek Property Boundary

SINKING CREEK SITE: PROPERTY BOUNDARY

Noise Level Estimate for Northwest Regional Power Facility at the Property Boundary

Noise Level Calculations 800 Feet From Turbine Generator Building

Total noise level estimates are based on the following individual noise sources

(A) Four General Electric Type 7FA Combustion Turbines

(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters)

(C) Two Air Cooled Condensers (each with 24 fan drives)

Octave Band Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted
Sound Wavelength (feet)	35.81	17.90	9.02	4.51	2.26	1.13	0.56	0.28	0.14	
A-weighting (dB)	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
A) Free Field Reference Data for GE 7FA [source: General Electric 9/21/94]										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Package SPL of GE 7FA @400 Feet (122 meters)	55	64	58	55	53	54	60	56	46	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	60
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	16	38	42	46	50	54	61	57	45	64
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Package SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	61	70	64	61	59	60	66	62	52	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	66
Package A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	22	44	48	52	56	60	67	63	51	70
A1) Calculation of Combustion Turbine *Package* Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Package SPL of GE 7FA at inside building wall from 4 turbines (free field)	85.1	94.1	88.1	85.1	83.1	84.1	90.1	86.1	76.1	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (free field)	45.7	67.9	72.0	76.5	79.9	84.1	91.3	87.1	75.0	94
Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	110.6	119.6	113.6	110.6	108.6	109.6	115.6	111.6	101.6	
A-weighted Package Sound Power Level of GE 7FA at inside of building wall from 4 turbines	71.2	93.4	97.5	102.0	105.4	109.6	116.8	112.6	100.5	
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	86.3	95.3	89.3	85.8	83.7	84.8	90.8	86.8	76.8	
A-weighted Package SPL of GE 7FA at inside of building wall from 4 turbines (reverberation field)	46.9	69.1	73.2	77.2	80.5	84.8	92.0	87.8	75.7	94

SINKING CREEK SITE: PROPERTY BOUNDARY

Noise Level Estimate for Northwest Regional Power Facility at the Property Boundary

Noise Level Calculations 800 Feet From Turbine Generator Building

A2) Calculation of Combustion Turbine *Package* Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
Package SPL of GE 7FA at outside of building wall from 4 turbines	67	76	70	64	55	55	56	45	46	
A-weighted Package SPL of GE 7FA at outside of building wall from 4 turbines	28	50	54	55	52	55	57	46	45	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Package Sound Power Level of GE 7FA at outside of south building wall from 4 turbines	96	105	99	93	84	84	85	74	75	
A-weighted Package Sound Power Level of GE 7FA at outside of building wall from 4 turbines	57	79	83	84	81	84	86	75	74	91
A3) Calculation of Combustion Turbine *Package* Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	800	800	800	800	800	800	800	800	800	
Distance from Turbine Generator Building to Receiver (meters)	244	244	244	244	244	244	244	244	244	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.1	0.3	0.7	1.2	2.4	6.8	6.8	
Package SPL of four GE 7FAs at Receiver	38	47	40	34	24	24	24	8	9	
A-weighted Package SPL of four GE 7FAs at Receiver	-2	20	24	25	21	24	25	9	8	31
A4) Calculation of Combustion Turbine *Inlet* Noise Levels										
Inlet SPL of GE 7FA @400 Feet (122 meters)	51	50	43	45	43	37	35	33	28	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters)	12	24	27	36	40	37	36	34	27	44
Inlet SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	57	56	49	51	49	43	41	39	34	
Inlet A-weighted Noise of GE 7FA @400 Feet (122 meters) from 4 turbines	18	30	33	42	46	43	42	40	33	50
Distance from turbine inlets to Receiver (feet)	800	800	800	800	800	800	800	800	800	
Distance from turbine inlets to Receiver (meters)	244	244	244	244	244	244	244	244	244	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.1	0.3	0.7	1.2	2.4	6.8	6.8	
Inlet SPL of four GE 7FAs at Receiver	51	50	43	45	42	36	33	26	21	
A-weighted Inlet SPL of four GE 7FAs at Receiver	12	24	27	36	39	36	34	27	20	43
A5) Calculation of Combustion Turbine Exhaust Noise Levels										
Exhaust SPL of GE 7FA @400 Feet (122 meters)	76	76	69	63	54	54	41	20	10	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters)	37	50	53	54	51	54	42	21	9	62
Exhaust SPL of GE 7FA @400 Feet (122 meters) from 4 turbines	82	82	75	69	60	60	47	26	16	
Exhaust A-weighted Noise Level of GE 7FA @400 Feet (122 meters) from 4 turbines	43	56	59	60	57	60	48	27	15	68
Distance from Exhaust to Receiver (feet)	800	800	800	800	800	800	800	800	800	
Distance from Exhaust to Receiver (meters)	244	244	244	244	244	244	244	244	244	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.1	0.3	0.7	1.2	2.4	6.8	6.8	
Silencer DIL, Based on IAC MODEL 3 PS, +2000 fpm	-4.0	-11.0	-23.0	-26.0	-44.0	-48.0	-44.0	-37.0	-22.0	
Exhaust SPL of four GE 7FAs at Receiver	76	76	69	63	53	53	39	13	3	
A-weighted Exhaust SPL of four GE 7FAs at Receiver	33	39	30	28	6	5	-4	-23	-20	40

SINKING CREEK SITE: PROPERTY BOUNDARY

Noise Level Estimate for Northwest Regional Power Facility at the Property Boundary

Noise Level Calculations 800 Feet From Turbine Generator Building

Composite Noise Levels from four GE 7FAs at Receiver [Package + Inlet + Exhaust]										
Composite SPL of Four GE 7FAs at Receiver	76	76	69	63	54	53	40	26	22	
Composite A-weighted Noise Level of Four GE 7FAs at Receiver	33	39	32	37	39	36	34	27	20	45
(B) Two Steam Turbine-Generator Units (incl. turbines, generators, and shaft driven exciters) [source: Edison Electric Institute 1978 rev. 1984]										
Gross electrical generating rating of each unit, MWe (assumed)	120	120	120	120	120	120	120	120	120	
Octave band level adjustments per Table 4.14 EEI	9	3	5	10	14	18	21	29	35	
Sound power level of the two units, (dB) (see Table 4.3 EEI)	115.3	121.3	119.3	114.3	110.3	106.3	103.3	95.3	89.3	
A-weighted sound power level of the two units, (dBA)	75.9	95.1	103.2	105.7	107.1	106.3	104.5	96.3	88.2	113
B1) Calculation of Steam Turbine-Generator Noise Levels Inside Turbine Generator Building Assuming Reverberant Field in Building										
Distance from turbine center to wall, feet	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Distance from turbine center to wall, meters	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
SPL at inside building wall from 2 steam turbine-generator units (free field)	89.8	95.8	93.8	88.8	84.8	80.8	77.8	69.8	63.8	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (free field)	50.4	69.6	77.7	80.2	81.6	80.8	79.0	70.8	62.7	87
Directivity Factor, Q_θ	2	2	2	2	2	2	2	2	2	
Interior Surface Area of First floor of Building in (m^2) [50 ft high (2-story), 75 ft wide, and 400 ft. long]	7785	7785	7785	7785	7785	7785	7785	7785	7785	
Absorption Factor for R-11 and R-19 mounted on 24-gauge sheet metal walls and ceiling, respectively (see AVNC	0.61	0.61	0.61	1.10	1.20	1.11	1.08	1.09	1.09	
SPL at inside building wall from 2 steam turbine-generator units (reverberation field)	91.0	97.0	95.0	89.5	85.5	81.5	78.5	70.5	64.5	
A-weighted SPL at inside of building wall from 2 steam turbine-generator units (reverberation field)	51.6	70.8	78.9	80.9	82.3	81.5	79.7	71.5	63.4	88
B2) Calculation of Steam Turbine-Generator Noise Levels Outside Turbine Generator Building										
Transmission Loss Data for building walls (sheet metal, 24 gauge - see AVNC Tab 7)	13	13	13	16	23	24	29	36	25	
SPL at outside of building wall from 2 steam turbine-generator units	72	78	76	68	56	52	44	29	34	
A-weighted SPL at outside of building wall from 2 steam turbine-generator units	33	52	60	59	53	52	45	30	32	
Surface area of south building wall directed towards residences	793	793	793	793	793	793	793	793	793	
Sound Power Level at outside of south building wall from 4 turbines	101	107	105	97	85	80	73	58	63	
A-weighted Package Sound Power Level at outside of building wall from 2 steam turbine-generator units	62	81	89	88	82	80	74	59	61	93
B3) Calculation of Steam Turbine-Generator Noise Levels at Receiver										
Distance from Turbine Generator Building to Receiver (feet)	800	800	800	800	800	800	800	800	800	
Distance from Turbine Generator Building to Receiver (meters)	244	244	244	244	244	244	244	244	244	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.1	0.3	0.7	1.2	2.4	6.8	6.8	
Composite Noise Levels from two steam-generator units at Receiver [includes turbines, generators, and shaft-driven exciters]										
SPL of two steam turbine-generator units at Receiver	42	48	46	37	26	21	11	-8	-3	
A-weighted SPL of two steam turbine-generator units at Receiver	3	22	30	29	23	21	13	-7	-4	34

