Final Environmental Impact Statement

Headquarters Camp Solid Waste Disposal Facility

Cowlitz-Wahkiakum Health District

Volume 2

Appendices

December 1992

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Headquarters Camp
Solid Waste Disposal Facility

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Appendices

Cowlitz-Wahkiakum Health District
1516 Hudson, P.O. Box 458
Longview, Washington 98632

December 1992

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Proposed Natural Resources Mitigation Plan

Headquarters Camp
Solid Waste Disposal Facility

Proposed Natural Resources Mitigation Plan for the Headquarters Camp Solid Waste Disposal Facility

Prepared for:
Weyerhaeuser Company
Tacoma, Washington 98477

Prepared by:
Beak Consultants Incorporated
317 SW Alder St., Suite 800
Portland, Oregon 97204

December 17, 1992

Project No. 73306

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ACKNOWLEDGMENTS

Mitigation measures presented within this plan have been developed as a cooperative effort among biologists and engineers from Beak Consultants, Emcon Northwest, and Inter-Fluve.

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1.0 INTRODUCTION

Development of the Headquarters landfill site will result in the unavoidable loss of wetland and stream habitat. Approximately 11.9 acres of emergent and scrub-shrub wetlands will be filled over the life of the project. The stream habitat impacted consists of 2,590 feet of Type 3 water and 3,346 feet of Type 4 water based on Washington Department of Natural Resources stream type classifications. This mitigation and monitoring plan presents measures to compensate for these losses. The objective of the plan is to fulfill the specific compensatory mitigation requirements of Section 404(b)(1) by providing appropriate and practicable mitigation for the unavoidable impacts associated with the proposed project.

The mitigation and monitoring plan has been designed for a landfill with a total capacity of 45 million cubic yards and a lifetime of 30-60 years (Alternative Site Plan A, Figure 1). Approximately 46 percent of the wetlands at the site will be filled within the first 5 years (Figure 2). The remaining 54 percent of wetlands will be lost over the next 25 years (Figure 2). Weyerhaeuser plans to provide mitigation for the entire landfill concurrently with the construction of the first cell so that all mitigation will be completed within the first year of the project.

Weyerhaeuser has examined the feasibility of delaying wetland impacts during the early years of site development (i.e., the first 10 years of operation). However, the development sequence for the site is largely determined by site topography and the requirement for locating the leachate collection system at the downgradient portion of the site where a substantial amount of the wetland habitat occurs. In addition, diversion of runon water during the construction phase of the project will require diversion of the Southern Tributary. This will result in the loss of the primary water source for the wetlands associated with the Southern Tributary within the project boundary.

The mitigation and monitoring plan is based on current resource management theory and practice. Two assumptions underlying the mitigation plan include 1) optimal habitat conditions can be described for a given species and 2) improvements in habitat can generally be achieved by managing toward these optimal habitat conditions. The mitigation methods prescribed are designed to create replacement habitat and to preserve or enhance existing aquatic, upland, and wetland habitats in the project vicinity as mitigation for unavoidable losses.

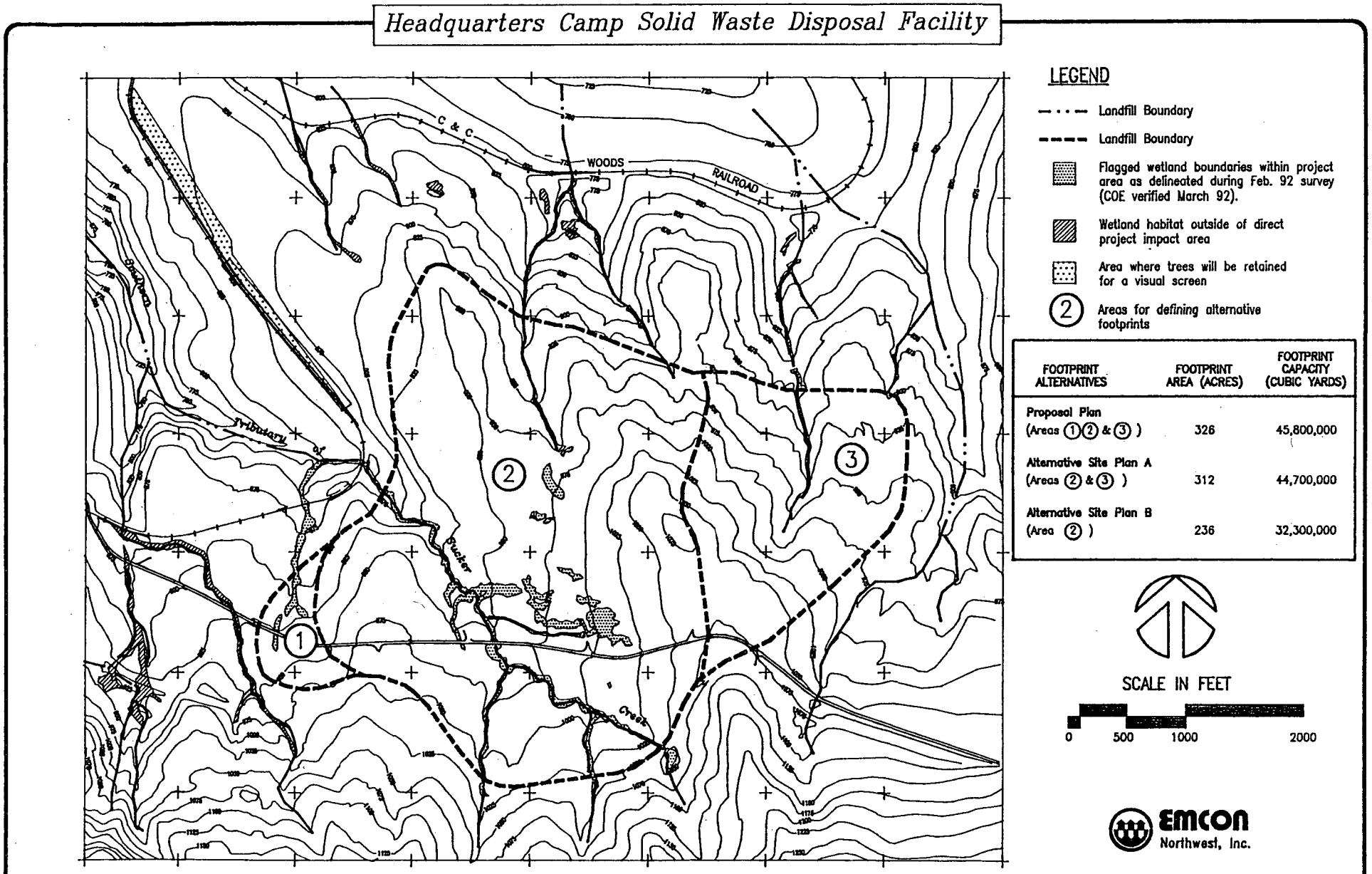


Figure 1. Alternative configurations for the Headquarters Solid Waste Disposal Facility.

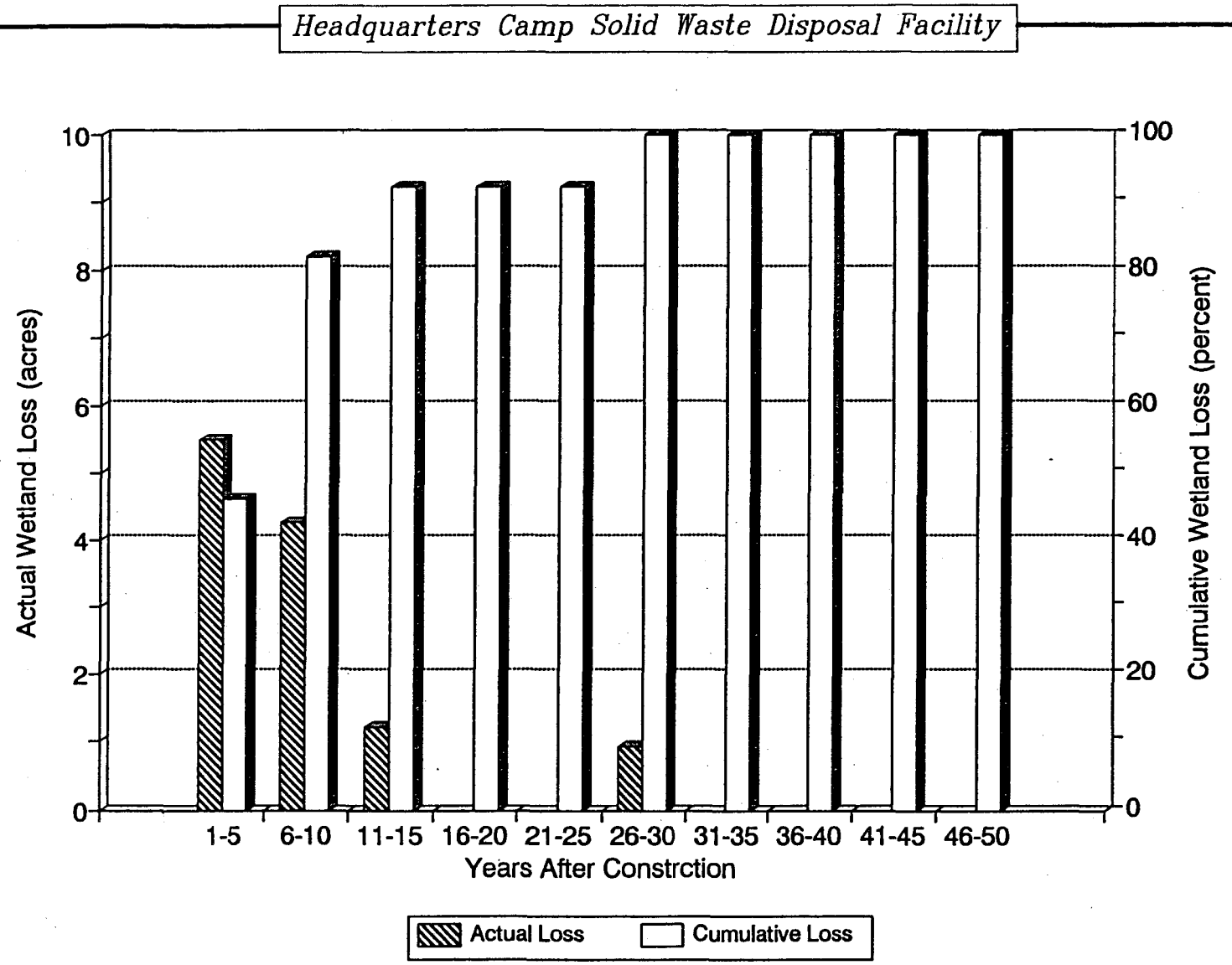


Figure 2. Wetland area filled during construction of the Headquarters Solid Waste Disposal Facility.

The plan is structured around specific management areas and the important resource features associated with each area, such as surface water, soils, upland vegetation, and wildlife. Specific management areas include:

(1) fill area within the project footprint,

(2) diversion channel and associated wetlands adjacent to the project,

(3) off-channel ponds near the confluence of Sucker Creek and the Southern Tributary, and

(4) wetland preservation and enhancement in the vicinity of the project.

For each management area, existing resource conditions and values are described, potential impacts identified, mitigation objectives defined, and resource management techniques described.

A Technical Advisory Committee has been formed to provide technical review of the mitigation plan. The committee is composed of representatives from the National Marine Fisheries Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, Washington Department of Ecology, Washington Department of Wildlife, and the Weyerhaeuser Company. Meetings will be held as needed during the development and implementation of this plan to ensure the mitigation goals are met. An action plan with a list of tasks for developing final construction plans and bid documents from this mitigation plan is presented in Appendix A.

2.0 MANAGEMENT AREA MITIGATION

Various mitigation strategies and techniques are recommended for each management area. Each proposal is intended to restore or improve conditions for one or more resources. A summary matrix of the proposed mitigation is presented in Table 1. A detailed discussion of the proposed mitigation for each management area follows.

Table 1. Summary of mitigation for the Headquarters Camp Solid Waste Disposal Facility.

Resource	Landfill	Diversion Channel and Wetlands	Off-channel Ponds	Wetland and Riparian Areas
Fisheries			Provide pool habitat for resident cutthroat trout, juvenile coho salmon, and other fish species.	
Botanical	Reestablish vegetative cover. Develop shrub and mixed forest cover.	Establish riparian habitat.	Establish riparian habitat. Increase vegetative diversity and structure.	Increase vegetative diversity and structure.
Wetlands		Create and enhance riparian/wetland hydrologic and habitat conditions.	Restore and enhance wetland areas.	Preserve forested, scrub-shrub, and emergent, and open water wetland system.
Wildlife	Develop vegetative and topographic structure and diversity within the landfill. Provide habitat elements and structures. Reduce hazards and disturbance to wildlife by closing roads after landfill closure and fencing leachate pond.	Establish riparian habitat. Provide access to stream.	Increase habitat diversity by providing open water areas and wetlands.	Restore and enhance wildlife cover and forage (e.g., vegetative diversity, provide logs, debris piles, and snags). Protect habitat from future impact.

2.1 FILL AREA

2.1.1 OVERVIEW - FILL AREA

The fill area (Alternative Site Plan A, Figure 1) comprises approximately 312 acres which will serve as a disposal site for forest products solid waste. Additionally, approximately 68 acres will be needed to accommodate project facilities, including the sedimentation/biofiltration basins, leachate pond, transfer station, and new roads.

The project area is managed timberland with a 45 to 50-year rotation harvest schedule. These forest management practices result in dynamic habitat conditions as forest stands develop from clearcut/seedling to sawtimber. Early seral forest stands predominate within the project boundary, a result of sequential harvesting during the last 12 years. Existing wildlife include west-slope Cascade species which typically utilize early seral phases of coniferous plantations. Several small drainages with associated wetland/riparian habitat (emergent and scrub-shrub) occur within the fill area. The Southern Tributary accounts for the majority of the surface flow and supports most of the aquatic biota found at the site. The northern and eastern portion of the site drains into Sucker Creek.

Operation of the proposed facility will result in the sequential opening, filling, closing, and reclaiming of nineteen discrete areas or cells within the project boundary. Cells will be cleared of all vegetation prior to construction, eliminating existing plant communities and associated wildlife habitat. Prior to opening the first cell, all existing surface flow onto the project area will be diverted around the fill area, resulting in a loss of wetland and aquatic habitat within the landfill boundary.

2.1.2 MITIGATION CONSTRAINTS - FILL AREA

Terrestrial reclamation and habitat enhancement prescriptions proposed for the facility must not compromise the integrity of the upper liner of the closed cells. Deep-rooted vegetation will only be permissible as post-closure vegetative cover where the upper liner is specifically designed for that purpose. All Minimum Functional Standards for landfill construction and operation will be met.

2.1.3 MITIGATION GOALS - FILL AREA

The following mitigation goals are proposed for the fill area:

(1) Reestablish vegetative cover as quickly as possible on final cell grade and in temporarily disturbed areas using a diverse mix of species that emphasizes native species.

(2) Develop vegetative structure and diversity of the reclaimed areas to improve wildlife habitat diversity.

(3) Provide specific habitat elements or structures to encourage use by wildlife which otherwise may not occur in appreciable numbers (e.g., nest boxes for secondary cavity nesters, perch poles).

2.1.4 MITIGATION PROCEDURES - FILL AREA

Botanical Resources

Mitigation for botanical resource impacts within the landfill project area focuses on reestablishment of vegetation on all disturbed sites. All areas will be planted with a diverse grass/forb seed mix. In addition, selected areas will be planted with shrub and tree species. Trees will be planted only in limited areas where the landfill cap is specifically designed for the deeper rooting depth and greater weight of trees. The landfill cap in these areas must also remain functional if any of the trees blow over.

The general steps involved in revegetation (i.e., stockpiling topsoil, preparing seedbeds, planting, fertilizing, and mulching) are described below and are applicable to permanent seeding efforts in all management areas:

(1) Remove topsoil at the initiation of construction and stockpile in predesignated upland areas.

(2) Protect exposed soils prior to revegetating by covering with plastic, mulching, or hydroseeding. Stockpiles will have side slopes not exceeding 2:1. Silt fences will be installed around stockpiles, and runoff will be directed into a sedimentation basin and biofiltration swale.

(3) Prepare seedbeds on disturbed areas by spreading stockpiled topsoil as the uppermost layer of the final grade. The topsoil will be rolled to provide a firm, but not compacted, seedbed. Topsoil will not be frozen or muddy when spread, nor will it be spread over an excessively wet subgrade. Areas will be seeded within two weeks of completing construction activity. The optimal seeding periods for the Project site are 1 April to 30 June and 1 September to 31 October. Seeding may occur during other time periods if soil moisture and temperature are suitable for seed germination. If an area is exposed when conditions are not suitable for seeding, the exposed area will not be prepared for seeding but will be protected with mulch or covered with plastic until conditions are again suitable for seeding.

(4) Seed with diverse grass/forb mixtures that emphasize native species compatible with the specific soil type to be revegetated. The following species are recommended to provide an extensive root-mat system to stabilize soils and to provide optimal wildlife forage:

Common Name	Scientific Name
wild rye	*Elymus glaucus* or *E. canadensis*
perennial ryegrass	*Lolium perenne*
mountain brome	*Bromus carinatus* or *B. marginatus*
creeping red fescue	*Festuca rubra*
tall fescue	*F. arundinacea*
chewings fescue	*F. rubra commutata*
Kentucky bluegrass	*Poa pratensis*
sickle-keeled lupine	*Lupinus albicaulis*
American vetch	*Vicia americana*
birdsfoot trefoil	*Lotus corniculatus*
Dutch white clover	*Trifolium repens*
sweetclover	*Meliotus* sp.

(5) Apply seed mixtures hydraulically whenever possible. When hydraulic seeding (i.e., hydroseeding) is not possible or practicable, areas will be broadcast seeded and mulched by hand or alternatively through the use of helicopters.

(6) Apply mulch following seeding. Hay or straw mulch should be air-dried and free of undesirable weed species. Recommended application rate is 75-100 pounds per 1000 square feet for a minimum depth of 2 inches. Wood or cellulose fiber should be applied with a hydromulcher at a rate of 1000 to 1500 pounds per acre (double rate for erosion control in critical areas). Use tackifier as recommended by manufacturer.

(7) Apply fertilizer at appropriate rates determined from soil analyses for specific sites. Open water and wetland areas will not be fertilized.

A mosaic of shallow-rooted shrubs will be developed as a series of patches over approximately 15 percent (50 acres) of the landfill to provide increased habitat structure and diversity. The shrub communities will be established by seeding or planting of bareroot seedlings. Shrubs will also naturally invade the areas seeded with grasses and forbs. Grazing by herbivores could influence the method(s) used to establish the shrub communities. To assess the optimal method(s) for establishing patches of shrubs on the closed landfill, the following program will be implemented over a portion of the first cell to be closed:

(1) Hand broadcast selected shrub seeds on two 0.25-acre areas. The following list contains species recommended for seeding:

Common Name	Scientific Name
snowberry	*Symphoricarpos alba*
oceanspray	*Holodiscus discolor*
Oregon grape	*Berberis* spp.
salal	*Gaultheria shallon*
red huckleberry	*Vaccinium parvifolium*
thimbleberry	*Rubus parviflorus*
elderberry	*Sambucus* spp.
rose	*Rosa* spp.

(2) Hydroseed entire study area with a grass/forb mix (see grass/forb species list given above in this section).

(3) Plant shrub seedlings on one of the 0.25-acre areas seeded with grass/forb and shrub seeds. Plant shrub seedlings on another 0.25-acre area receiving only a hydroseed application of grass/forb seed. The following list contains species recommended for planting as bareroot seedlings:

Common Name	Scientific Name
snowberry	*Symphoricarpos alba*
oceanspray	*Holodiscus discolor*
red huckleberry	*Vaccinium parviflolium*
red elderberry	*Sambucus racemosa*
blue elderberry	*Sambucus cerulea*
western serviceberry	*Amelanchier alnifolia*
wild rose	*Rosa* spp.
thimbleberry	*Rubus parviflorus*

(4) Monitor area to assess the success of shrub establishment in each experimental area. The most successful method(s) for establishing shrubs will be implemented in the other areas on the closed landfill selected for shrub establishment. See Section 3.3.2 for specific monitoring procedures.

Wildlife Resources

The following measures are proposed to mitigate for project-related impacts to wildlife. Habitat reclamation procedures that benefit wildlife are presented under botanical resources.

(1) Clear existing forest vegetation just prior to construction of individual cells to retain existing wildlife habitat for the maximum time practicable.

(2) Provide dead and down woody material within tree and shrub areas to improve habitat structure for wildlife at initial planting. When available from harvest of adjacent forest stands, large (greater than 12 inches in diameter at the large end and 20 feet or more in length) non-merchantable logs will be placed within these areas at a rate of two per acre. When logs are unavailable, brush piles composed of woody debris and piled to a minimum height of 4 feet will be substituted for each log.

(3) Erect nest boxes within tree and shrub areas to provide nesting sites for secondary cavity nesters (e.g., wrens, chickadees, nuthatches). Design (i.e., nest box dimensions and hole size), location (i.e., habitat and height of placement), and the number of nest boxes erected (i.e., spacing based on species territory size) will be specific for intended target species.

(4) Erect four raptor perch/nest poles to provide loafing, hunting, and nesting sites for raptors within the landfill. Poles will be pressure treated, at least 25 feet in length, and range from 4 to 6 inches in diameter. A frame platform must be constructed at the top of the pole to provide a suitable surface for nest construction. Adding a base of sticks to the platform after installation may facilitate nest construction. The poles will be anchored in about 6 feet of soil, limiting pole placement to the mixed forest stands or the perimeter of the landfill; these are the only areas where the soil cap will be deep enough to prevent problems with the integrity of the cap. Smaller poles with crossbars, which could be erected in those portions of the landfill with the shallow soil cap (the majority), could be substituted as perch sites for two of the platforms.

(5) Contour the final topography of the north slope of the landfill face to provide topographic hiding cover for wildlife. Additional hiding cover will be provided by the trees, shrubs, and grass to be planted on the landfill cap.

(6) Limit intensive habitat or vegetation maintenance operations (e.g., removal of danger trees) to late summer and early fall after most wildlife reproductive and rearing activities are completed.

(7) Design and construct all new electrical distribution lines to the specifications of Olendorff et al. (1981) to minimize avian electrocution hazards.

(8) Fence the leachate pond to control access to the pond. The design and material to construct the fence will be determined in coordination with the agencies.

(9) After landfill closure, remove all nonessential landfill perimeter roads to regulate traffic and minimize disturbance and hazards to wildlife. Roads that cannot be removed will be gated. The 1600 Road will be left open after landfill closure and will not be gated.

(10) Prepare a spill response program to manage and control potential spills to minimize impacts to resources.

2.2 DIVERSION CHANNEL AND ASSOCIATED WETLANDS

2.2.1 OVERVIEW - DIVERSION CHANNEL AND ASSOCIATED WETLANDS

The Headquarters site contains a section of the Southern Tributary which provides habitat for fish and other aquatic organisms. Cutthroat trout (*Oncorhynchus clarki*) and reticulate sculpin (*Cottus perplexus*) were the only fish species collected from the Southern Tributary within the project boundary (Beak 1991). A population estimate conducted in June 1990 indicated that approximately 23 cutthroat trout were present within the project boundary. Salamanders, other amphibians, and macroinvertebrates also inhabit this section of the Southern Tributary. The total length of stream within the footprint is 5,936 feet with 2,590 feet classified as Type 3 water and 3,346 feet classified as Type 4 water. The stream forks approximately 190 feet south of the 1600 Road. Upstream from this fork, the Southern Tributary is divided into narrow channels only 1 to 2 feet wide and choked with logs and brush.

Approximately 12 acres of wetland will be filled by the project. The majority of these wetlands are confined to narrow strips along the six drainages within the project boundary (Figure 3). Emergent wetlands comprise about 70 percent of the wetland area with the remaining area composed of scrub-shrub wetland. Functions and values of the wetlands at the Headquarters site are discussed in Section 2.4.1.

Mitigation for the aquatic resource losses will include construction of a diversion channel and wetlands, construction of off-channel ponds, and enhancement and preservation of other wetland areas. As discussed below, the diversion channel and associated wetlands will provide mitigation for aquatic resources other than fish as well as partial mitigation for wetland habitat. Additional aquatic resource mitigation is discussed in Section 2.3. The remainder of the wetland mitigation is discussed in Section 2.4.

2.2.2 DESIGN CONSTRAINTS AND CRITERIA - DIVERSION CHANNEL AND ASSOCIATED WETLANDS

The design and location of the diversion channel and associated wetlands are limited by physical constraints as well as design criteria. The most limiting factors include available space, local topography, drainage patterns, and slope. In brief, there are very few locations where a new channel or wetland could be constructed. The local topography requires that the new features follow the southern and western perimeters of the landfill boundary and discharge into the Southern Tributary downstream of the proposed landfill. The following constraints and criteria place limitations on the channel and wetland design:

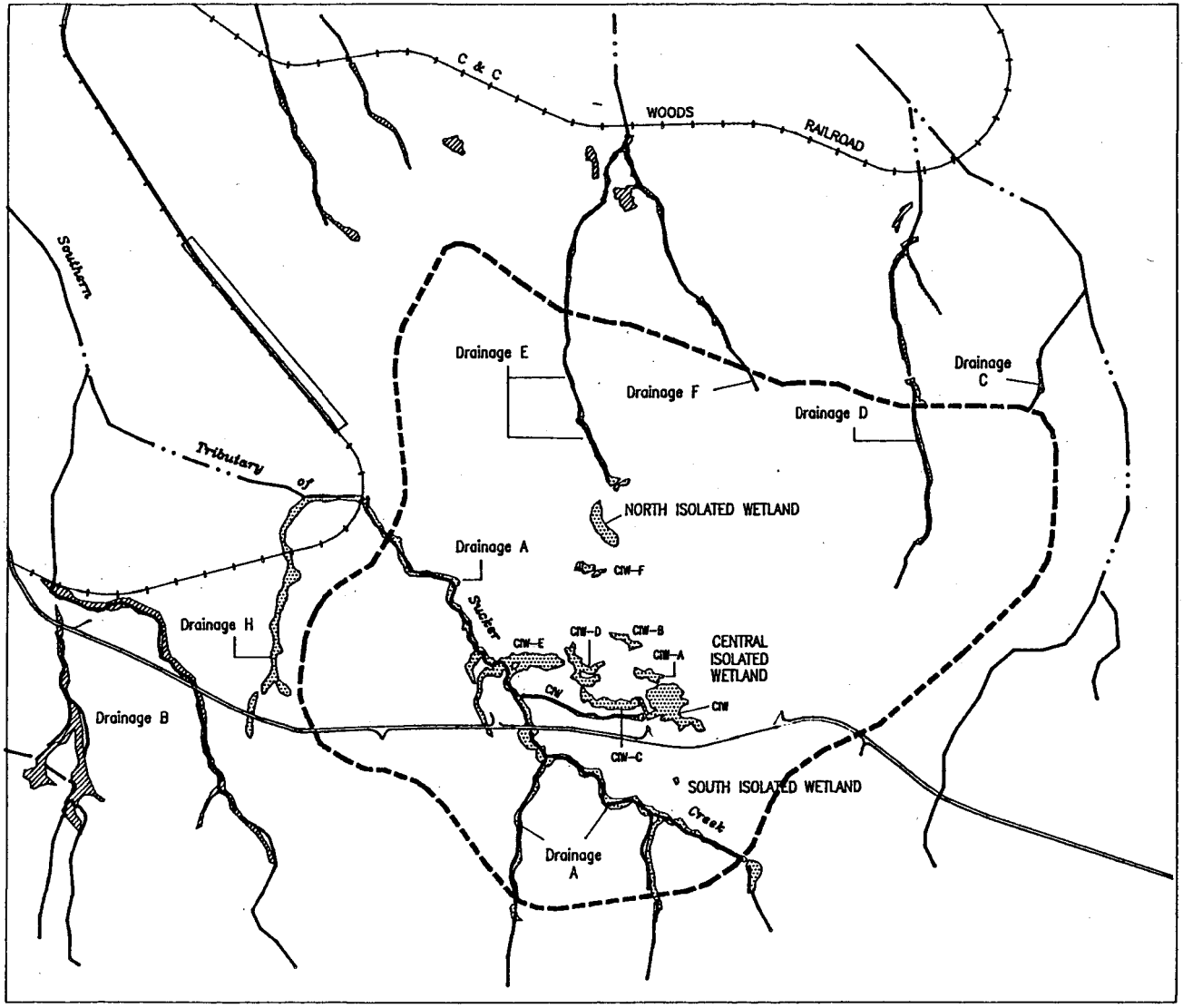
(1) route channel over existing topography;

(2) locate wetlands within existing topographic flats;

(3) route channel to minimize channel gradient;

(4) provide conveyance capacity for 100-year storm event;

Headquarters Camp Solid Waste Disposal Facility



LEGEND

- Flagged wetland boundaries within project area as delineated during Feb. 92 survey (COE verified March 92).
- Wetland habitat outside of direct project impact area

SCALE IN FEET

0 500 1000 2000

EMCON Northwest, Inc.

Figure 3. Wetlands delineated at the Headquarters site.

(5) conserve summer baseflow;

(6) maintain existing water quality;

(7) provide erosion protection for a 25-year storm event; and

(8) minimize potential for erosion and downcutting.

2.2.3 GOALS - DIVERSION CHANNEL AND ASSOCIATED WETLANDS

Natural vegetative succession and geomorphic processes will play a large role in the creation and evolution of habitat for macro-invertebrates, riparian animals, and other wildlife. Vegetative diversity, bank stability, basin storage, micro-hydrology, and soil development will adjust to natural inputs of water, sediment, and organic debris. The following list outlines the goals for the diversion channel and associated wetland areas:

(1) Geomorphic Characteristics:
   (a) provide appropriate channel geometry to convey the range of anticipated flows,
   (b) provide natural channel materials, and
   (c) enhance channel stability.

(2) Hydrology:
   (a) enhance summer baseflow and micro-hydrologic conditions,
   (b) provide for stormwater detention,
   (c) disperse flood energy and increase infiltration where appropriate,
   (d) improve water quality, and
   (e) minimize length of the Southern Tributary impacted by diversion of water.

(3) Terrestrial Resources and Wildlife Habitat:

(a) maintain a 50-foot wide managed buffer south and west of the channel and associated wetlands, this buffer will be managed as a riparian management zone for a Type 3 water greater than 5 feet wide or a wetland management zone for a Type A wetland less than 5 acres in size, as appropriate,

(b) maintain an undisturbed buffer extending from the channel and wetlands to the landfill perimeter road,

(c) provide for diversity of native plant and animal species,

(d) provide for wildlife access to the channel and wetlands, and

(e) restore forested habitat of existing wetlands along lower reach of diversion channel.

(4) Soils:

(a) stabilize soils with native vegetation and biodegradable blankets, as necessary,

(b) import wetland soils from impacted wetlands within the landfill footprint and other areas,

(c) limit seepage losses of water where appropriate,

(d) minimize potential for erosion, and

(e) minimize disturbance to existing wetlands.

Descriptions of the actual channel and wetland features are detailed below. The diversion channel has been divided into two segments, an upper reach and a lower reach.

2.2.4 DESIGN FEATURES - DIVERSION CHANNEL AND ASSOCIATED WETLANDS

Upper Reach

The upper reach of the diversion channel will begin at the southeast corner of the landfill and flow west along the 1600 Road (Figure 4). The lower reach begins at the point where the Southern Tributary meets the realigned 1600 Road. Above the upper reach, the channel will consist of a small grass-lined swale which will be sufficient to handle the minor runoff expected for the area (Figure 4). The total length of the upper reach will be approximately 3500 feet. The first 2800 feet

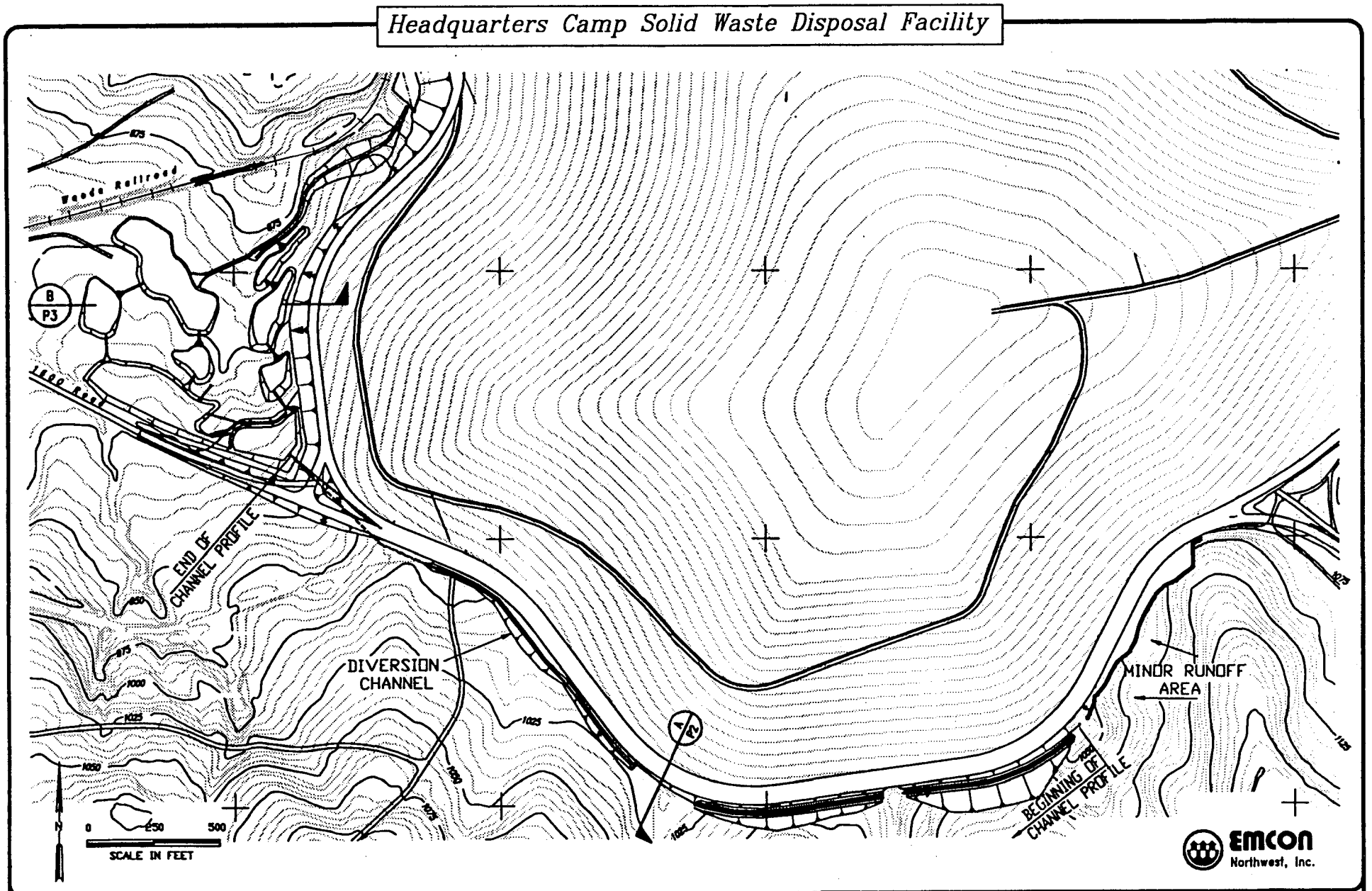


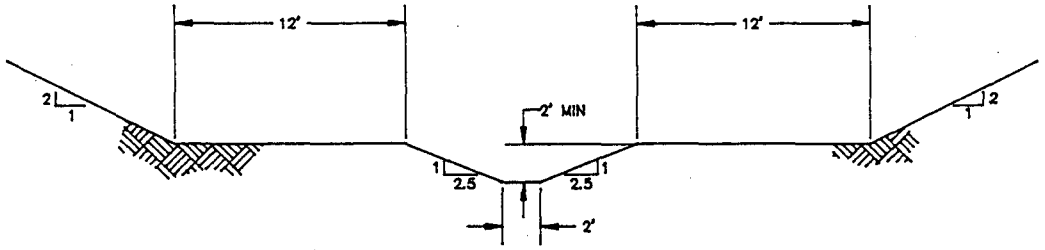
Figure 4. Plan view of the diversion channel and associated wetlands. Final topography of the landfill is also shown.

will consist of an open channel. The last 700 feet of the upper reach is currently planned to consist of a large diameter pipe. This pipe will direct water under the 1600 Road to the first wetland in the lower reach.

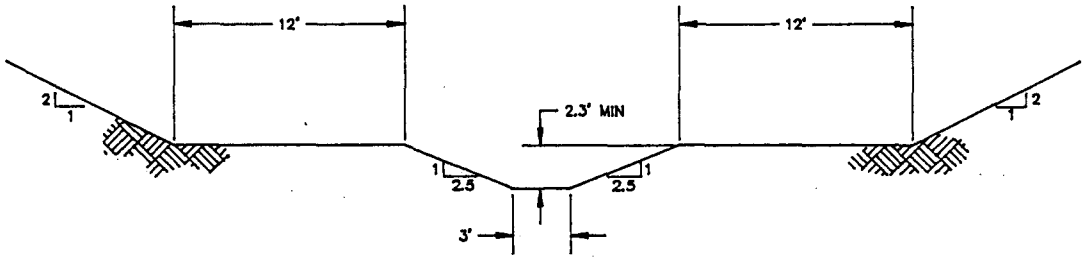
The design of the upper reach channel changes from the upper to lower end because of increasing flow and gradient. The channel will be trapezoidal in shape with the bottom width increasing from 2 feet at the headwaters to 4 feet at the lower end (Figures 5 and 6). The minimum depth will also increase going from 2 feet at the headwaters to 3 feet at the lower end (Figures 5 and 6). A grass lining will be sufficient to prevent erosion of the channel within the upper 1800 feet because of the shallow gradient and expected low flows in this portion of the upper reach (Figure 5). The gradient begins to steepen approximately 1800 feet down the channel (Figure 6). The steeper gradient and the expected flows at this point will necessitate the use of a rock-lined channel. At the end of the rock-lined channel, approximately 1100 feet further downstream, water will be directed into the large diameter pipe currently planned for the lower end of the upper reach (Figure 6). The pipe will initially be 42 inches in diameter and change to 36 inches in diameter after a approximately 200 feet (Figure 6). A structure for dissipating energy will be used to prevent erosion downgradient of the pipe outlet.

Much of the upper reach will have a shallow gradient. Over 90 percent of the open channel portion of the upper reach will have a gradient less than or equal to 2 percent (Figures 5 and 6). The gradient of the large diameter pipe will be much greater ranging from 7 to 11 percent (Figure 6).

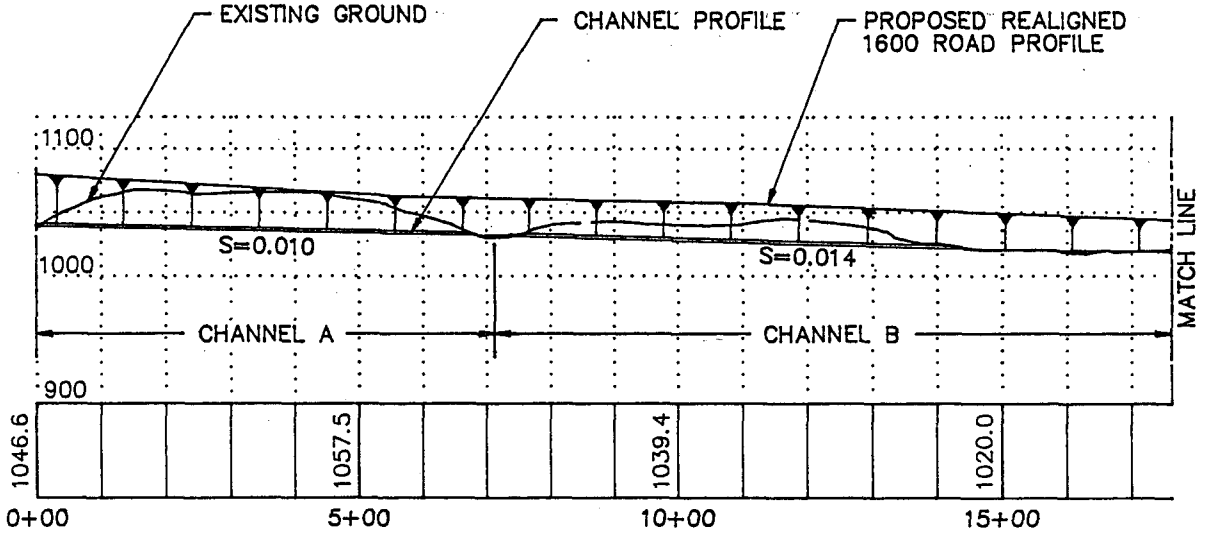
Construction of the diversion channel will require filling three small wetlands along the southern perimeter of the landfill (Figure 3). These wetlands will be replaced by three wetlands created on compacted fill material. The new wetlands will be located where three tributaries will join the diversion channel, which is the same location of the old wetlands (Figures 3 and 4). At the lower end of the wetlands, small rock weirs, approximately 1 to 1.5 feet high, will be constructed to detain floodwaters (Figure 7). The detained floodwaters will help establish wetland communities in these areas. The rock weirs will be designed to detain floodwaters but allow passage of summer baseflow with little or no ponding of water. To help pass summer baseflow through the wetlands,



GRASS-LINED CHANNEL A SCALE 1/10"=5'



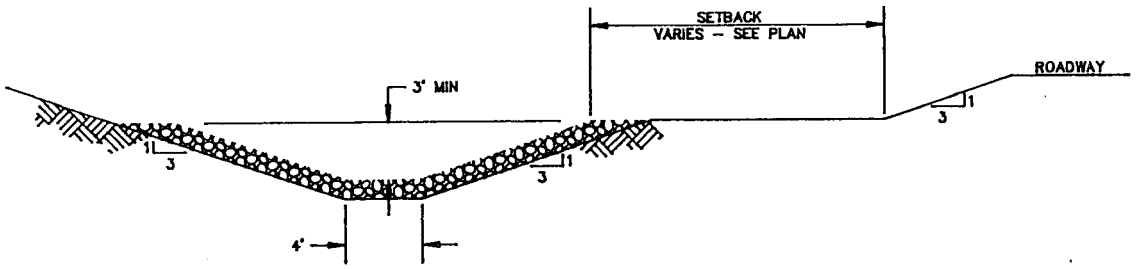
GRASS-LINED CHANNEL B SCALE 1/10"=5'



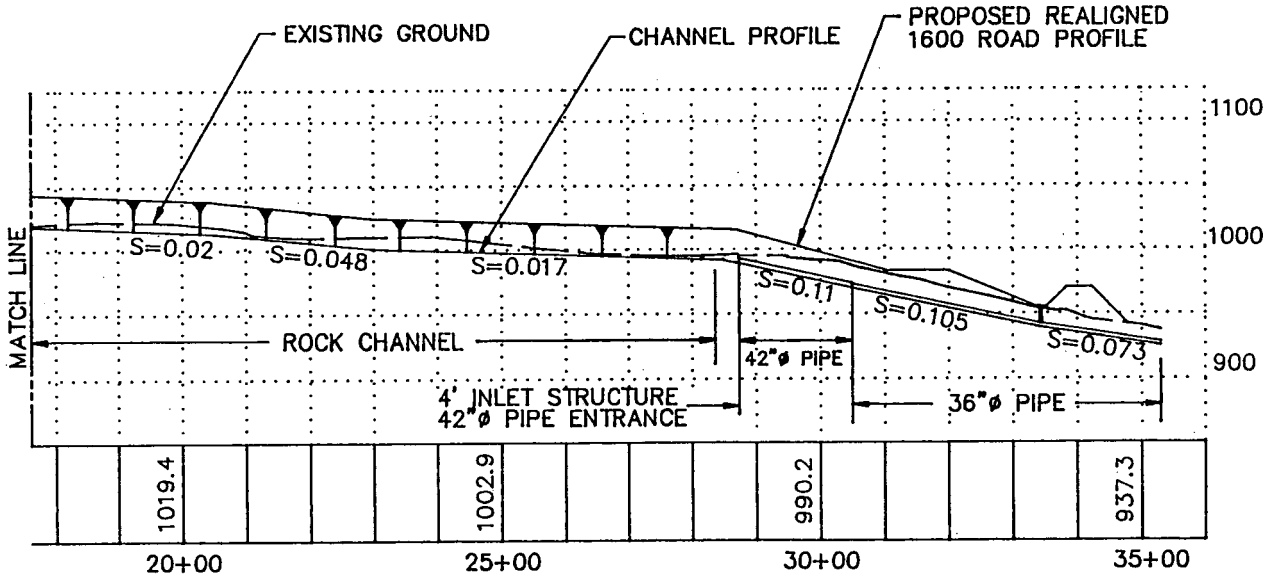
CHANNEL PROFILE

emcon Northwest, Inc.

Figure 5. Longitudinal profile and representative cross-sections of the upper 1800 feet of the upper reach of the diversion channel.



ROCK–LINED CHANNEL SCALE 1/10"=5'



CHANNEL PROFILE

EMCON Northwest, Inc.

Figure 6. Longitudinal profile and representative cross–sections of the lower 1800 feet of the upper reach of the diversion channel.

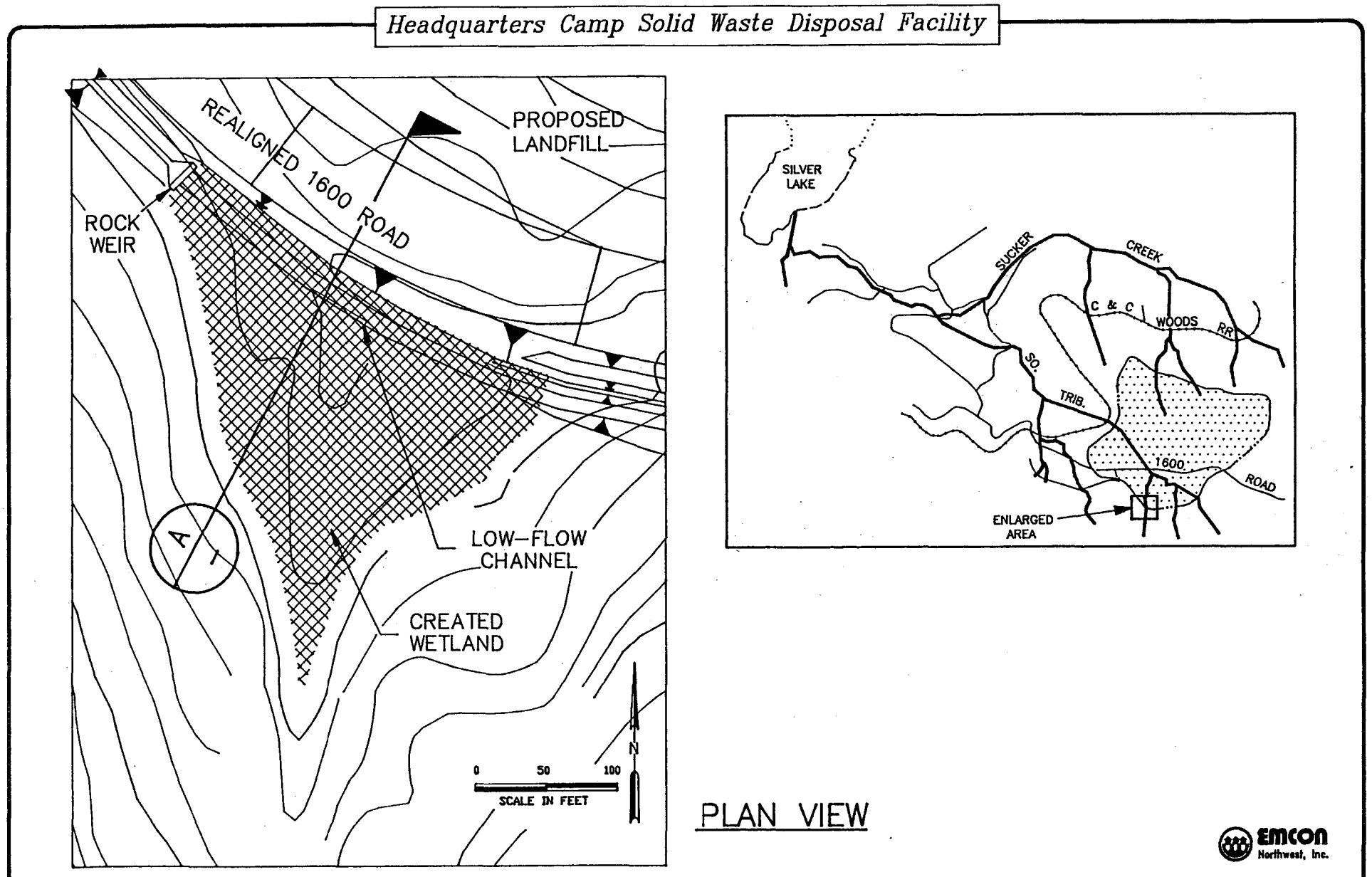


Figure 7. Plan view of a typical upper reach wetland.

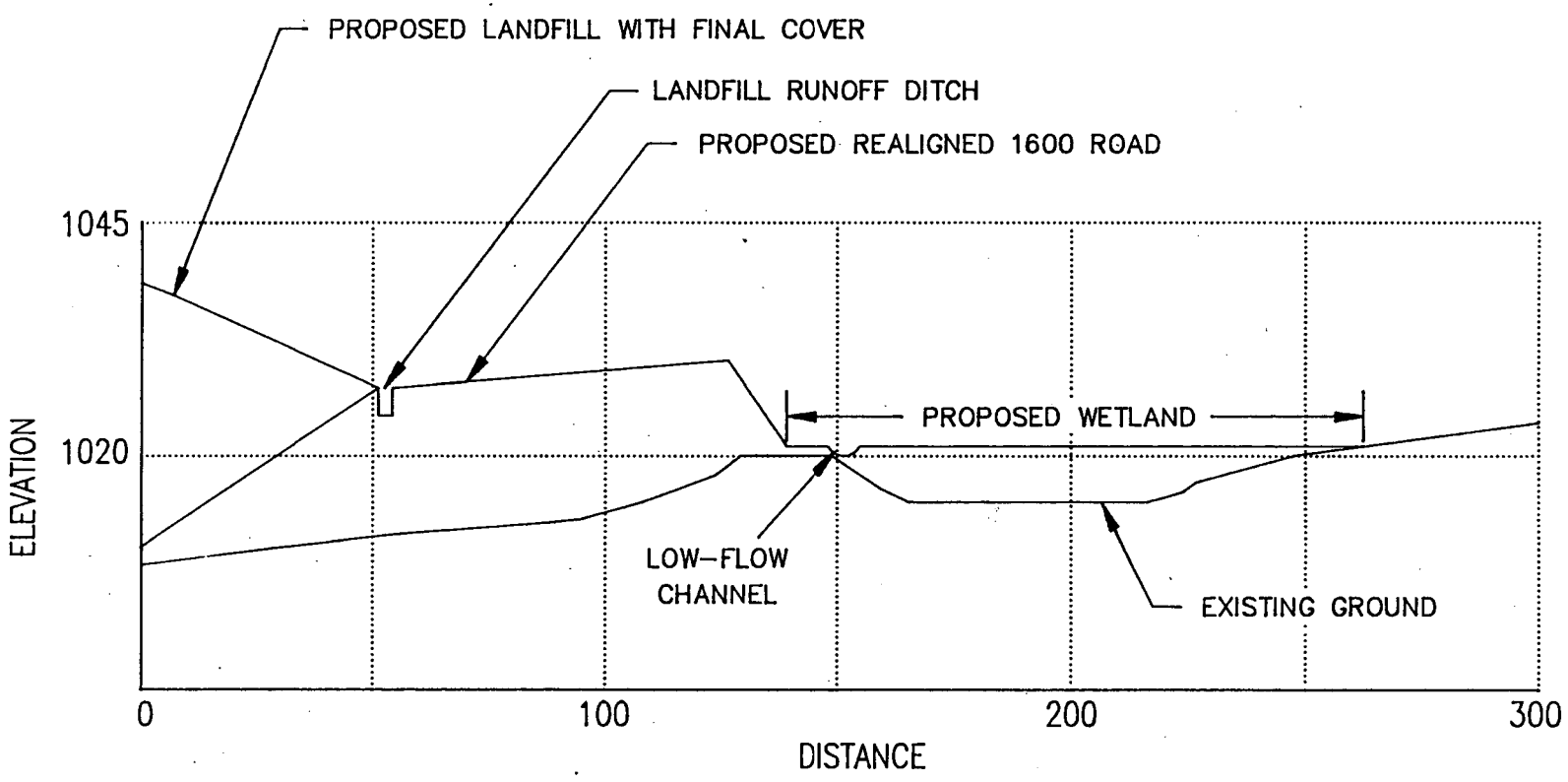
a small low-flow channel will be excavated through the newly created wetlands from the incoming diversion channels to the rock weirs (Figure 7). Figure 8 shows a typical cross-section through one of the upper reach wetlands.

Approximately 1.4 acres of wetlands will be created at the confluence of the diversion channel and the three tributaries. The 3 impacted wetland areas comprise approximately 0.2 acres of the total 11.9 acres of wetland impacts associated with project construction. Therefore, 0.2 acres of wetland restoration and 1.2 acres of wetland creation will be accomplished in the upper reach of the diversion channel.

Lower Reach

The lower reach of the diversion channel extends from the 1600 Road to the Southern Tributary. Water will enter the lower reach through a large diameter pipe. Floodwaters will flow into the uppermost wetland, rise to a designed elevation based on the desired vegetative communities, and then flow over two spillways (Figures 9 and 10). Water leaving each spillway will flow through a series of wetlands adjacent to the existing wetlands before coming together in a single drainage channel south of the C&C/Woods Railroad. During baseflow conditions and storm events, a small amount of water, equivalent to summer baseflow, will flow through the channel in the existing wetlands. Water flowing through the existing wetlands and the adjacent created wetlands will come together in a channel starting within the existing wetlands approximately 300 feet south of the C&C/Woods Railroad and extending east to the Southern Tributary between the landfill and the railroad (Figure 9). This single drainage channel will start as a depression receiving water from a large spillway draining wetlands west of the existing wetlands and water flowing through the existing wetlands. A spillway draining the wetlands east of the existing wetlands will join the drainage channel just downstream from its beginning. This drainage channel will join the Southern Tributary just south of the C&C/Woods Railroad (Figure 9).

A small amount of water will always flow through the existing wetlands. The amount of water released to the existing wetlands will be equivalent to summer baseflow in the diversion channel. During baseflow conditions, water leaving the large diameter pipe will flow through the first wetland to a baseflow inlet structure (Figures 9 and 10). Water entering the inlet structure will



SECTION A

EMCON Northwest, Inc.

Figure 8. Typical cross-section through one of the upper reach wetlands.

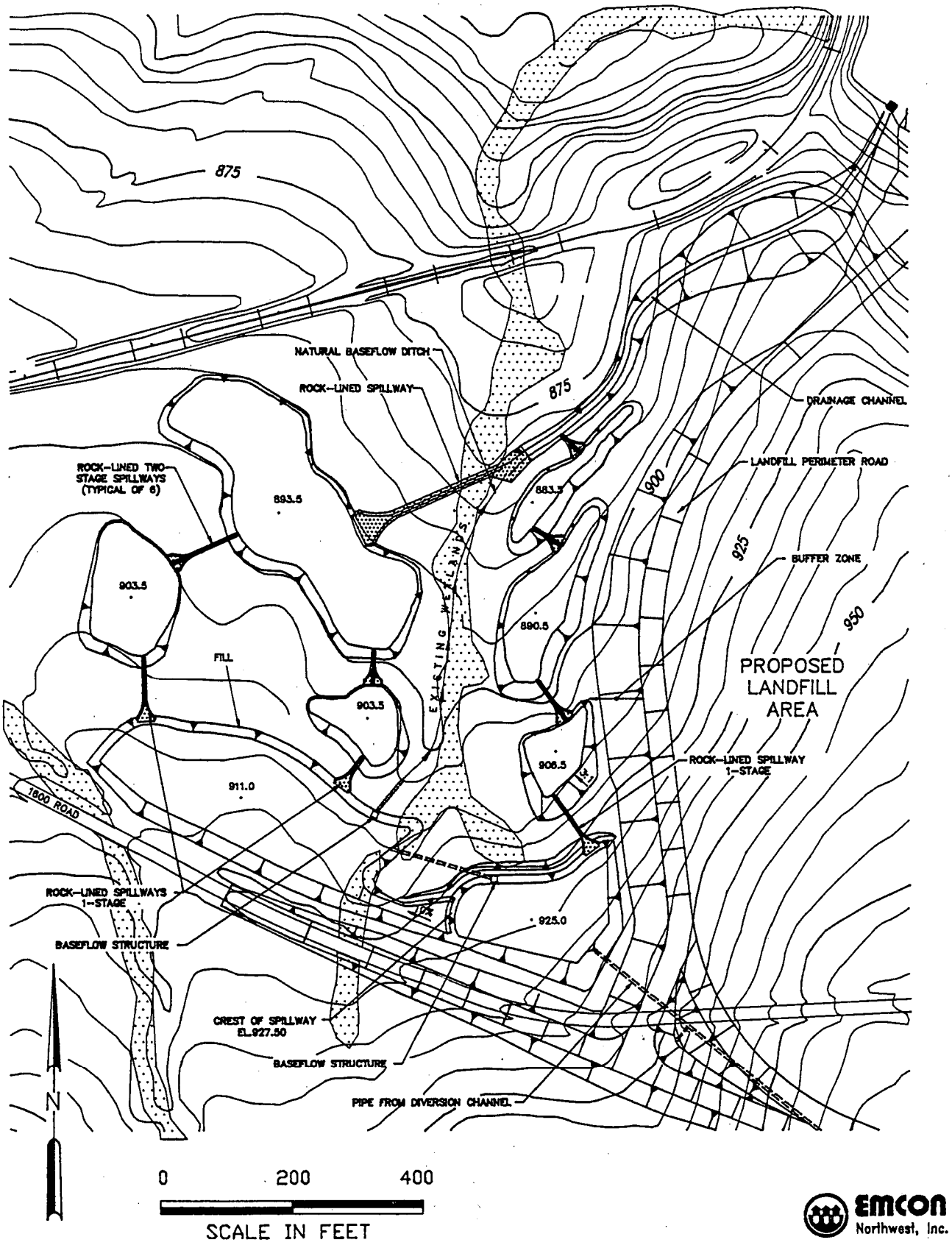


Figure 9. Plan view of the lower reach wetlands.

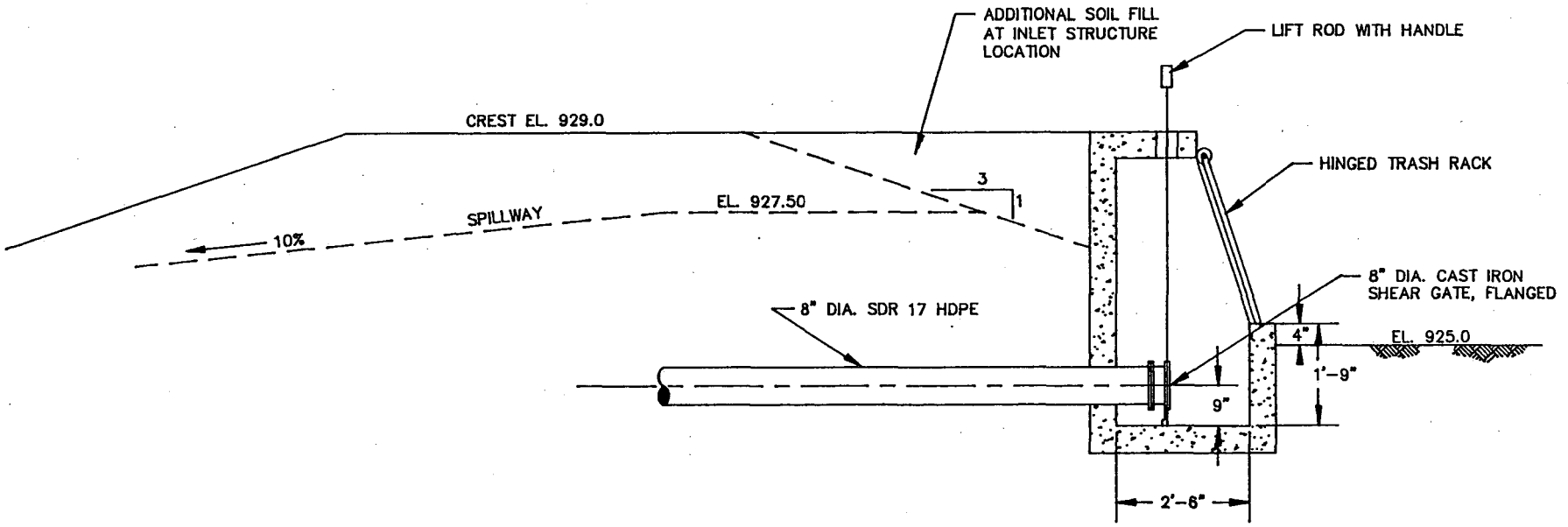


Figure 10. Cross-section of wetland berm showing relationship of spillway and baseflow inlet structure for the uppermost wetland. Relationship of the other baseflow inlet structures and associated spillways would be similar.

flow through a pipe to a second wetland to the west. From there it will enter a second baseflow inlet structure and pipe. The outlet for the second pipe will be within or adjacent to the existing wetlands. Water exiting the pipe will flow through the channel in the existing wetlands, enter the single drainage channel, and then flow to the Southern Tributary. During storm events, the majority of flow will be routed through created wetlands and rock-lined spillways located on both sides of the existing wetlands (Figure 9).

Water is expected to pond in the two uppermost wetlands during winter baseflow but not during the lower summer baseflow. This ponding will not adversely affect water quality or quantity as it would during the summer for three reasons. First, soils in each of the wetlands should be saturated during the winter reducing the possibility of losing water to infiltration. Second, colder temperatures and reduced plant growth during the winter should limit losses to evapotranspiration. Third, cold winter temperatures and reduced solar radiation should eliminate any concerns for deleterious increases in water temperature.

The two uppermost wetlands will each have three outlets: two single-stage spillways and one baseflow inlet structure. The spillways will only pass water when water behind the berms has reached a specific elevation. As currently designed, the baseflow inlet structure can be adjusted to regulate flow through the structure and the amount of time runoff is detained by the berms. Regulation of water levels behind the berms would be restricted by the requirement to quickly pass summer baseflow. Water levels would be regulated to ensure adequate wetting to allow development of a wetland plant community over as large an area as possible.

The baseflow inlet structure is designed to minimize maintenance requirements and provide easy and consistent passage of baseflows (Figure 10). The hinged trash rack will allow access to the interior of the structure and will collect larger debris carried by stormwaters. Sediment and smaller debris building up immediately in front of the pipe inlet is expected be flushed through the pipe. Sediment and debris not flushing through the pipe should be easily removed by hand.

Unlike the spillways of the two uppermost wetlands, the other created wetlands will have two-stage spillways (Figure 9). The first stage will pass small storm flows and drain the wetland at a restricted rate. The second stage will be much larger then the first, allowing unrestricted passage of large storm flows.

For the most part, wetlands and spillways will be created by excavating soils in upland areas. The two uppermost wetlands will require some fill to create berms for detaining and controlling water. These berms will consist of soils excavated to create the wetlands. Rock for lining the spillways will be obtained from a nearby gravel pit.

The slopes of the existing ground and the proposed wetlands and spillways to the east of the existing wetlands are shown in Figure 11 as representative of the created wetlands and spillways of the lower reach. The slope through the created wetlands will be very shallow, near zero. To provide for the shallow slope through the wetlands, the slope of the spillways will be much steeper, often exceeding 20 percent (Figure 11). Figure 11 also shows a typical cross-section through the proposed and existing wetlands and the landfill perimeter road.

Direct impacts to the existing wetlands resulting from construction will be limited. Most of the construction will occur in upland areas. Some excavating and filling within the existing wetlands will be necessary to create the channels, spillways, and wetlands. Construction related impacts will be reduced by limiting the area that construction equipment may work. In the existing wetlands, a small tracked excavator will shape the new channel from within the channel alignment. Excavated material and supplies necessary for channel construction will travel on a temporary road constructed directly over this alignment or over areas planned for excavation. Areas designated for excavation will be used for equipment maneuvering to facilitate construction, which will restrict ground disturbance to these areas and limit disturbances to other upland areas as well as the existing wetlands.

In addition, the existing wetlands along the lower reach of the diversion channel will be restored to the original forested habitat dominated by western redcedar (*Thuja plicata*) (Appendix C, Photo Series A & B). Enhancement of the existing 1 acre of emergent wetland will be achieved by planting tree seedlings such as western redcedar, black cottonwood (*Populus trichocarpa*), and

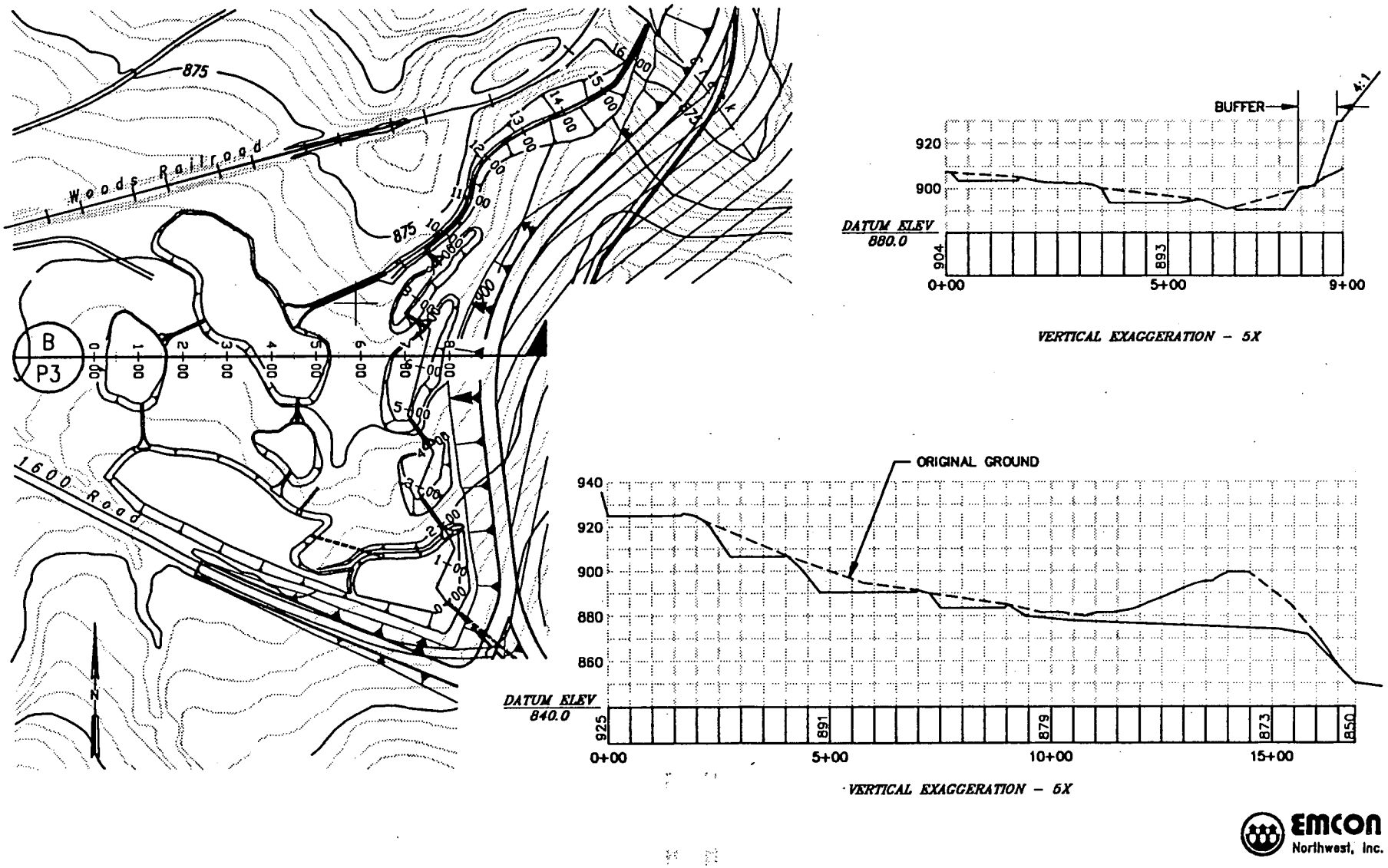


Figure 11. Typical longitudinal profile and cross–section through the lower reach wetlands.

Oregon ash (*Fraxinus latifolia*). Shrub species will also be planted where necessary; preferred species include willow (*Salix* sp.), red osier dogwood (*Cornus stolonifera*), and Pacific ninebark (*Physocarpus capitatus*). In addition, all areas disturbed by the construction activities will be revegetated with native species and protected with biodegradable erosion control fabric as necessary to control erosion.

An estimated 3.4 acres of wetland habitat will be created in the lower reach of the diversion channel. However, approximately 0.1 acres of wetland habitat will be impacted by the wetland and channel construction in this reach. Therefore, a net gain of 3.3 acres of wetland habitat will be created in the lower reach.

Summer baseflow will be maintained or enhanced with the proposed design of the upper and lower reaches of the diversion channel. The rock weirs of the upper reach wetlands and the baseflow inlet structures within the lower reach wetlands will be designed to quickly pass baseflow and prevent ponding of water. During the summer, ponded water would quickly heat up causing increased evaporative water loss. The design of the diversion channel in the lower reach may also permit any water discharging from the existing wetlands to be captured in the diversion channel. The diversion channel will be lined with compacted native soils to prevent seepage losses of baseflow to dry upland soils. The compacted soils will also prevent groundwater inflow from wet soils of the existing wetlands, eliminating any potential for draining the wetlands.

2.3 OFF-CHANNEL HABITAT IMPROVEMENT

2.3.1 OVERVIEW - OFF-CHANNEL HABITAT IMPROVEMENT

Off-channel ponds near the confluence of the Southern Tributary and Sucker Creek will mitigate for fisheries losses resulting from the project. The off-channel ponds will be excavated in the floodplain of the Southern Tributary to intercept local groundwater. Small channels will be constructed to connect the ponds to the Southern Tributary and to connect the ponds to each other (Figure 12).

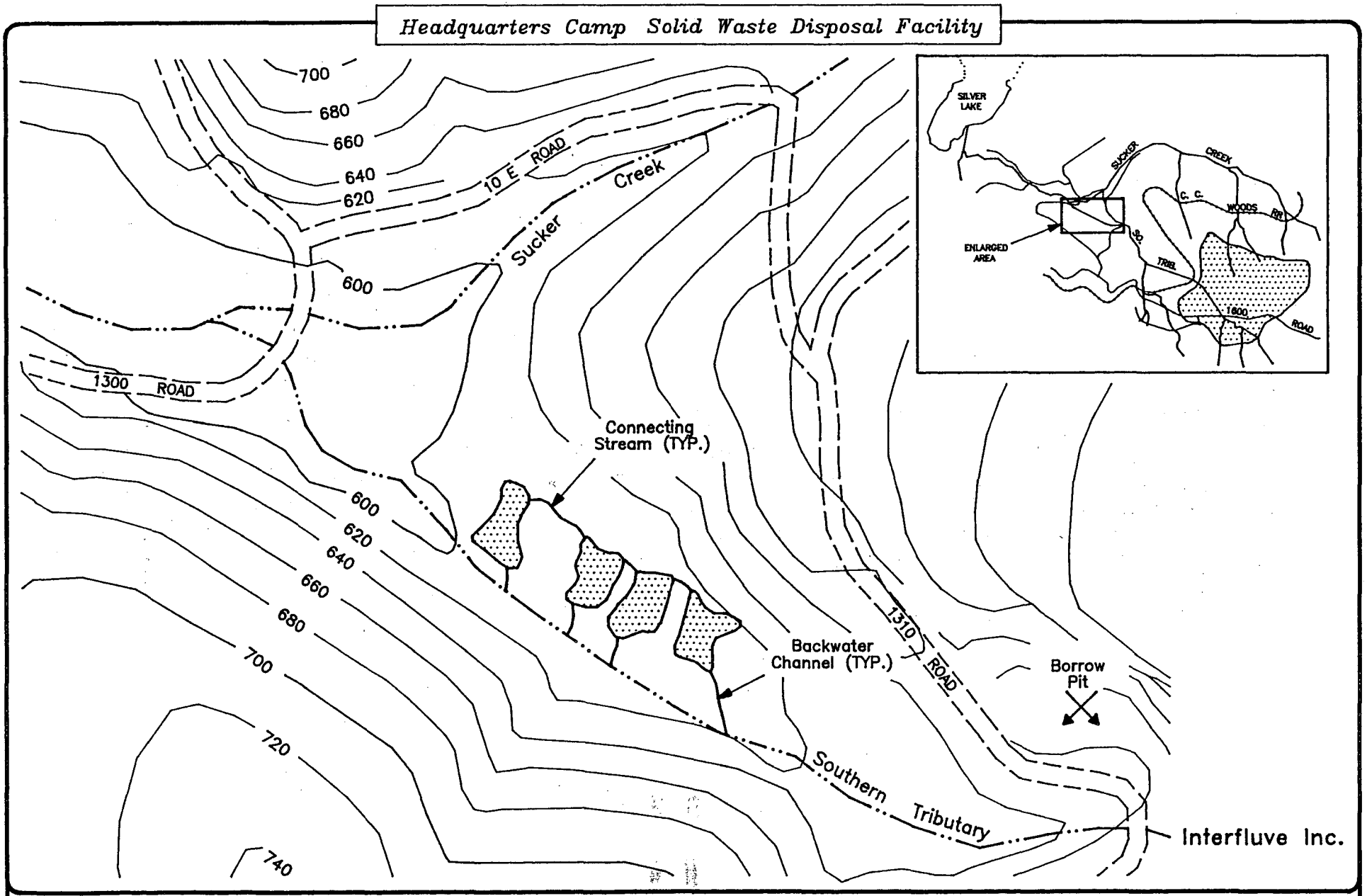


Figure 12. Plan view of the off-channel ponds.

The area proposed for the off-channel ponds presently supports emergent, scrub-shrub, and forested wetland habitat (Figure 13). A stand of 15 to 20-year-old Douglas fir (*Pseudotsuga menziesii*) is found north of this wetland area. The extreme eastern portion of the wetland is dominated by slough sedge (*Carex obnupta*), but also contains bulrush (*Scirpus microcarpus*), horsetail (*Equisetum* sp.), speedwell (*Veronica americana*), skunk cabbage (*Lysichitum americanum*), and cattails (*Typha latifolia*). A band of forested wetland, consisting of red alder and salmonberry (*Rubus spectabilis*), lies between this emergent wetland and the Southern Tributary. Velvet grass (*Holcus lanatus*) dominates the central portion of the entire wetland area. The western section of the wetland is primarily comprised of emergent and scrub-shrub habitat. The emergent component is dominated by species typical of disturbed areas with Canada thistle (*Cirsium arvense*) the most commonly observed plant species. This area was formerly inundated by beaver ponds. Evidence of old beaver channels still exists. Shrub willow (*Salix* sp.) and shrub and tree-size red alder are also found in the extreme western section of the wetland.

As discussed in Section 2.2.1, the portion of the Southern Tributary within the project footprint provides habitat for cutthroat trout, reticulate sculpin, and other aquatic organisms. Development of the off-channel ponds will provide habitat for these species plus other species such as coho salmon (*Oncorhynchus kisutch*). During a July 1992 survey, both cutthroat trout and juvenile coho salmon were found in the Southern Tributary in the area proposed for the off-channel ponds. Although individual fish and fish populations within the Southern Tributary appear healthy, habitat could be limiting production and survival of fish within the stream. The created habitat is expected to be utilized by fish primarily for refuge during high flows and rearing during baseflows. Many fisheries researchers have determined that off-channel habitat is beneficial to both cutthroat trout and overwintering coho salmon. Section 2.3.3 discusses the potential limiting factors and the potential benefits of off-channel ponds to fish.

2.3.2 DESIGN CONSTRAINTS AND CRITERIA - OFF-CHANNEL HABITAT IMPROVEMENT

The design of the off-channel ponds is constrained by four factors:

(1) Summer baseflow in the Southern Tributary must be conserved.