SINKING CREEK SITE: PROPERTY BOUNDARY

Noise Level Estimate for Northwest Regional Power Facility at the Property Boundary

Noise Level Calculations 800 Feet From Turbine Generator Building

C) Two Aircooled Condensers [source: Zurn Balacke-Durr, Inc. August 31, 1995 fax transmittal to Ms. Teresa Trotman/C&SW Energy]										
Sound power of one (1) air cooled condenser unit w/ 24 fan drives (ACC)	124.3	124.30	127.30	124.30	120.30	117.30	118.30	107.80	100.80	
Total sound power level for two (2) ACCs	127.3	127.3	130.3	127.3	123.3	120.3	121.3	110.8	103.8	
A-weighted sound power level from two (2) ACCs	87.9	101.1	114.2	118.7	120.1	120.3	122.5	111.8	102.7	127
Distance from ACCs to Receiver (feet)	800	800	800	800	800	800	800	800	800	
Distance from ACCs to Receiver (meters)	244	244	244	244	244	244	244	244	244	
Atmospheric Attenuation Coefficient (dB/100m or dB/328ft)	0.00	0.00	0.04	0.12	0.28	0.50	1.00	2.80	2.80	
Atmospheric Attn. (68deg F & 50% Humidity) (dB)	0.0	0.0	0.1	0.3	0.7	1.2	2.4	6.8	6.8	
Composite Noise Levels from two air cooled condensers at Receiver										
Total SPL of two ACCs at Receiver	69	69	71	68	64	60	60	45	38	
A-weighted SPL of two ACCs at Receiver	29	42	55	60	61	60	61	46	37	67
Noise Level Estimate for Northwest Regional Power Facility at Receiver	**34**	**44**	**55**	**60**	**61**	**60**	**61**	**46**	**37**	**67**

APPENDIX D

CULTURAL RESOURCES SURVEY OF THE BONNEVILLE POWER ADMINISTRATION'S MASTER GRID SUPPORT PROJECT, EASTERN WASHINGTON

Cultural Resources Survey of the Bonneville Power Administration's Master Grid Support Project, Eastern Washington

by Stan Gough

Principal Investigator: Jerry R. Galm

In Partial Fulfillment of Bonneville Power Administration Task Order: 94AT08064
Contract Number: 93AM60384

Short Report SR-509
Archaeological and Historical Services
Eastern Washington University

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Introduction

The results of an intensive cultural resources survey for the Bonneville Power Administration (BPA) Eastern Washington Main Grid Support Project are presented in this report. The project area extends from the Grand Coulee 500 kV and Left Bank switch yards (substations), north of the town of Grand Coulee, Washington, to the Bell Substation in Spokane, Washington, a distance of about 130 km (82 mi) (Figure 1). The survey was conducted by personnel from Archaeological and Historical Services (AHS) during two periods of fieldwork, one in November of 1993 and the second in March and April of 1994. Forty sites were identified within or adjacent to the project area.

Proposed Project Description

The BPA's proposed Main Grid Support Project, as planned at the time of the AHS cultural resources survey, was to include: 1) the removal of one or both of the wood structure Grand Coulee-Bell (GC-B) No. 1 and 2 transmission lines from towers 3/9 to the Bell Substation; 2) improvement of existing, and construction of some new, access roads; 3) expansion of the existing right-of-way in some segments; 4) possible construction of a series compensation station; and, 5) expansion of the Bell Substation.

Transmission line towers (structures) are numbered sequentially by mile from the beginning to the end points, so Grand Coulee-Bell No. 1, 5/6 refers to the fifth tower in the sixth mile of a transmission line that begins at the Grand Coulee Substation and ends at the Bell Substation. Note that tower numbers are sequential by mile, therefore individual tower numbers begin again with one at each mile change. Transmission line and tower designations are written in abbreviated form on the towers and the above example would appear something like GC-B 1 5/6. Throughout the report, reference is made to various transmission lines and site locations in relationship to specific towers.

A 500 kV steel, lattice structure transmission line is proposed for construction within the corridor vacated by the GC-B No. 1 transmission line from the GC-B tower 3/9 to the Bell Substation. From GC-B No. 1 tower 3/9 the proposed 500 kV transmission line would be located in new right-of-way for a distance of about 0.6 mi (1 km) to a point adjacent to, and east of, Grand Coulee-Hanford No. 1 tower 3/1. From this point, the proposed 500 kV transmission line would be located in a new right-of-way parallel and adjacent to the Grand Coulee-Hanford No. 1 transmission line to the Grand Coulee 500 kV Switchyard.

Most of the proposed construction work for the Main Grid Support Project is to occur within the Grand Coulee-Bell transmission line right-of-way which is 122 m (400 ft) wide and contains five transmission lines on four sets of structures. The single circuit 500 kV GC-B No. 5 transmission line is on a set of steel lattice structures on the outside edge of the right-of-way. Adjacent to this transmission line are the double circuit 230 kV GC-B No. 3 and 4 transmission lines which are also suspended from a single set of steel lattice towers. Adjacent to the GC-B No. 3 and 4 transmission lines is the GC-B No. 1 transmission line and next to it, on the other

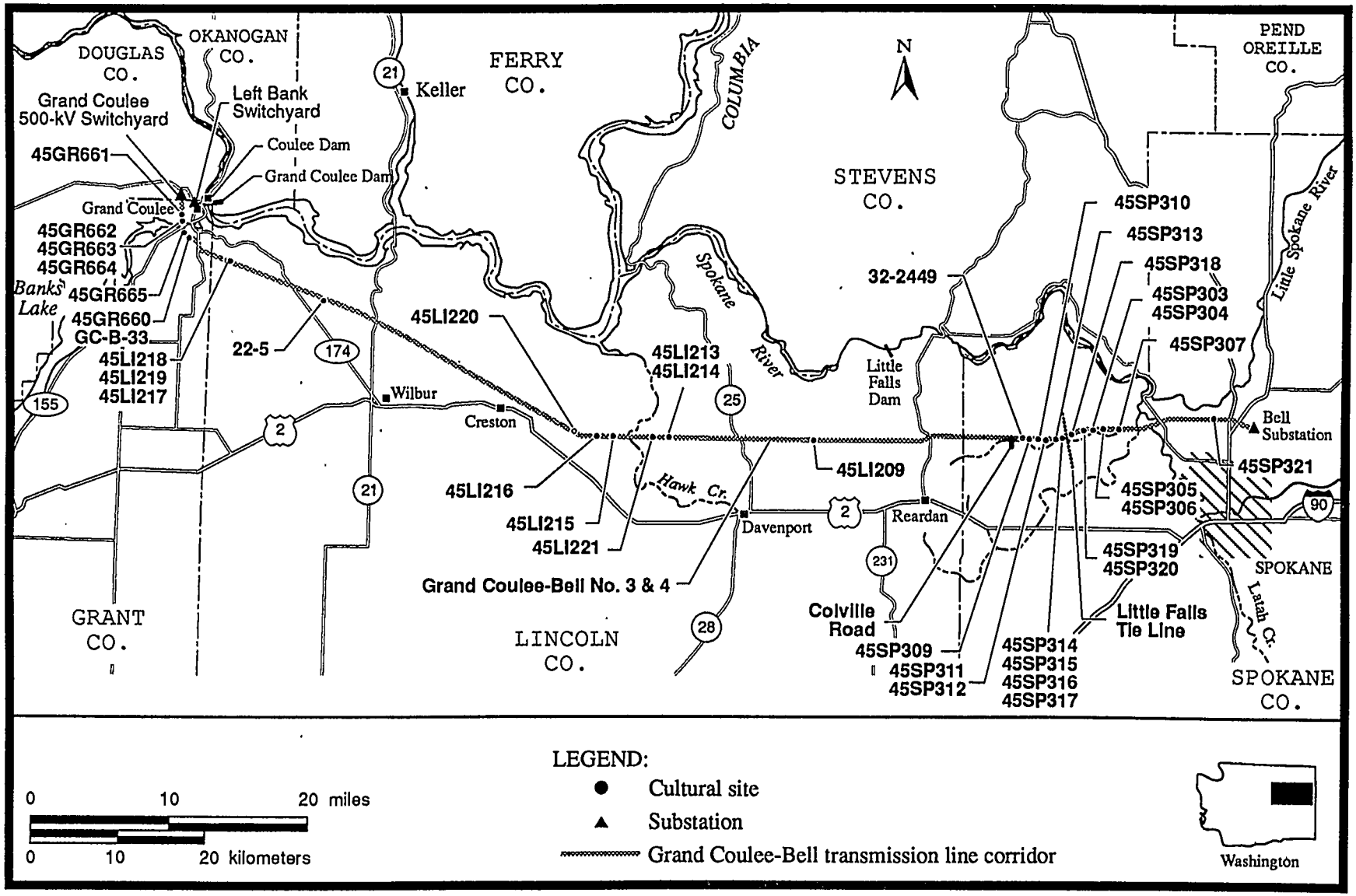

Figure 1. The Master Grid Support Project Area showing the locations of all identified cultural resource sites.

outside edge of the right-of-way, is the GC-B No. 2 transmission line. The 115 kV GC-B No. 1 and 2 transmission lines are each on a set of H-frame wood structures.

Project Area

The project area, for the purposes of this report, consists of all of the areas surveyed by AHS personnel. These ares are described in detail below. Portions of the project area are most easily described by refering to specific transmission lines and tower numbers. Bonneville Power Administration transmission lines are named for the substations at their begining and end points. Transmission lines in this project area begin at two Grand Coulee substations, the Left Bank Substation and the 500 kV Switchyard.

The areas surveyed consist of:

1) The entire 53-m-(175 ft)-wide corridor containing the GC-B No. 1 and 2 transmission lines extending from the Grand Coulee (Left Bank) Substation to the Bell Substation. This corridor was expanded by up to 23 m (75 ft) in width in some areas (Appendix A);
2) A 53-m-(175 ft)-wide corridor on the east side of the Grand Coulee-Hanford (GC-H) No. 1 transmission line from the Grand Coulee (500 kV Switchyard) to GC-H No. 1 tower 3/1;
3) A 53-m-(175 ft)-wide, 1 km (0.6 mi) long corridor from GC-H No. 1 tower 3/1 to GC-B No. 1 and 2 tower 3/9.
4) Three alternate locations for the proposed construction of a series compensation station adjacent to the transmission corridor. The three alternate locations are on the south side of, and adjacent to, the existing Grand Coulee-Bell transmission line right-of-way between GC-B No. 1 and 2 towers: 1) 37/5-37/6; 2) 38/3-38/4; and, 3) 45/5-45/6. An area measuring 183 m (600 ft) by 183 m (600 ft) was surveyed at each of the three alternate locations;
5) An expansion measuring 76 m by 91 m (250 ft by 300 ft) on the west side of the Bell Substation.
6) A 53-m-(175 ft)-wide corridor from the northeast corner of the Grand Coulee 500 kV Switchyard at a bearing of about 143 degrees true north, for a distance of about 812 m (2,664 ft); and,
7) Multiple 6-m-(20 ft)-wide rights-of-way for existing and proposed access roads.

Setting

The project area crosses parts of Douglas, Grant, Lincoln, and Spokane counties extending from west to east across the northern portion of the Columbia Plateau physiographic province. The northern Columbia Plateau is comprised of a thick sequence of predominantely Miocene flood basalts over crystalline basement rocks (Stradling and Kiver 1984; Baker et al. 1987). Numerous episodes of glacial lake-origin floodwaters swept across eastern Washington during the Pleistocene dramatically shaping the present landscape (Baker and Bunker 1985; McDonald and Busacca 1992). Loess accumulated to considerable depths in much of the project area during the Pleistocene and Holocene. Glacial floodwater differentially removed the loess

creating the distinctive mosaic of channeled scabland and loess-covered uplands that characterize the project area. Folsom (1984a:2) described the channeled scabland and the aeolian uplands.

> This [scabland] landscape is a rough and irregular terrain of water-scoured features including stripped basalt flow surfaces, vertical cliffs, plunge pools, and deep closed depressions. Local relief is not usually large, but topographic texture is very intensely detailed and irregular. There are many lakes but few streams.
>
> Aeolian uplands is a landscape of intermediate elevation lying below the mountain slopes and above the structural basins and river valleys. . . .This region is undistinguished by either great relief or by complex topographic texture, being a broad rolling plain or subdued hill country in most of its expression. An important characteristic is the wind-blown origin of most of the material of this landscape. This is a region of fine sands and silts. Very few streams originate in this landscape, and there are very few lakes.

Vegetation patterns in the project area are diverse and vary in relation to a number of factors including geology and soils. The project area has been broadly divided into two vegetation types, Columbia uplands threetip sage steppe and mixed conifer transitional woodland (Folsom 1984b). The majority of the project area is characterized by deep loessal soils and native vegetation belonged to the Columbia uplands threetip-sage steppe vegetation type. The channeled scabland areas of shallow rocky soils are where a variety of plants with edible roots are found. These edible roots were very important prehistorically and their collection and consumption still play an important role in Indian life. Euro-American settlers prized the areas of deep soils of the aeolian uplands for farming.