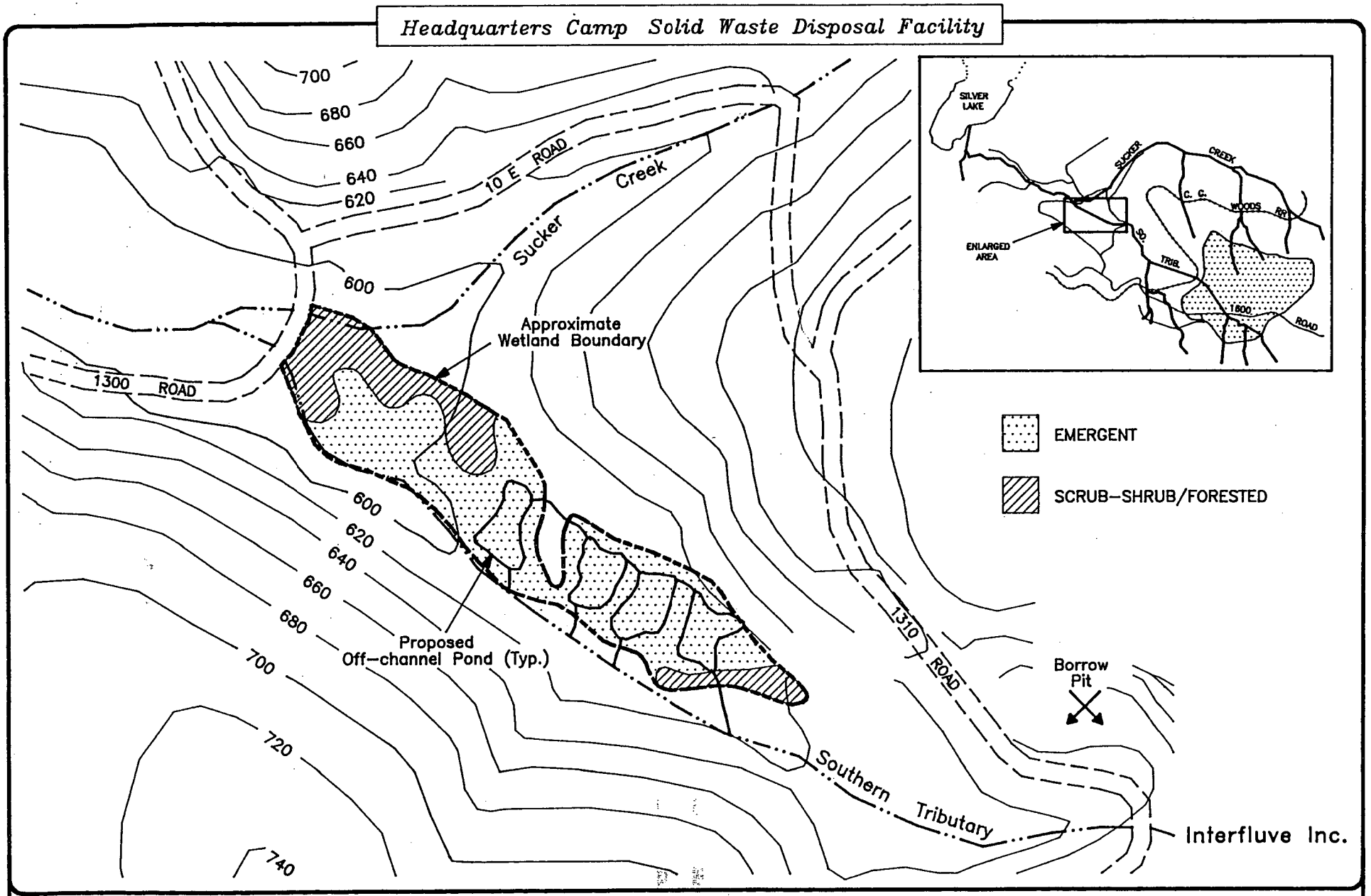


Figure 13. Approximate location of the wetland boundary and habitat types in the off-channel pond area.

(2) The ponds must be located in a geomorphically correct location.

(3) The ratio of open water to emergent habitat must be properly balanced.

(4) The ponds should require minimal maintenance to remain functional.

Baseflow in the Southern Tributary near its confluence with Sucker Creek is occasionally less than 0.1 cubic foot per second during the summer months. Utilizing the Southern Tributary baseflow for maintenance of off-channel ponds would adversely affect existing habitat within the channel. Therefore, the ponds will be constructed to use groundwater as the primary source of water. Groundwater can be most easily accessed within the floodplain of the Southern Tributary.

The off-channel ponds will be located in an area of relatively flat topography. Historically this area appears to have been flooded by beavers dams. Ground topography and soils are quite variable and random throughout the site. Designs will follow existing topography to most efficiently provide habitat, to minimize disturbance of the area, and to increase stability of the pond system. Construction of the ponds within the low-lying floodplain (as opposed to an upland area) will reduce the tendency for channels and ponds to shift over time, thus, providing the most maintenance-free setting possible.

The off-channel ponds will be created with a balance of open water and emergent habitat. Vegetation within the emergent wetland margins could increase productivity of the ponds, but could be detrimental under certain circumstances. In the summer, the vegetation will produce oxygen during the day and consume oxygen during the night. Because turnover of water in the ponds will be extremely slow during baseflow conditions, depletion of oxygen could occur. During fall and winter when the vegetation dies, oxygen within the ponds could potentially be depleted by the decomposing vegetation. By excavating the ponds to a depth below the photic zone, emergent vegetation will be restricted to a limited area of the ponds. Thus, the possibility of dissolved oxygen concentrations reaching deleterious levels should be reduced.

The entire off-channel pond habitat will be designed to work passively. No head gates or valves will be used. Water flow through the ponds will be controlled solely through establishment

of suitable base elevations and cross-sectional areas of the created channels. Relying on channel hydraulics to control flow distribution is inherently more stable and reliable than requiring periodic and precise adjustments of gates or valves.

2.3.3 GOALS - OFF-CHANNEL HABITAT IMPROVEMENT

Streams of the Pacific Northwest are hydrologically dynamic systems in which winter flows greatly exceed baseflows. In these streams, survival during winter floods is likely a limiting factor for coho salmon production (Cederholm and Scarlett, 1981). Juvenile coho salmon commonly use winter habitats with lower water velocities and increased depth and cover (Bryant, 1988; Cederholm and Scarlett, 1981; Nickelson et al., 1992a; Nickelson et al., 1992b; Tschaplinski and Hartman, 1983). In streams with limited habitat for refuge from high flows, construction of off-channel ponds has improved overwinter survival of juvenile coho salmon (Cederholm et al., 1988).

The primary goal of the off-channel ponds is to provide winter habitat for juvenile coho salmon. As discussed in Section 2.3.1, juvenile coho salmon have been captured in the Southern Tributary near its confluence with Sucker Creek. Habitat surveys indicate that the majority of instream habitat is composed of riffles. Little complex habitat in the form of deep pools, log jams, or undercut banks exists. Therefore, based on the habitat preferences discussed above, winter habitat for juvenile coho salmon in the Southern Tributary may be limiting.

A secondary goal of the off-channel ponds is to provide rearing and living habitat for cutthroat trout. Cederholm and Scarlett (1981) documented movement of cutthroat trout into tributaries and ponds from a mainstem drainage in western Washington. Mesa (1991) determined that wild cutthroat trout prefer pool habitat and concluded that energy expenditure for feeding and holding position in the stream may influence this preference. Heggenes et al. (1991) also determined that cutthroat trout prefer pool habitat and concluded that water depth and cover were the most important factors in the selection of habitat by cutthroat trout. Thus, because Southern Tributary lacks deep pools, the deep off-channel ponds should be beneficial to cutthroat trout inhabiting the stream.

2.3.4 DESIGN FEATURES - OFF-CHANNEL HABITAT IMPROVEMENT

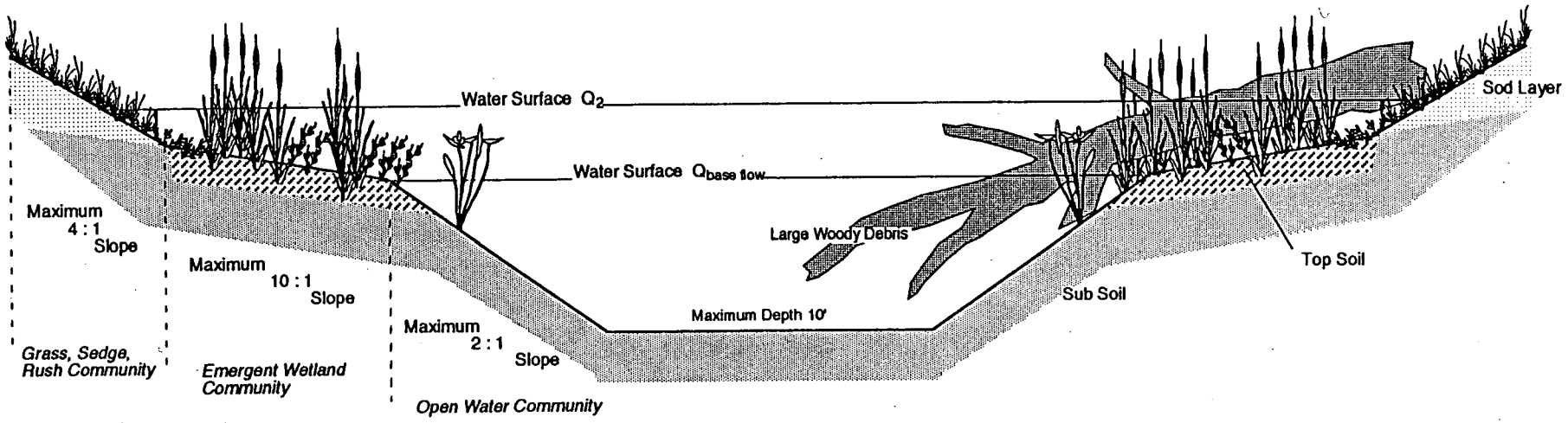
The four off-channel ponds will be approximately 0.25 acres in size. Each pond will be connected to the Southern Tributary by a small backwater channel. Another channel will connect the ponds on their northern ends.

The ponds and their associated channels will be excavated and, aside from a construction access road, no major berms or fill areas will be necessary for construction. Sides of the ponds above the water surface will be contoured at a 4:1 slope or less to control erosion (Figure 14). All excavated material will be removed from the site. To reduce impacts to adjacent vegetation and soils, construction activities will be limited to the excavated areas. Native, non-weedy plants removed prior to excavation will be used, if necessary, to revegetate disturbed areas. If sufficient plants are not available, then local plants will be supplemented with native species obtained from nurseries.

The water surface of the ponds will fluctuate seasonally in conjunction with the water level of the surrounding groundwater table and the Southern Tributary. Water surfaces will increase slightly, likely less than 2 feet during the wettest months. The lowest water surface elevation will occur during summer baseflows. The ponds are not anticipated to significantly affect post-project groundwater elevations because of their small size and location within the Southern Tributary floodplain.

About 30 percent of each pond's area will be excavated to a depth of approximately 10 feet below the local groundwater table to produce open water habitat. A fringe around the edge of the pond composing about 30 percent of the surface area will be a flat bench about 1 foot deep. This bench will be planted with emergent wetland vegetation. The remaining 40 percent of area will be a transition area between the shallow wetland bench and the deeper open water habitat. Over time, the transition area will be expected to become vegetated down to the limit of the photic zone. In their mature state, the ponds will be expected to be approximately 50 percent open water with the remaining area at least partially vegetated. This configuration should provide suitable rearing and living areas for both coho salmon and cutthroat trout, and yet eliminate any potential for deleterious effects as discussed in Section 2.3.2.

Headquarters Camp Solid Waste Disposal Facility



* Pond water surface to be maintained by ground water level during baseflow periods.
* Emergent wetland margins will account for about 30 percent of pond surface area.
* Topsoil will be placed on emergent wetland benches to facilitate growth of planted wetland vegetation.
* Sod removed during pond excavation will be stockpiled and used for revegetation of pond margins.
* Maximum pond depth will be 10 feet to maintain open water habitat.
* Large woody debris will be placed around margins to increase habitat complexity.

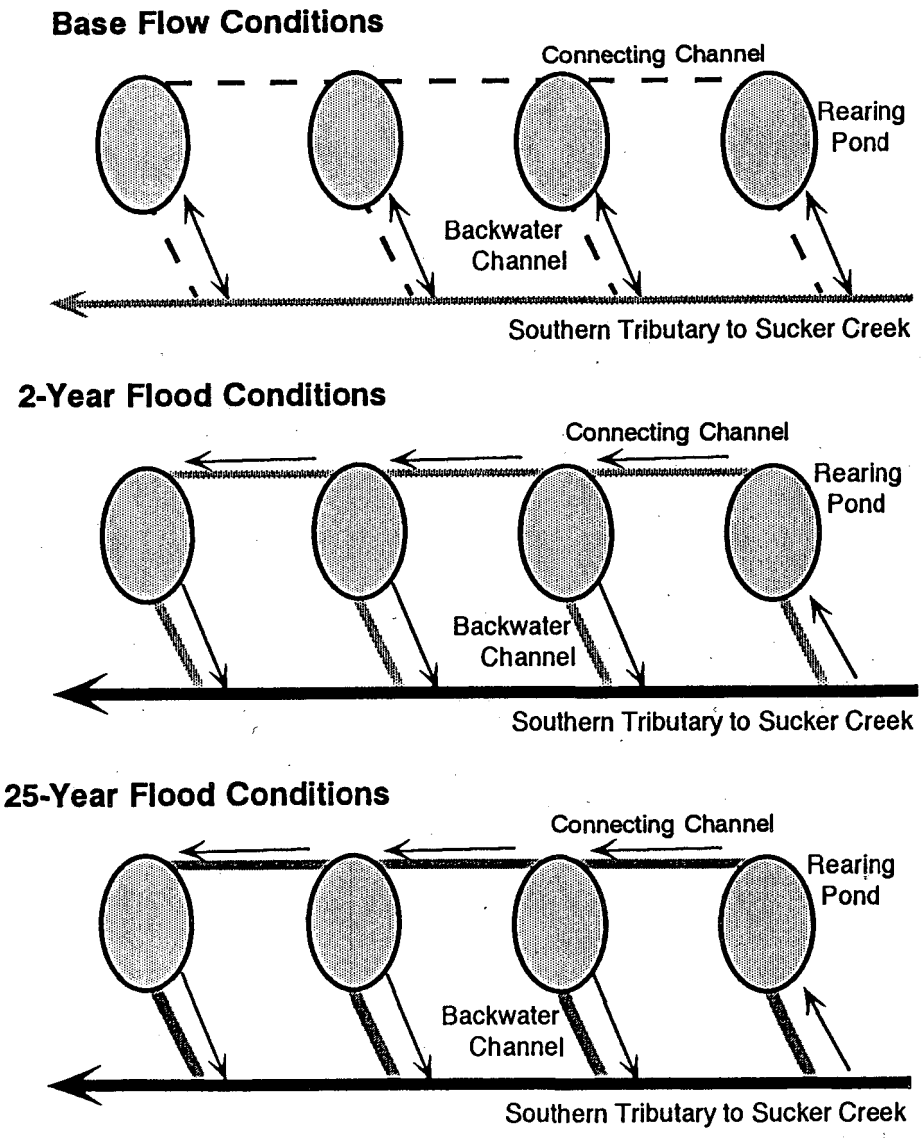
Figure 14. Typical cross-section through one of the off-channel ponds.

The design of the connecting and backwater channels will be based upon desired flows through each of the channels at different discharges (Figure 15). In general, no flow from the Southern Tributary will enter the off-channel ponds during summer baseflow. As discharge increases in the Southern Tributary, flow will begin to enter the off-channel pond system. During a bankfull discharge in the Southern Tributary, a flood that occurs about once every two years (estimated to be 75 cfs), about 5 cfs will be routed through the ponds. During the 25-year flood in the Southern Tributary (estimated to be about 225 cfs), 10 cfs will be routed through the system, and portions of the floodplain will be flooded. Average water velocities within the ponds should range from 0 to 0.05 feet per second.

The connecting channel will function much like a side channel that is seasonally inundated. When flow in the Southern Tributary has increased sufficiently above baseflow, water will begin flowing in the connecting channel. Water flow will be controlled by the elevation of the connecting channel, which will be slightly higher than the bed of Southern Tributary (Figure 16). Water is expected to flow from the Southern Tributary into the upstream pond and enter the connecting channel, where it will flow to all downstream ponds. At each downstream pond, a portion of the flow entering from the connecting channel will return to the Southern Tributary through the backwater channels. This design will allow sediment accumulations that may build up in the backwater channels to be flushed out during higher flows.

The backwater channels connecting the ponds to the Southern Tributary will be designed to provide access to the pond system during all times of the year. Data currently being collected on groundwater elevations in the area will be essential in properly designing the off-channel system. These channels will contain standing water even when the Southern Tributary is not actively flowing, much like channels created by beavers in pond complexes. The bed of each backwater channel will be excavated below the adjacent streambed surface in the Southern Tributary (Figure 16). During baseflow, no water will flow between the Southern Tributary and the ponds; however, ponded water in the backwater channel will allow fish access to the ponds.

Rock will be necessary for controlling erosion and flow in both the backwater and connecting channels. In addition, rock weirs will be placed in critical areas of the backwater and connecting channels to stabilize channel cross-sections and maintain associated hydraulic functions. Boulders



- During base flow conditions, the backwater channels will provide access to the Southern Tributary.
- During base flow conditions the connecting channel will not provide access to the Southern Tributary.
- During storm flow conditions, both the backwater and connecting channels provide access to the Southern Tributary.
- During storm flow conditions, the connecting channel functions as a flushing mechanism for the backwater channels.

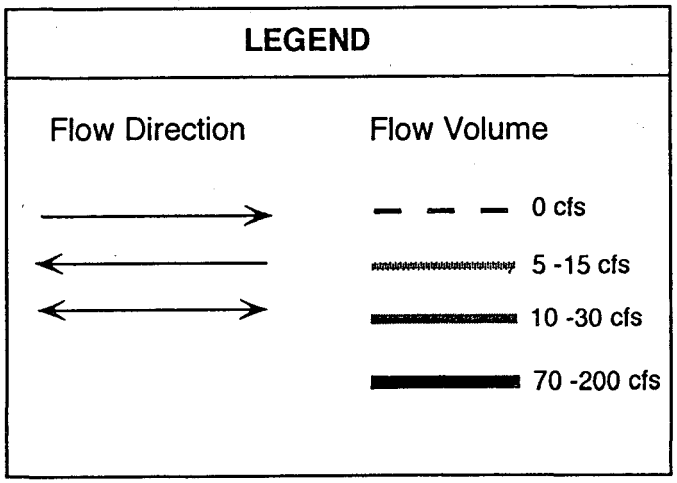
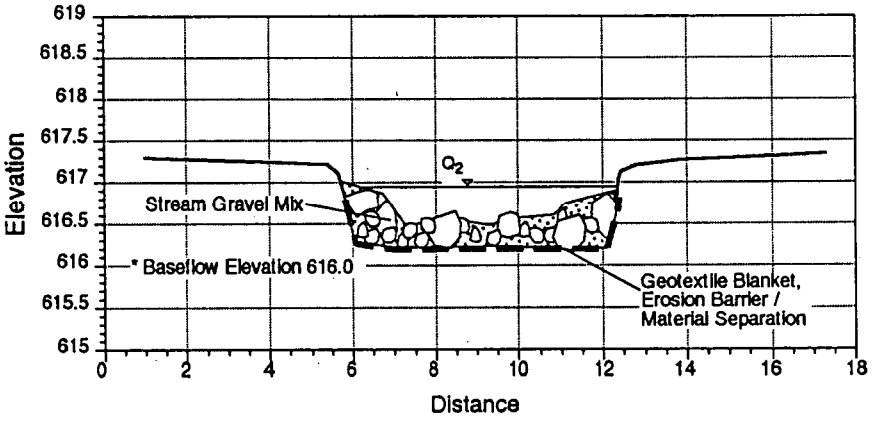
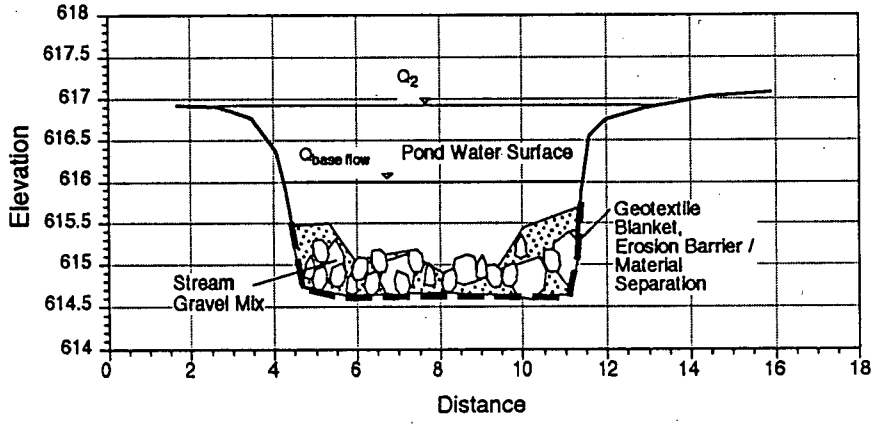


Figure 15. Expected flow network created by the off-channel ponds during three different flows.

Connecting Stream Channel, Typical Section at Off Channel Pond Outflow.



Backwater Channel, Typical Section



Southern Tributary Downstream of Backwater Channel

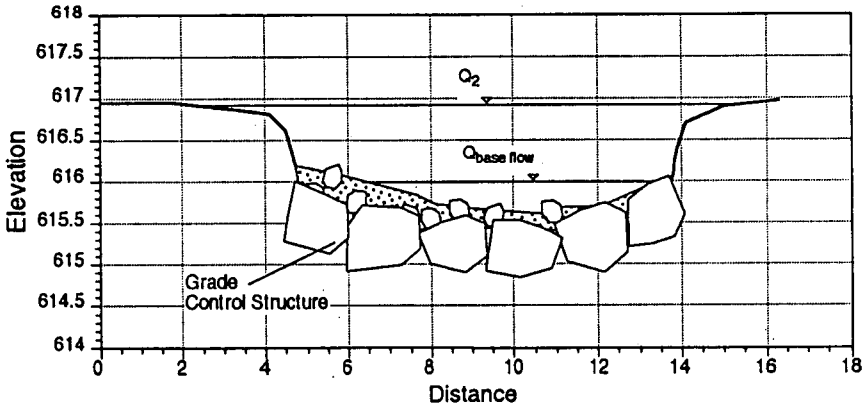


Figure 16. Representative cross-sections of the connecting channel, backwater channel, and Southern Tributary in the off-channel pond area.

will be placed within the bed of the Southern Tributary, level with the existing grade, to control channel elevations within the proximity of the ponds (Figure 16). If suitable, rock excavated on-site will be used for erosion protection, grade control structures, and weirs; otherwise, rock will be obtained from a nearby gravel pit. Geotextile fabrics may be necessary to provide a firm base to prevent the rock from mixing with fine subsoils. Based on the past beaver activity and the existing wetlands in the area, most of the soil could be composed of fine materials and unable to support the rock.

2.4 WETLANDS

2.4.1 OVERVIEW - WETLANDS

Wetlands at the Headquarters site are primarily associated with the six drainages located in the project area (Figure 3). These riparian wetlands are mostly confined to narrow strips along the drainages (Appendix C, Photo Series C). The wetlands are predominantly emergent wetlands dominated by soft rush (*Juncus effusus*), Baltic rush (*J. balticus*), slough sedge, and reedgrass (*Calamagrostis* sp.). Successional scrub-shrub wetland is associated primarily with the Southern Tributary where it passes through stands of young coniferous trees (10 to 20 year age classes). The scrub-shrub wetlands are dominated by salmonberry, with willow and red alder also present. Dense narrow bands of salmonberry also occur along several of the other drainages.

Wetlands not directly associated with the drainages were identified in 3 general areas and comprised 4.8 acres of the wetlands planned for filling within the project boundary (Appendix C, Photo Series D). These wetlands are found in swales and depressions in the central portion of the site. The configuration of these wetlands has been partially influenced by compaction from logging equipment. Although labelled as "isolated", these systems are typically associated with the drainages through a direct surface or subsurface connection with the on-site drainages. These wetland systems are composed predominantly of emergent wetland species; although, a small portion of the central isolated wetland is dominated by willow and salmonberry.

The Weyerhaeuser soil survey identifies the Morgan and Raught soil series within the Headquarters site. These are well-drained soils and are not considered to be hydric. The wetland field delineation identified small inclusions of hydric soils at the site. Some of the hydric soils are associated with the small drainages where water tables are consistently high. Others are found in small isolated inclusions and appear to be variants of the Morgan and Raught series with high clay content.

The wetlands in the project area increase wildlife habitat diversity (Table 2). The scrub-shrub riparian wetlands provide a wildlife habitat component which varies in structure and species composition from the upland forest cover types within the Headquarters site. The emergent riparian wetlands provide cover for small mammals, amphibians and reptiles, and provide a varied food source from upland vegetative species. In addition, woody debris scattered throughout the wetland and upland habitat provides additional cover for small animals.

The isolated wetlands and wetlands associated with the drainages provide limited surface water retention, groundwater discharge, and biofiltration functions (Table 2). The north and central wetlands are likely groundwater discharge areas which also provide biofiltration of local surface runoff. Riparian wetland vegetation provides bank stabilization for the drainages and dissipates surface runoff into the drainages.

Approximately 11.9 acres of wetland will be filled during the development of the project. Table 3 summarizes the wetland area lost by vegetation type and wetland category (see Appendix B for definition of wetland categories).

2.4.2 GOALS - WETLANDS

Goals for the wetland mitigation areas include the following:

(1) Replace lost biological and hydrologic functions of the filled wetlands, such as
   (a) stream cover and shading,
   (b) streambank stabilization and surface water dissipation,
   (c) groundwater recharge and biofiltration, and
   (d) wildlife cover and forage.

Table 2. Functions and values of wetlands within and adjacent to the Headquarters site.

Wetland Area	Acres Per Habitat Type			Functions and Values	
	Emergent	Scrub-Shrub	Total	Biological	Physical
Drainage A	2.80	2.70	5.50	Wildlife habitat - limited diversity; pool/riffle habitat supports resident trout	Stream bank stabilization; biofiltration
Drainage C	0.09		0.09	Small area, little diversity	Limited biofiltration
Drainage D	0.33	0.33	0.66	Little wildlife habitat in upper drainage, moderate diversity in lower drainage	Bank stabilization, limited biofiltration in upper drainage
Drainage E	0.49	0.21	0.70	Deer forage in upper drainage, dense scrub-shrub limits large animal movement in lower drainage but provides some passerine bird habitat	Significant biofiltration in upper drainage
Drainage F		0.18	0.18	Dense scrub-shrub, limited diversity, passerine bird habitat	Bank stabilization
Drainage H	1.10		1.10	Limited diversity, year-round water source	Spring-fed system, significant biofiltration and recharge
South Isolated Wetland	0.02		0.02	Small isolated patch of wetland habitat; does not provide any significant/unique function	
North Isolated Wetland	0.52		0.52	Limited diversity, deer forage observed	Moderate recharge and biofiltration
Central Isolated Wetland	4.07	0.19	4.26	Limited diversity, deer forage observed	Moderate recharge and biofiltration
TOTAL	9.42	3.61	13.03		

Table 3. Wetland area, grouped by WDOE wetland category, impacted by the landfill footprint and support facilities for Alternative Site Plan A.

Habitat Type	Wetland Area (acres)			
	Category II	Category III	Category IV	Total
Scrub-Shrub	2.7	0.9	0	3.6
Emergent	2.8	5.0	0.5	8.3
Total	5.5	5.9	0.5	11.9

(2) Provide compensatory mitigation for filled wetlands at minimum replacement and enhancement ratios recommended by WDOE:

(a) minimum replacement ratios

Category II and III wetlands (see Appendix B for definition of wetland categories)

1.5:1 for emergent wetlands

2:1 for scrub-shrub wetlands

(b) minimum enhancement ratios

Category II and III wetlands

3:1 for emergent wetlands

4:1 for scrub-shrub wetlands

(3) Preserve stands of mature forested and riparian wetland habitat which is currently harvestable under State Forest Practices Act or other pertinent regulations. An important consideration in selecting set aside areas for preservation is the adjacent land use and wildlife habitat quality.

Protection for streams and wetlands within commercial timberlands is contained within the Forest Practices Rules and the State Shorelines Management Act. New forest practices management guidelines for wetlands and prescribed buffers were adopted in June 1992. These rules prescribe timber harvest restrictions within wetland management zones (WMZs) of nonforested wetlands, but only assign operational restrictions within forested wetland systems (WAC 222-30). The present requirements are described below.

Forest Practices Rules and Regulations

(State of Washington Forest Practices Board and Department of Ecology, effective 8/1/92)

Riparian Management Zone

Waterway		Max. Width of RMZ (feet)	Ratio of Conifer to Deciduous/Min. Leave Tree Size	Number of Trees per 1000 feet of Shoreline	
Type	Ave. Width (feet)			Gravel/Cobble <10" Diameter	Boulder/ Bedrock
1 & 2	≥ 75	100	representative of stand	50	25
1 & 2	< 75	75	representative of stand	100	50
3	≥ 5	50	2 to 1/ 12" or next largest available	75	25
3	< 5	25	1 to 1/ 6" or next largest available	25	25

Wetland Management Zone

Wetland Type	Acres of Nonforested Wetland	Wetland Management Zone Width (feet)[1]			Number of Leave Trees Required in WMZ
		Maximum	Average	Minimum	
A	> 5	200	100	50	Leave 75 trees per acre > 6" dbh, 25 of which shall be > 12" dbh including 5 trees > 20" dbh where they exist
A	0.5 to 5	100	50	25	
B	> 5	100	50	25	
B	0.5 to 5			25	
B	0.25 to 0.5	No WMZ Required			

[1] Width of WMZ measured horizontally from edge of wetland or the point where the nonforested wetland becomes a forested wetland.

Shorelines Management Act

The Shorelines Management Act requires selective commercial timber cutting so that no more than 30 percent of the merchantable trees may be harvested in any 10-year period.

2.4.3 MITIGATION MEASURES - WETLANDS

Wetland impacts have been minimized by adjusting the landfill design to reduce the total area of wetland filling. Several mitigation measures have been proposed to compensate for the direct loss of 8.3 acres of emergent wetland and 3.6 acres of scrub-shrub wetland. The general locations of wetland mitigation areas are shown in Figure 17. The proposed mitigation measures are discussed below:

(1) Create and enhance wetlands along the diversion channel. Adjacent to the southern perimeter of the landfill, three small wetlands will be created at the confluences of three tributaries with the diversion channel. These wetlands will replace wetlands filled during construction of the diversion channel and provide an additional 1.2 acres of wetland habitat. Between the 1600 Road and the C&C/Woods Railroad, several acres of wetland will be created by excavating soil adjacent to the existing wetlands and by detaining floodwaters behind berms. The existing wetlands will also be enhanced through selective plantings. Some additional wetland habitat will likely develop within the diversion channel itself, although no effort will be made to establish wetland plants within the diversion channel. See Section 2.2.4 for a full description of the wetland creation associated with the diversion channel.

(2) Preserve mature forested and riparian wetland habitat in the Sucker Creek basin with relatively high biological value (i.e., beaver dam complex, Figure 17, Appendix C, Photo Series E - G). The Sucker Creek drainage supports a series of beaver dams immediately north of the proposed Headquarters project site. The Sucker Creek drainage is wide and gently sloped in this area. Deciduous forested wetland habitat is found throughout the drainage in this area (Appendix C, Photo Series F), including small stands of Oregon ash scattered throughout the area. Salmonberry, skunk cabbage, slough sedge, and bulrush are the dominant understory and ground cover species. Significant ungulate browse was observed in March 1991 on newly emergent skunk cabbage, bulrush, and slough sedge. A coniferous forest wetland component is found near the wetland-upland zones in the basin (Appendix C, Photo Series G). The deciduous and coniferous stands in this

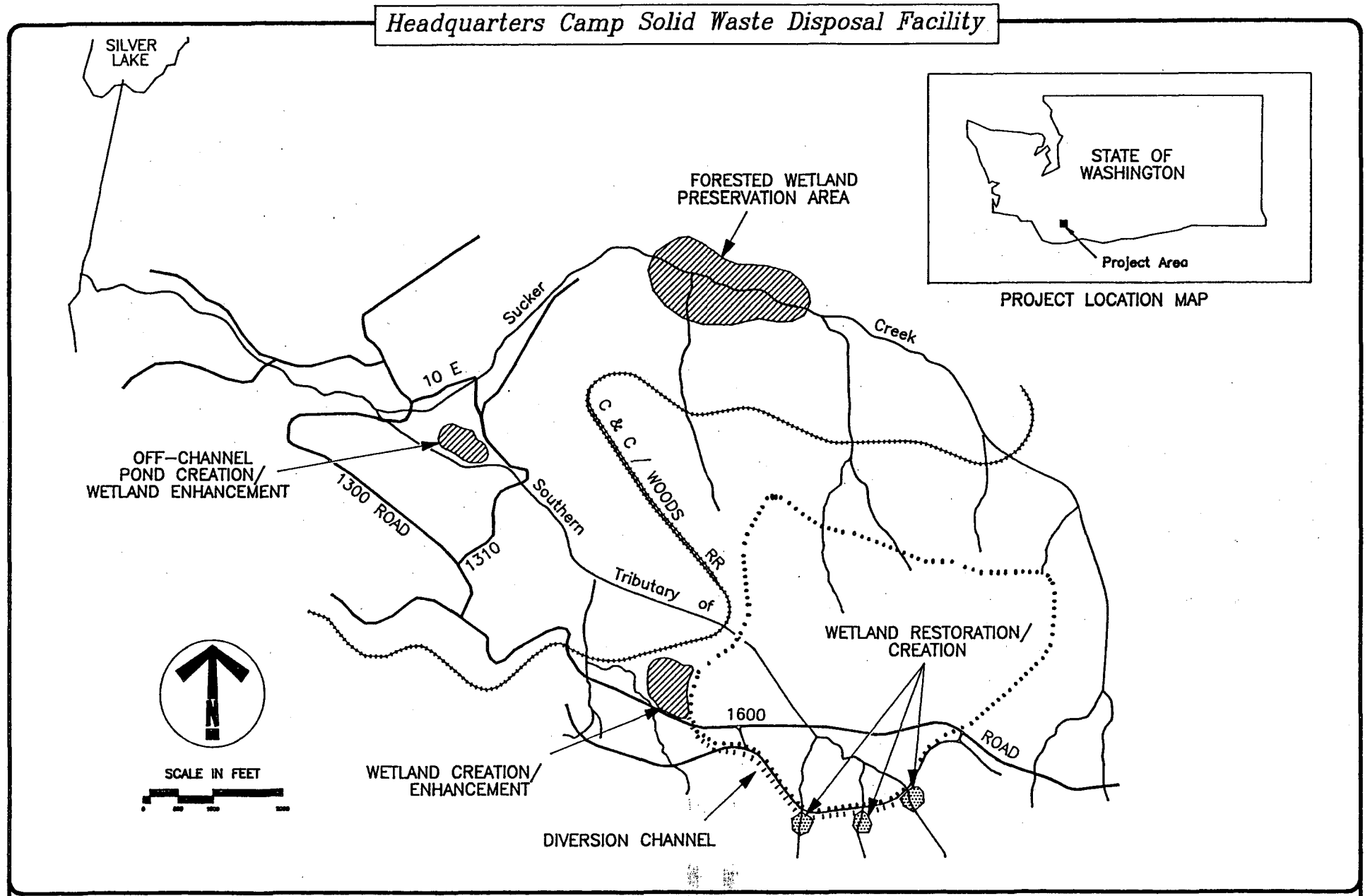


Figure 17. General location of the wetland mitigation areas. Mitigation areas not shown to scale.

portion of the drainage range from 50 to 72 years in age. Diameter at breast height (dbh) of most red alder ranges from 6 to 15 inches, and height ranges from 42 to 76 feet. Red alder, used for lumber, cabinet veneer, pallets, chips, and pulp, is merchantable at 4 inches dbh. Preservation from proposed harvest activities permitted under the Forest Practices Act will allow the mature forested component to remain in an extended portion of this drainage area.

(3) Add habitat components to existing wetlands such as logs and snags to enhance wildlife habitat functions.

(4) Establish and maintain buffer zones around created wetlands. Provide upland buffer adjacent to these wetland systems with site-specific harvest prescriptions for the forested buffer.

2.4.4 SUMMARY - WETLANDS

A total of 62.6 acres of wetland will be enhanced, created, or preserved as compensation for the loss of 11.9 acres of existing wetlands (Table 4). The estimated acreage presented in Table 4 is based on the mitigation plan outlined above. Refinement of these estimates will occur through further agency review and during the development of contractor bid documents. Currently, WDOE does not have recommended ratios for determining the area of preserved wetlands acceptable for mitigating wetland losses. For this mitigation plan, the proposed acreage for preservation was determined by doubling the minimum enhancement ratios recommended by WDOE.

3.0 MONITORING OF MITIGATION MEASURES

A monitoring program will be developed to evaluate the success of the proposed mitigation measures. This section provides some general guidelines and resource-specific criteria and methods for monitoring mitigation measures. These guidelines serve as the framework for developing a comprehensive monitoring plan for review and approval by the agencies. In addition, a contingency plan will be developed to make appropriate adjustments should monitoring indicate that mitigation goals are not being achieved.

Table 4. Proposed acres of wetland mitigation to compensate for wetland losses. Acreages may adjust as the mitigation design and construction plans are refined.

Type/Location	Open Water	Emergent	Scrub-Shrub	Scrub-Shrub Forested	Total
Replacement-Creation/ S. Perimeter Road	-	0.9	0.5	-	1.4
Creation/ Lower Reach of Diversion Channel	-	1.5	-	1.8	3.3
Enhancement/ Diversion Channel	-	-	-	0.5	0.5
Enhancement/ Off-channel Ponds	-	1.0	-	-	1.0
Preservation/ Sucker Creek Beaver Ponds	3.0[1]	-	3.0[1]	50.4[1]	56.4
Total	3.0	3.4	3.5	52.7	62.6

[1] Acreages for the various habitat types comprising the preservation area are preliminary estimates. More accurate estimates of each habitat type will be determined from ground surveys, at which time, the proposed preservation area will be flagged for agency review.

As-built drawings will be developed for each of the mitigation measures. These drawings will serve as the baseline conditions. Drawings will include plan views and cross-sections for each measure as well as additional detail relating to construction such as slopes, compaction of soils, fill areas, and fill materials. Planting details for each area will also be shown.

Photographs of each of the mitigation areas will be taken from permanent photo stations to document changes in the mitigation measures. Photographs will be taken before and during construction as well as annually throughout the length of the monitoring program. Aerial photos of the mitigation areas will also be taken annually for five years following initiation of construction.

All mitigation areas and buffers will be marked with permanent markers to facilitate monitoring and to ensure that only authorized activities occur within the mitigation areas and buffers.

The first monitoring report will be submitted within 13 months following construction of the first mitigation measure. Monitoring reports will be submitted annually thereafter for the duration of the planned monitoring activities.

3.1 FISHERIES

3.1.1 MONITORING OVERVIEW - FISHERIES

A monitoring program will be developed to determine the success of off-channel ponds in providing fish habitat. Stream habitat and water quality conditions will also be monitored downstream of the landfill to ensure that the construction and operation of the landfill have not adversely affected available fish habitat.