The project area has a semi-arid climate with winter maximum precipitation and dry summers. Annual average precipitation ranges from about 305 mm (12 in) at Grand Coulee, in the west, to 457 mm (18 in) near Spokane, in the east (Quinn 1984). Landform features exert strong influence on microclimates and local variations on many occaisions rival the total range of west to east regional gradients (Quinn 1984).

Ethnography

The project area is within the ethnographic territory of the Upper, Middle and Lower Spokane, as well as the Sanpoil and Nespelem Indians (Ray 1936). All of these Indian groups spoke closely-related dialects of the Salish language. The ethnographic yearly cycle of the Sanpoil and Nespelem is generally applicable to the Spokane Indians as well and the summary that follows is from Ray (1933).

Most of the people spent the winter months in groups of substantial houses in the the major river valleys. The winter homes were abandoned late in the season in favor of nearby temporary camps offering access to the first green plants. Spring was the time of year when large quantities of edible roots were gathered for immediate consumption as well as for preservation, storage, and use throughout the coming year. About the month of April or:

> ..."time that the leaves come out," there was a general removal from the Columbia to the root digging grounds on the plains south of the river. . . .Village groups did not move in a body across the river but bands formed of four or five families each and journeyed to their favorite spots. Each band before leaving notified the chief of its intended destination. . . .A whole year's supply of roots had to be gathered and dried. It was necessary to move camp often in order to be near fresh fields. [Ray 1933:27]

While root gathering and processing were the primary activities during the spring, some hunting was conducted from these camps. Summer was a time of concentrated salmon harvest and preservation. Fresh vegetable foods and raw materials including berries and roots were gathered whenever available throughout the growing season. During the fall, a variety of economic activities were conducted based upon a family's or individual's needs or preferences. These activities included deer hunting, fishing, berry and root collecting and, with the exception of fishing, were often conducted in mountainous regions. People who intended to spend the winter at one of the villages on the river returned around the middle of October and began preparing winter houses and materials for the coming season. Stored foods were moved to areas in proximity to the villages and a supply of firewood was gathered. A considerable portion of the winter months were spent making baskets, mats, clothing, and other items. Some hunting was conducted at this time. A period of great ceremony including a succession of dances to which people traveled from their winter homes, characterized the mid-winter months.

From the preceeding ethnographic summary, it appears the primary activity conducted in the project area would have been spring season root gathering and processing. It is likely that all portions of a group's territory was used to some extent throughout much of the year, however an idealized seasonal round can be formulated from the ethnographic information identifying where in the landscape late prehistoric people's activities were likely to have been concentrated at any one season. See Leeds et al. (1985) and Mierendorf et al. (1981) for additional details regarding ethnographic-based seasonal land use modeling for this region.

Previous Investigations

Previous cultural resources investigations in proximity to the project area have included overviews, surveys, test and data recovery excavations, and documentation of historic properties to Historic American Building Survey (HABS) and Historic American Engineering Record (HAER) standards. The cultural resources literature sources most relevant to this project are summarized below.

The greatest amount of regional archaeological research has been conducted along the Columbia and Spokane rivers. Much less work has been conducted in areas outside of the major eastern Washington river valleys. Cultural resources surveys include those of Boreson (1988; 1992) and Holstine (1984).

Summaries of archaeological research in eastern Washington include those in Galm et al. (1981), Mierendorf et al. (1981), and Draper and Andrefsky (1991). Numerous cultural resources surveys have been conducted near the project area resulting in the identification of a variety of site types. Relatively complete lists of these surveys can be found in Galm et al. (1981), Gough (1990), Mierendorf et al. (1981), and Draper and Andrefsky (1991).

Cultural resources survey and test excavations conducted near Creston, Washington about 2.5 km (1.6 mi) south of the project area, resulted in the identification of 71 prehistoric and 19 historic sites (Morgan et al. 1981). Talus pit sites were the most common prehistoric site type comprising 62 percent of the sample. Farmsteads/homesteads were the most prevalent historic site type (52 percent).

Excavations at prehistoric sites in the Columbia and Spokane river valleys resulted in the recovery of information from semi-permanent and temporary occupation sites. The discovery of the Ritchey-Roberts Clovis site near East Wenatchee confirmed human occupation of eastern Washington by ca. 11,200 yr B.P. (Mehringer and Foit 1990). Cultural chronologies have been developed as the result of excavations conducted in the Columbia and Snake river valleys (Figure 2). Details of the cultural chronologies have been modified by subsequent research in the river valleys and uplands (Chatters 1980; Galm et al. 1981).

Methodology

Inspection of the Office of Archaeology and Historic Preservation site files in Olympia, Washington and a literature search revealed that the Washington Water Power (WWP) Little Falls Tie Line intersects the proposed project area. The BPA GC-B No. 3 and 4 double circuit 230 kV transmission line is adjacent to the proposed project area. The first land survey maps prepared for the United States Surveyor's General indicate that the route of the historic Colville Road intersects the project area east of Reardan, Washington.

The cultural resources survey of the project area was conducted by three person crews. The surveyors walked parallel meandering transects within the 54-m-(175 ft)-wide corridor. In those portions of this corridor proposed for widening, the crew expanded spacing between individuals to cover the additional area (Appendix A). Where access roads were located within the survey corridor or within contiguous portions of the 122 m (400 ft) Grand Coulee-Bell right-of-way they were surveyed as part of the corridor survey. Access roads that extended outside of the Grand Coulee-Bell right-of-way were surveyed subsequent to completion of the corridor survey. As a three person crew came to one of the three possible locations for the proposed series compensation station, it was surveyed separately.

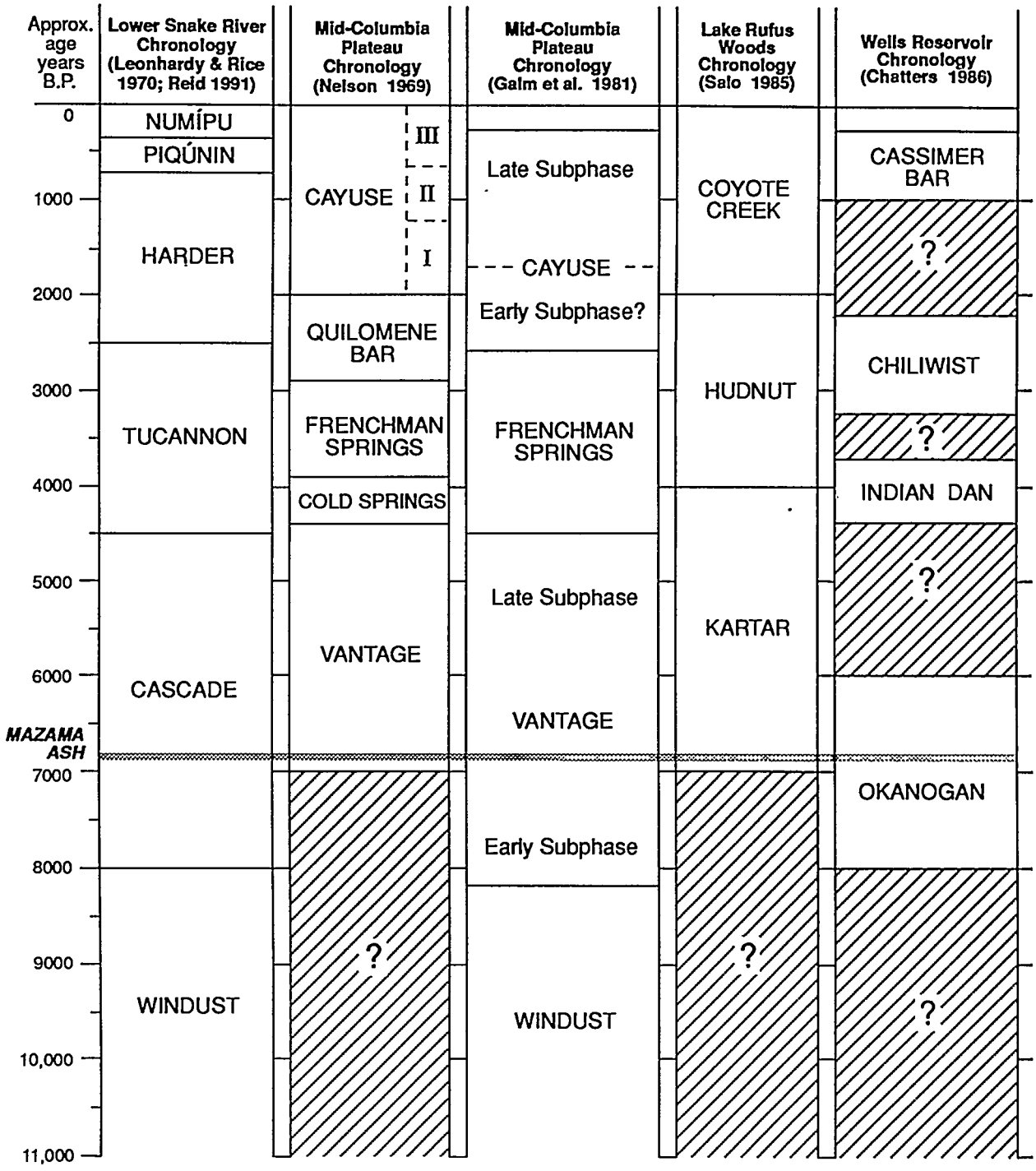

Figure 2. Columbia Plateau cultural sequences.

Results

Thirtyone prehistoric, seven historic, and two sites of unknown temporal affiliation are within or adjacent to the project area (Table 1).

Table 1. Cultural Resources Site Location, National Register of Historic Places Status, and Probability of Project Impact.

Site Name or Number	Site Type	Location in Relation to Grand Coulee-Bell No. 1 Towers [1]	NRHP Eligibility	Impact Probability[2]	Recommended Mitigation
Grand Coulee-Bell Nos. 3 & 4	transmission line	adjacent to proposed 500 kV transmission line	yes	low	avoidance
Little Falls Tie Line	transmission line	49 m W of 73/3	no	low	none
Colville Road	road	adjacent to and S of 66/8	yes	high	avoidance
32-2449	farmstead	12-134 m E of 67/10	unknown	low	avoidance
22-5	farmstead	between 14/3 and 14/4	unknown	low	avoidance
45GR662	foundation and dump	85 m S of 2/1	no	low	none
GC-B 33	dump	vicinity of 2/8 and 3/1	unknown	high	avoidance
45SP321	talus pit	61 m NE of 81/6	unknown	high	avoidance
45SP318	talus pit	22 m N & NE of 71/3	unknown	high	avoidance
45SP320	talus pit	61 m E of 71/9	unknown	moderate	avoidance
45SP304	talus pit	50-85 m E of 72/2	unknown	high	avoidance
45SP303	talus pit	73-100 E m of 72/3	unknown	moderate	avoidance
45SP305	talus pit	50-110 m E of 72/7	unknown	moderate	avoidance
45SP306	talus pit	43 m SE of 73/1	unknown	moderate	avoidance
45SP307	talus pit	12 m S of 73/6: 12 m S of 73/7	unknown	high	avoidance
45SP317	talus pit	61 m SE of 70/6	unknown	moderate	avoidance
45SP316	talus pit	adjacent to 70/4	unknown	high	avoidance

Table 1., continued

Site Name or Number	Site Type	Location in Relation to Grand Coulee-Bell No. 1 Towers[1]	NRHP Eligibility	Impact Probability[2]	Recommended Mitigation
45SP314	talus pit	adjacent to 70/3	unknown	high	avoidance
45SP315	talus pit	85 m NW of 70/3	unknown	low	avoidance
45SP313	talus pit	24 m NE of 70/1	unknown	moderate	avoidance
45SP311	talus pit	adjacent to and downslope of 69/8	unknown	high	avoidance
45SP310	talus pit	50 m SW of 69/3	unknown	moderate	avoidance
45SP309	talus pit	73 m E of 69/8	unknown	high	avoidance
45LI209	talus pit	110 m E of 52/1	unknown	moderate	avoidance
45LI213	talus pit	18 m W of 42/1	unknown	high	avoidance
45LI214	talus pit	18 m E of 40/8	unknown	high	avoidance
45LI217	talus pit	30-90 m W of 6/3	unknown	low	avoidance
45LI218	talus pit	145-210 m W of 6/3	unknown	low	avoidance
45LI219	talus pit	90 m NE of 6/2	unknown	low	avoidance
45LI220	talus pit	east of 34/7	unknown	moderate	avoidance
45LI221	talus pit	adjacent to Grand Coulee-Spokane access road 13 (GC-S-AR-13)	unknown	low	avoidance
45GR660	talus pit	60 m NW of 3/2	unknown	low	avoidance
45GR661	talus pit	226 m N of Grand Coulee-Hanford No. 1, 2/1	unknown	low	avoidance
45GR663	talus pit	25 m NW of 1/8	unknown	low	avoidance
45GR664	talus pit	45 m SW of Grand Coulee-Hanford No. 1, 2/1	unknown	high	avoidance
45GR665	talus pit	45 m NW of Potholes-Grand Coulee No. 1, 65/3	unknown	high	avoidance

Table 1., continued

Site Name or Number	Site Type	Location in Relation to Grand Coulee-Bell No. 1 Towers [1]	NRHP Eligibility	Impact Probability[2]	Recommended Mitigation
45LI216	campsite	120 m west of 36/8: adjacent to access road	unknown	high	conduct test excavations
45LI215	cairn	61-200 m N of 38/1	unknown	low	avoidance
45SP319	pit	24 m E of 71/7 and adjacent to access road	unknown	high	avoidance
45SP312	pit	adjacent to 69/5	unknown	high	avoidance

[1] Tower numbers are those for the Grand Coulee-Bell No. 1 transmission line unless noted otherwise.
[2] See **Construction and Operation Impacts** section below for an explanation of probability categories.

Prehistoric Sites:

Twentynine (94 percent) of the prehistoric sites are talus pit sites, a common type in east-central Washington. The other two prehistoric site types consist of one example each of campsite and cairn.

Sixteen (55 percent) of the talus pit sites are in a 10 km (6 mi) portion of the project area along the rocky north wall of Coulee Creek valley (see Figure 1). These talus pit sites frequently consist of a number of circular pits, 1-2 m (3-7 ft) in diameter and 0.2-0.5 m (0.7-2.0 ft) deep, although pits also occur singularly, have a variety of plan forms, and sizes extend beyond both ends of the stated ranges. Rock berms, when present, usually occur on the downslope edge of the pits and less often to adjacent lateral sides. Only infrequently is a rock berm present on the upslope edge of the pit.