3.1.2 MONITORING METHODS AND CRITERIA - FISHERIES

The monitoring of the off-channel ponds will consist of two parts; biological monitoring and physical monitoring. Biological monitoring will assess vegetative growth around the ponds and fish use of the ponds. Methods and criteria used for assessing the establishment and success of plantings will be similar to those described in Section 3.4.2. Physical monitoring will consist of visually determining of system stability and maintenance problems. Physical monitoring will also consist of recording development of the pond area with photographs taken from permanent photo stations.

Success of the off-channel ponds will be determined by documenting use of the ponds by either coho salmon or cutthroat trout. Biologists will snorkel each of the ponds and visually estimate the number of coho salmon and cutthroat trout present in the ponds.

Biological and physical monitoring will be conducted for a minimum of 5 years to ensure success of the off-channel ponds. Annual monitoring reports will be compiled and submitted to the agencies for review.

3.2 SURFACE WATER

3.2.1 MONITORING OVERVIEW - SURFACE WATER

The surface water monitoring plan discussed below relates specifically to the off-channel ponds and diversion channel as habitat mitigation measures. The goal of the surface water monitoring plan during and after project construction is to determine whether the chemical and physical aspects of the water are being protected and to evaluate whether the diversion channel is functioning as intended. The monitoring plan will consist of routine water quality sampling and visual observations of physical condition.

3.2.2 MONITORING METHODS AND CRITERIA - SURFACE WATER

The following monitoring methods will be used to determine if water quality within the off-channel ponds and diversion channel is meeting applicable water quality standards and mitigation plan goals:

(1) Sampling of key water quality parameters (e.g., temperature, dissolved oxygen, and total suspended sediment) will be conducted. Sampling frequency and locations and the suite of parameters to be sampled will be determined in coordination with resource agencies. Additional water quality sampling will also be required to monitor landfill operations outside the scope of this mitigation plan.

(2) The diversion channel and associated wetlands will be walked once a year for the duration of the monitoring program to ensure stability and proper functioning of the channel and wetlands. In addition, the channel and wetlands will be surveyed during or immediately following two large runoff events to look for erosion.

(3) Photographs will be taken from permanent photo stations to document changes in the channel and wetlands.

3.3 BOTANICAL

3.3.1 MONITORING OVERVIEW - BOTANICAL

Trees, shrubs, grasses, and forbs will be seeded or planted at various management units to restore and enhance wildlife habitat. These seedings and plantings will be monitored to ensure successful vegetation survival, establishment, and coverage.

3.3.2 MONITORING METHODS AND CRITERIA - BOTANICAL

The criteria for successful plantings is 75 percent survivorship 1 year after planting and an increase in average percent cover each year for 3 years following planting. Percent cover data from monitoring in the first year of planting will serve as baseline data for comparison in future years. Additional components of the botanical monitoring plan are discussed below:

(1) Tree and shrub planting areas will be monitored for 3 successive years following planting and seeding of each closure area. A walk-through survey will be conducted over the entire reclaimed area. Percent cover and survivorship will be estimated in established sample plots. Photographs will be taken from permanent photo stations to record development of planting areas.

(2) Seeded areas, including topsoil stockpiles, with less than 85 percent cover will be reseeded, mulched, and/or fertilized. Reasons for seeding failure will be determined before remedial actions are taken. Patterns of failure (e.g., patchy, homogeneous, species-specific) and locations of unsuccessful plantings and seedings will be documented.

(3) If planting criteria are not met, replanting/reseeding will be undertaken following a review to consider whether other species should be substituted for the originally planted species.

(4) Evaluate the success of shrub planting and seeding for the first closed cell. Several transects will be established in each of the following experimental areas: 1) seedling planting and natural regeneration, 2) seedling planting with supplemental shrub seeding, 3) shrub seeding, and 4) natural regeneration. Number of shrubs established per species and percent cover will be monitored in sample plots established along the transects. Plant damage due to animal browsing will also be examined. Information gathered will help determine the most viable methods for establishing shrub habitat on the closed landfill. Data collected will also help determine if the shrubs established in these areas are the result of seeding or germination of seed already present in the topsoil. Future shrub plantings and seeding will be adjusted accordingly. See Section 2.1.4 for additional details.

3.4 WETLANDS

3.4.1 MONITORING OVERVIEW - WETLANDS

Wetland mitigation areas will be monitored to assess the vegetation restoration and enhancement efforts and the overall biological and physical functioning of the wetlands. In addition, the wildlife habitat enhancement features implemented in the mitigation areas will be monitored to determine their effectiveness.

3.4.2 MONITORING METHODS AND CRITERIA - WETLANDS

Permanent sample plots and photo stations will be established at each mitigation area in locations representative of the plant community being sampled. All planted and seeded areas will be sampled and monitored to evaluate the success of the revegetation efforts. The areas will be visually inspected for percent ground cover, survivorship of the seedlings, level of browse damage to the seedlings, and percent cover of the shrub and tree layers. Areas which have not met the following criteria will be reseeded or replanted: 85 percent ground cover and 70 percent seedling survivorship (only applies the first year following planting). Reasons for poor survivorship will be determined prior to reseeding or replanting to ensure that suitable species are selected for the local

environmental conditions. If browse damage is significant, plastic, biodegradable tubing can be used to protect the seedlings.

Observed wildlife use will be recorded including activity and the type of habitat being used. The hydrologic regime of the wetland areas will also be monitored. Evidence of seasonal saturation or inundation or depth of open water will be recorded and compared to the project design.

Other aspects of the wetland area monitoring plan include 1) inspecting all wetland areas and buffers to ensure that no encroachment has occurred and 2) preparing an annual monitoring report and submitting it for agency review.

In addition, impacts on the hydrology and vegetation within the wetland areas downgradient of the project site will be monitored for 5 years and evaluated using results from groundwater monitoring wells and permanent sample plots to measure vegetative cover by dominant species/strata. Health and vigor of dominant species will also be assessed. If the wetland communities are adversely impacted by the project, additional mitigation will be undertaken to compensate for the loss (see Section 4.0)

3.5 WILDLIFE

3.5.1 MONITORING OVERVIEW - WILDLIFE

A variety of habitat enhancement and reclamation measures are proposed that will improve habitat suitability for wildlife. Other measures will be implemented to reduce wildlife hazards resulting from project operation. Success of mitigation measures will be evaluated by determining suitability of mitigation areas for wildlife and monitoring wildlife use of these areas. A monitoring and reporting system will be established to evaluate success of excluding wildlife from the leachate pond.

3.5.2 MONITORING METHODS AND CRITERIA - WILDLIFE

Monitoring is proposed for habitat enhancement plantings and seedings (see also Sections 3.3 and 3.4). As a part of this monitoring, wildlife habitat suitability of these sites will be evaluated in a qualitative manner. Criteria to be considered will include, but not be limited to, habitat type, habitat interspersion, vegetative diversity, availability of important habitat components (e.g., downed logs, snags, bird boxes), degree of human disturbance, and percent cover of herbaceous, shrub, and tree species. The effectiveness of wildlife mitigation measures will also be assessed through the following measures:

(1) All signs of wildlife use observed at the habitat enhancement sites will be recorded during the vegetation monitoring efforts.

(2) Periodic sampling of the diversion channel will be conducted to ensure barrier-free wildlife access and vegetated banks for cover and forage. This sampling will be conducted in association with the water quality, botanical, and wetland monitoring programs (see Sections 3.2, 3.3, and 3.4).

(3) During routine operations, the date and species of any observed effects to wildlife in or near the leachate pond will be recorded and reported monthly to the Washington Department of Wildlife. Periodic inspection of fencing will be conducted. Appropriate repairs will be instituted as necessary.

4.0 CONTINGENCY PLANS

Contingency plans will be fully developed to ensure that mitigation requirements are met. Through consultation with the regulatory agencies, specific periods will be set by which success criteria must be met. If initial mitigation measures are not successful within these periods, steps will be taken to correct the problem(s). Reasons for failure of the planned mitigation measures will be determined, and measures to correct the problem(s) will be developed and submitted for approval by the agencies. The corrective measures will be initiated as soon as possible. If the proposed mitigation is not successful (as defined by the success criteria) after corrective measures have been

implemented, alternative mitigation measures will be initiated (i.e., wetland creation in adjacent tributaries, creation of pool habitat within the mainstem of the Southern Tributary). These alternative measures will be selected and developed in coordination with the appropriate resource agencies.

5.0 LITERATURE CITED

Beak Consultants, Inc. 1990. Wetland determination and delineation for Weyerhaeuser's S.W. Washington solid waste facility. 15pp. + appendices. Addendum to March 1990 report 5pp. + data sheets.

Beak Consultants, Inc. 1991. Environmental technical report for the proposed Weyerhaeuser S.W. Washington solid waste facility. The Weyerhaeuser Company, Tacoma, Washington. 336pp.

Bjornn, T. C., and D. W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 *in* W. R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19.

Bryant, M. D. 1988. Gravel pit ponds as habitat enhancement for juvenile coho salmon. U. S. Forest Service General Technical Report PNW-GTR-212.

Cederholm, C. J., and W. J. Scarlett. 1981. Seasonal immigrations of juvenile salmonids into four small tributaries of the Clearwater River, Washington, 1977-1981. Pages 98-110 *in* E. L. Brannon and E. O. Salo, editors. Salmon and trout migratory behavior symposium. University of Washington, Seattle.

Cederholm, C. J., W. J. Scarlett, and N. P. Peterson. 1988. Low-cost enhancement technique for winter habitat of juvenile coho salmon. North American Journal of Fisheries Management 8:438-441.

Federal Interagency Committee for Wetland Delineation. 1989. Federal manual for identifying and delineating jurisdictional wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington D.C. Cooperative Technical Publication.

Heggenes, J., T. G. Northcote, and A. Peter. 1991. Seasonal habitat selection and preferences by cutthroat trout (Oncorhynchus clarki) in a small, coastal stream. Canadian Journal of Fisheries and Aquatic Sciences 48:1364-1370.

Mesa, M. G. 1991. Variation in feeding, aggression, and position choice between hatchery and wild cutthroat trout in an artificial stream. Transactions of the American Fisheries Society 120:723-727.

Nickelson, T. E., J. D. Rodgers, S. L. Johnson, and M. F. Solazzi. 1992a. Seasonal changes in habitat use by juvenile coho salmon (Oncorhynchus kisutch) in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 49:783-789.

Nickelson, T. E., M. F. Solazzi, S. L. Johnson, and J. D. Rodgers. 1992b. Effectiveness of selected stream improvement techniques to create suitable summer and winter rearing habitat for juvenile coho salmon(Oncorhynchus kisutch) in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 49:790-794.

Olendorff, R.R., A.D. Miller, and R.N. Lehman. 1981. Suggested practices for raptor protection on power lines, the state of the art in 1981. Raptor Res. Rep. No. 4. Raptor Research Foundation, St. Paul, MN. 111pp.

Sweet-Edwards/EMCON, Inc. 1990. Solid waste disposal facility site selection study. 17 pp. + appendix.

Tschaplinski, P. J., and G. F. Hartman. 1983. Winter distribution of juvenile coho salmon (Oncorhynchus kisutch) before and after logging in Carnation Creek, British Columbia, and some implications for over winter survival. Canadian Journal of Fisheries and Aquatic Sciences 40: 452-461.

U.S. Forest Service. 1985. Fish habitat improvement handbook. U.S. Dept. of Agriculture Technical Publication R8-TP 7. 21pp.

Washington State Department of Ecology. 1990. State Environmental Policy Act Wetlands Policies. Olympia, WA.

Washington State Department of Fisheries. 1990. Stormwater management interim criteria and guidelines for protection of stream channels and aquatic life. Habitat Management Division, WA. 4pp.

Appendix A

Action Plan for Developing Final Construction Plans and Bid Documents from the Proposed Natural Resources Mitigation Plan

An action plan and schedule for developing construction plans, bid documents, and detailed monitoring procedures from the *Proposed Natural Resources Mitigation Plan* will be submitted with a more detailed mitigation and monitoring plan to regulatory agencies on 29 December 1992. Appendix A has been left blank to provide consistency between the *Proposed Natural Resources Mitigation Plan* and the plan to be submitted to the agencies in late December.

Appendix B

Washington State Four-tier Wetlands Rating System

a. Washington State Four-tier Wetlands Rating System.

1) Category I Criteria
   A. Documented habitat for endangered or threatened fish or animal species or for potentially extirpated plant species recognized by state or federal agencies; or
   B. High quality native wetland communities, including documented category I or II quality Natural Heritage wetland sites and sites which qualify as a category I or II quality Natural Heritage wetland; or
   C. High quality, regionally rare wetland communities with irreplaceable ecological functions, including sphagnum bogs and fens, estuarine, wetlands, or mature forested swamps; or
   D. Wetlands of exceptional local significance. The criteria for such a designation shall be developed and adopted by the local jurisdiction under appropriate public review and administrative appeal procedures. The criteria may include, but not be limited to, rarity, groundwater recharge areas, significant habitats, unique educational sites or other specific functional values within a watershed or other regional boundary.

2) Category II Criteria
   A. Regulated wetlands that do not contain features outlined in category I; and
   B. Documented habitats for sensitive plant, fish or animal species recognized by federal or state agencies; or
   C. Rare wetland communities listed in subsection 1)C which are not high quality; or
   D. Wetland types with significant functions which may not be adequately replicated through creation or restoration.
   E. Regulated wetlands with significant habitat value based on diversity and size.
   F. Regulated wetlands contiguous with salmonid fish-bearing waters, including streams where flow is intermittent; or
   G. Regulated wetlands with significant use by fish and wildlife.

3) Category III Criteria
   A. Regulated wetlands that do not contain features outlined in category I, II or IV.

4) Category IV Criteria
   A. Regulated wetlands which do not meet the criteria of a category I or II wetland; and
   B. Isolated wetlands that are less than or equal to one acre in size; and have only one wetland class; and have only one dominant plant species (monotypic vegetation); or
   C. Isolated wetlands that are less than or equal to two

acres in size, and have only one wetland class and a predominance of exotic species.

b. Puget Sound Region Wetlands Rating System

1) Category I Criteria

A. Documented habitat for endangered or threatened plant, fish, or animal species or for potentially extirpated plant species recognized by state or federal agencies; or

B. High quality native wetland communities, including documented category I or II quality Natural Heritage wetland sites and sites which qualify as a category I or II quality Natural Heritage wetland; or

C. High quality, regionally rare wetland communities with irreplaceable ecological functions, including sphagnum bogs and fens, estuarine, wetlands, or mature forested swamps; or

D. Wetlands of exceptional local significance. The criteria for such a designation shall be developed and adopted by the local jurisdiction under appropriate public review and administrative appeal procedures. The criteria may include, but not be limited to, rarity, groundwater recharge areas, significant habitats, unique educational sites or other specific functional values within a watershed or other regional boundary.

2) Category II Criteria

A. Regulated wetlands that do not contain features outlined in category I; and

B. Documented habitats for sensitive plant, fish or animal species recognized by federal or state agencies; or

C. Rare wetland communities listed in subsection 1)C which are not high quality; or

D. Wetland types with significant functions which may not be adequately replicated through creation or restoration. In the Puget Sound planning area, these wetlands may be demonstrated by the following characteristics:

i. significant peat systems; or

ii. forested swamps that have three canopy layers, excluding monotypic stands of red alder averaging 8 inches diameter at breast height or less; or

iii. significant spring fed systems;

E. Wetlands with significant habitat value based on diversity and size.

i. 10 acres or greater in size; and 2 or more wetland classes together with open water at any time during a normal year; or

ii. 10 acres or greater in size; and 3 or more wetland classes; and 5 or more subclasses of vegetation in a dispersed pattern; or

Appendix C

Photographs of Wetlands in the Vicinity of the Headquarters Site



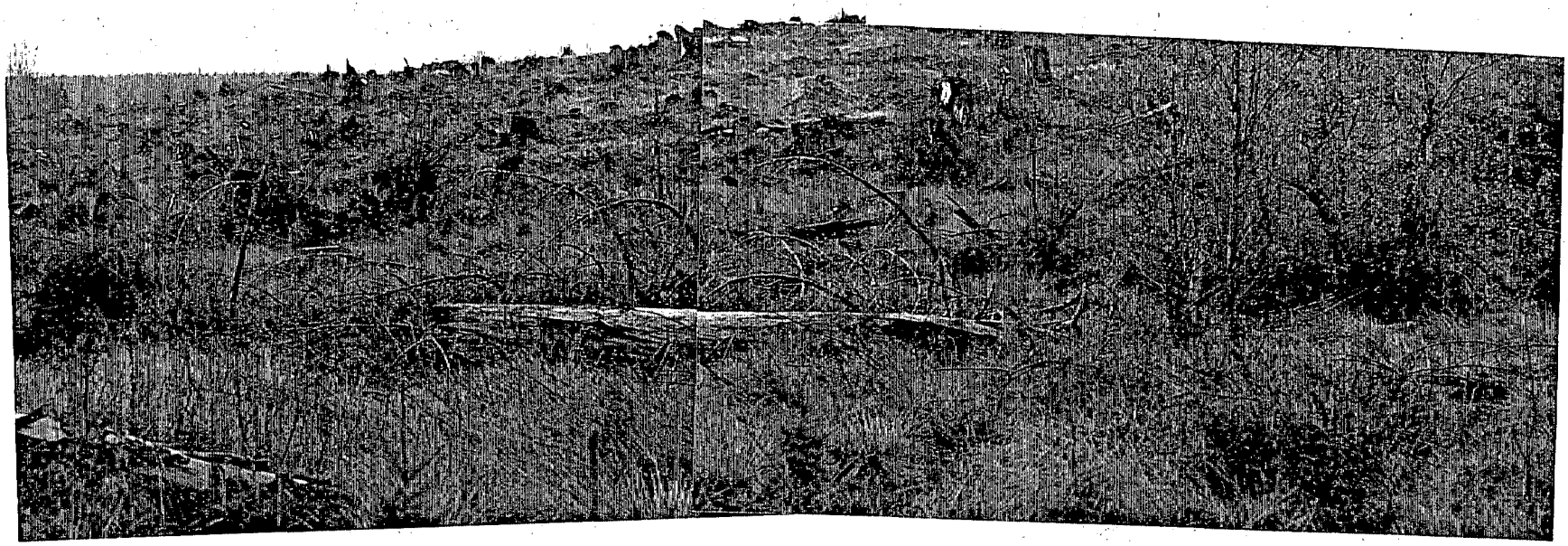


Photo Series A & B: Emergent wetland habitat located immediately west of the proposed project area at the Headquarters site. The diversion channel is proposed to be located adjacent to this wetland area. The existing habitat would be enhanced with tree and shrub plantings. Douglas fir are regenerating outside of the wetland area, but no tree species are presently regenerating within the wetland habitat at this site.

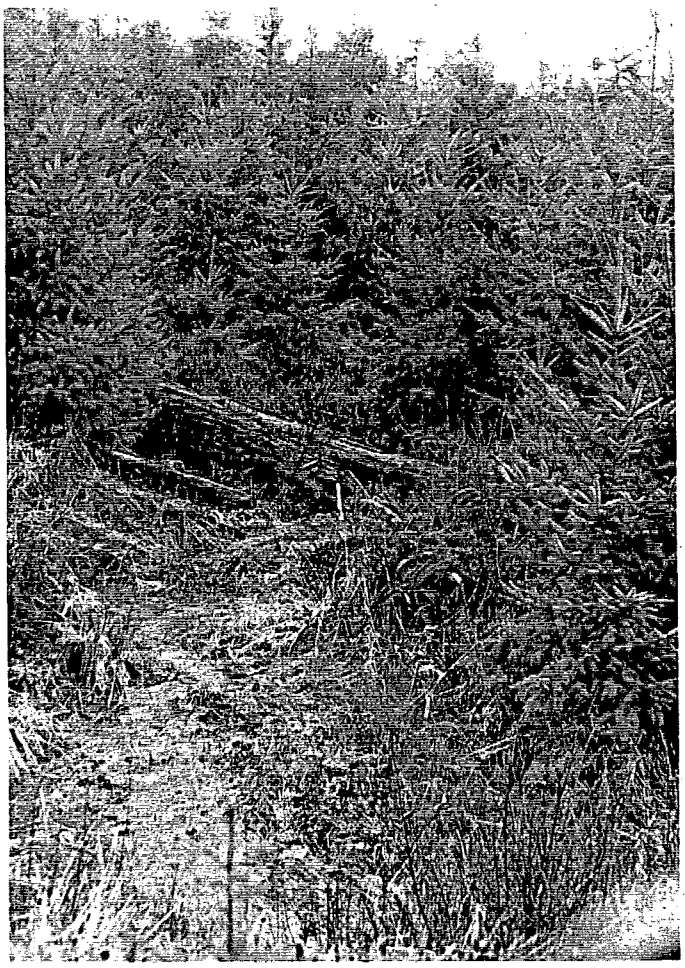
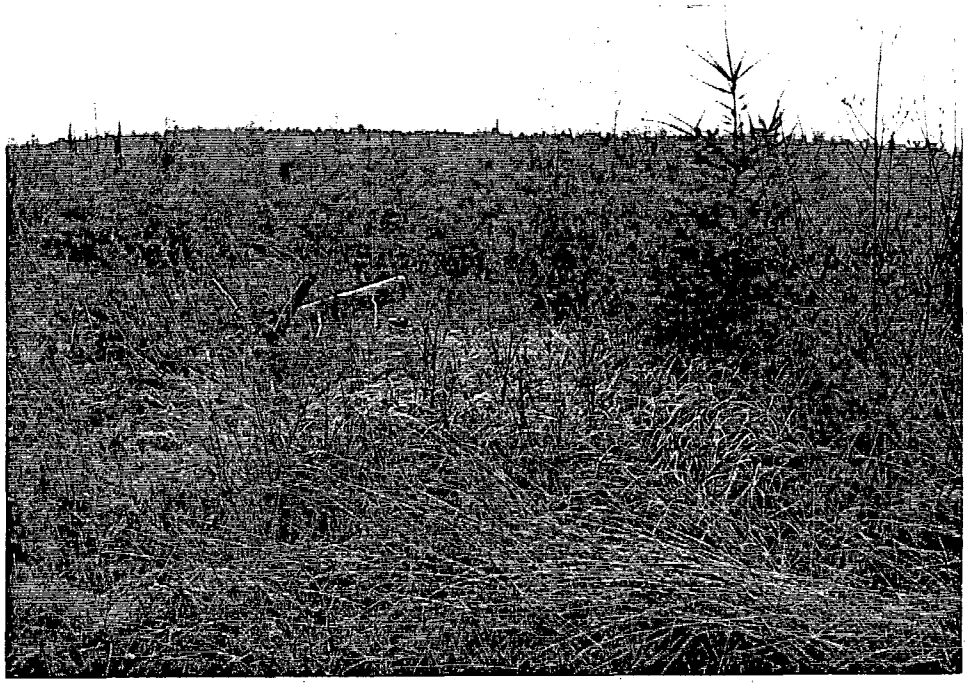






Photo Series C: Emergent and scrub-shrub riparian wetland habitat on the Headquarters site.



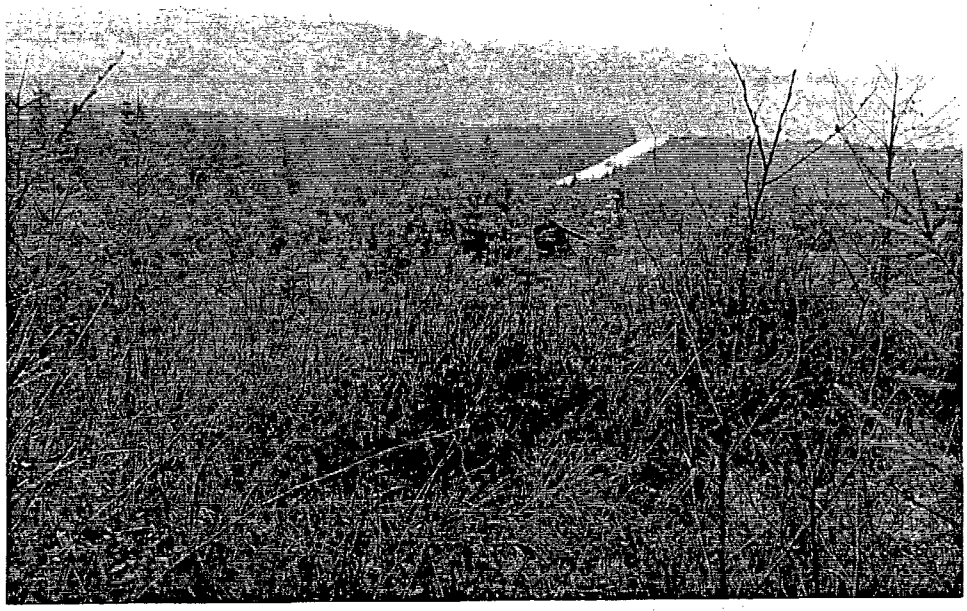


Photo Series D: "Isolated" emergent wetland habitat found on the Headquarters site.

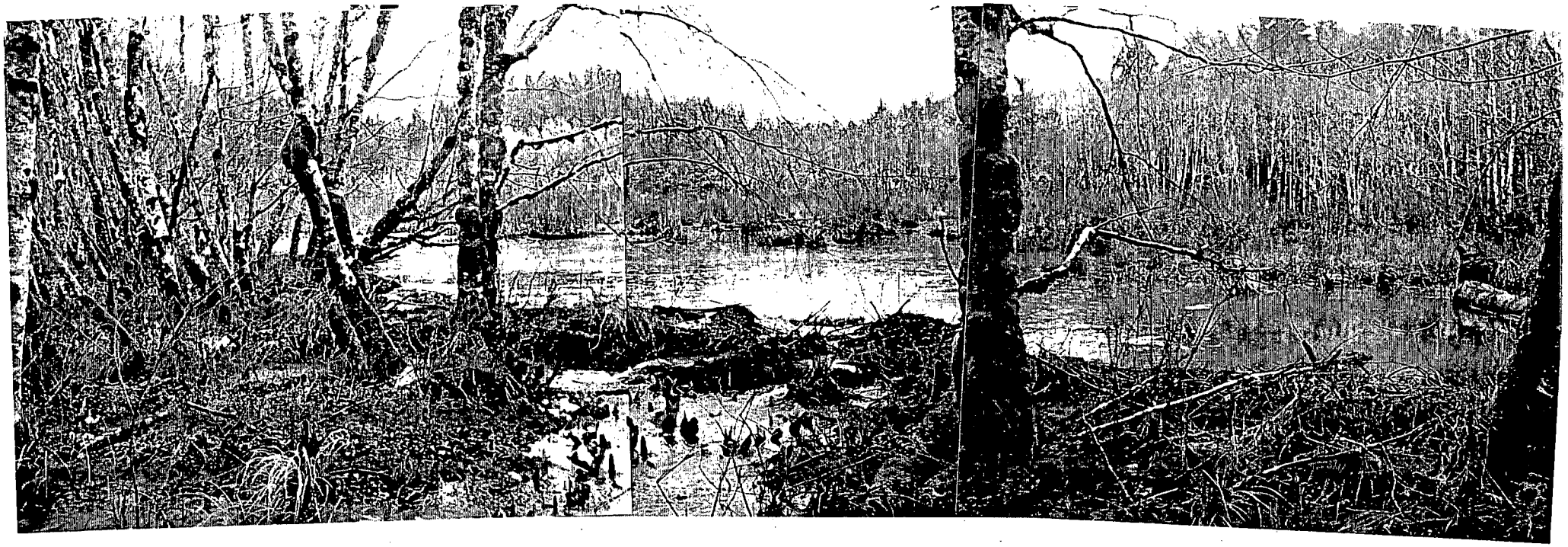


Photo Series E: Forested riparian wetland habitat and beaver dam associated with Sucker Creek.



Photo Series F: Deciduous forested wetland habitat in the Sucker Creek basin in the general vicinity of the beaver dam complex. Dominant tree species is red alder with Oregon ash found scattered throughout the area (see far left photograph). The dominant understory species include salmonberry, slough sedge, and skunk cabbage.





Photo Series G: Mature coniferous forest habitat found within the Sucker Creek drainage within the beaver dam area. The upland forest is dominated by Douglas fir (left photograph), and the forested wetland habitat is dominated by western hemlock and western redcedar (right photograph). Both stands are over 50 years old.

Appendix B

Liner Leak Scenario

Headquarters Camp
Solid Waste Disposal Facility

Sweet-Edwards/EMCON, Inc.

15055 S.W. Sequoia Parkway, Suite 140
P.O. Box 231269
Portland, Oregon 97224
(503) 624-7200
FAX (503) 620-7658

RECEIVED
AUG 26 1991
URS CONSULTANTS

August 22, 1991
Project S4115.12

Grant Bailey
URS Consultants, Inc.
1100 Olive Way, Suite 200
Seattle, WA 98101

Re: Weyco Headquarters - Liner Leak Scenario

Dear Grant:

This letter describes the liner leak scenario for the proposed Weyerhaeuser Headquarters landfill. This information is being provided as a submittal pursuant to our meeting of August 14, 1991.

PURPOSE

A leak scenario was developed primarily to provide input for an evaluation of possible impacts to shallow and deep ground water. The evaluation of impacts to ground water will be conducted separately by hydrogeologists from Sweet-Edwards/EMCON and URS.

The results of the leak scenario will also be used to develop a leak response action plan as part of the complete solid waste permit application at a later date.

APPROACH AND ASSUMPTIONS

Standard methods are described in the literature for estimating leakage from composite liners such as the one being proposed at the Headquarters landfill. Studies that have been performed consisting of numerical modeling (Giroud and Bonaparte, 1989; Bonaparte et al, 1989; USEPA, 1987), laboratory testing (Giroud and Bonaparte, 1989; Jayawickrama et al, 1988), and monitoring of field installations (Bonaparte and Gross, 1990; USEPA, 1987) can be used to model liner leakage for site specific parameters.

The basic methodology and development of the liner leakage modeling equations is described by Giroud and Bonaparte (1989). Inputs required for estimating composite liner leakage are hole size and frequency, liquid

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head over the liner, permeability of the soil portion of the liner, and the condition of the geomembrane/soil interface. Geomembrane/soil interface conditions are defined as follows (Bonaparte et al, 1989):

- Best Case: The soil is well compacted, flat and smooth, has not been deformed by rutting, and has no clods or cracks; the geomembrane is flexible and has no wrinkles; and the geomembrane and soil are in close contact.

- Good: The soil has been adequately compacted and has a smooth surface; the geomembrane has been installed with as few wrinkles as possible.

- Poor: The soil has not been well compacted and does not appear smooth; the geomembrane has been installed with a certain amount of wrinkles.

- Very Poor: The soil has been poorly compacted, has an irregular surface and is cracked; the geomembrane is stiff and exhibits a pattern of large, connected wrinkles.

The rationale and guidelines for establishing hole size and frequency limits are presented by Giroud and Bonaparte (1989), and confirmed by Bonaparte and Gross (1990). As a guideline for evaluating the performance of a lining system they recommend using one hole per acre with a hole area of 0.005 square inches. The analysis for the Headquarters site was conducted with a much more conservative scenario using 10 holes per acre with each hole having an area of 1.0 square inches.

Selecting a value for the liquid head over the liner is dependent on the design of the leachate collection and removal system (LCRS). For landfill liners with a well designed LCRS Giroud and Bonaparte (1989) recommend a value between 0.1 and 1.0 feet of head. Preliminary design for the Headquarters LCRS indicates that the maximum head buildup (except over sump areas which will be double-lined) will be less than one foot during peak periods in active areas, and will generally be much less in inactive and closed areas. Based on a discussion with Carlos Herrera (August 20, 1991) a value of 2.0 feet was selected as being conservative and consistent with the maximum allowable head buildup per the Washington Minimum Functional Standards (MFS) for solid waste landfills.

The coefficient of permeability of the soil liner was taken as 1×10^{-6} cm/sec. This is the design maximum allowable permeability. The field-placed permeability should always be equal to or less than this specification.

The anticipated condition of the geomembrane/soil interface is expected to be classified as "good" or better with a diligent construction quality assurance program. For the liner leak scenario the condition of the interface was assumed to be "poor" during and right after construction. For bottom liners, however, the interface condition can be considered one level better than when constructed (Giroud and Bonaparte, 1989) to take into account the effect of high overburden pressures. Therefore, the leakage calculations were performed assuming a "good" condition.

RESULTS

The results of the computations, using the conservative input parameters described above, indicate a potential leakage rate from the bottom of the landfill liner of approximately 18 gallons per acre per day (see attached calculations). For purposes of comparison, the same calculations indicate that a more realistic maximum leakage rate would be on the order of 0.3 gallons per acre per day using input parameters suggested by Giroud and Bonaparte (1989), and Bonaparte and Gross (1990).

Please call if you have questions.

Sincerely,

Sweet-Edwards/EMCON, Inc.

Rick Thiel

Rick Thiel, P.E.
Senior Project Engineer

Attachment: References and Spreadsheet Calculations

cc/enc: Chris Haynes, Weyerhaeuser
Carlos Herrera, Herrera Env.
Dorothy Atwood, SE/E

P/WEYCO-L.822/BR:(wp)

LINER LEAKAGE RATE ESTIMATE 21-Aug-91

Weyerhaeuser Headquarters Site Project No. S4115.12

References:

1. Bonaparte, R., Giroud, J., and Gross, B. 1989. "Rates of Leakage Through Landfill Liners." Proceedings, Geosynthetics '89 Conf. IFIA.
2. Bonaparte, R., and Gross, B. 1990. "Field Behaviour of Double Liner Systems." Waste Containment Systems: Construction, Regulation, and Performance. ASCE Geotechnical Special Publication No. 26.
3. Giroud, J., and Bonaparte, B. 1989. "Leakage Through Liners Constructed With Geomembranes." Geotextiles and Geomembranes. Part I, Vol. 8, No. 1; Part II, Vol. 8, No. 2.
4. Jayawickrama, P., Brown, K., Thomas, J., and Lytton, R. 1988. "Leakage Rates Through Flaws in Membrane Liners." ASCE Journal of Environmental Engineering, Vol. 114, No. 6, Dec. 1988.
5. USEPA. 1987. Background Document on Proposed Liner and Leak Detection Rule. EPA/530-SW-87-015.

CALCULATION:

Qb = 0.21*a(exp 0.1)*h(exp 0.9)*k(exp 0.74)

NOTATION:

Qb = steady state leakage rate (cubic meters per second)
subscript "b" stands for Bonaparte (1989) equation, "good" condition. "Good" condition was used to represent an initially poor condition subjected to a high overburden pressure (Giroud and Bonaparte, 1989).
a = hole area (square meters)
h = liquid head (meters)
k = soil hydraulic conductivity (meters per second)
(Note that the equation is independent of soil thickness)
(Units for parameters below converted for formula)
cm/sec = centimeters per second
gpd = gallons per day (per hole)
gpad = gallons per acre per day

hole diam. (in)	a (sq in)	h (ft)	k (cm/sec)	Qb (cfs)	Qb (gpd)	holes per acre	TOTAL FLOW (gpad)
PRUDENT PARMETERS FOR PERFORMANCE ANALYSIS PER GIROUD AND BONAPARTE (1989)							
0.08	0.005	0.5	1.0E-06	4.6E-07	0.30	1	0.3
CONSERVATIVE ANALYSIS FOR HEADQUARTERS SITE							
1.13	1.000	2.0	1.0E-06	2.7E-06	1.77	10	17.7

MEMORANDUM

TO: Jean Garber DATE: August 24, 1992

FROM: Rick Thiel

RE: Weyco Headquarters Liner Leak Scenario

Recent discussions with you and representatives of URS have indicated that there may be some concern and questions regarding the methodology and nomenclature associated with the liner leak scenario prepared for the subject project EIS. Enclosed with this memo are the following references for your files:

- Bonaparte, R., and Gross, B. 1990. "Field Behaviour of Double Liner Systems." Waste Containment Systems: Construction, Regulation, and Performance. ASCE Geotec. Special Pub. No. 26.

- Giroud, J., and Bonaparte, B. 1989. "Leakage Through Liners Constructed with Geomembranes." Geotextiles and Geomembranes. Part II, Vol. 8, No. 2.

The first paper (Bonaparte and Gross, 1990) references the second paper on page 70 and uses the terminology "reasonable upper bound" estimate of the liner leakage using the assumed equations and associated parameters, including hole size and frequency.

On page 71 the first paper also discusses the "action leakage rate" rationale and mentions that the "leakage" may actually consist mostly of construction and consolidation water.

The second paper (Giroud and Bonaparte, 1989, Part II) contains several noteworthy items related to the appropriate parameters for a leak study in the conclusions section starting on page 104. First, they mention that it is reasonable to expect "one or two defects per acre" with intensive construction quality assurance (CQA) (page 104). Second, their reference table uses one defect per acres (page 105) which implies intensive CQA, extreme care for ancillary liner appurtenances, and an excellent design (standard practice for modern landfills). Third, a distinction is made between a small hole (d=0.08 inch) and a large hole (d=0.45 inch) (page 107). A large hole would be attributed to "defective design or construction."

Fourth, they make a statement that "there is no significant difference in leakage rate between the small hole and the large hole" for a composite liner (page 107). Fifth, they mention that the design average liquid head in a granular leachate collection layer over a liner is about 0.1 foot (page 106).

EMCON's liner leak scenario prepared for the EIS was conservative in its estimate for the "reasonable upper bound" scenario based on the 1989 Giroud and Bonaparte paper. This is substantiated by the attached spreadsheet which shows the following calculations:

- Original Calculation - The calculation submitted for the EIS as the "reasonable upper bound"-type of scenario yields a leakage of 0.30 gallon per acre per day (gpad) assuming one "small" hole per acre and a head of 0.5 foot.

- Modification 1 - The same calculation but with a "large" hole yields a leakage of 0.42 gpad (40 percent increase).

- Modification 2 - The original calculation with a "small" hole but with a more realistic average head of only 0.1 foot head yields a leakage of 0.07 gpad (77 percent decrease).

- Modification 3 - The original calculation modified to have a "large" hole and a more realistic average head of 0.1 foot yields a leakage of 0.1 gpad (67 percent decrease).

- Modification 4 - Like Modification 2 but with two holes per acre yields a leakage of 0.14 gpad (53 percent decrease).

- Modification 5 - Like Modification 3 but with two holes per acre yields a leakage rate of 0.20 gpad (33 percent decrease). Of all the possible variations this condition probably is most representative of the "reasonable upper bound" as intended by the Giroud and Bonaparte. The original calculation is more conservative than this primarily because of the higher head assumed.

It is EMCON's opinion that the liner leakage rate presented in the EIS as the "reasonable maximum value" is appropriately conservative.

Regarding the scenario called "extreme worst-case" in the EIS, EMCON believes this scenario is remote and speculative for the following reasons:

- The model assumes a hole size of over 1-inch diameter at a frequency of 10 holes per acre everywhere under the landfill. This amount of liner defects during construction or operations could only occur with inadequate design and gross negligence. The state of the practice for liner design and construction is as described in the literature as "intensive CQA" and excellent design and specifications. Anything below this is considered substandard and would not be permitted by the Department of Ecology.

- The model assumes a 2-foot head everywhere under the landfill existing at all times. While it is conceivable that a localized head may build up, especially in the sump areas, the average head build up shown in our typical calculations and expressed in the literature is less than a few inches.

Please call if you have questions.

Attachments

cc: Chris Haynes, Weyco

LINER LEAKAGE RATE ESTIMATE 24-Aug-92

Weyerhaeuser Headquarters Site Project No. S4115.12

CALCULATION:

Qb = 0.21*a(exp 0.1)*h(exp 0.9)*k(exp 0.74)

NOTATION:

Qb = steady state leakage rate (cubic meters per second)
subscript "b" stands for Bonaparte (1989) equation, "good" condition. "Good" condition was used to represent an initially poor condition subjected to a high overburden pressure (Giroud and Bonaparte, 1989).
a = hole area (square meters)
h = liquid head (meters)
k = soil hydraulic conductivity (meters per second)
(Note that the equation is independent of soil thickness)
(Units for parameters below converted for formula)
cm/sec = centimeters per second
gpd = gallons per day (per hole)
gpad = gallons per acre per day

hole diam. (in)	a (sq in)	h (ft)	k (cm/sec)	Qb (cfs)	Qb (gpd)	holes per acre	TOTAL FLOW (gpad)
0.08	0.005	0.5	1.0E-06	4.6E-07	0.30	1	0.30
0.45	0.159	0.5	1.0E-06	6.5E-07	0.42	1	0.42
0.08	0.005	0.1	1.0E-06	1.1E-07	0.07	1	0.07
0.45	0.159	0.1	1.0E-06	1.5E-07	0.10	1	0.10
0.08	0.005	0.1	1.0E-06	1.1E-07	0.07	2	0.14
0.45	0.159	0.1	1.0E-06	1.5E-07	0.10	2	0.20

NOTE: Due to the volume of the papers referenced in the preceding memorandum (Bonaparte and Gross, 1990; and Giroud and Bonaparte, 1989), they are not included in this document. Both papers are available for review at the Cowlitz-Wahkiakum Health District office at 1516 Hudson, Longview, Washington.

Appendix C

Alternatives Analysis for Section 404 Permit

Headquarters Camp
Solid Waste Disposal Facility

Alternatives Analysis for the Proposed Weyerhaeuser S.W. Washington Solid Waste Facility Project

Submitted to
United States Army Corps of Engineers
Seattle District

Submitted by
Weyerhaeuser Company

Prepared by:

David M. Heineck
Heller, Ehrman, White & McAuliffe

Richard S. Thiel, P.E.
Sweet-Edwards/EMCON, Inc.

Paul H. Whitney, Ph.D.
Beak Consultants Incorporated

November 1991

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12	George Taylor B site
13	Barnes Drive site
14	Headquarters site
15	March 11, 1991 letter from Washington Department of Transportation

ALTERNATIVES ANALYSIS

Proposed Weyerhaeuser Southwest Washington Solid Waste Facility Project

I. INTRODUCTION

Weyerhaeuser proposes to develop a solid waste disposal facility to meet the waste disposal needs of its Longview, Washington mill and its other facilities in western Washington. The landfill would be part of an integrated solid waste management system for these facilities, supplementing Weyerhaeuser's current waste minimization and recycling programs.

Following extensive studies, the company has identified a potential site for this landfill near Headquarters Camp in Cowlitz County, Washington. The site meets the company's project purposes, it is practicable from the standpoint of logistics, cost and available technology, and it complies with applicable federal, state and local requirements.

Since the Headquarters site includes approximately 15 acres of wetlands and a stream tributary that would be filled during the active life of the facility, a Clean Water Act section 404 permit is required. The permitting guidelines under section 404(b)(1) generally require applicants to identify potential "practicable alternative" sites for the project, and to select the site that would involve the least aquatic impact unless that alternative would cause other significant environmental impacts. This report describes the iterative process Weyerhaeuser used to identify and evaluate potential alternatives, and the factors that lead to identification of the Headquarters site as the least environmentally damaging practicable alternative under the section 404(b)(1) guidelines.

II. STATEMENT OF PROJECT PURPOSE

Weyerhaeuser owns and operates a number of forest products facilities in western Washington. The largest of these is the Longview manufacturing complex, which produces a variety of wood, pulp and paper products. It has been Weyerhaeuser's practice to use third-party contractors to dispose of the solid waste generated by these facilities at existing private and municipal landfills. Increasing concerns regarding the environmental and economic risks associated with this practice have prompted Weyerhaeuser to maximize its waste reduction and recycling programs and to develop other options for waste disposal.

The company took a number of steps in the early and mid-1980's to better control its solid wastes. Major efforts were made at the Longview complex to minimize and recycle solid waste to reduce the net amount of waste requiring landfilling. The company succeeded in reducing the volume of landfilled waste generated at the mill by approximately 25% between 1981 and 1989, despite 25% higher production during this same period. Each year, the Longview mill alone now recycles 160,000 cubic yards of log yard debris and 65,000 cubic yards of waste paper/lugger box waste; it incinerates and recovers energy from more than 300,000 cubic yards of wastewater treatment solids and de-inking fiber rejects; and it salvages over 3,000 cubic yards of polyethylene. The company also has carried out pilot composting projects, and is continually developing other means of waste reduction at its southwestern Washington facilities. These include incineration of additional organic wastes, an improved sorter to increase the recycling of log yard debris and utilization of lime waste and boiler ash.

Even with optimum waste reduction and recycling, however, some portion of the company's solid waste still must be landfilled. Weyerhaeuser has determined that it should own and operate a state-of-the-art landfill to manage these wastes. The planned facility would accept only forest products, manufacturing waste and demolition and construction debris. No hazardous, dangerous or municipal waste would be accepted. Almost all the waste would be Weyerhaeuser-generated, although up to ten percent of the waste stream might be accepted from third parties located within Cowlitz and Wahkiakum counties so long as there were no reduction below the minimum long-term capacity needed by Weyerhaeuser facilities. Weyerhaeuser ownership and operation of its own landfill would help it achieve three basic objectives: (1) greater control over the environmental risks associated with land disposal; (2) assurance that adequate long-term disposal capacity will be available; and (3) stabilization and reduction of its solid waste disposal costs.

With respect to the first objective, Weyerhaeuser can minimize the environmental risks associated with its solid waste only by taking control of the waste from the point of generation through disposal. The company's historical reliance on third-party contractors for waste disposal has caused it to be held responsible for environmental impacts over which it had little or no control. The risk of such liability has increased under recent regulatory standards, which can create strict and essentially perpetual responsibility on the part of solid waste generators. Weyerhaeuser has the commitment and the necessary technical and financial capabilities to design and operate a solid waste disposal facility to the highest technical standards, and to assure proper closure and post-closure care. Such a facility would sharply reduce the environmental risks associated with disposal through third parties.

Second, Weyerhaeuser needs to assure that there will be long-term capacity for the solid waste generated by its Longview mill and other facilities in the region. The company has made and plans to make very large investments in these facilities, representing thirty to forty year commitments of company resources. At the Longview complex, for example, Weyerhaeuser has invested over $1 billion in new plant and equipment from 1981 to the

present. The company currently is considering an additional investment of more than $300 million to modernize the Longview kraft mill. These capital improvements have a useful life of over thirty years. It is essential that there be capacity over this same term for the solid wastes these facilities are expected to generate. This is particularly important since current and planned third-party landfills in the area cannot assure such long-term capacity.

Third, the proposed landfill would be critically important in the company's efforts to reduce and stabilize production costs at its Longview mill. Such stabilization is needed to keep the mill competitive in its product lines. The Longview mill produces approximately 400,000 tons of kraft pulp and corrugated medium board per year, consisting of 115,000 tons of corrugated board and 285,000 tons of kraft. Two-thirds of the kraft production is used in the manufacture of bleached paperboard, with the remaining one-third used for production of uncoated free sheet paper. The company's costs of producing these and other products are among the highest in the nation.

Weyerhaeuser currently is investigating a number of ways to reduce production costs at the Longview mill. An increasing component of these costs is the cost of waste disposal, which has increased from $3.00 per cubic yard in 1985 to $22.00 per cubic yard for long-haul disposal in 1991. Use of the Headquarters site would reduce disposal costs to approximately $9.00 per cubic yard. This would achieve a large percentage of the cost reductions that the company has determined are available, as shown in Attachment 1 to this report.

Reducing production costs is critical to company decisions regarding modernization of the Longview plant. Modernization is needed both to keep the Longview mill competitive and to enable the plant to meet increasingly stringent regulatory requirements. Weyerhaeuser's current modernization plan for the kraft mill projects an investment of more than $300 million. Across product lines, this capital investment is expected to provide 50% of the needed manufacturing cost reductions. Continued support for modernization, however, is dependent on the company's ability to stabilize and reduce other elements of its production costs.

Waste management currently is the least stable production cost. If disposal costs continue to increase as they have over the past 7 years, improvements at the Longview mill will not achieve the cost reductions outlined in Attachment 1 and the company will not realize the needed return on its modernization investments. At some point, increasing disposal costs would cause Weyerhaeuser to re-assess the business decision of whether to continue the needed modernization program at the mill. Stabilization and reduction of disposal costs would help justify Weyerhaeuser's continued investment in the plant.

The importance of these project objectives-- minimizing environmental risks from waste management, assuring long-term disposal capacity, and stabilizing and reducing disposal costs-- led Weyerhaeuser to conduct extensive studies to identify potential landfill

sites. The following describes the application of the Clean Water Act section 404(b)(1) guidelines to the company's consideration of alternatives for this landfill.

III. NO-ACTION ALTERNATIVES

If the company did not develop its own solid waste disposal facility, there would be two potential options for disposal of the waste generated by its Western Washington facilities. The first would be to attempt to avoid the need for disposal through waste minimization and recycling. The second would be to attempt to use nearby or distant third-party landfills. These options are unavailable, not practicable in terms of cost and logistics, or would not achieve the company's basic project purposes.

1. Waste reduction and recycling

Weyerhaeuser has examined waste reduction and recycling as a conceivable no-action alternative. As discussed earlier, Weyerhaeuser already has taken significant steps in these areas and will continue to implement all practicable means to reduce its landfilling requirements. The waste volumes projected for the minimum thirty-year planning period for this project, discussed later in this report, take into account current and future measures to minimize solid wastes as well as potential future expansions at Weyerhaeuser facilities in the region. The company anticipates that improvements in waste minimization will keep pace with the added waste from proposed plant expansions, leaving waste volumes approximately at their current levels for the next thirty years. Waste reduction measures, although an essential part of the company's solid waste management program, thus do not constitute an alternative to the proposed landfill.

2. Utilizing third-party landfills

Using existing landfills in the region, even if they were available, or shipping the waste by long-haul to distant landfills as Weyerhaeuser recently has done with its Longview and Cosmopolis wastes would not meet any of the company's project purposes. First, these options would involve third-party landfills, preventing the company from gaining direct control over the environmental risks that disposal sites can create. Second, these options would not provide Weyerhaeuser with assured long-term disposal capacity, since the operators of these facilities have a strong economic incentive to maximize near-term utilization rather than to reserve capacity for the long-term needs of the region. Finally, use of these landfills would subject the company to continued increases in disposal costs instead of providing essential cost stabilization and reduction.

Utilizing third-party landfills also undermines Weyerhaeuser's goal, and State of Washington policy, of minimizing the amount of solid waste that is landfilled. Consistent with the hierarchy of solid waste management goals set forth at WAC 173-304-010, the

company seeks to minimize or recycle its solid waste wherever feasible before resorting to landfilling. To secure long-term capacity at a third-party landfill, however, Weyerhaeuser like any generator would have to agree to a contract price based on minimum waste volumes. Weyerhaeuser would lose its flexibility under such a contractual arrangement to minimize or recycle its solid waste. The company also would have less flexibility to change the types of solid waste that it disposes of, which can be expected to change with the development of new product lines. Waste minimization and flexibility are best promoted by the use of a Weyerhaeuser owned and operated landfill, where the company would have both the incentive and the ability to reduce waste volumes to maximize the useful life of the facility.

Even if existing landfills met Weyerhaeuser's project purposes, they are not practicable alternatives. The potentially available landfills in the area either are unavailable or lack the required capacity. The company historically has used the Mt. Solo landfill in Longview, Washington for disposal of the solid wastes generated by the Longview mill. Operations at that landfill have been suspended at times in the past two years, and it currently operates only by virtue of a variance granted by the Cowlitz-Wahkiakum Health District ("CWHD") and the Washington Department of Ecology. Both Ecology and the CWHD, which are the jurisdictional authorities with respect to solid waste disposal at the landfill, have indicated that the variance will not be extended beyond the fall of 1993. The Mt. Solo landfill thus is not available for long-term disposal. Also unavailable is the Leichner landfill in Clark County, which is scheduled to close at the end of 1992. Another possibility is the Cowlitz County landfill at Tennant Way in Kelso, Washington. This landfill is available in principle; but it is primarily dedicated to municipal and county solid waste and does not have the long-term capacity to accept the waste generated by the Weyerhaeuser's facilities in the region.

Transporting solid waste to distant regional facilities also is not practicable. As discussed above, this option would not achieve any of the company's project purposes--gaining control over waste disposal risks, assuring adequate long-term capacity, stabilizing disposal costs, and providing the company with the flexibility to reduce its waste volumes. Even if it achieved these purposes, it would not be a practicable alternative because of its substantially greater logistical difficulties and much higher costs as compared to a company-owned landfill in the area.

Added logistical problems would include the need to operate considerably more trucks, or construct one or more transfer facilities at company locations in addition to Longview to transport the waste by rail. Hauling for substantially greater distances by truck also would make the disposal operation much more vulnerable to traffic-related delays, and would increase impacts to local traffic and the potential for traffic accidents. Added environmental risks, related to accidental spills of the solid waste, also would be created by the increased hauling distances. Transportation most likely would be provided by contractors, further undermining Weyerhaeuser's goal of gaining control over the risks associated with solid waste management.

Long-haul also would be impracticable on the basis of added cost. Major elements of this added cost would be the increased expense of truck or rail transport, which represents a substantial percentage of the overall cost of disposal, and the high tipping fees at candidate long-haul facilities. Weyerhaeuser has determined that these factors would make long-haul more than twice as expensive as a company-operated landfill-- disposal costs in current dollars would increase from an estimated $9 per cubic yard for a company-operated facility to approximately $22 per cubic yard for long-haul disposal. As discussed in more detail later in this analysis, the company estimates that its western Washington facilities will generate solid waste that requires landfilling at a rate of approximately one million cubic yards per year for the next thirty years or more. Shipping this amount of solid waste to a long-haul facility thus would increase the company's disposal costs from approximately $9 million to $22 million per year, an increase of some $13 million. This is a very substantial increase by any measure, and it would have a significant impact on the competitiveness of the Longview mill and the company's other facilities in the region.

Apart from considerations of project purposes, logistics and costs, there is also a substantial question as to the long-term availability of long-haul disposal facilities. This is particularly true for facilities located in the State of Oregon. Disposal of out-of-state solid waste in Oregon landfills has a very uncertain future, based on recently enacted and proposed state legislation. For example, a 1989 Oregon statute (ORS 459.297 and .298) authorized the state solid waste management commission to impose a direct tax on solid waste that is imported to the state. This commission recently imposed such a tax, in the amount of $2.25 per ton. Another 1989 Oregon statute (ORS 459.305) in effect prohibits out-of-state municipalities from using Oregon landfills unless they provide the same opportunity to recycle as provided by Oregon towns and cities. The 1989 Oregon legislative session also considered a number of bills that would have restricted waste imports. These included a proposal to limit certain waste disposal capacity only to that which is required by Oregon generators, and a bill that would ban out-of-state waste altogether. The risk of an outright ban on waste imports is increased by proposed federal legislation that would remove current impediments to such bans. All of this enacted or proposed Oregon legislation clearly is intended to discourage waste imports. It is impossible to have any assurance that Oregon facilities will remain available as a practical matter to out-of-state waste.

In summary, using existing landfills in the area or at distant locations would not achieve Weyerhaeuser's basic project purposes. Even if they achieved these purposes, they still would not be practicable alternatives-- landfills in the vicinity of the Longview mill cannot provide the needed long-term disposal capacity, and long-haul facilities would involve significant logistics problems and much higher costs.

IV. ALTERNATIVE SITES FOR A WEYERHAEUSER-OWNED SOLID WASTE LANDFILL

Since alternatives to a Weyerhaeuser-owned landfill do not meet the company's needs for solid waste management, a landfill site must be selected that both meets these needs and is practicable within the meaning of the Clean Water Act section 404(b)(1) guidelines. Weyerhaeuser used an iterative process to identify and evaluate practicable alternative sites that the company either owned or reasonably could obtain. The following describes that process.

1. Distance

The first step in the selection process is to define the geographic area to be examined for suitable landfill sites. Since the vast majority of the solid wastes will be transported from the Longview mill complex, Weyerhaeuser defined the area by distance from the mill. The distance chosen was thirty miles. The area for detailed consideration thus consists of a circular area having a radius of thirty miles from the Longview mill. A map of this area is shown in Attachment 2.

A thirty-mile distance was selected on the basis of several considerations. The most important is that transportation costs would increase significantly beyond this distance. The company has concluded that, as a general rule waste disposal trucks could make three round-trips per day within the thirty-mile radius, but would be reduced to two daily round-trips beyond that point. Transportation beyond thirty miles thus would increase the costs of waste transport by approximately one-third. Transportation costs are a major element of the overall cost of this project, comprising approximately 35% of the estimated total cost. A cost differential of one-third on such a major element makes it unreasonably expensive to use landfill sites located more than thirty miles from the Longview mill. Sites beyond this distance thus are not practicable alternatives.

Confining the area under consideration to locations within a reasonable proximity to the Longview mill, which the thirty-mile radius achieves, also is supported on the basis of logistics. Hauling for longer distances would increase impacts on local traffic and the potential for traffic accidents, and make the operation more vulnerable to road closures, restrictions and delays. These impacts and delays would make more distant landfills less dependable and of greater concern from the standpoint of transportation safety.

Another factor supporting a thirty-mile radius is the fact that it places a very large area under consideration, consisting of approximately 2,827 square miles or 1,809,536 acres. This area has a mix of uplands and wetlands similar to the southwestern Washington region as a whole. The large size of this area and the fact that it is similar to more distant areas with respect to wetlands make the thirty-mile demarcation a reasonable one. The area within thirty miles is as likely as other areas in the vicinity to have suitable landfill sites that would avoid or minimize impacts to wetlands.

2. Areas within Oregon

Approximately one-third of the area within thirty miles of the Longview mill is in the State of Oregon. Although Weyerhaeuser made preliminary surveys to identify potential sites in Oregon, the company excluded Oregon areas from detailed consideration due to the increasing restrictions the state is placing on importation of out-of-state solid waste. As discussed earlier, the Oregon legislature has enacted surcharges and recycling requirements with respect to out-of-state waste, and it has considered direct limits and an outright ban on such waste. These restrictions would undermine one of Weyerhaeuser's basic purposes in planning a landfill-- to assure adequate long-term capacity for its solid wastes. There can be no assurance that a landfill located in Oregon would remain available over the company's minimum thirty-year planning period. The trend toward increased surcharges also would undermine the company's objective of stabilizing its disposal costs. The increasing restrictions also indicate that Oregon sites are likely to become impracticable on the basis of increased costs or logistical problems, even if they technically remain available with respect to out-of-state waste.

3. Areas within Clark County and Lewis County

Approximately twenty percent of the area within thirty miles of the Longview mill is located in Clark or Lewis Counties. To receive a solid waste permit for a landfill in either of those counties, the landfill would have to be in conformance with the county's Comprehensive Solid Waste Management Plan ("Plan"). This is a requirement of the state solid waste regulations at WAC Chapter 173-304. The Plans adopted by those counties, however, do not provide for acceptance of out-of-county solid waste. The State of Washington Pollution Control Hearings Board ("PCHB") has held that in these circumstances importation of out-of-county waste is not in conformance with the Plan, and cannot be allowed. The PCHB stated this principle in Weyerhaeuser v. Cowlitz-Wahkiakum Health District (PCHB No. 90-165). Under current state law, therefore, Clark and Lewis Counties are unavailable for purposes of waste disposal from the Longview mill.

The area within a thirty-mile radius of the Longview mill is very substantial even after excluding the portions within Oregon and Clark and Lewis Counties. The remaining area, as shown in Attachment 3 to this report, comprises approximately 1,230 square miles or 787,200 acres. The next step is to identify locations within this large area where practicable alternative sites might be found.

4. Slope

Site stability is a basic engineering requirement for landfill construction and operation. It also is a legal requirement under the Washington minimum functional standards for solid waste facilities, which at WAC 173-304-130(f) state that "No facility's active area shall be located on any hill whose slope is unstable." These requirements make sites with

unstable slopes legally unavailable, and impracticable from the standpoint of the logistics and technology that would be required to construct and operate a landfill in such areas.

To assure that prospective sites would have adequate stability, Weyerhaeuser excluded areas having slopes greater than 15 percent over 20 percent or more of their area as being unstable for landfill construction. These criteria reflect the engineering judgment of the company and its consultants that sites exceeding these limits are likely to be unstable. The company identified areas that failed this criterion through a detailed review of topographical maps and other reference material. The areas excluded on this basis are shown in Attachment 4 to this report.

5. Site access

Potential landfill sites must be reasonably accessible. After identifying the areas that met slope requirements, Weyerhaeuser evaluated the road and rail access to these areas. A first option that Weyerhaeuser considered was to look for potential landfill sites only in those areas that were contiguous to improved roads or rail lines. Such areas would present the fewest logistical problems in developing and operating the landfill. The company nevertheless decided to expand its search beyond these contiguous areas. The decision was made that a certain amount of access road or rail spur construction would be feasible, up to a maximum distance of two miles from existing roads or one mile from a rail line (grade restrictions make it more difficult to reach a straight-line distance by rail). Construction beyond these distances generally would be impracticable on the basis of cost and logistics, due to factors such as direct construction costs, the need to acquire easements and other property rights, permit requirements and added environmental impacts.

Attachment 5 to this report shows the transportation corridors resulting from the maximum practicable construction of access facilities from existing roads and rail lines. The corridors based on road access have been truncated as needed at less than thirty miles from the Longview mill, to assure that trucks could make at least three round trips per day to those areas. As discussed earlier, the primary rationale for the thirty-mile radius was the company's determination that as a general rule trucks could not make three daily round trips beyond this point. This estimate, however, needs to be adjusted for each transportation corridor to take into account the specific types of roads involved. The company used the travel speed factors listed in Attachment 6 to make adjustments for travel times depending on whether the roads were interstate, primary, secondary or urban roads. The truncations in the transportation corridors shown in Attachment 5 reflect this adjustment, and define the areas to be examined in closer detail for suitable landfill sites.

As can be seen from a comparison of Attachments 4 and 5, there were very few areas excluded due to site access that had not already been excluded due to slope. This is to be expected, since steep and hilly areas generally are less accessible.

6. Floodplains

Areas located in a one hundred year floodplain are poor candidates for a landfill, both on engineering and legal grounds. Designing a landfill to withstand surface flooding is a formidable technical task, involving not only containment of the solid waste itself but protection of subsurface systems such as the groundwater monitoring network and the leachate collection system. Access roads or rail lines also would have to be enhanced through grade elevation, the use of appropriate construction materials and installation of higher capacity drainage systems. All these changes would have to be accomplished in a way that complied with the state solid waste regulations at WAC 173-304-460(3)(d). Under these regulations, landfills in floodplains must not interfere with the flow of the base flood, reduce the water storage capacity of the floodplain or present a risk of washout that could endanger human health or the environment. The landfill also must comply with local floodplain management ordinances.

These concerns indicate that areas within a one hundred year floodplain are impracticable for purposes of constructing a landfill. Even if legal and engineering requirements could be met, designing the landfill and adjacent facilities to meet these requirements would involve difficult technological and logistical issues, and substantially increased costs. It is also imprudent from an environmental and public health standpoint to construct a landfill in a floodplain if alternative sites are available. Floodplain areas within the transportation corridors discussed above are shown in Attachment 7 to this report, and are excluded from further consideration.

7. Proximity to populated areas

One of Weyerhaeuser's most important objectives in this landfill project is to assure long-term disposal capacity for its solid wastes. This objective would be undermined by placing the facility near areas that are incorporated or otherwise populated. Development pressures in such areas make it doubtful that needed permits could be obtained, and could force any permitted landfill to close before its capacity were fully utilized. The landfill needs to be located in a low-density area to avoid foreseeable impacts, either actual or perceived, on nearby residents.

To determine where populated areas are located, Weyerhaeuser reviewed maps and land use classifications for the areas remaining under consideration. Populated areas were classified as any recognized city, town or community based on county maps. The company believes that the landfill must be separated by at least one-half mile from these areas if there is to be any assurance that the landfill can operate for its full design life. Attachment 8 shows the exclusions based on proximity to populated areas.

8. Capacity

The cumulative effect of the above criteria, as shown in the overlays in Attachment 9, is to identify the areas where practicable alternative sites might be found. The areas remaining under consideration after applying these criteria are shown by combining the overlays. The next task is to identify potential landfill sites in these areas. This requires consideration of the needed capacity and size of the landfill facility.

As discussed earlier, one of Weyerhaeuser's basic project purposes is to assure landfill capacity for the solid waste that the Longview mill and other company facilities in the area are expected to generate over at least the next thirty years. There is inherent uncertainty in estimating the volume of this waste, due to currently unforeseeable events such as facility expansions, production changes and advances in waste minimization and recycling. The company's best estimate is that these facilities will require approximately one million cubic yards of solid waste landfill capacity each year over the next thirty years. Approximately 75% of this capacity will be required by the Longview mill. Weyerhaeuser expects that improvements in waste reduction and recycling will allow the company to keep waste volumes at their current levels despite the production increases and changes that are likely to occur. The company's facilities in the area thus will require approximately 30 million cubic yards of solid waste landfill capacity over the next thirty years. A landfill engineered to accommodate this waste volume will require a minimum footprint of 250 acres, excluding ancillary facilities.

Weyerhaeuser closely examined a number of sites that otherwise appeared to meet the site selection criteria to determine whether they could provide the needed capacity. The examination included overflights, site visits and detailed reviews of topographical and soils maps. Land managers and consultants familiar with the area were involved in identifying and reviewing candidate sites. Thirty-five potential sites were evaluated in this process, as described in a report entitled "Solid Waste Disposal Facility Site Selection Study" that the consulting firm of Sweet-Edwards/Emcon ("SE/E") prepared in October 1990. Attempts to configure a landfill having a 250-acre footprint at these sites showed that most did not provide the needed capacity, and that all but four of the available sites failed to meet capacity requirements or one of the other criteria discussed above. The locations of the four sites that met all the criteria are shown on the map in Attachment 10. They are known as the George Taylor A, George Taylor B, Barnes Drive and Headquarters sites, shown respectively in Attachments 11, 12, 13 and 14.

9. Comparison of potential alternatives

The Clean Water Act section 404(b)(1) guidelines generally prohibit the filling of wetlands if there is a practicable alternative that would involve less aquatic impact, so long as the alternative would not involve other significant environmental consequences. Determining which of the four sites listed above is the least environmentally damaging practicable alternative under the guidelines thus is basically a two-part process. The first is

to rank the sites in terms of the aquatic impacts the project would cause at each site. The second is to closely evaluate the site involving the least aquatic impact to determine whether there would be other significant environmental impacts from use of that site.

The starting point in ranking the sites according to aquatic impacts is to determine the extent of any Clean Water Act wetlands at the four sites. Weyerhaeuser retained Beak Consultants, Inc. to perform wetlands delineations at these sites. Based on the 1989 Federal Manual for Identifying and Delineating Wetlands, Beak determined that each site contained wetlands, in the following amounts:

Site	Emergent Wetland	Scrub Shrub	Forest Wetland	Total Acreage
George Taylor B	52.8	0.0	1.0	**53.8**
George Taylor A	2.8	4.0	12.1	**18.9**
Headquarters	12.1	3.1	0.0	**15.2**
Barnes Drive	0.8	0.0	0.4	**1.2**

The next step is to determine whether the functions and values of the wetlands at the four sites would change a ranking of impacts based solely on the amount of wetlands present. The wetlands at these sites were evaluated to determine their role in providing physical and biotic wetland functions such as biofiltration, stormwater retention, wildlife habitat and stream bank stabilization. The results of this examination were set forth in an Environmental Technical Report that Beak Consultants prepared in June 1991. Wetlands at the four sites differ in their functions and values, but not to the extent that these differences change a ranking of site impacts based on wetlands acreage. The following table summarizes the findings of this report:

Site	Physical Functions	Biological Functions	Value
George Taylor B	Significant retention, recharge and biofiltration	Limited diversity; no fish habitat	Moderate to high
George Taylor A	Significant retention and biofiltration functions; instream cover and shade; stream bank stabilization	Mature, diverse habitat; pool and riffle habitat; supports resident trout	High
Headquarters	Moderate recharge and biofiltration functions; stream bank stabilization	Limited diversity; pool and riffle habitat; supports resident trout	Moderate
Barnes Drive	Limited and disturbed	Limited wetlands diversity; no pool and riffle habitat	Low

As indicated by this table, the Environmental Technical Report found that the George Taylor B site has extensive wetlands that provide important retention and biofiltration functions. The George Taylor A site was found to have high value wetlands, which provide important physical functions and support a mature and diverse biological habitat. The wetlands at the Headquarters site were judged to be of moderate value. They provide some biofiltration and stabilization functions and contain pool and riffle habitat that support resident cutthroat trout, but provide little substrate for spawning and relatively little biological diversity. The Barnes Drive site was found to have disturbed wetlands that provide few physical functions and only limited biological diversity. Based on considerations of the extent and functions and values of the wetlands at each site, this analysis indicates that the George Taylor sites would involve the greatest aquatic impact and the Barnes Drive site would involve the least. The first part of the section 404(b)(1) analysis therefore indicates that Barnes Drive appears to be the preferred alternative.

The second part of the analysis, however, indicates that use of the Barnes Drive site could involve other significant environmental impacts, and substantially greater logistical problems and costs as compared to the other sites. For these reasons it is neither a practicable alternative nor the least environmentally damaging alternative that is available.

After having determined that the Barnes Drive site was likely to involve the least aquatic impact among the four potential alternatives, Weyerhaeuser directed the consulting firm of SE/E to evaluate the overall environmental issues associated with Barnes Drive and

the other sites. The results of this evaluation were set forth in a report entitled "Addendum to the Solid Waste Disposal Facility Site Selection Study" that SE/E prepared in October 1990.

SE/E found that 31 wells for public, domestic and irrigation purposes are located within one mile of where the landfill at the Barnes Drive site would be situated. The site is located on a hilltop, as indicated by the topographical map at Attachment 13. The groundwater gradient leads away from the site on all sides. Virtually all the wells thus are located downgradient from the site. Although the engineered landfill would incorporate multiple and redundant systems to safeguard groundwater, the proximity of these wells would sharply reduce the important protections that distance alone can provide. For example, their proximity would significantly reduce the effectiveness of leak detection systems at the site in the unlikely event of a liner failure. Reduced travel times between the points of leak detection and the wells would give only limited opportunity to take remedial action before the wells were affected. The wells also would be vulnerable to highly unlikely but conceivable simultaneous failures of groundwater protection systems at the site. Virtually all the wells could be affected by such failures.

Three of the wells are of particular importance. All three are located less than one-quarter mile from what would be the site boundary; two of them are within 100 feet of the site and directly downgradient from it. These wells provide water to an Interstate 5 rest stop that the Washington Department of Transportation operates at Barnes Drive. This rest stop, which is adjacent to the landfill site, serves more than 3 million people per year. Situating a landfill within this proximity to drinking water wells would violate WAC 173-304-130(2)(b) of the state solid waste regulations. This regulation requires a minimum separation of 1,000 feet between the active area of a landfill and drinking water wells. Weyerhaeuser would need to obtain a variance from this requirement to construct a landfill at this location.

Such a variance would be very difficult or impossible to obtain, given substantial doubts as to whether Weyerhaeuser could meet the technical requirements for a variance and the fact that these wells are heavily used for important public purposes. If a variance could not be obtained, Weyerhaeuser could avoid the minimum separation requirement only by acquiring and decommissioning these wells and providing the Interstate 5 rest stop with an alternate source of drinking water. Inability to acquire these wells would make the Barnes Drive site unavailable. Even if the wells could be acquired, providing an alternate water supply for the rest stop would be costly and logistically complicated. The company would have to purchase water rights, obtain permits, and construct and maintain pipelines, pumps and associated equipment. These requirements would make the Barnes Drive site impracticable from the standpoint of both cost and logistics.

The remaining 28 wells near the site also would present potential environmental problems. These wells provide water to some of the 47 residences that are located within one mile of the proposed site boundary. The residences that do not use wells appear to obtain water from surface springs. No public water supply is available to the area.

Although a failure of the facility's groundwater protection systems is highly unlikely, as discussed above, any such failure could endanger these wells and springs. Eliminating a distance buffer between the facility and nearby residences removes an important part of what otherwise would be multiple and redundant means of avoiding impacts.

Use of the Barnes Drive site also could result in significant air quality impacts. Despite the most careful operational practices, landfills can generate dust, odors and other air pollutants. The prevailing winds at the site are from the southwest. These winds would transport any air pollutants in the direction of the nearby Interstate 5 rest stop, potentially affecting travelers and discouraging its use. Other wind conditions would carry pollutants toward the substantial number of residences located to the west and south of the site. Air quality problems thus could cause significant impacts in most wind conditions.

The visual and noise impacts from construction and operation of the landfill also would be significant at the Barnes Drive location. As can be seen from the map attached at Attachment 13, most of the 47 residences within one mile of the site boundary are situated on or near the road that Weyerhaeuser would use for access to the site. These residences would be directly affected by truck traffic to and from the site. The waste disposal trucks would substantially increase road congestion and, since the road is steep, would cause significant noise impacts. The prominent hilltop location of the landfill also would cause long-term visual impacts to local residents and travelers on Interstate 5. The 3 million annual users of the Barnes Drive rest stop would be particularly affected.

The Barnes Drive site thus is not a practicable alternative for two principal reasons. First, the virtual impossibility of obtaining a variance allowing a landfill to be placed near wells that supply the adjacent Interstate 5 rest stop makes the site either unavailable or impracticable. Inability to acquire and decommission the wells in the likely event of a variance denial would make the site unavailable; if the wells could be obtained, the significantly increased logistical problems and costs involved in providing an alternate water supply for the rest stop would make the site impracticable. Second, use of the site would present significant non-aquatic environmental impacts even if the site were available and practicable. These would include potentially serious groundwater, air and traffic-related impacts. These impacts also are of concern to governmental agencies, as indicated by a March 11, 1991 letter from the Washington Department of Transportation that is included as Attachment 15 to this report. These factors indicate that Barnes Drive is not a practicable alternative under the section 404(b)(1) guidelines.

Among the three remaining sites, the Headquarters location involves the least amount of wetlands impacts and thus as an initial matter would be the preferred alternative under the section 404(b)(1) guidelines. The guidelines require two additional considerations, however. As discussed above in connection with Barnes Drive, the site must not involve other significant adverse environmental impacts. Also, as provided by the guidelines at 40 C.F.R. § 230.10(c), use of the site must not cause or contribute to significant degradation of wetlands or other waters covered by the Clean Water Act.

Use of the Headquarters site would not cause any significant adverse non-aquatic impacts. Weyerhaeuser expects this conclusion to be confirmed by the SEPA process currently underway in connection with its application for a solid waste permit for the site. Unlike the Barnes Drive location, there are no private residences near the proposed facility. The nearest residence is located 1.5 miles from the site. Also, there are only two wells within one mile of the proposed site, both owned by Weyerhaeuser. They do not serve any residences or public facilities, and they are neither downgradient from the site nor located within 1,000 feet of the proposed site boundary. The site thus complies with the Washington regulation discussed earlier requiring a minimum separation of 1,000 feet between landfills and drinking water wells. Traffic impacts also would be essentially non-existent, since the solid waste would be shipped to the Headquarters site entirely by rail. A landfill at the site also would not cause significant visual or air impacts. This is due to the low elevation of the site in comparison to the surrounding area, and the lack of residences or public facilities near the site.

A second issue to consider under the section 404(b)(1) guidelines is whether use of the Headquarters site would cause significant degradation to wetlands or other waters. The guidelines at 40 C.F.R. § 230.10(c) describe the types of impacts that may constitute significant degradation. The Mitigation Plan prepared by Beak Consultants in November 1991, which Weyerhaeuser has submitted with this alternatives analysis, fully evaluates the impacts that would be caused by use of the Headquarters site and proposes steps to mitigate and compensate for these impacts. The following briefly summarizes the Plan with respect to its evaluation of impacts associated with the Headquarters site.

Impacts to aquatic life from use of the Headquarters site would include loss of approximately one-half acre of fish habitat used by cutthroat trout and reticulate sculpin, including 0.22 acre of Type 3 stream and 0.19 acre of Type 4 stream as classified by the State of Washington stream classification system. This area includes shallow riffle (54 percent) and pool (16 percent) habitat, as well as beaver pond habitat. It contains little substrate that is suitable for spawning. The relatively small size of the affected area and the lack of unique habitat indicates that the aquatic impacts would not be significant. Weyerhaeuser plans to compensate for the impacts that would occur by constructing a stream diversion channel and habitat complex at the site, which will provide pool and riffle areas and significant wetlands habitat. Details of this stream diversion channel are set forth in the Mitigation Plan.

Other aquatic impacts would consist of the filling of approximately 15 acres of emergent and scrub-shrub wetlands at the Headquarters site. These wetlands are of moderate function and value. They are not unique or rare, and no threatened or endangered plants or animals are known to inhabit the area. Most of these wetlands are riparian in nature. Their principal value is the in-stream cover and bank stabilization they provide. These functions would be recreated or enhanced by the diversion channel and habitat complex that Weyerhaeuser has proposed for the site. Approximately five acres are "isolated" wetlands that provide some detention and recharge functions. The loss of filtration functions should

not cause significant impacts, however, since many of these functions would be replaced by the landfill design itself. The detention and sedimentation ponds that would be part of the landfill system would provide retention and biofiltration functions for the landfill runoff. Additional compensation would be accomplished through restoration and enhancement of other wetlands in the Sucker Creek basin. These and other measures are described in detail in the Mitigation Plan.