Indians utilized talus for both burial and food storage (cache) activities (Mallory 1962:27; Mandelbaum 1938:127; Post 1938:31-32; Ray 1933:150; Smith 1910:139-142; Sprague 1967). Much less than one percent of the recorded talus pit features in eastern Washington are estimated to have been investigated through excavation. Human remains have been recovered from numerous talus sites in major eastern Washington river valleys and in the lower Grand Coulee (Collier et al. 1942; Mallory 1962; Smith 1910; Sprague 1967). Nine talus pits at three upland sites near Creston, Washington, were excavated during investigations for the WWP Creston Generating Project and no associated prehistoric cultural materials nor human remains were found (Morgan et al. 1980). No excavation or other subsurface investigation has been conducted at any of the talus pit sites identified in the proposed project area. While a large number of talus pit sites have been recorded in eastern Washington, much less is known about the origin, content, and use of upland talus pit sites than those in the major river valleys.
Depressions in talus are not exclusively of cultural origin and may form as a result of tree growth and blowdown. Where trees grow in talus, natural pits may be formed that are

morphologically indistinguisable from pits of cultural origin. As the tree grows, it wedges the talus sliderock blocks apart forming a void. The void formed by a large ponderosa pine or Douglas fir can be of a similar size to pits usually assumed to be of cultural origin.

Below are two possible scenerios of how the void created by a tree can come to resemble a cultural talus pit, both require that the tree fully decay. A large tree in a talus may blow down uprooting sliderock blocks and enlarging the pit it had created as it grew. The rocks caught in the roots of the tree fall to the ground as the roots decay. These rocks may accumulate differentially on one or more edges of the pit creating a berm, as well as contributing to the filling of the void. Or dead trees may simply decay in place leaving a pit of the same general size and shape of cultural talus features.

If sliderock accumulation is active or if the sliderock is mobile, pits formed by trees may be more likely to have small berms on their upslope sides, as this is where sliderock would accumulate against the trunk of the tree. Such a berm is likely to be destroyed if the tree blows down and falls in any but an upslope direction.

The absence of cultural materials in talus pits does not indicate that they are of natural rather than cultural origin, as an emptied cache would not contain cultural material. When cultural materials or human remains are present, a cultural origin can be reliably ascribed to the pit. Likewise a talus pit found at the basal end of a blown down tree or one that contains incompletely decayed wood and/or bark may be inferred to be of natural origin. However, in areas where large trees grow or have grown in talus, no reliable criteria have been defined allowing accurate sorting of cultural and non-cultural talus pits where no physical remains are extant.

Upland prehistoric sites in eastern Washington are more likely to be located in areas of rocky soils than in areas of deep loessal soils (Chatters 1980). As noted above, rootcrops important to the Indians grow in greatest abundance in rocky scabland soils in the project area. Water resources such as streams, springs, and lakes, as well as the bedrock outcrops, around which sliderock blocks accumulate to form taluses, are most common in scabland areas. All of these environmental factors influenced upland prehistoric land use and are concentrated in the rocky portions of eastern Washington. The prehistoric sites located in the project area are primarily distributed in three areas of rocky terrain supporting previously observed relationships: 1) Grand Coulee-Spring Canyon; 2) Creston Scabland Tract; and, 3) Coulee Creek-Spokane River valleys. No prehistoric sites were found in those portions of the project area characterized by deep soils.

Talus Pits

Talus pit sites consist of one or more depressions in a talus. Individual talus pit features vary from well defined to barely recognizable examples. The taluses have formed below a number of different types of basalt bedrock outcrops including, isolated outcrops, low linear scarps that are a few meters high, and high valley wall scarps, as well as around landslide blocks. The basalt frequently outcrops in steep-sided, narrow, short draws along larger valley walls. This

is especially true in the Coulee Creek valley. The recorded talus pit sites are briefly desribed below.

45GR660: At least eight pits are present in this large talus formed at the base of the wall of the Grand Coulee.

45GR661: The site consists of three, and possibly four, pits near the base of a north-facing talus.

45GR663: A single pit is present in the talus at this site.

45GR664: The site contains a mixture of features of probable aboriginal and historic origin. Two pits that are identical to others of presumed aboriginal origin are present in a talus. Also present are a leveled area in the talus and a stacked rock wall apparently dating from the historic/recent period.

45GR665: This site consists of a single pit in a small talus.

45LI209: The site is a single pit in a talus below a basalt outcrop. The downslope edge of the pit is characterized by a distinctive berm.

45LI213: Two pits are present here, one of which has a small ponderosa pine growing from the its center.

45LI214: The site consists of two pits in talus on the west side of a small pond northeast and downslope of GC-B No. 1 tower 40/8. These two pits are outside of the project area. The third pit is in the project area east of GC-B No. 1 tower 40/8 and appears to have been modified historically/recently and may not be of aboriginal origin.

45LI217: At least 15 pits are present in two taluses on the east side of Spring Canyon.

45LI218: Six pits are present in a talus near the bottom of Spring Canyon. A small cairn is located near the base of the talus.

45LI219: This site consists of one pit in talus and a stacked rock wall both of which appear to have been truncated by high water flow in Spring Canyon. The rock wall may be temporally and functionally related to a longer segment of rock wall located upslope and to the northwest of this site.

45LI220: A single pit in talus surrounded by ponderosa pine is present at this site.

45LI221: There are at least 13 well formed pits near the base of a large talus. There is a distinctive, nearly level, bench-like part of the landform and the pits are located on this level area. Broken, very weathered, and partially burned pieces of a cedar stake or post are present

in association with the pits. Some of this cedar stake remains embedded within the sliderock blocks. No wire or other stakes or posts were observed that might indicate that the burned cedar was part of a former fenceline.

45SP321: Sixteen pits were counted in the talus at the base of a number of closely spaced basalt bedrock outcrops or landslide blocks. Three cairns consisting of multiple boulder size basalt blocks stacked from one to three rocks high are present in silty sediments adjacent to the south side of the talus. A number of 50 to 70-cm-(20 to 28 in)-diameter tree stumps are present in the talus.

45SP307: The site consists of 13 pits in talus below basalt outcrops separated by a narrow gully. An historic stacked rock fence measuring about 40 m (131 ft) long, 2.5 m (8.2 ft) wide and 0.7 m (2.3 ft) high is also present on the site.

45SP306: Three well formed pits and three poorly shaped pits are present in a talus below the north wall of the Coulee Creek valley.

45SP305: The talus containing the seven pits is vegetated by ponderosa pine and Douglas fir trees, and shrubs. The talus forms the steep wall of a draw and the pits are near the lower margin of the talus.

45SP303: Ten poorly to well formed pits are present in a talus forming the sloping sides of a small draw.

45SP304: The eight pits comprising the site are in a talus in a small draw.

45SP320: Six pits are present in a talus within a small draw.

45SP318: The site consists of three pits in a talus formed below a low escarpment.

45SP317: Four pits are in a talus below a low basalt escarpment.

45SP316: Nine pits in a talus, a low, short (8-m-[26-ft]-long) historic stacked rock fence and rock fence post anchors are the features at the site.

45SP314: The eight pits at the site are in two groups of four pits each. The talus formed below a basalt outcrop.

45SP315: Three pits are present in a talus below a basalt outcrop.

45SP313: The site consists of seven pits in a talus below a basalt outcrop.

45SP311: One pit in talus and one in silty sediments are present at the site. The remains of two dead, 20 cm (8 in) diameter ponderosa pine trees are present in the talus pit.

45SP310: The site consists of five pits in a talus that has formed below a bedrock outcrop.