Taken together, these aquatic impacts are not the kind of unacceptable impacts either in absolute or relative terms that preclude a permit under the section 404(b)(1) guidelines. The wetlands at the Headquarters site do not provide unique aquatic or wildlife habitat, particularly in comparison to the George Taylor sites that support wetlands providing greater habitat value and hydrologic functions.

Based on the above considerations, the Headquarters site remains the preferred alternative under the section 404(b)(1) guidelines. It meets Weyerhaeuser's project purposes for a solid waste landfill, it is practicable in terms of cost, logistics and technology, it involves the least wetlands impacts among the practicable alternatives and it will not create other significant adverse environmental impacts.

V. CONCLUSION

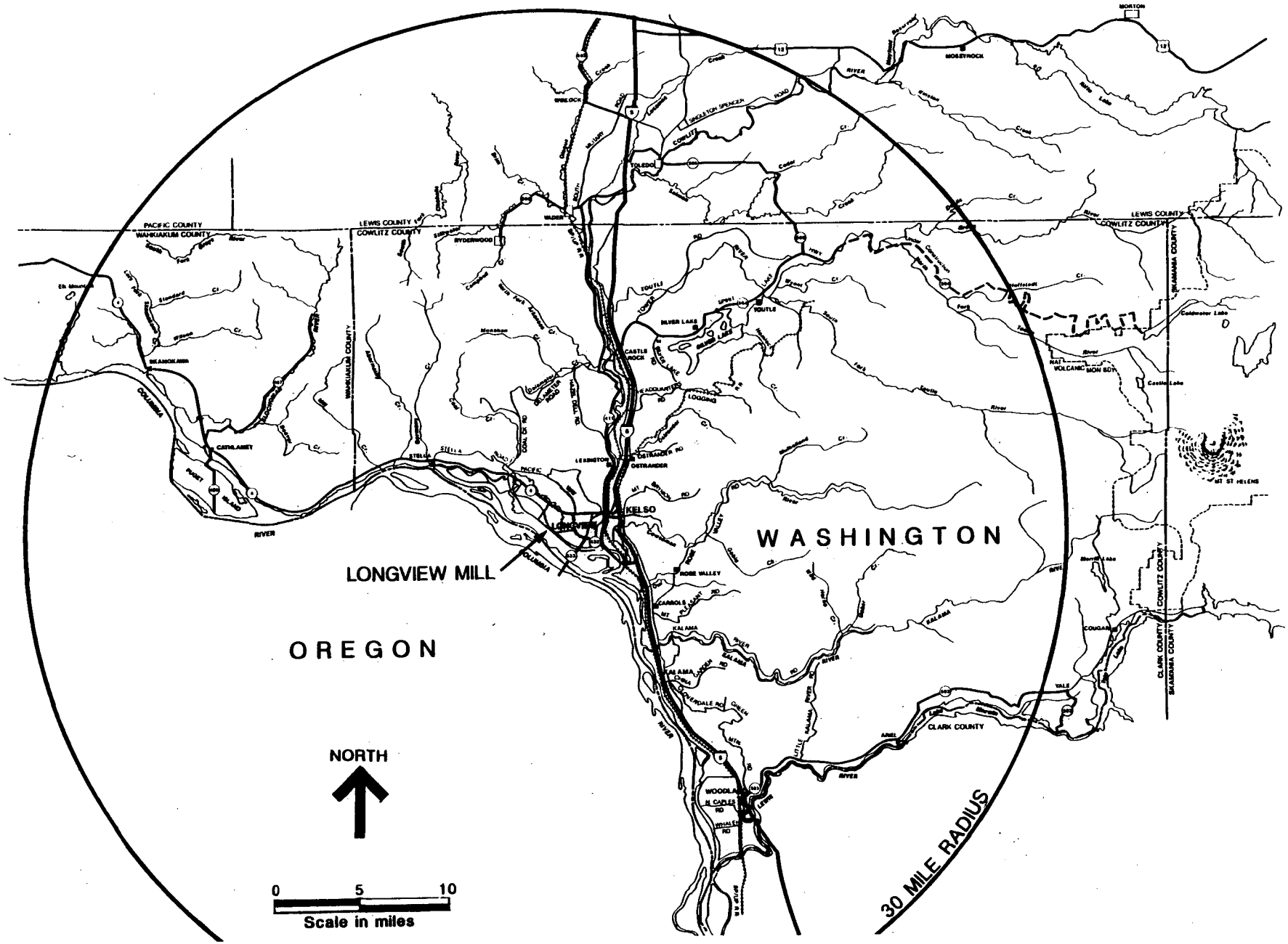
One of Weyerhaeuser's highest priorities is to provide an integrated waste management system for the solid wastes generated by its Western Washington facilities. The first element of this management system is a concerted program of waste minimization and recycling. An essential second element is a company-operated landfill for those solid wastes that cannot feasibly be reduced or recycled. This landfill would complement rather than detract from waste minimization-- unlike third party landfill operators, the company would have not only an environmental but also a strong business incentive to maximize the useful life of any disposal facility it operated.

A Weyerhaeuser-operated facility would allow the company to better control the environmental risks associated with solid waste disposal, assure needed disposal capacity, stabilize and reduce its disposal costs, and maintain the flexibility to change the types and reduce the volumes of its solid wastes. The company has made extensive studies to identify potential landfill sites that both achieve these project purposes and meet permit requirements, in particular the requirements of the Clean Water Act section 404(b)(1) guidelines. The Headquarters site meets all these requirements, and with proposed mitigation measures would provide an environmentally sound location with minimal adverse impacts.

ATTACHMENT 1

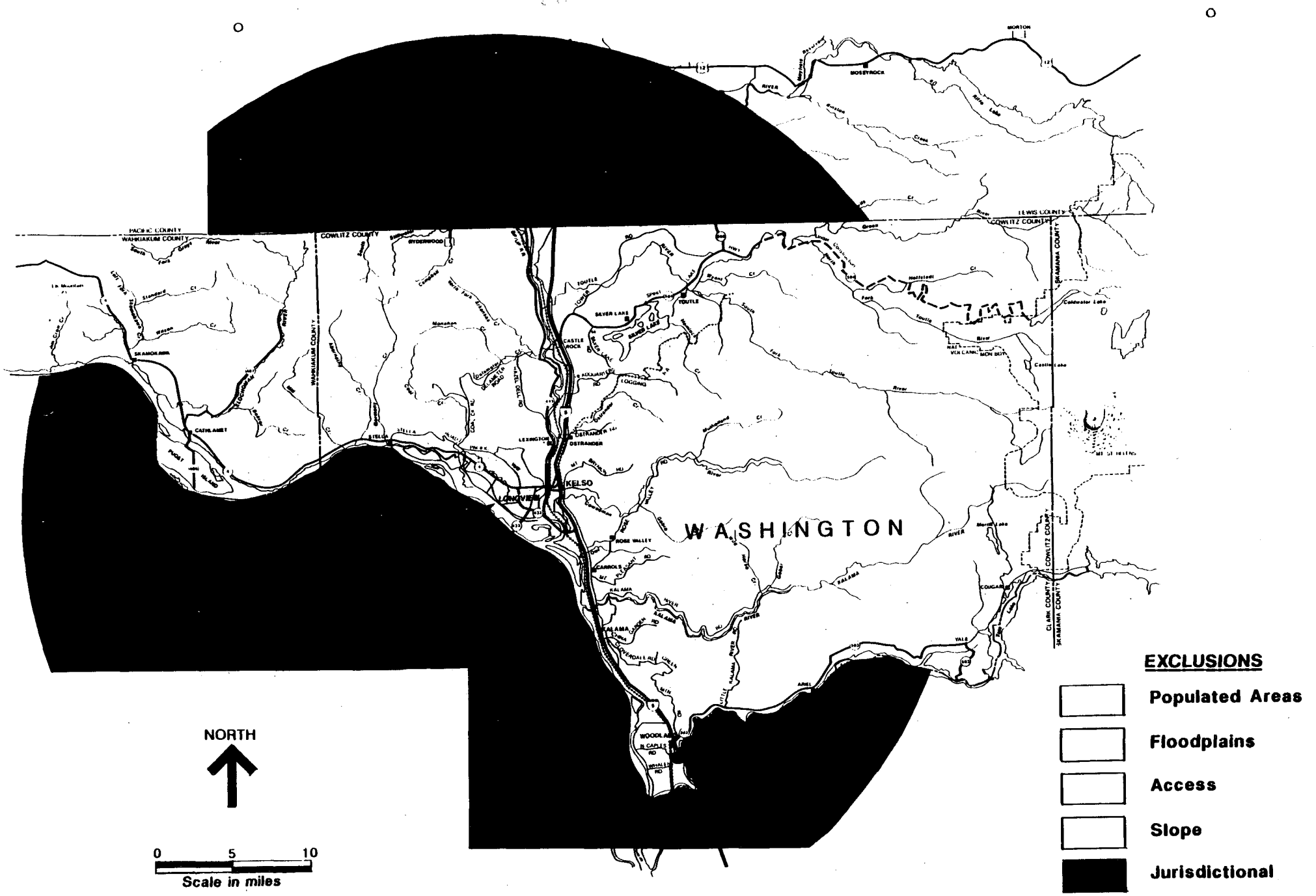
Production Costs at Longview Mill

Product	Current Production Cost per Ton	Desired Production Cost per Ton	Improve-ment Opportunity	Waste Disposal Opportunity per Ton	Waste Disposal Opportunity As Percent of Total
Bleached paperboard	$640	$540	$100	$13	13%
Uncoated free sheet paper	$430	$350	$80	$13	16%
Corrugated medium	$260	$200	$60	$13	22%

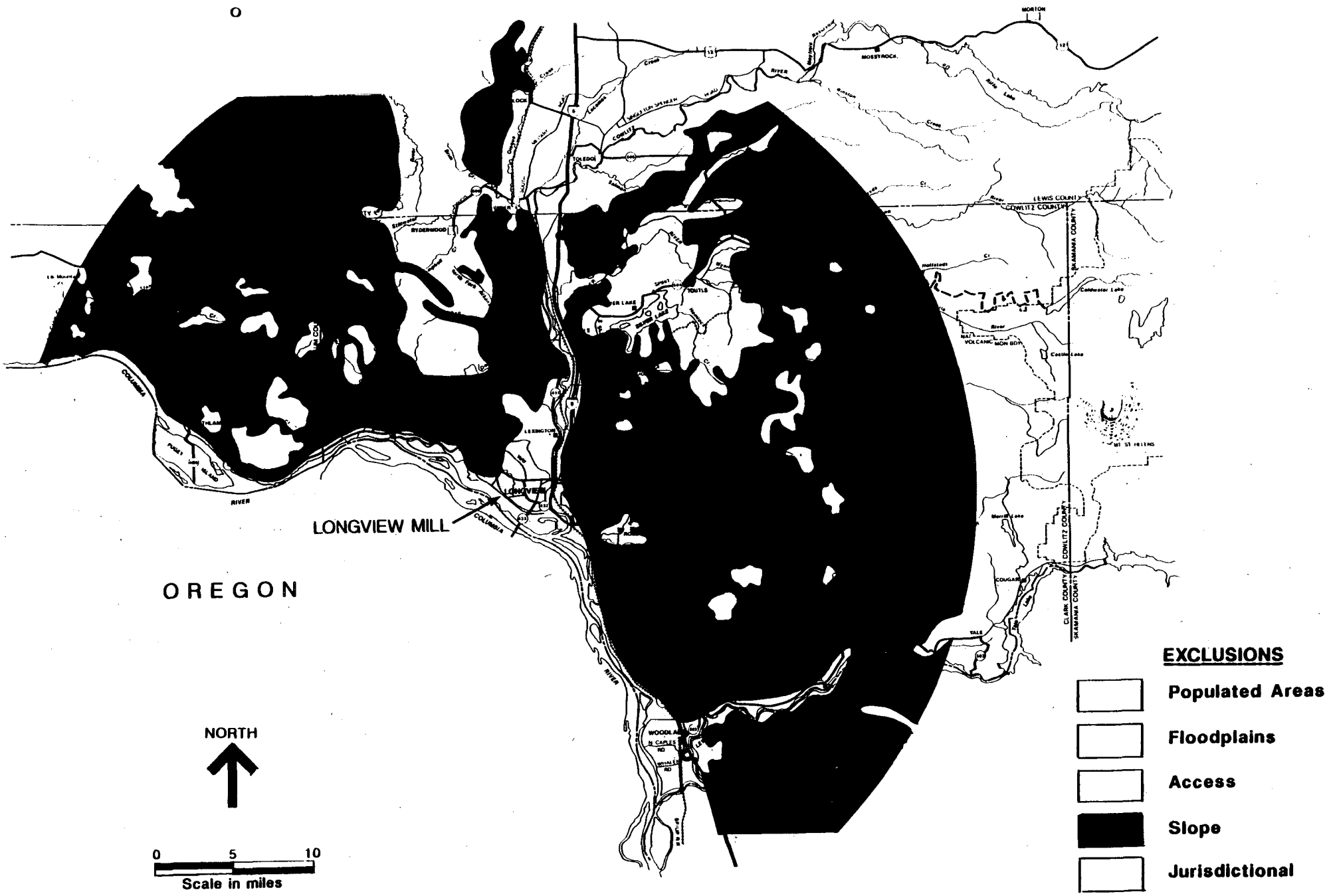


AREA CONSIDERED FOR SOLID WASTE FACILITY - 30 MILE RADIUS

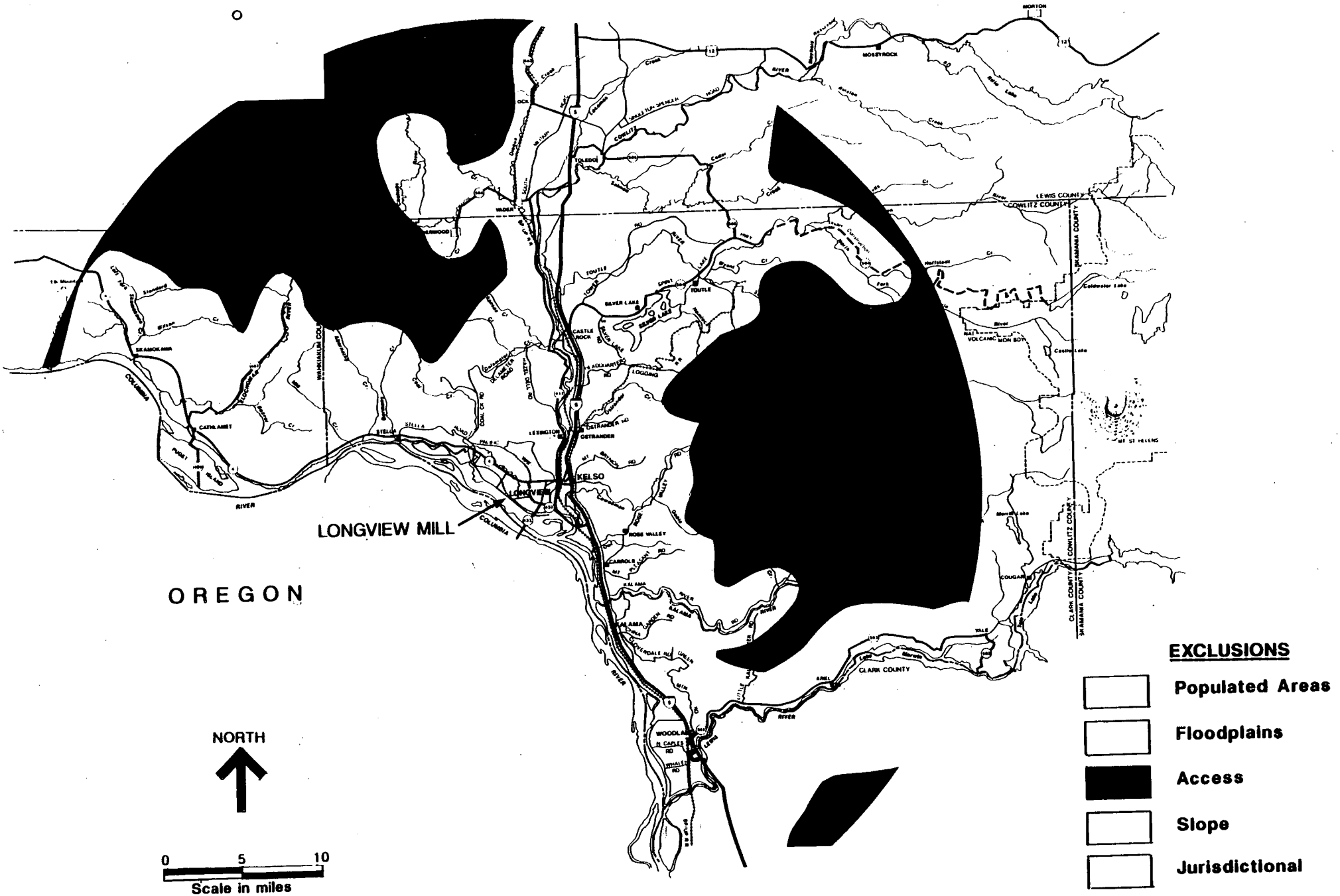
Attachment 2



JURISDICTIONAL EXCLUSIONS Attachment 3



SLOPE EXCLUSIONS Attachment 4

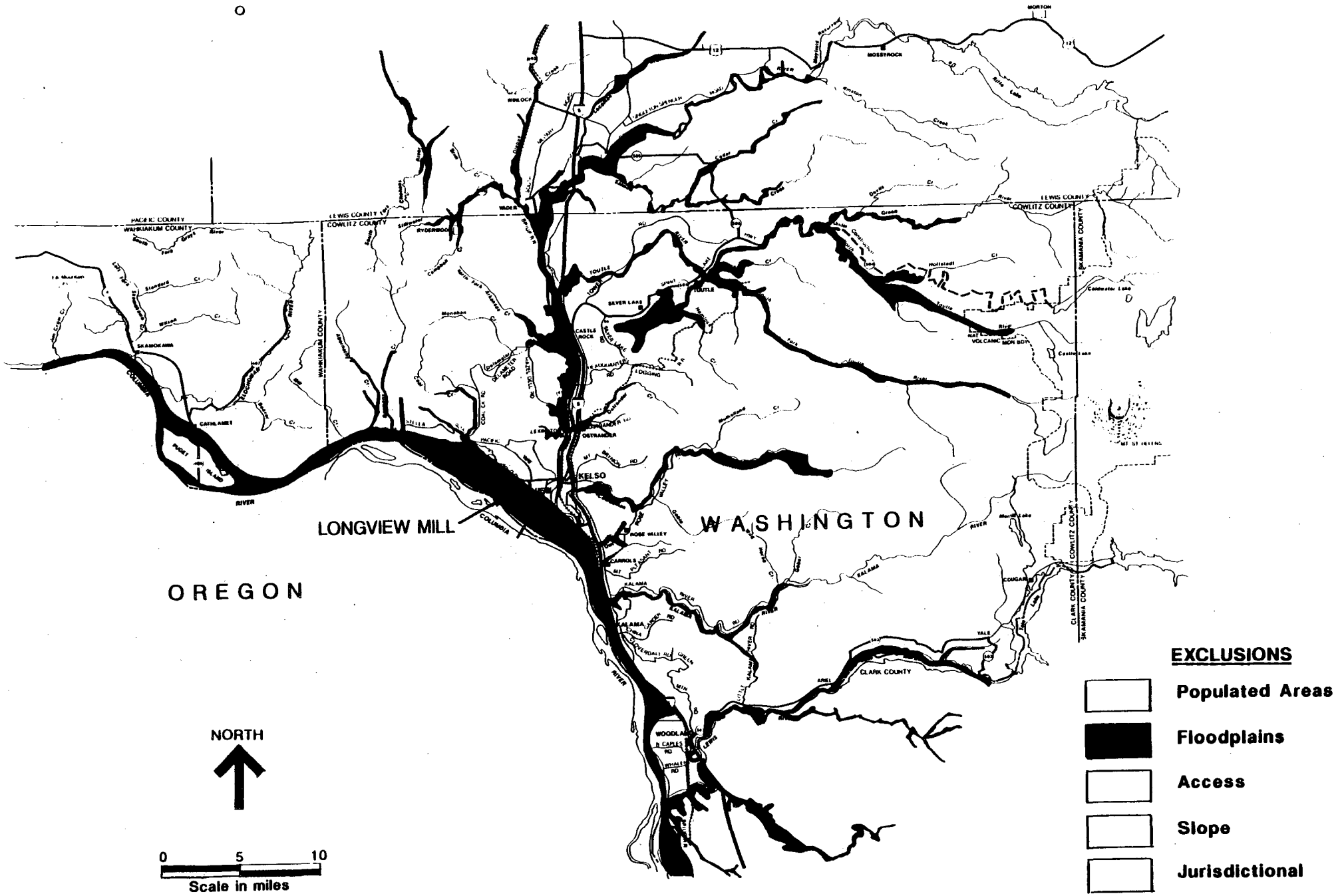


ACCESS EXCLUSIONS Attachment 5

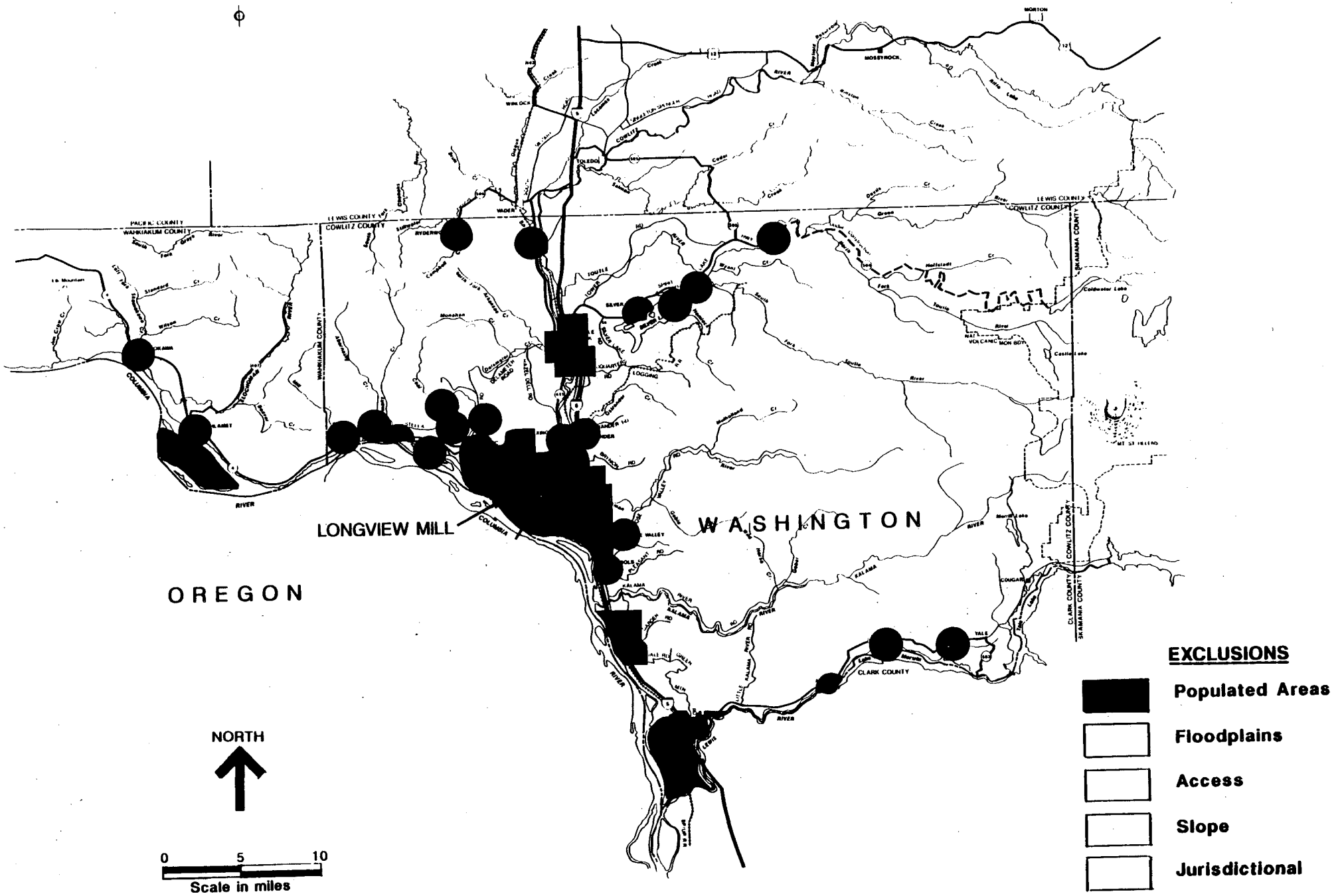
ATTACHMENT 6

Road Types and Distance Factors Used in Evaluating Site Access

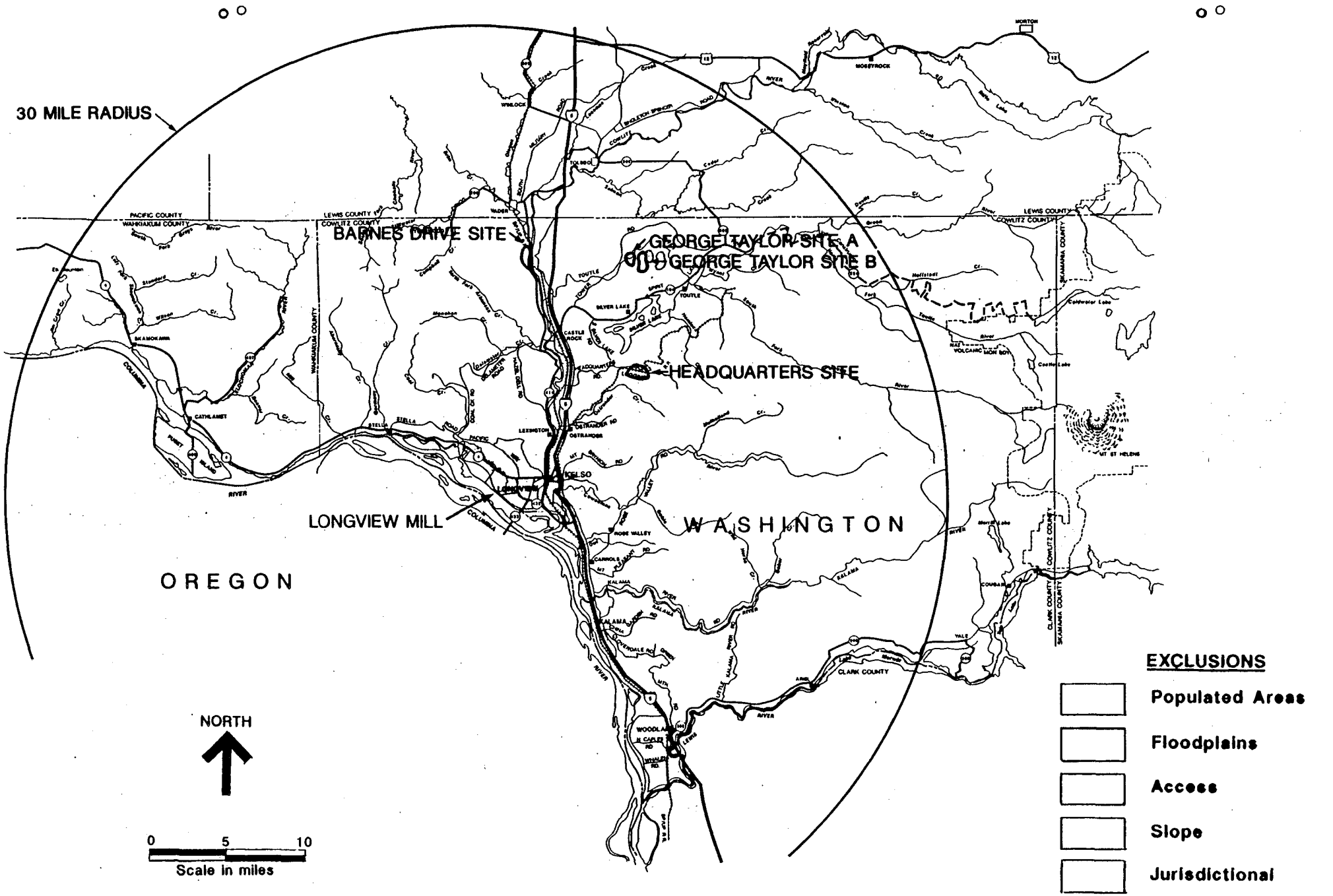
Road Type	Factor	Approx. Average Speed (mph)
Interstate highway	1.0	50
Primary road	1.5	35
Secondary road	2.5	20
Urban or community road	5.0	10



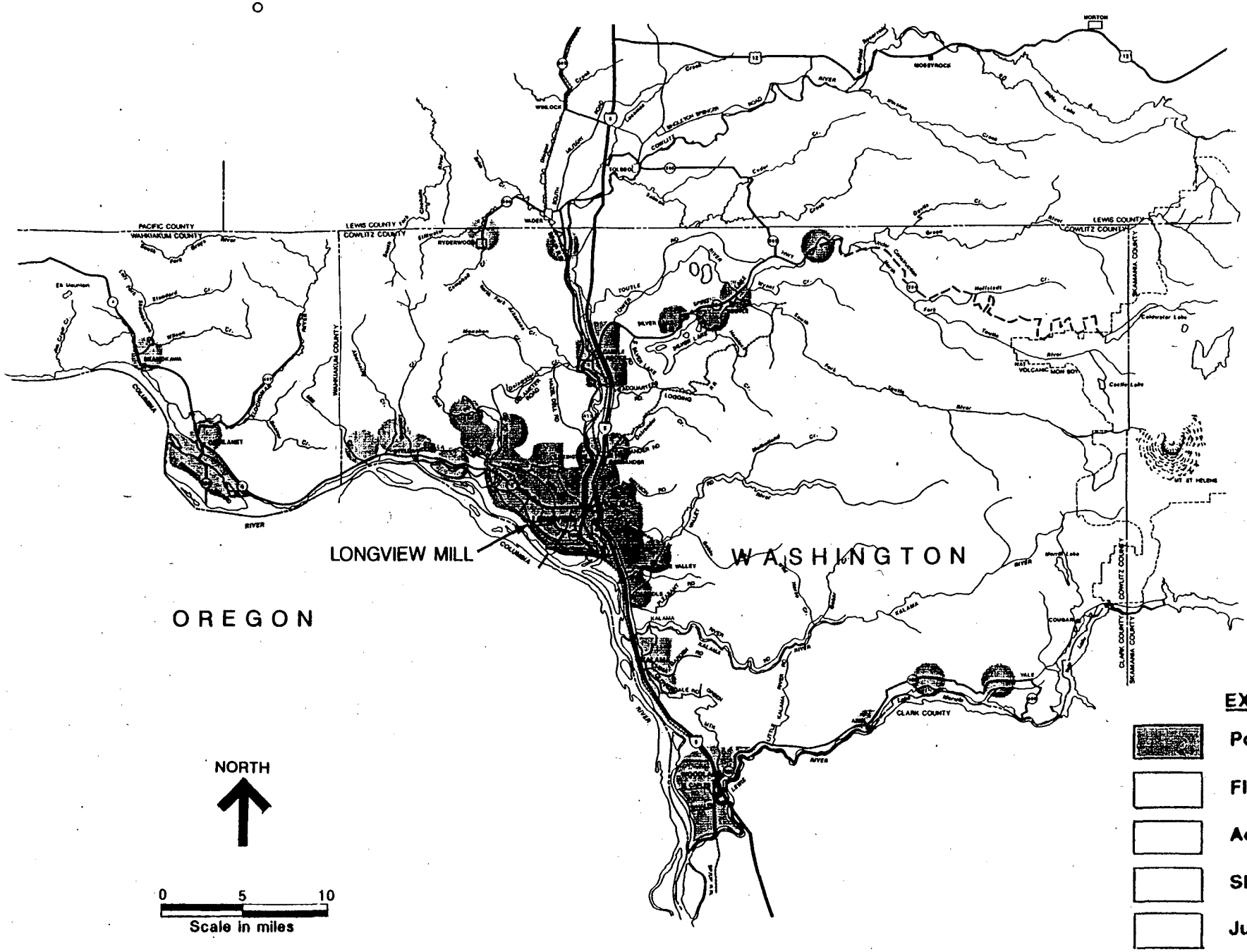
FLOODPLAINS EXCLUSIONS Attachment 7



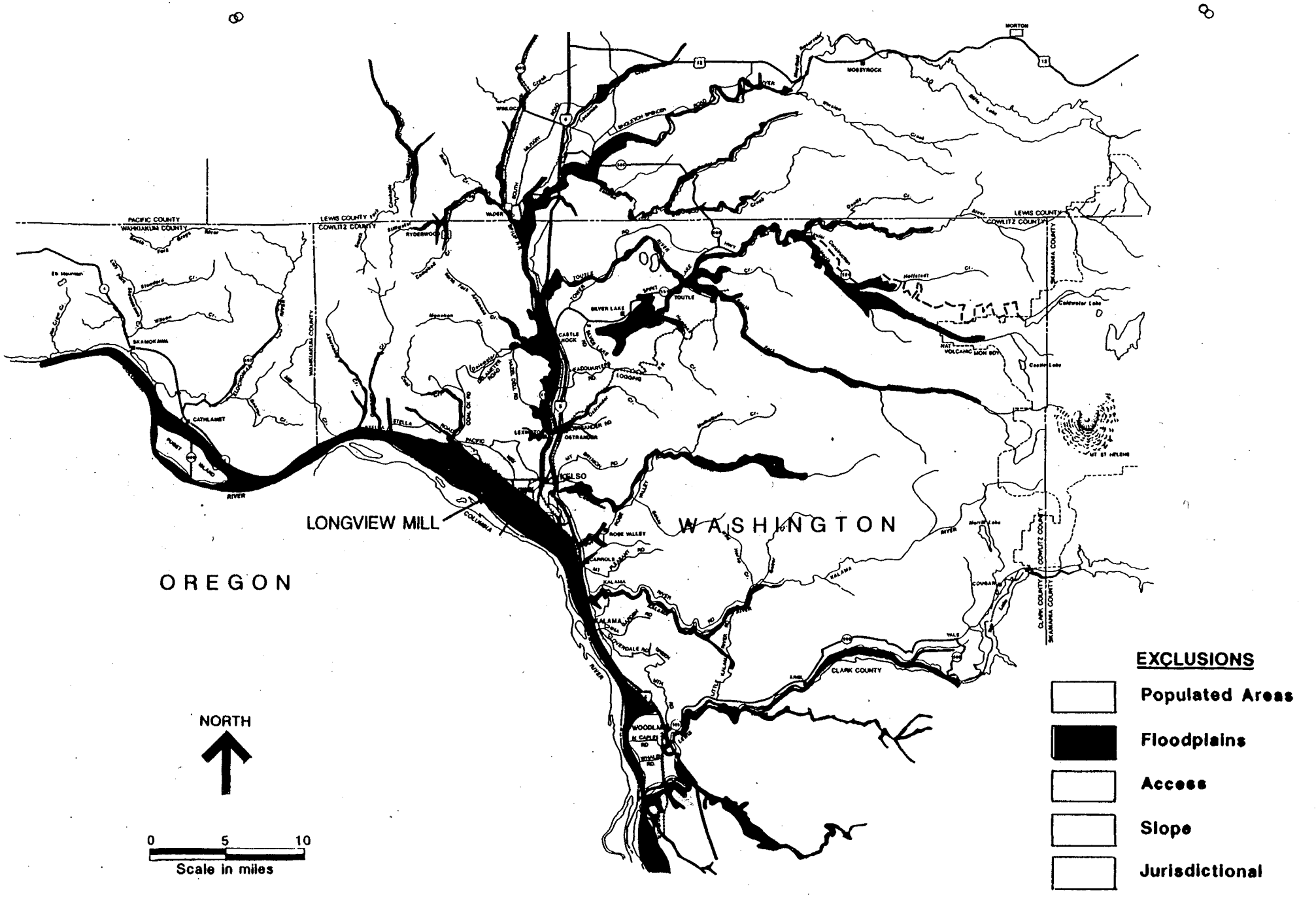
POPULATED AREAS EXCLUSIONS Attachment 8



OVERLAYS SHOWING CUMULATIVE APPLICATION OF SITING CRITERIA Attachment 9

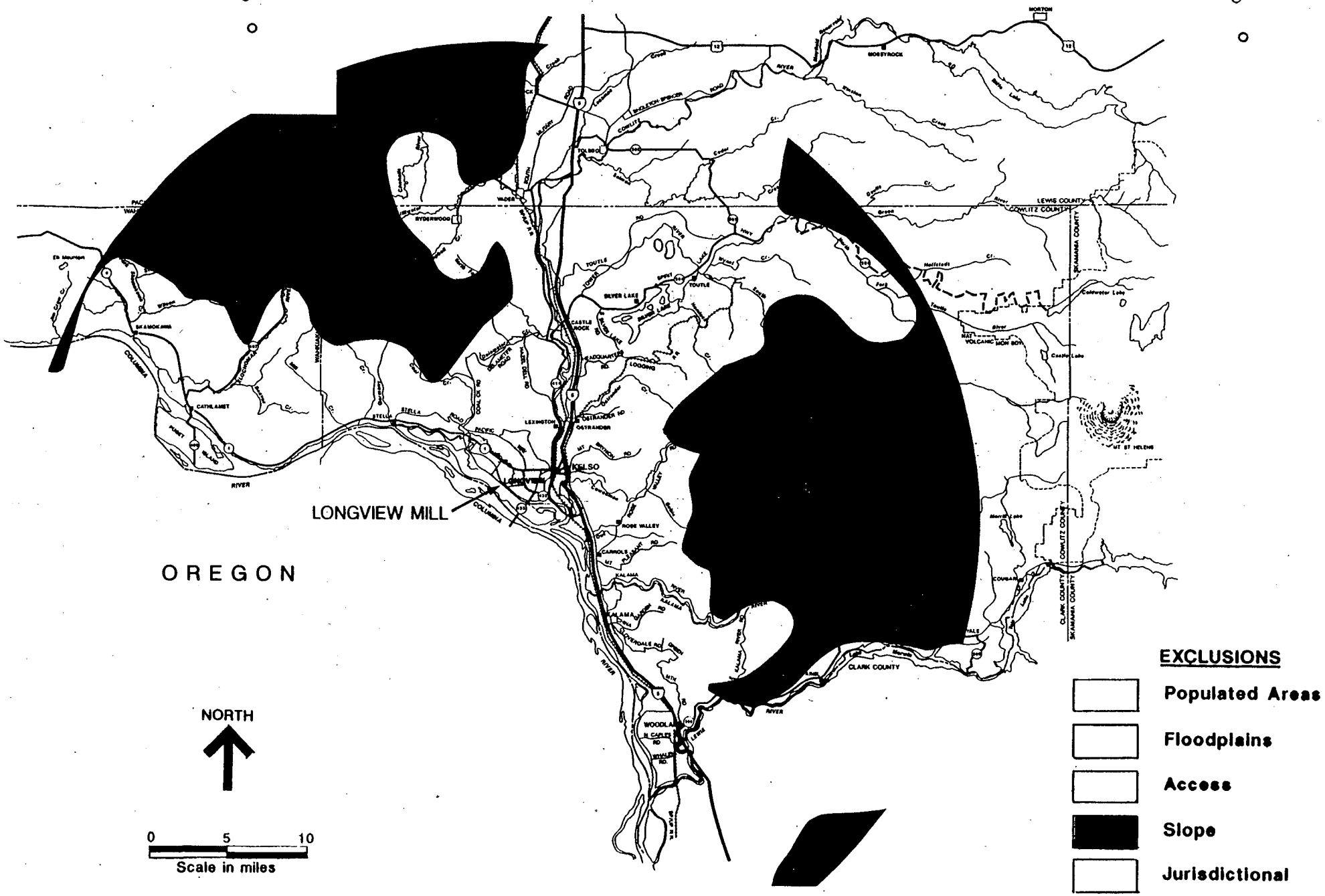


OVERLAYS SHOWING CUMULATIVE APPLICATION OF SITING CRITERIA Attachment 9



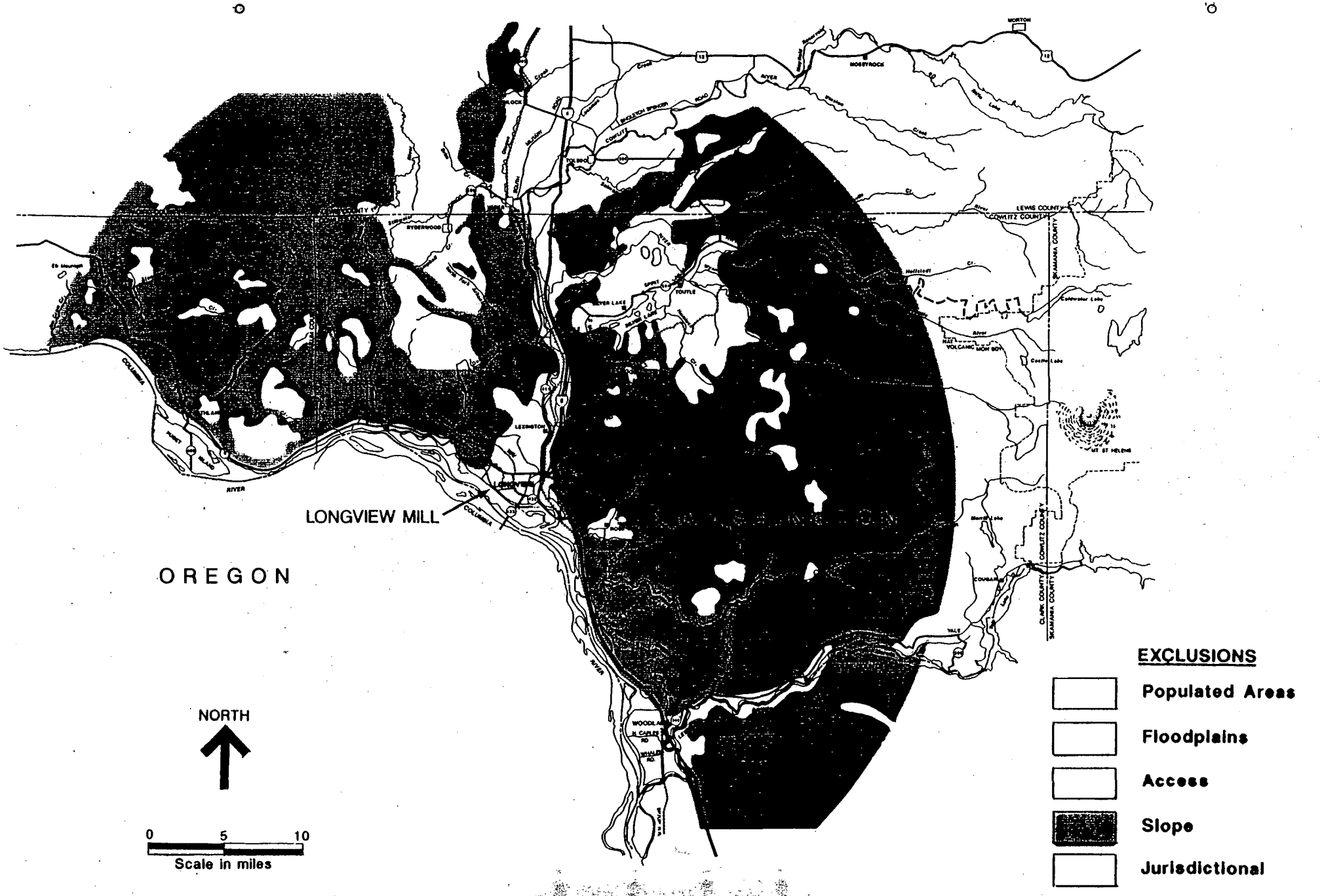
OVERLAYS SHOWING CUMULATIVE APPLICATION OF SITING CRITERIA

Attachment 9



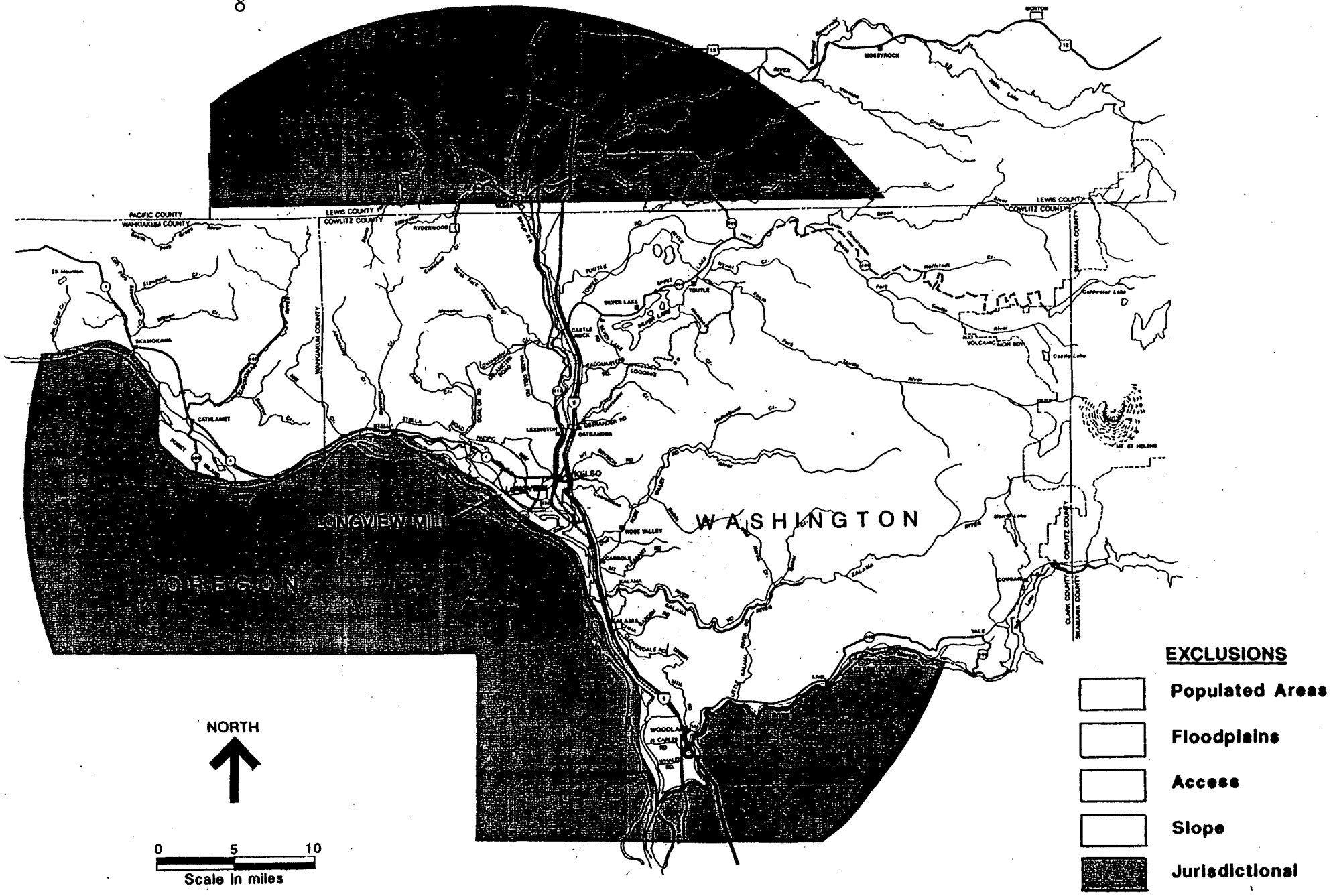
OVERLAYS SHOWING CUMULATIVE APPLICATION OF SITING CRITERIA

Attachment 9

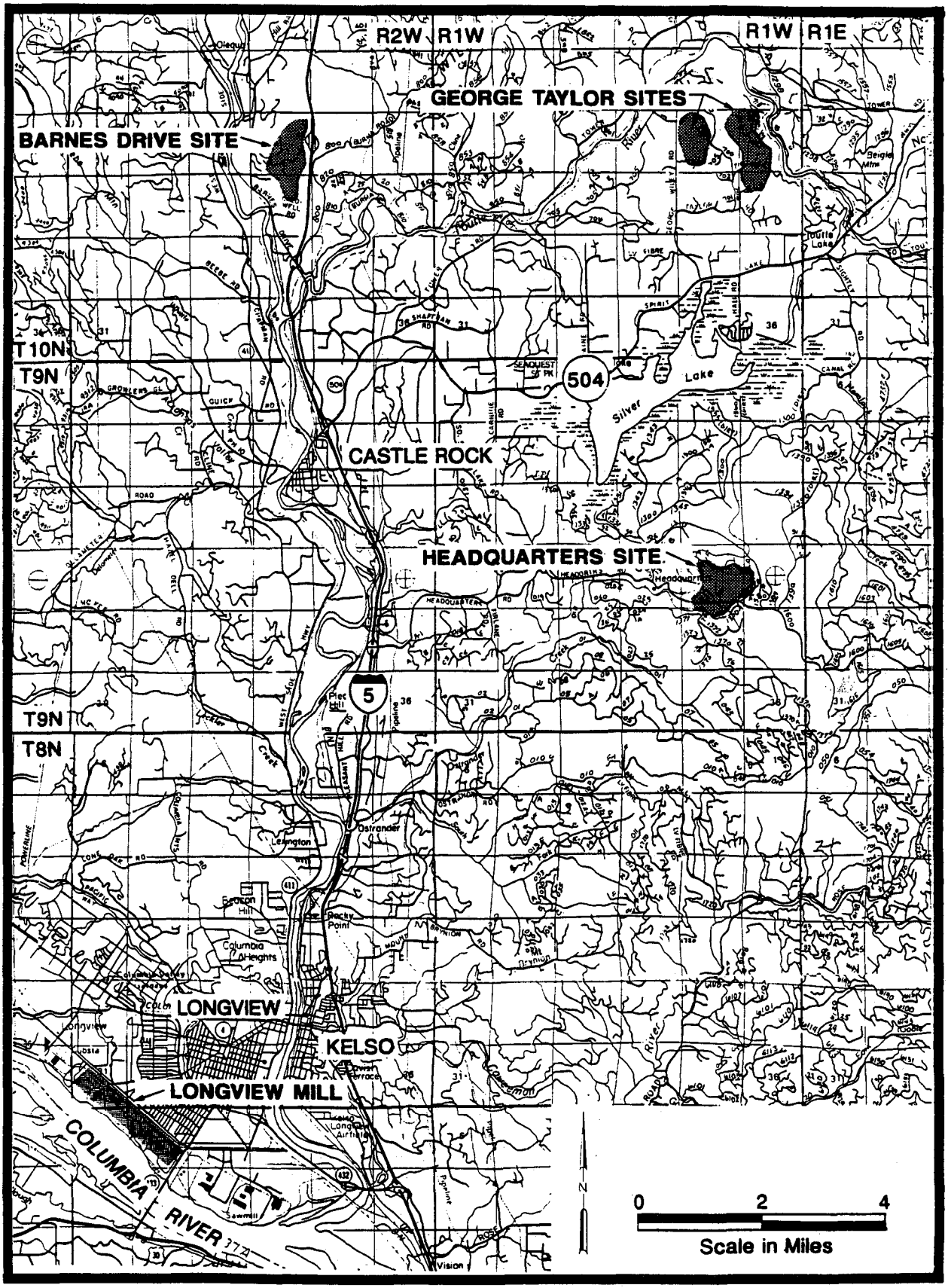


OVERLAYS SHOWING CUMULATIVE APPLICATION OF SITING CRITERIA

Attachment 9

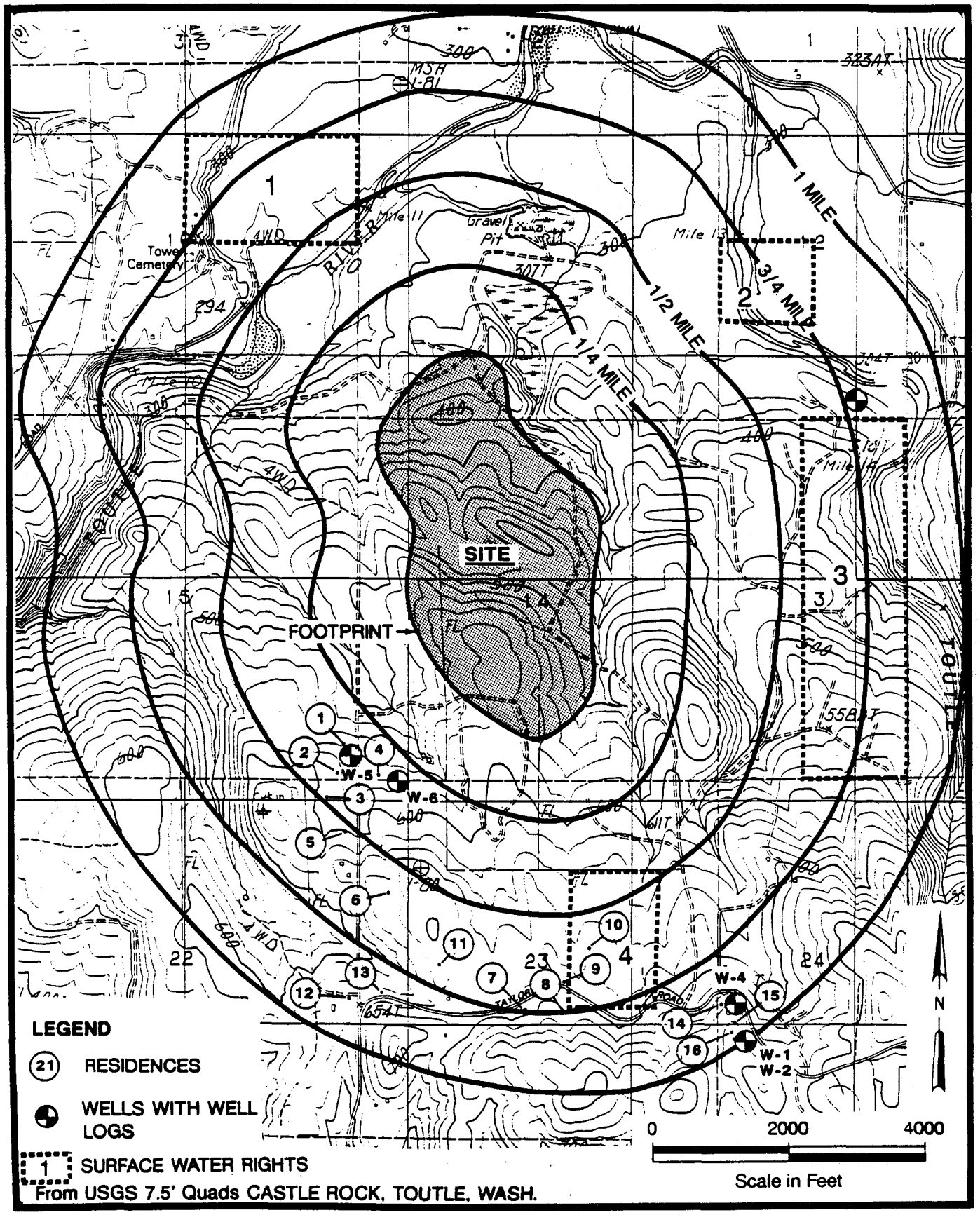


OVERLAYS SHOWING CUMULATIVE APPLICATION OF SITING CRITERIA Attachment 9



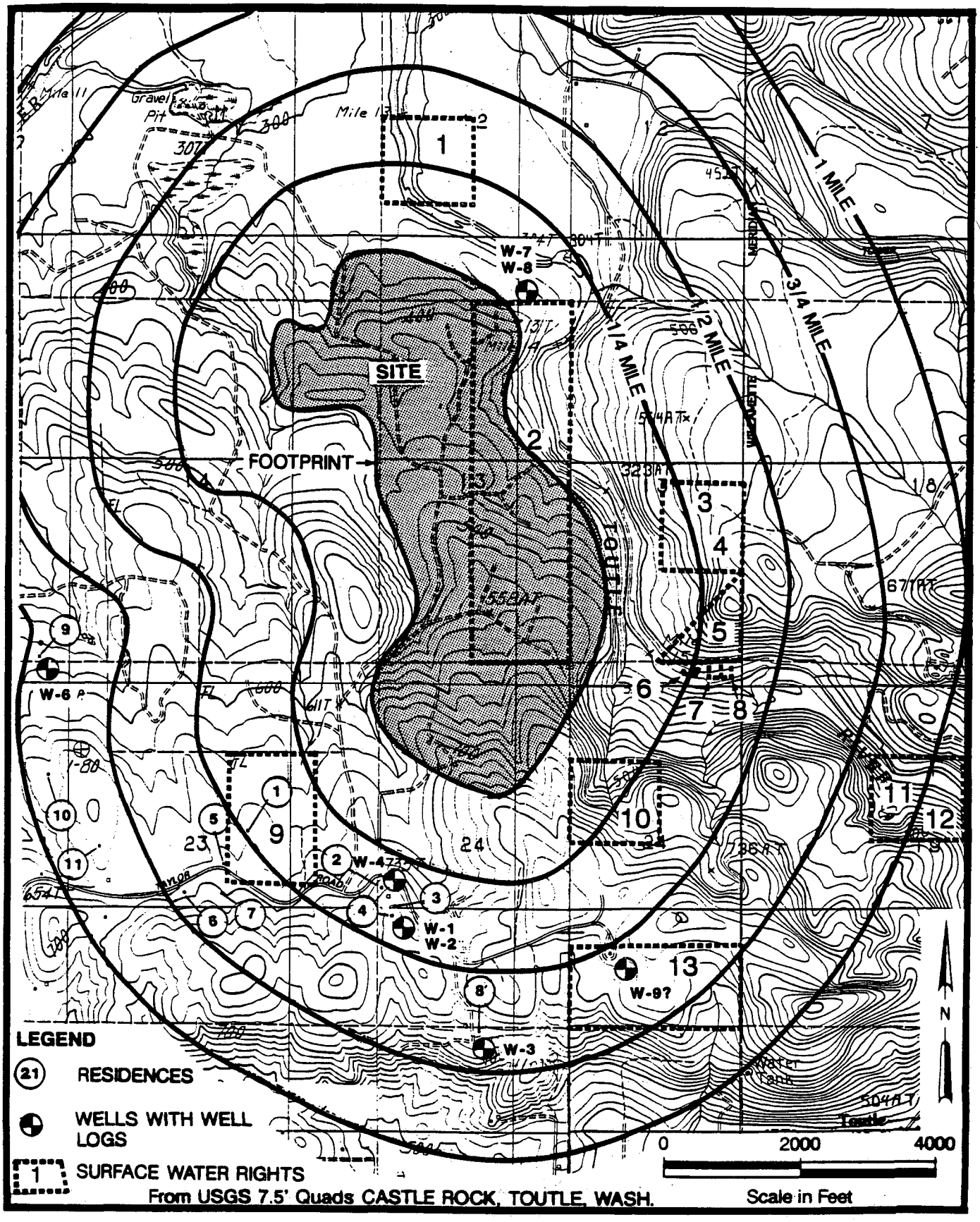
LOCATION MAP FOR ALTERNATIVE SITES

Attachment 10



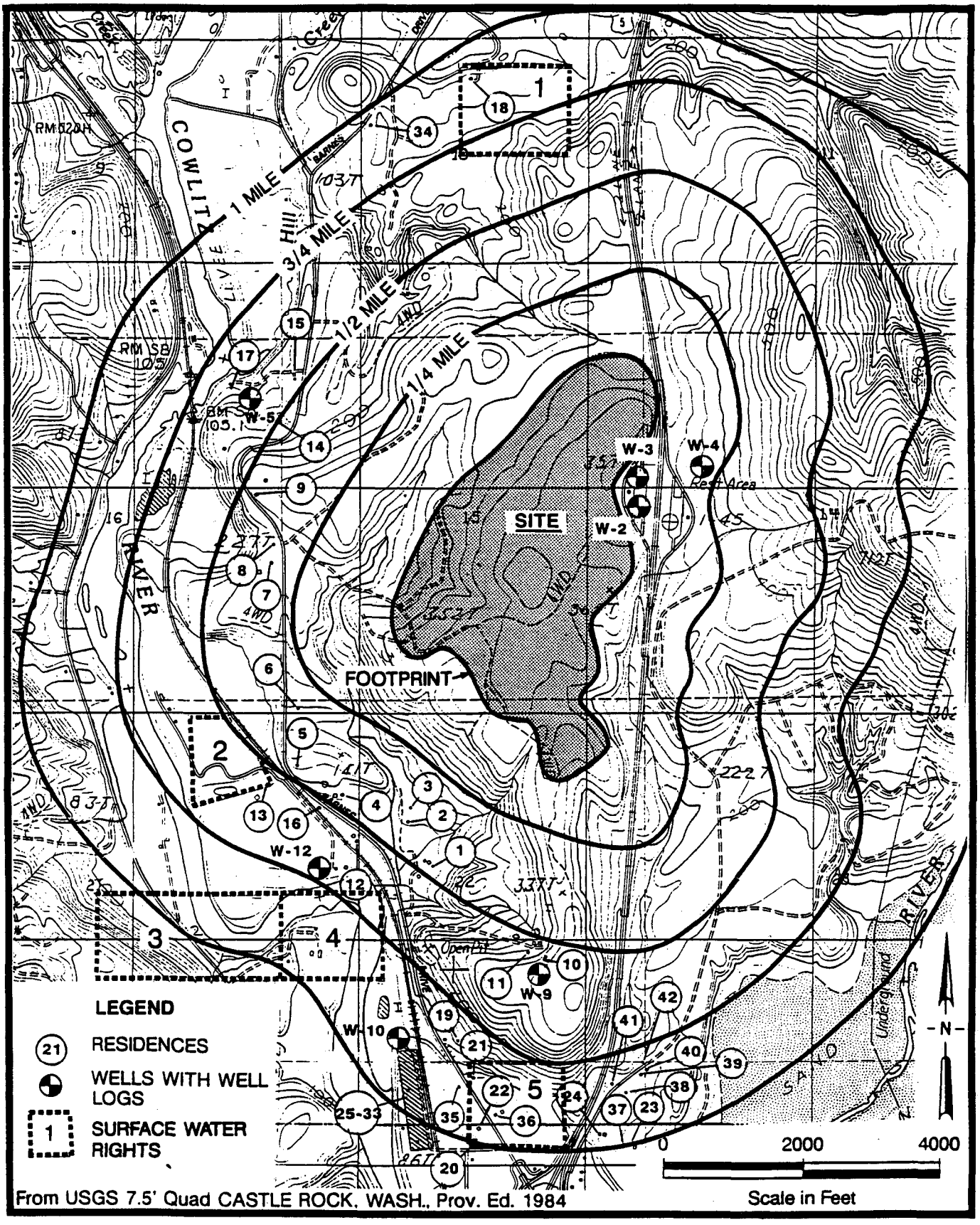
GEORGE TAYLOR A SITE.

Attachment 11



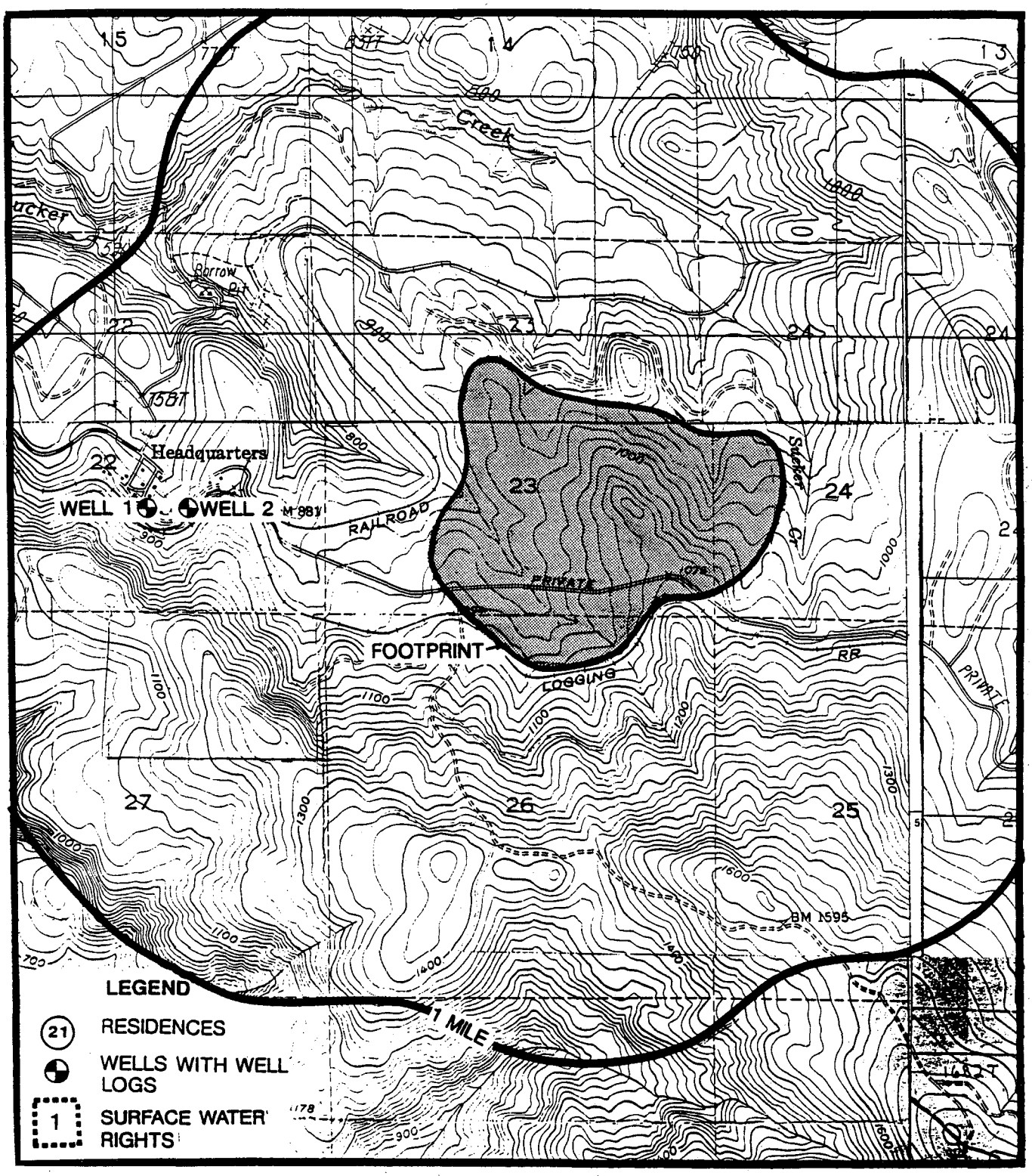
GEORGE TAYLOR B SITE

Attachment 12



BARNES DRIVE SITE

Attachment 13



Base Map from 7.5' quads SILVER LAKE, MT. BRYNION, TOUTLE, HEMLOCK PASS, WASH.

HEADQUARTERS SITE

Attachment 14

ATTACHMENT 15

March 11, 1991 Letter from Washington Department of Transportation

Washington State Department of Transportation
District 4
4200 Main Street S-15
P.O. Box 1709
Vancouver, Washington 98668-1709
(206) 696-6461

Duane Berentson
Secretary of Transportation

March 11, 1991

Chris Haynes
Weyerhaeuser
Campus Center II
Tacoma, WA 98477

Solid Waste Disposal Facility
Site Selection Study

We have reviewed the site selection study for a solid waste disposal facility and offer the following comments.

Although the Barnes Road site has sufficient capacity, it does not easily lend itself to rail transport since the railroad tracks are over 0.5 mile from the site.

In addition, the site's close proximity to the Toutle River rest area may result in adverse visual and noise impacts as well as possible contamination of the drinking wells.

We agree with the study's recommendation that rail transport to the Headquarters site is the best alternative. Since the site is adjacent to the railroad, this appears to be the most appropriate method of transporting waste materials. Rail transport would alleviate both truck congestion on the highway as well as lessen the possibility of spillage onto state facilities.

Both visual and noise impacts on surrounding residences would be minimal at this site since the nearest home is located over a mile away.

We do not anticipate any drainage impacts from the Headquarters site.

RECEIVED
MAR 19 1991

A letter of our comments has been sent to Cowlitz-Wakiakum County Health District.

If you have any questions please contact Steve Jacobson, District Transportation Planning Engineer, at 696-6347.

Sincerely,

GARY F. DEMICH, P.E.
District Administrator

By: ED J. BLODGETT, P.E.
Dist. Proj. Dev. Engineer

GFD:djm
EJB:djm
cc:files
weywaste

Appendix D

Leachate Production Estimates

Headquarters Camp
Solid Waste Disposal Facility

Sweet-Edwards/EMCON, Inc.

15055 S.W. Sequoia Parkway, Suite 140
P.O. Box 231269
Portland, Oregon 97224
(503) 624-7200
FAX (503) 620-7658

RECEIVED
AUG 30 1991
URS CONSULTANTS

August 28, 1991
Project S4115.12

Grant Bailey
URS Consultants, Inc.
1100 Olive Way, Suite 200
Seattle, WA 98101

Re: Weyco Headquarters - Leachate Production Estimate

Dear Grant:

This letter summarizes the analyses performed to estimate the leachate quantities that may be collected over the first 30 years of the proposed Headquarters landfill life. This information is being provided as requested in our August 14, 1991 meeting.

PURPOSE

Leachate production estimates for the proposed landfill will be used to:

- Design flow capacity for the leachate collection and removal system (e.g., drainage layer permeability and thickness, and pipe size and spacing)
- Provide guidelines for establishing the size of the leachate holding pond needed to contain the leachate before loading it into rail tank cars or trucks
- Estimate the number of rail tank cars or trucks required to transport leachate from the landfill to the Longview Mill

P/WEY-L2.828/BR:(wp)

CONCEPTUAL LANDFILL MODEL TO ESTIMATE LEACHATE PRODUCTION

General

Estimating landfill leachate production is a very approximate analysis with a high degree of uncertainty. Leachate production is influenced by many factors such as precipitation; sizes of active area, interim, and closed areas; cover types; runoff control; and antecedent moisture conditions in the waste and cover materials.

Leachate production for the Headquarters site was estimated using the USEPA computer program HELP (Hydrologic Evaluation of Landfill Performance). Depending on the input parameters, the HELP analysis generally overestimates the amount of leachate production.

The leachate production analysis consisted of the following general steps:

- Define 5 cross sections representative of different stages of landfill development for input into the HELP model
- Using HELP, estimate the amount of leachate production for each type of cross section on a unit acre basis
- Tabulate the number of acres of each cross section represented, and multiply the leachate production by the number of acres for each year over the first 30 years of landfill life

Each of these steps is described in more detail in the following sections.

Representative Landfill Cross Sections

Leachate production was estimated for the following five cross sections representing different stages of development in the landfill.

1. New liner - newly constructed liner with no waste, covered with temporary plastic. This cross section will be used in areas of new cells that will not receive waste for several months. The

temporary plastic allows clean storm water to be collected and prevented from running into the leachate collection system.

2. New fill - active landfill face for initial cell operations during the first year of a new cell in which the average waste thickness is 10 feet with no cover

3. Active stage - active landfill area after the first year with a waste thickness of 40 feet and no cover

4. Interim stage - temporarily inactive landfill area with a temporary plastic cover over 40 feet of waste

5. Closed stage - permanently inactive landfill area with the final cover elements over 40 feet of waste

Help Simulations

HELP input parameters include

- Climatological data (such as rainfall, daily temperature, solar radiation)

- Soil and waste data for each layer (e.g., moisture content, soil texture, porosity, field capacity, wilting point, hydraulic conductivity, or liner leakage fraction for geomembranes); in some cases (e.g., active, interim, and closed stages) the end conditions from the previous stage are used as initial input for the next stage

- Design data (e.g., areas, slopes, and drainage distances)

The input parameters were selected using field measurements, data from the literature, laboratory testing, design parameters, and engineering judgement.

The representative cross sections were analyzed using HELP to estimate the amount of water that may percolate through the landfill to the leachate collection and removal system at the bottom. The change in leachate production over time was accounted for in the HELP analyses for the interim

and closed stages. This aging effect was incorporated into the life cycle analysis discussed in the next section.

The output from the HELP analyses resulted in an estimate of the leachate produced from each type of cross section in gallons per acre per month. A summary of the estimated leachate production for the five cross sections over one acre is given on Table 1.

Life Cycle Analysis for First 30 Years

Monthly leachate production was estimated over the first 30 years of landfill life. The estimate was performed by multiplying the HELP results by the number of acres for each cross section and adding them together.

The number of acres of each cross section for any given year were estimated according to the following guidelines:

- The landfill cell sequencing was based on Table 3 and Drawing 2 of the preliminary Solid Waste Handling Facility Permit Application dated August 13, 1990 for the proposed facility.

- The size of the active landfill face was assumed to be limited to 5 acres. An additional 2 acres was added to the 5 acres to account for haul roads or other areas with thin or permeable soil covering. Consequently 7 acres of either new fill or active stage was included for each year (as described in the next two items).

- In years where a new cell is opening, the cell was modelled with 7 acres of new fill stage. The remaining area was evenly divided between the interim cover stage and the new liner with temporary cover stage.

- The years of a cell life after the first year (usually only 1 or 2 years after the first year) were modelled with 7 acres of active fill stage. The remaining cell area was modelled as combinations of interim and closed stages, with the specific acreages and ages of each stage dependent on the closure sequencing.

- Inactive cells were modelled with combinations of interim or closed stages, with the specific acreages and ages of each stage dependent on the closure sequencing.

RESULTS

The estimated leachate quantity is shown plotted over the first 30 years by month and by year in Figures 1 and 2, respectively. The monthly values for all 30 years are listed in Table 2. The results suggest a peak value of 4.6 million gallons per month, or approximately 153,000 gallons per day, in January of year 2.

The conservatively estimated average daily value for the 30 year period is 67,000 gallons per day.

Please call if you have any questions.

Sincerely,

Sweet-Edwards/EMCON, Inc.

Rick Thiel

Richard Thiel, P.E.
Senior Project Engineer

rt
Enclosure: Tables, Figure

cc/enc: Chris Haynes, Weyerhaeuser
Carlos Herrera, Herrera Env.
Dick Jones, CWHD
Paul Whitney, Beak

P/WEY-L2.828/BR:(wp)

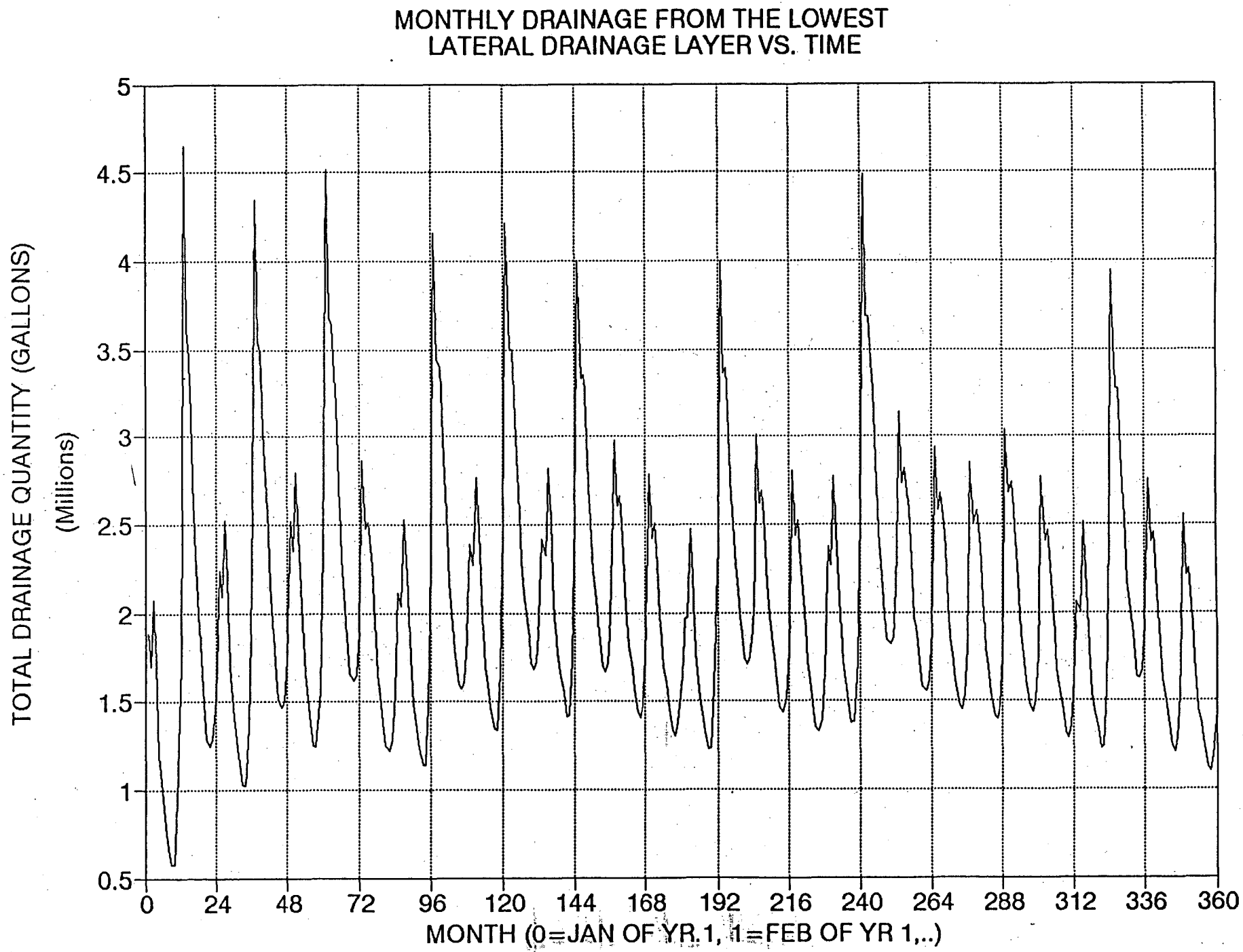

MONTHLY DRAINAGE FROM THE LOWEST
LATERAL DRAINAGE LAYER VS. TIME
TOTAL DRAINAGE QUANTITY (GALLONS)
(Millions)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
24
48
72
96
120
144
168
192
216
240
264
288
312
336
360
MONTH (0=JAN OF YR.1, 1=FEB OF YR 1,..)