45SP309: Eight pits are present in a talus below a bedrock outcrop. Several holes, that appear to have been recently excavated by badgers or other large mammals, are present in the talus and in adjacent areas of silty sediments. These recently dug pits are smaller than the eight recorded talus pits.

Campsite
A single example of the prehistoric campsite site type is located in the proposed project area.

45LI216: The site consists of burned bone fragments, freshwater mussel shell fragements, lithic flakes, and other artifacts exposed on the ground surface in the vicinity of a spring. Cultural materials were visible in areas where the ground surface was exposed as the result of overgrazing, as well as in burrowing animal backdirt piles. A transmission line access road passes through the site area.

Cairn
45LI215: Two stacked basalt cairns located on the south-facing slope of a small basalt outcrop comprise this site. Lichen grows uniformly on the upper surfaces of the rocks indicating the passage of some time since their stacking.

Historic Sites:
Seven historic cultural sites are known in or adjacent to the project area. These sites are grouped within the following site types: electrical transmission lines; historic road; farmsteads; structural remains; and dump.

Electrical Transmission Lines
Grand Coulee-Bell No. 3 and 4 double circuit 230 kV transmission line: The GC-B No. 3 and 4 transmission lines are two of the five BPA transmission lines within the Grand Coulee-Bell right-of-way. The GC-B No. 3 and 4 transmission lines were the first double circuit 230 kV transmission line constructed by BPA (Holstine 1988). This transmission line is part of BPA's Main Grid built between 1942 and 1943 (Holstine 1988). This lattice steel structure transmission line is located adjacent, and parallel, to the GC-B No. 1 transmission line.

Little Falls Tie Line: Constructed by the Washington Water Power Company between 1909 and 1910, the Little Falls Tie Line was one of, if not the first, steel tower electrical transmission line in the northwest (Luttrell 1993). It crosses the project area on the north side of the Coulee Creek valley between GC-B No. 1 towers 71/2 and 71/3.

Historic Road
Colville Road: The Colville Road was primarily utilized from the 1850s until 1881 when construction of the Northern Pacific railroad to Spokane Falls (Spokane) made the road obsolete (Freeman 1954). The Colville Road does not appear on a 1912 Spokane County atlas, by which

time numerous other roads were in use to serve the growing population of the area (Anonymous 1912).

An unaltered section of the Colville Road is located south of and adjacent to the project area at GC-B No. 1 tower 66/8. This section of the road consists of a presently unused, approximately 3.5-m-(11.5 ft)-wide two-track road leading from the north bank of Coulee Creek to tower 66/8. A ca. 2-m-(6.6 ft)-high basalt escarpment forms the boundary between the Coulee Creek floodplain/terrace tread and the uplands north of the creek. There are two breaks in the escarpment where wagons could ascend from Coulee Creek to the uplands. The extant section of the Colville Road passes through one of these breaks. The other lies approximately 274 m (900 ft) to the west and is where a spring fed tributary stream enters Coulee Creek.

That portion of the existing transmission line access road from the center of Section 22, T26N, R40E, southwest to the vicinity of GC-B No. 1 tower 66/8 matches the alignment of the Colville Road depicted on the 1881 General Land Office map (United States Surveyor General's Office 1881) of township T26N, R40E. This section of transmission line access road appears to be an altered portion of the Colville Road.

About 800 ft (244 m) south of GC-B No. 1 tower 66/5 along Coulee Creek is the probable site of Camp Washington, where Washington Territorial Governor Isaac I. Stevens camped from October 26-29, 1853 while travelling on the trails that were to become the Colville Road. The precise location of Camp Washington has not been determined but, based upon historic documents and area topography, the camp appears to have been adjacent to Coulee Creek south of the project area.

Farmsteads

32-2449: This farmstead consists of a scatter of late nineteenth-early-twentieth century domestic and farming artifacts within the project area between GC-B No. 1 towers 68/10 and 67/1. No structures remain at the site and many of the artifacts have been burned. The artifacts include single-crimp and solder-sealed tin cans, cork-stopper machine finished bottle necks, milk glass canning jar lids, white porcelain sherds with maker's marks, a piece of silver (?) flatware, fire bricks, structural wire-cut bricks, pot bellied sheet metal and cast iron stove parts, a barrel hoop, a graniteware kettle, a galvanized wash tub, flat glass, cut glass, and a wooden wheeled wagon axle. A nearby spring likely served as a source of water for the farmstead.

22-5: Scattered horse drawn farming equipment associated with farmstead 22-5 is located adjacent to the project area between GC-B No. 3 and 4 towers 14/1 and 14/2. The abandoned turn-of-the-century farmstead including house, corral, and well/spring house is located approximately 500 ft (152 m) north of the project area.

Structural Remains

45GR662: The site consists of a subterranean, rubble-filled basalt cobble wall structure and debris scatter upslope to the northwest. Cultural remains at the site include: solder-sealed and sanitary food tins, ceramic sherds, bottle glass, electrical insulator fragments, a nail polish

bottle, a small women's shoe sole, and a section of a log bridge that has been dumped at the site.

Dump

GC-B 33: The dump is part of a large area that includes the Grand Coulee municipal dump. Garbage disposal is ongoing in a nearby area to the west. The dump contains automobile bodies and parts, bottles, and domestic and industrial garbage dating from or before the 1940's.

Temporally and Functionally Unassigned Resources

Two pit sites (45SP319 and 45SP312) were recorded that may be of either cultural or natural origin. These two sites are not in a talus, like the prehistoric talus pit site type, nor are these sites similar to historic depressions such as ditches, foundations, prospect pits, etc.

45SP312: The site consists of at least four pits around a closed scabland depression. One pit is large (4.4 x 4.0 m [14.4 x 13 ft]) relative to the others as well as to talus pits. The pits have been excavated into rocky, silty sediments and none of the pits are in a talus.

45SP319: A single trench-like (5 m x 1.2 m [16.4 x 4 ft]) pit with a low berm on the downslope side comprises the site. The pit is not located in a talus

National Register of Historic Places Eligibility

The Grand Coulee-Bell No. 3 and 4 transmission lines and the Little Falls Tie Line have been evaluated for National Register of Historic Places (NRHP) eligibility. All other sites will have to be formally evaluated through the completion of NRHP Determination of Eligibilty forms. Tentative NRHP eligibility for all sites is summarized in Table 1.

Talus pit sites are a particularly sensitive site type because of the possibility that they may contain human burials. Even if it has not been determined that these sites actually contain human burials, the sites as a type are problematical and every effort should be made to avoid impacts to them.

The GC-B No. 3 and 4 transmission lines were formerly evaluated as part of a nomination of BPA properties to the NRHP. The property was recommended as being eligible for inclusion in the NRHP. The nomination has not been forwarded to the State Historic Preservation Officer, however the site is considered eligible for listing in the NRHP (see Table 1). The site will not be impacted by the proposed project and a comment regarding a determination of no adverse effect should be sought from the Washington State Office of Archaeology and Historic Preservatoin (OAHP).

The WWP Little Falls Tie Line was determined eligible for inclusion in the NRHP prior to a proposed conductor reconfiguration. As mitigation of the effect of the proposed action on this eligible property, the site was recorded to Historic American Engineering Record (HAER) standards. The proposed WWP project proceeded as planned. The Little Falls Tie Line no

longer retains its historic integrity and therefore does not appear eligible for listing in the NRHP. A comment regarding a finding of no effect should be sought from the OAHP.

The Colville Road is very likely eligible for listing in the NRHP (see Table 1). One portion of the road near Washtucna has been determined eligible for listing in the NRHP, so other extant segments of the road including the one in and adjacent to the project area are presumed eligible as well. If the Colville Road is eligible for listing in the NRHP then the project will have an effect on the site that will require appropriate mitigation. Suitable mitigation measures may include photographic and archival documentation and avoidance of the unaltered segment of the Colville Road adjacent to the south side of the project area.

Sites 32-2449 and 22-5 (the remains of turn-of-the-century farmsteads), the structural remains at site 45GR662, and the dump (GC-B 33) do not appear to be eligible for inclusion in the NRHP, although formal evaluations have not been conducted.

Project Construction and Operation Impacts

Transmission line removal and transmission line and access road construction can damage or destroy cultural resources. Visual, audible, or atmospheric elements that alter the character or setting of a NRHP eligible historic site are forms of disturbance, as are direct physical impacts to site integrity. Increased access to cultural resources resulting from project construction or operation can lead to vandalism. Any action that results in the alteration of a cultural resource's eligibility for listing in the NRHP is an "effect" as defined in Section 106 of the National Historic Preservation Act of 1966 (as amended). This definition of effect is narrow and should not be confused with physical or indirect impacts.

The effect of BPA's proposed project will have to be assessed for any sites determined eligible for listing in the NRHP. If a site is not eligible for inclusion in the NRHP the proposed project will not affect the site no matter what type of physical or other impact may occur. The no action alternative may also affect cultural resources eligible for listing in the NRHP. Once NRHP eligible sites have been identified, ongoing maintenance of the existing transmission lines may have an effect on these sites.

Several of the talus pit sites are in topographic situations where it is a certainty that the proposed transmission line will span them; in addition, they do not appear to be near existing or planned access roads. The Project in all likelihood will not effect any of these properties that may be NRHP eligible. However, until the NRHP status is known for all sites and the design of the proposed transmission line has proceeded to a point that the exact locations of new towers and attendant access roads are known, it will not be possible to fully assess project effects on most cultural sites.

Project Impact Probability Assessment

Tentative probability assessment of physical impacts to known cultural sites in the project area resulting from tear-down of the existing Grand Coulee-Bell No. 1 transmission line and construction of the proposed 500 kV transmission line has been prepared assuming:

- The area of probable impact around existing Grand Coulee-Bell No. 1 wooden pole structures that will be removed is 46 x 46 m (150 x 150 ft);
- Proposed 500 kV steel lattice towers will be located offset from the existing GC-B No. 3 and 4 steel lattice towers;
- The area of probable impact around proposed steel lattice towers is 46 m x 46 m (150 x 150 ft); and,
- Access to proposed tower locations will be by the shortest route from existing access roads.

Impact probability categories are:

- High, for sites within a square, 46 m (150 ft) on a side, centered over an existing Grand Coulee-Bell No. 1 tower or a proposed 500 kV tower location or sites adjacent to an access road;
- Moderate, for sites within 30 m (100 ft) of any side of the 46 x 46 m (150 x 150 ft) square tower impact zone or sites downslope of an access road or tower location; and,
- Low, for sites outside of the high and moderate impact zones or sites in a deep narrow draw likely to be spanned.

Physical impact to sites in the high impact probability category is nearly certain unless adequate avoidance measures are taken. Sites in the moderate category may be impacted unless locations are identified on large scale project maps, air photos, and in the field. The sites in the low category are unlikely to be impacted given the stated assessment criteria. Physical impact probability analysis results and other site characteristics are presented in Table 1.

Project design efforts directed to avoiding physical impacts to sites resulting from: 1) tear down of the GC-B No. 1 transmission line; 2) construction of the proposed 500 kV transmission line; and, 3) improvement or construction of access roads, if implemented during the planning stages of the proposed project, can result in minimal project effects on cultural resources. Note that potential impacts to sites as a result of the possible removal of the GC-B No. 2 transmission line have not been evaluated as part of this project. The same potential impact criteria could be

employed to generate results of a similar degree of confidence as those for the removal of GC-B No. 1.

Mitigation Measures

Mitigation of project impacts to cultural resources requires the assessment of two criteria: 1) eligibility for inclusion in the NRHP; 2) finding of effect; and, 3) nature of impact. Appropriate mitigation measures for NRHP eligible properties could include:

- Avoidance;
- Data recovery (including excavation); and,
- Documentation to Historic American Building Survey (HABS) or Historic American Engineering Record (HAER) standards.

Mitigation measures will be designed on a site-by-site basis once all NRHP sites have been assessed for effect. The no action alternative will not create new effects to cultural resources that would require mitigation.

Conclusions

A variety of prehistoric and historic sites were recorded as part of a cultural resources survey of Bonneville Power Administration's Main Grid Support Project (see Table 1). The sites consist of 31 prehistoric sites, seven historic, and two of unknown temporal affiliation.

Consistent with previous research (c.f. Chatters 1980), project area prehistoric sites are located in scabland areas of shallow, rocky soils rather than in areas of deep, loessal soils. A number of important resources including edible roots and berries, game, and surface water are, and were formerly, found in the scablands as opposed to the intervening areas of deep silty soils.

The majority (n=29, or 94 percent) of the recorded sites consist of pits in basalt talus. Common to talus in eastern Washington, ethnographic and archaeologic information indicate that talus pit site functions included places for human burial and as resource caches. One prehistoric campsite and one rock cairn site were also recorded.

Talus pit sites are not necessarily of cultural origin. In the more mesic portions and microenvironments of eastern Washington where large conifers are presently growing adjacent to or within talus, pits may be formed by natural rather than cultural means. Growth of large trees create voids in talus that once the tree has rotted away may be mistaken for cultural talus pit features. Blowdown of large trees growing in talus creates even larger voids. Pits created by either of these processes may have rock berms associated with them as do some cultural examples.

Determining which pits are of cultural and which are of natural origin is not necessarily easily done. If archaeological excavation reveals that the pit contains prehistoric cultural materials and/or human remains, then the pit is a cultural site. On the other hand, if a pit had been utilized as a cache and its contents removed, then no cultural materials would be expected to be present, even though the site is of human origin. Reliable criteria for separating talus pits of cultural from those of natural origin in the absence of artifacts, human remains, logs, wood, or bark have not been developed.

Historic sites in or adjacent to the project area include historically important transmission lines, an extant section of the Colville Road, farmsteads, structural remains, and a municipal dump. Two sites consisting of pits in silty sediments and of unassigned temporal or functional affiliation were also recorded.

While the Little Falls Tie Line has been evaluated for NRHP eligibility and a NRHP Nomination Form that includes the GC-B No. 3 and 4 transmission line has been completed, none of the other sites have been formally evaluated for NRHP eligibility.

Transmission line removal, construction, and operation can impact cultural resources. Whether or not such impacts constitute an "effect" on an individual site depends on that site's eligibility for listing in the NRHP.

Given the design of the proposed project as described in this report, a preliminary impact probability assessment indicates seventeen (42.5 percent) of the sites have a high probability, nine (22.5 percent) a moderate impact probability, and 14 (35 percent) a low impact probability (see Table 1). Changes in project design will invariably require re-analysis of potential project impacts.

Potential mitigation of project effects on NRHP eligible sites could include:

- Avoidance
- Data recovery (including excavation); and,
- Documentation to HABS/HAER standards.

This report should not be considered permission to proceed with the proposed project. The report should be submitted to the proper review agencies for review and comment prior to the iniation of any land altering activity.

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