FIGURE 1

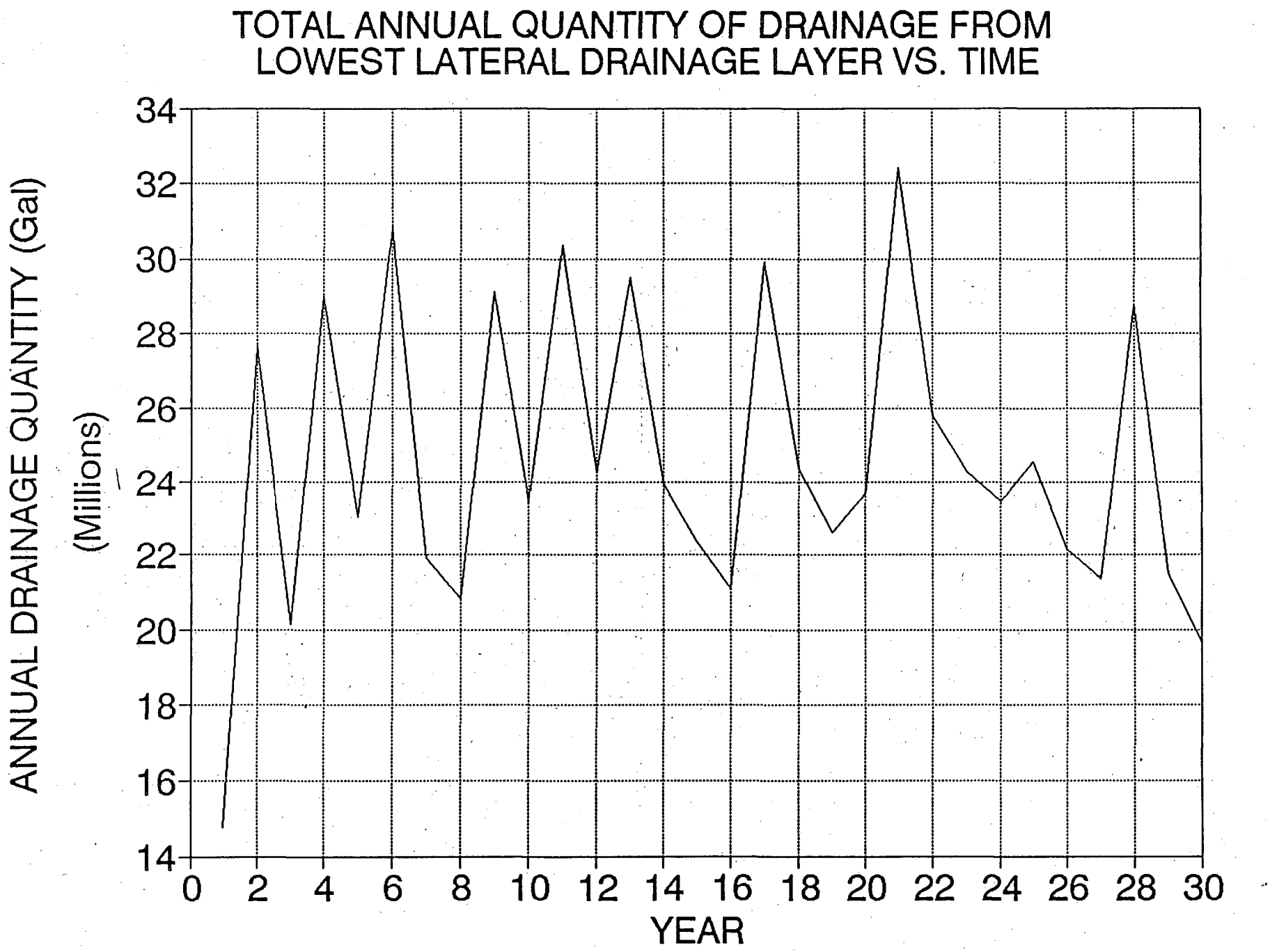

TOTAL ANNUAL QUANTITY OF DRAINAGE FROM
LOWEST LATERAL DRAINAGE LAYER VS. TIME
ANNUAL DRAINAGE QUANTITY (Gal)
(Millions)
34
32
30
28
26
24
22
20
18
16
14
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
YEAR

FIGURE 2

TABLE 1

Summary of Leachate Production for Representative Landfill Cross Sections
(Gallons Per Acre Per Month [gpam])

Mo.	New Liner	New Fill	Active Fill	Interim Stage(1)	Closed Stage(1)
Jan	2,091	57,020	247,087	116,755	32,583
Feb	1,846	84,172	206,358	86,888	29,868
Mar	2,254	146,623	203,643	81,457	32,583
Apr	1,439	122,186	176,491	67,881	29,868
May	977	62,451	133,047	59,735	27,152
Jun	1,385	40,729	100,464	51,590	24,437
Jul	652	29,868	84,172	46,159	24,437
Aug	652	21,722	67,881	40,729	21,722
Sep	1,466	16,291	57,020	35,298	21,722
Oct	1,385	16,291	51,590	35,298	21,722
Nov	3,095	70,596	67,881	32,583	19,007
Dec	2,770	181,921	100,464	32,583	19,007

(1) Values for interim and closed stages are for the first year after conversion from active stage. The value for interim stage decreases to a steady state value of approximately 1,090 gpam after about 12 years. The value for closed stage decreases to about 145 gpam after about 25 years.

TABLE 2

LEACHATE QUANTITIES (Gallons)

Yr -->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Jan	1,884,546	4,648,491	2,240,207	4,342,348	2,526,074	4,520,250	2,870,144	2,113,682	4,152,579	2,387,304	4,208,731	2,422,121	3,995,992	2,978,781	2,786,284
Feb	1,698,383	3,616,700	2,093,085	3,543,657	2,352,038	3,678,118	2,475,813	2,037,191	3,430,597	2,272,648	3,502,525	2,326,572	3,330,754	2,597,452	2,421,074
Mar	2,072,848	3,457,892	2,518,944	3,485,822	2,793,230	3,636,791	2,512,300	2,529,694	3,399,563	2,763,586	3,498,044	2,824,592	3,353,725	2,662,214	2,505,217
Apr	1,721,700	2,932,459	2,197,107	3,023,558	2,446,813	3,172,021	2,262,909	2,218,115	2,986,031	2,450,884	3,093,174	2,518,847	2,983,151	2,423,326	2,272,768
May	1,195,961	2,424,709	1,697,460	2,574,317	1,943,319	2,728,547	1,947,642	1,748,401	2,570,330	1,981,469	2,686,756	2,053,501	2,605,134	2,123,804	1,984,923
June	947,279	1,992,986	1,418,304	2,161,331	1,656,176	2,310,071	1,654,830	1,489,278	2,170,322	1,698,371	2,291,663	1,773,527	2,234,807	1,817,932	1,694,527
July	794,140	1,743,184	1,278,942	1,951,308	1,514,186	2,105,777	1,529,630	1,381,778	1,999,800	1,592,009	2,122,016	1,666,418	2,076,343	1,712,935	1,599,897
Aug	669,239	1,493,382	1,146,706	1,723,908	1,377,858	1,873,568	1,385,289	1,265,348	1,791,026	1,469,983	1,913,810	1,547,869	1,884,025	1,569,027	1,461,016
Sep	573,730	1,281,593	1,030,981	1,513,473	1,246,115	1,659,042	1,253,356	1,143,250	1,598,214	1,340,695	1,713,698	1,416,357	1,695,671	1,438,591	1,337,499
Oct	572,576	1,243,580	1,021,609	1,470,441	1,239,435	1,618,500	1,216,046	1,142,673	1,568,975	1,338,547	1,678,482	1,420,493	1,665,093	1,410,676	1,302,911
Nov	940,118	1,289,739	1,359,478	1,502,889	1,565,378	1,650,245	1,284,690	1,480,697	1,609,703	1,671,144	1,718,500	1,737,692	1,710,654	1,475,026	1,385,259
Dec	1,715,353	1,517,819	2,153,729	1,733,273	2,361,307	1,894,991	1,536,938	2,283,421	1,852,497	2,473,831	1,961,024	2,551,533	1,971,945	1,745,495	1,644,134
TOTAL:	14,785,873	27,642,534	20,156,553	29,026,325	23,021,929	30,847,920	21,929,588	20,833,528	29,129,638	23,440,470	30,388,424	24,259,521	29,507,295	23,955,259	22,395,508

(Note: above quantities are the sum of main and supplementary leachate quantities.)

SUM_GAL.wq1 8/24/91

TABLE 2 (cont.)

LEACHATE QUANTITIES (Gallons)

Yr –>	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Jan	1,964,539	3,995,571	3,007,278	2,808,617	2,374,267	4,489,351	3,139,768	2,942,397	2,849,672	3,043,893	2,777,093	2,056,657	3,941,117	2,758,521	2,555,937
Feb	1,968,593	3,361,220	2,620,259	2,439,288	2,269,778	3,688,081	2,732,781	2,578,992	2,508,612	2,678,446	2,406,899	2,002,018	3,276,233	2,395,463	2,208,253
Mar	2,479,036	3,393,048	2,695,448	2,521,396	2,775,760	3,681,297	2,823,932	2,676,224	2,580,323	2,744,891	2,471,138	2,516,156	3,268,416	2,455,093	2,245,421
Apr	2,209,566	3,020,678	2,455,392	2,294,864	2,452,739	3,257,720	2,587,541	2,444,180	2,362,206	2,484,579	2,251,338	2,235,894	2,907,506	2,200,407	2,034,500
May	1,767,378	2,650,508	2,158,451	2,006,099	1,982,985	2,856,979	2,290,600	2,155,766	2,073,060	2,184,923	1,961,488	1,792,455	2,533,401	1,910,250	1,738,539
June	1,515,567	2,271,459	1,860,725	1,718,395	1,722,808	2,450,448	1,972,326	1,850,732	1,790,705	1,874,653	1,682,230	1,541,281	2,170,614	1,618,635	1,453,633
July	1,432,420	2,119,518	1,751,517	1,615,815	1,609,662	2,272,327	1,873,246	1,761,293	1,693,689	1,758,473	1,580,300	1,448,059	2,010,744	1,503,211	1,367,045
Aug	1,329,135	1,925,920	1,609,240	1,481,953	1,490,737	2,055,272	1,723,609	1,622,113	1,550,701	1,610,302	1,445,076	1,338,337	1,824,155	1,363,267	1,238,935
Sep	1,224,560	1,735,442	1,471,907	1,350,694	1,372,068	1,850,298	1,577,801	1,479,694	1,418,604	1,467,075	1,319,173	1,224,504	1,638,487	1,239,915	1,120,227
Oct	1,236,903	1,704,572	1,442,309	1,324,633	1,386,635	1,825,105	1,558,032	1,456,805	1,399,650	1,441,194	1,290,502	1,243,090	1,623,579	1,208,013	1,101,954
Nov	1,575,989	1,746,797	1,514,992	1,390,203	1,717,587	1,864,555	1,621,597	1,535,061	1,474,510	1,503,944	1,356,505	1,575,890	1,675,737	1,285,176	1,183,658
Dec	2,387,334	2,003,062	1,772,483	1,664,091	2,535,570	2,132,795	1,895,402	1,796,322	1,747,695	1,752,227	1,622,629	2,394,349	1,933,685	1,530,311	1,428,762
TOTAL:	21,091,020	29,927,796	24,360,000	22,616,046	23,690,596	32,424,226	25,796,635	24,299,577	23,449,427	24,544,599	22,164,371	21,368,690	28,803,672	21,468,260	19,676,864

Appendix E

Shallow Aquifer Impact Analysis

Headquarters Camp
Solid Waste Disposal Facility

Sweet-Edwards/EMCON, Inc.

15055 S.W. Sequoia Parkway, Suite 140
P.O. Box 231269
Portland, Oregon 97224
(503) 624-7200
FAX (503) 620-7658

September 24, 1991
Project S4115.12

Mr. Tom Abbott
URS Consultants, Inc.
1100 Olive Way, Suite 200
Seattle, WA 98101

Re: Shallow Aquifer Impact Analysis - Weyerhaeuser Company Headquarters Site

Dear Tom:

This letter describes the shallow aquifer impact analysis for the proposed Weyerhaeuser Headquarters landfill. This information is being provided as a submittal pursuant to our meeting of August 14, 1991.

Purpose

The shallow aquifer impact analysis has been performed by Sweet-Edwards/EMCON (SE/E) to evaluate the potential impact of a leak from the landfill on the shallow ground water system. This analysis will be used to evaluate the necessity of obtaining additional field data to assess the likelihood of a landfill leak adversely affecting the ground water beneath the landfill.

Approach

The approach URS and SE/E agreed upon was to use a simplified methodology with conservative assumptions and then more complex methods if required to obtain more detailed information.

Assumptions

The methodology consists of a simple mass balance approach where it is assumed that all of the leachate which leaked from the landfill mixes directly with the upper 10 feet of the shallow aquifer at the original leachate concentration. This is a very conservative assumption given the design of the landfill. The landfill will have a sand hydraulic gradient control drainage layer below the bottom liner which will have a hydraulic conductivity two to three orders of magnitude higher than the underlying native sediments.

The results of the leak scenario, developed jointly by SE/E and Carlos Herrera, have been used as input for the shallow aquifer analysis (see letter to URS dated August 22, 1991). For the leak scenario, a leak rate of 18 gallons per day per acre of landfill was calculated using conservative assumptions. This was compared with 0.3 gallons per acre per day more realistic maximum leakage rates based on accepted literature values. The shallow aquifer impact analysis uses the leak rate of 18 gallons per day per acre.

SE/E assumed a one year duration of leaking. This is a conservative assumption, given that with quarterly monitoring of the hydraulic gradient control layer, it is unlikely that a leak would go undetected for more than three months. The mixing calculation uses the volume of water that passes beneath the landfill during that one year period of time and the volume of leaked leachate generated within one year.

The concentrations for the aquifer and leachate were taken from existing analyses. The aquifer concentrations used in the calculations are the highest detected levels from all the analyses performed on the site ground water (Tables 4.2 and 4.3, SE/E, 1991a). In cases where there were not data for some of the constituents, the highest concentration from the site surface water analyses was used (Table 4.2, SE/E, 1991b). Manmade compounds were assumed to be zero in the aquifer. For compounds that could be naturally occurring which were below the detection limit, a concentration equal to one-half the detection limit was used for the calculation.

Two sets of leachate characterization data exist that are representative of expected leachate at the Headquarters Site: Mt Solo data (Table 1, Appendix B, BEAK, 1991) and laboratory leachate data (Tables 2 to 11,

Weyerhaeuser, 1990). Laboratory leach tests were run on the different waste streams that are anticipated for the Headquarters Site. These two sets of data were compared and the higher concentration for each constituent of the two sets was used for the calculations.

Methodology

The mixing calculation was performed to determine the final aquifer concentration using the volumes and concentrations for the leachate and aquifer (see attached calculations). The resultant concentrations were compared to the Washington State Ground water criteria (WAC 173-200-040), which are the standards for ground water quality in Washington. In cases where there was not a Washington standard the proposed federal drinking water standards (Maximum Contaminant Level - MCL) was used.

Results

A comparison with the standards, show that no standards are exceeded (see table on attached calculation sheet). In most cases the resultant concentration in the aquifer is one order of magnitude less than the applicable standard.

No volatile organic compounds were detected in the leachate analyses performed. The only semi-volatile compounds detected were phenol and pentachlorophenol in analyses from the Mt. Solo site. The source of the pentachlorophenol is the waste water treatment sludges from the mill. The impact analysis presented here indicates that there will be no impact to the shallow ground water system from either of these compounds. At the Headquarters site it is anticipated that these compounds will be at lower concentrations or not present in the waste because of mill modernization and the current practice of burning the waste water treatment sludges at the mill.

Conclusion

Based on this analysis, using conservative assumptions, no ground water standards will be exceeded in the shallow ground water beneath the site. Given this conclusion, SE/E recommends that no additional field work be

performed for the environmental impact analysis.

Please call if you have any questions.

Sincerely,

Sweet-Edwards/EMCON, Inc.

Dorothy Fisher Atwood, R.G.
Supervising Hydrogeologist

Enclosures: Spreadsheet calculations
References

cc/enc: Chris Haynes, Weyerhaeuser
Grant Bailey, URS
Rick Thiel, SE/E

Shallow Aquifer Impact Analysis
Project S4115.12
Weyerhaeuser Headquarters
9/12/91

Vaq = (V-static) + (V-1 year)
Vaq (ft3) = 21,607,500
V-static(ft3)=landfill area * aquifer thickness*porosity
V-static (ft3) = 21532500
V-1 year =1 yr gw travel distance(ft)*landfill width*aq-thickness*porosity
V-1year(ft3)= 75000

porosity =	0.15
aq-thickness(ft)=	10
landfill area(ft2)	14,355,000
annual gw travel distance(ft)=	10
landfill width (ft	5,000

Volume of leachate generated in one year (Vl) = 18 gal/day/acre * 365 days * 330 acres
Vl (ft3) = 289,853

Mixture Equation: Final Aquifer concentration (Cf) = (Cl*Vl + Caq*Vaq)/(Vaq+Vl)

CALCULATED CONCENTRATIONS IN SHALLOW AQUIFER

Constituent	Leachate (Cl)	Aquifer (Caq)	Leachate in aquifer(Cf)	Standards
	----Concentration (in mg/L except as noted) ----			
pH (in pH units)	11.7 b	8.15	8.20	6.5 to 8.5 f
Chloride	330 a	3.2	7.53	250.00 f
Nitrate-N	1.08 b	0.5	0.51	10.00 f
Sulfate	41 a	9.8	10.21	250.00 f
TDS	1050 b	396	404.66	500.00 f
Pentachlorophenol	0.005 a	0 e	6.6E-05	1.0E-03 g
Phenols	0.006 a	0 e	7.9E-05	
Other SemiVOAs	ND a,h			
VOAs (8240)	ND a			
Arsenic	0.002 a	0.025 c,d	2.5E-02	5.0E-02 f
Barium	4.1 b	0.015 c	6.9E-02	1.0E+00 f
Cadmium	0.01 b	0.002 c	2.1E-03	1.0E-02 f
Chromium	0.02 b	0.0025 c,d	2.7E-03	5.0E-02 f
Mercury	0.009 b	0 e	1.2E-04	2.0E-03 f
Nickel	0.006 a	0.01 c,d	9.9E-03	1.0E-01 g
Silver	0.002 a	0.005 c,d	5.0E-03	5.0E-02 f
Selenium	ND b			
Zinc	0.02 a	0.07	6.9E-02	5.0E+00 f

Notes:
a - from Mount Solo Leachate analyses
b - from Solid waste leaching analyses
c - not tested in gw, surface water value used
d - not detected, 1/2 detection limit used
e - not tested
f - Washington ground water criterion (WAC 173-200-040)
g - proposed federal MCL
h - analysis by EPA Method 8270
ND - not detected

REFERENCES

Beak, 1991. Environmental Technical Report for the Proposed Weyerhaeuser S.W. Washington Solid Waste Facility, June 1991.

Parker, D.B., 1990. Weyerhaeuser Company. Solid Waste Characterization Sampling, Longview, Washington. Weyerhaeuser Environmental Sciences and Technology, Feb. 9, 1990.

SE/E, 1991a. Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility, June 21, 1991.

SE/E, 1991b. Weyerhaeuser Southwest Washington Solid Waste Facility Solid Waste Permit Application - Part 1: Site Characterization, June 12, 1991.

Appendix F

Erosion and Sedimentation Calculations

Headquarters Camp
Solid Waste Disposal Facility

EROSION AND SEDIMENTATION CALCULATIONS FOR THE PROPOSED HEADQUARTERS SOLID WASTE FACILITY

Prepared by:

Beak Consultants Incorporated
Portland, Oregon

June 1992

Project No. 73306

EROSION AND SEDIMENTATION CALCULATIONS FOR THE PROPOSED HEADQUARTERS SOLID WASTE FACILITY

Introduction

The effect of project development on erosion and sedimentation was calculated for the disturbance caused by cell development within the project area after the sedimentation basins, biofiltration swales, and other erosion and sedimentation control measures are emplaced. The effects on mean annual sediment yield from the project area were calculated and related to existing sediment yields from the overall drainage basin.

Methods

Calculations of sediment yield were made according to the methods of Julien and Simons (1985). The following equation was used to determine rates of sediment discharge:

$$q_s = \alpha S^{\beta} q^{\gamma} i^{\delta} (1 - T_c/T_o)^{\epsilon}$$

where q_s is the unit sediment discharge in pounds per foot-second; α is a coefficient that is largely dependent on slope length; β, γ, δ, and ϵ, are coefficients that depend upon local site conditions; S is slope; q is unit water discharge in square feet per second; T_c is critical shear stress for the sediment; and T_o is the shear stress acting upon the sediment.

Several assumptions were made in order to calculate average annual sediment yield from the project area during the 57-year project life: (1) acreage of exposed soil on the landfill site will follow monthly construction and development sequencing as summarized in Attachment A, (2) the acreage of bare soil will consist of two square planar hillslopes of 10 percent and 20 percent grade, (3) the areal rate of sediment produced from the disturbed areas will be constant during each year of the project, (4) a sediment delivery ratio of 25 percent was applied to the disturbed areas to account for the drainage area (USDA 1983) and the effect of localized erosion control practices (e.g., silt fences). "Background" sediment yield for surrounding undisturbed portions of the S-4 and S-6 drainage areas was assumed to be 200 tons per square mile per year as estimated from the sediment yield and drainage area relationships of Langbein and Schumm for the Cascades region of Washington (1958).

Month-to-month exposure of soil from construction and development activities on the site will follow a relatively consistent pattern. Minimal exposed soil will occur from October through May. The greatest amounts of exposed soil will occur in June and decline in step-wise fashion through September. This pattern will keep exposed soil (and hence potential erosion) to a minimum during the months of greatest rainfall.

The sedimentation detention basins will be designed to trap all sediment coarser than 15 microns at the 25-year peak runoff event. The soil survey of the Cowlitz Area, Washington, indicates that the upper 20 inches of the soil at the Headquarters site is the Olympic silt loam (USDA 1974). Using a soil texture triangle (Birkeland 1984) the grain size distribution ranges for silt loam were estimated (Figure 1). Because of the variability of textures within a silt loam, it was assumed that the soils at the Headquarters site fall in the middle of these distribution ranges, such that 40 percent of the material was assumed to be larger than 15 microns. Therefore, calculated amounts of sediment delivered from the disturbed area to the basins were reduced by 40 percent to account for trapping of the >15 micron-sized sediment.

Results

Soil erosion on the site was calculated for each year by separately estimating erosion for two periods (October-May and June-September) and summing the results to obtain the total annual yield. For the October-May period, calculations were based on an exposed area of 3 acres (Attachment A). For June-September, calculations were based on the maximum area of exposure during that period (e.g., 41 acres in June of Year 1; Attachment A). Sediment yield (i.e., sediment discharge) from the site was then calculated by assuming sediment delivery and retention efficiencies as previously described. The resultant downstream sediment yields would include sediments actually discharged from the basins plus surrounding unaffected drainage areas. The calculated erosion and sediment yield values are summarized in Attachment B for sites S-4 and S-6, and for the entire Sucker Creek and Silver Lake basin areas.

The relatively small size of the disturbed area and the sediment control measures help to alleviate downstream sedimentation impacts. Actual exposed cell areas represent a very small percentage of the drainage area of Sucker Creek. In addition, due to localized erosion control measures and the three sedimentation basins, no more than 15 percent of eroded soil from the disturbed, undisturbed, and reclaimed areas of the landfill site is likely to be discharged downstream. Furthermore, even though on-site soil erosion will generally increase over existing conditions, the erosion and sedimentation control measures should actually reduce the downstream yield of sediments discharged from the site.

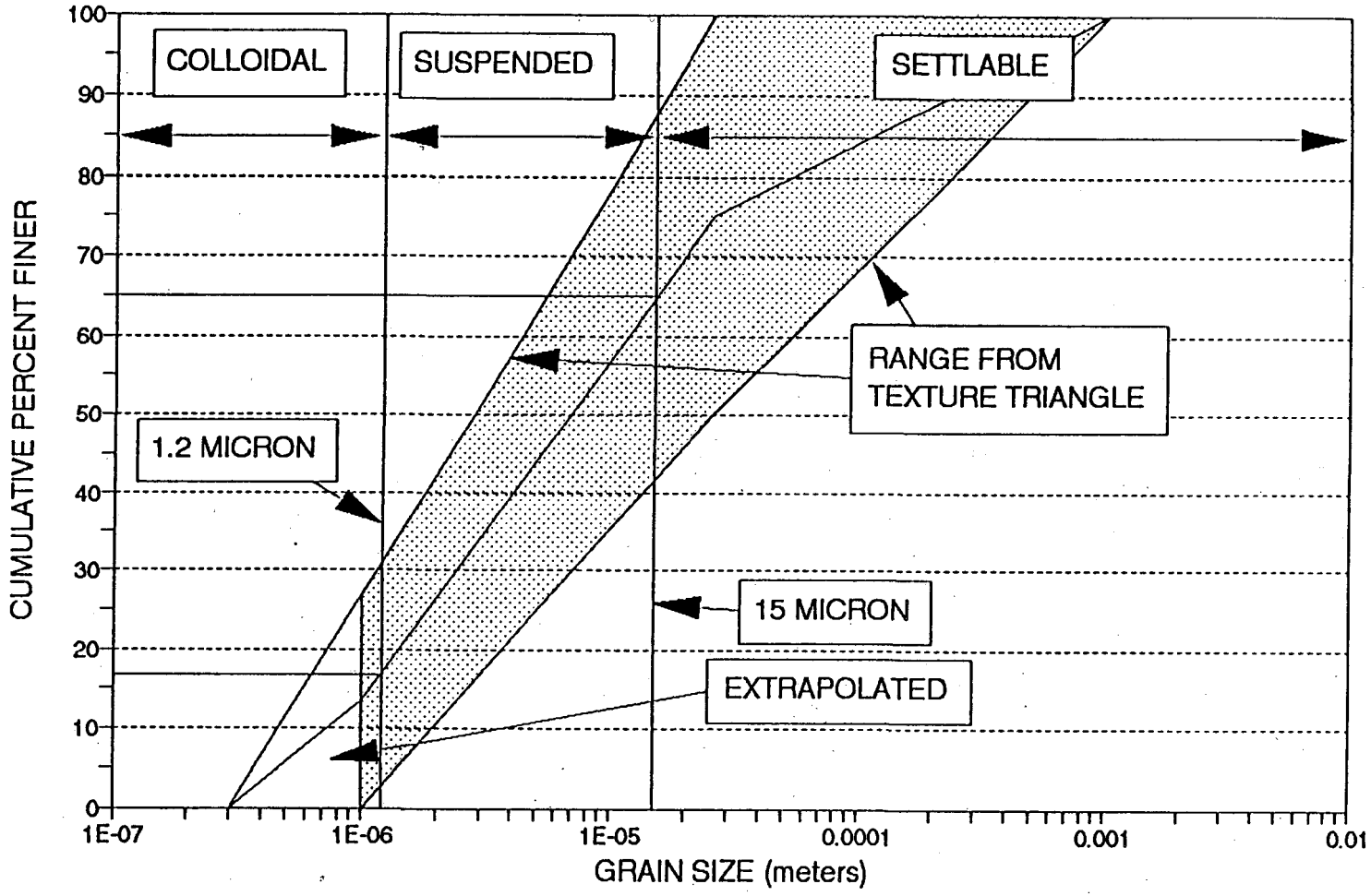


Figure 1. Cumulative percent frequency for silt loam.

ATTACHMENT A

Spreadsheet Summarizing Estimated
Acreage of Exposed Soil by Month and Year
for the Headquarters Solid Waste Facility

expose
Spreadsheet to Tabulate Exposed Soil
Headquarters Landfill Project
Compiled by KLC on 5/24/92

Year	Base Area (ac)	Final Grade Area (ac)	Cell Number/s	Estimated Area of Exposed Soil (acres)												Average	Maximum
				O	N	D	J	F	M	A	M	J	J	A	S		
1	32.0	.0	1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	41.0	38.0	23.0	6.0	11.2	41.0
2	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
3	21.9	.0	2	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	30.9	27.9	13.0	6.0	8.7	30.9
4	.0	18.5	1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	27.5	28.0	13.0	8.0	7.9	27.5
5	22.9	.0	3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	31.9	28.9	13.0	6.0	8.0	31.9
6	.0	9.3	2	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	18.3	13.0	8.0	5.0	5.9	18.3
7	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
8	19.5	.0	4	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	28.5	25.5	13.0	6.0	8.3	28.5
9	.0	9.0	3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	18.0	13.0	8.0	5.0	5.8	18.0
10	18.2	.0	5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	27.2	24.2	12.0	6.0	8.0	27.2
11	.0	11.6	4	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	20.6	15.0	10.0	6.0	6.5	20.6
12	16.9	.0	6	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	25.9	22.9	11.0	6.0	7.7	25.9
13	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
14	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
15	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
16	15.4	.0	7	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	24.4	21.4	10.0	6.0	7.3	24.4
17	.0	14.0	5,6	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	23.0	17.0	11.0	6.0	6.9	23.0
18	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
19	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
20	22.0	.0	8	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	31.0	28.0	14.0	6.0	8.0	31.0
21	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
22	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
23	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
24	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
25	.0	17.7	7,8	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	26.7	20.0	13.0	8.0	7.8	26.7
26	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
27	17.9	.0	10	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	26.9	23.9	12.0	6.0	7.9	26.9
28	21.3	.0	11	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	30.3	27.3	14.0	6.0	8.6	30.3
29	.0	35.3	9,10	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	44.3	41.3	24.0	11.0	12.2	44.3
30	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
31	17.6	.0	12	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	26.6	23.6	12.0	6.0	7.9	26.6
32	.0	20.1	11	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	29.1	26.1	13.0	8.0	8.5	29.1
33	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
34	18.4	.0	13	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	27.4	24.4	12.0	6.0	8.0	27.4
35	.0	16.0	12	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	25.0	19.0	13.0	8.0	7.6	25.0
36	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
37	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
38	.0	15.4	13	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	24.4	18.0	12.0	7.0	7.3	24.4
39	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
40	31.3	.0	15	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	40.3	38.0	23.0	6.0	11.1	40.3
41	.0	24.7	14	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	33.7	28.0	14.0	8.0	9.1	33.7
42	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
43	15.0	.0	16	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	24.0	21.0	10.0	6.0	7.3	24.0
44	.0	19.9	15	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	28.9	26.0	13.0	8.0	8.5	28.9
45	15.5	.0	17	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	24.5	21.0	10.0	6.0	7.3	24.5
46	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

expose
Spreadsheet to Tabulate Exposed Soil
Headquarters Landfill Project
Compiled by KLC on 5/24/92

Year	Base Area (ac)	Final Grade Area (ac)	Cell Number/s	Estimated Area of Exposed Soil (acres) O	N	D	J	F	M	A	M	J	J	A	S	Average	Maximum
47	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
48	22.7	.0	18	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	31.7	28.0	14.0	6.0	8.0	31.7
49	.0	12.2	16,17	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	21.2	16.5	11.0	6.0	6.7	21.2
50	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
51	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
52	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
53	.0	49.2	18	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	58.2	48.0	30.0	15.0	14.8	58.2
54	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
55	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
56	.0	.0	None	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
57	.0	55.7	19	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	64.7	51.0	31.0	15.0	15.6	64.7
TOTAL	328.5	328.6															
AVERAGE																6.0	17.0

ATTACHMENT B

Spreadsheet Summarizing Estimated
Soil Erosion and Sediment Yield by Year
for the Headquarters Solid Waste Facility

sediant3

Spreadsheet for Calculating Sediment Loads
Developed by KLC on April 28, 1992 from Julien and Simons (1985) Model Results

Assumptions:

Delivery Ratio =	.25	
Retention Rate =	.40	
S6 Drainage Area =	.69	sq. miles
S4 Drainage Area =	4.36	sq. miles
Sucker Cr. Drainage Area	5.15	sq. miles
Silver Lk. Drainage Area	38.92	sq. miles
Natural Erosion Rate =	200.0	tons/sq. mile
S6 DA to Sed Pond =	.23	sq. miles

	Exposed Soil (ac)		Estimated Soil Erosion (tons)			Sediment Discharge	Total Sediment Discharge (tons/yr) - Site + Natural				Total Sediment Discharge (tons/yr) - Natural				
Year	June-September	October-May	June-September	October-May	Total Eroded	(of Total Eroded)	S6	S4	Mouth of Sucker Creek	Drainage of Silver Lake	S6	S4	Mouth of Sucker Creek	Drainage of Silver Lake	Delta
1	41.0	3.0	107	139	246	37	135	870	1028	7782	138	872	1030	7784	-2.3
2	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
3	30.9	3.0	88	139	227	34	133	867	1025	7779	138	872	1030	7784	-5.0
4	27.5	3.0	81	139	220	33	132	866	1024	7778	138	872	1030	7784	-6.1
5	31.9	3.0	90	139	229	34	133	867	1025	7779	138	872	1030	7784	-4.8
6	18.3	3.0	61	139	200	30	129	863	1021	7775	138	872	1030	7784	-9.0
7	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
8	28.5	3.0	83	139	222	33	132	866	1024	7778	138	872	1030	7784	-5.8
9	18.0	3.0	60	139	199	30	128	863	1021	7775	138	872	1030	7784	-9.2
10	27.2	3.0	80	139	219	33	131	866	1024	7778	138	872	1030	7784	-6.2
11	20.6	3.0	66	139	205	31	129	864	1022	7776	138	872	1030	7784	-8.3
12	25.9	3.0	77	139	216	32	131	865	1023	7777	138	872	1030	7784	-6.7
13	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
14	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
15	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
16	24.4	3.0	74	139	213	32	130	865	1023	7777	138	872	1030	7784	-7.1
17	23.0	3.0	71	139	210	32	130	864	1022	7776	138	872	1030	7784	-7.5
18	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
19	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
20	31.0	3.0	88	139	227	34	133	867	1025	7779	138	872	1030	7784	-5.0
21	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
22	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
23	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
24	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
25	26.7	3.0	79	139	218	33	131	866	1024	7778	138	872	1030	7784	-6.4
26	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
27	26.9	3.0	80	139	219	33	131	866	1024	7778	138	872	1030	7784	-6.2
28	30.3	3.0	86	139	225	34	132	867	1025	7779	138	872	1030	7784	-5.3
29	44.3	3.0	113	139	252	38	136	871	1029	7783	138	872	1030	7784	-1.4
30	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
31	26.6	3.0	79	139	218	33	131	866	1024	7778	138	872	1030	7784	-6.4
32	29.1	3.0	84	139	223	33	132	866	1024	7778	138	872	1030	7784	-5.6
33	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
34	27.4	3.0	81	139	220	33	132	866	1024	7778	138	872	1030	7784	-6.1
35	25.0	3.0	76	139	215	32	131	865	1023	7777	138	872	1030	7784	-6.8

sediment3

Spreadsheet for Calculating Sediment Loads
Developed by KLC on April 28, 1992 from Julien and Simons (1985) Model Results

Assumptions:

Delivery Ratio =	.25	
Retention Rate =	.40	
S6 Drainage Area =	.69	sq. miles
S4 Drainage Area =	4.36	sq. miles
Sucker Cr. Drainage Area	5.15	sq. miles
Silver Lk. Drainage Area	38.92	sq. miles
Natural Erosion Rate =	200.0	tons/sq. mile
S6 DA to Sed Pond =	.23	sq. miles

	Exposed Soil (ac)		Estimated Soil Erosion (tons)			Sediment Discharge	Total Sediment Discharge (tons/yr) - Site + Natural				Total Sediment Discharge (tons/yr) - Natural				
Year	June-September	October-May	June-September	October-May	Total Eroded	(of Total Eroded)	S6	S4	Mouth of Sucker Creek	Drainage of Silver Lake	S6	S4	Mouth of Sucker Creek	Drainage of Silver Lake	Delta
36	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
37	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
38	24.4	3.0	74	139	213	32	130	865	1023	7777	138	872	1030	7784	-7.1
39	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
40	40.3	3.0	106	139	245	37	135	870	1028	7782	138	872	1030	7784	-2.4
41	33.7	3.0	93	139	232	35	133	868	1026	7780	138	872	1030	7784	-4.3
42	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
43	24.0	3.0	73	139	212	32	130	865	1023	7777	138	872	1030	7784	-7.2
44	28.9	3.0	84	139	223	33	132	866	1024	7778	138	872	1030	7784	-5.6
45	24.5	3.0	74	139	213	32	130	865	1023	7777	138	872	1030	7784	-7.1
46	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
47	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
48	31.7	3.0	89	139	228	34	133	867	1025	7779	138	872	1030	7784	-4.9
49	21.2	3.0	67	139	206	31	129	864	1022	7776	138	872	1030	7784	-8.1
50	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
51	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
52	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
53	58.2	3.0	136	139	275	41	140	874	1032	7786	138	872	1030	7784	2.0
54	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
55	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
56	3.0	3.0	17	139	156	23	122	856	1014	7768	138	872	1030	7784	-15.5
57	64.7	3.0	147	139	286	43	141	876	1034	7788	138	872	1030	7784	3.6
TOTAL	1,014.1	171.0	3,088.7	7,923.0	11,011.7	1,651.8	7,271.7	49,132.5	58,138.5	443,116.5	7,843.2	49,704.0	58,710.0	443,688.0	-571.5

Appendix G

Impacts of a Potential Liner Leak on Surface Water

Headquarters Camp
Solid Waste Disposal Facility

CALCULATION OF A POTENTIAL LEACHATE LINER LEAK TO SURFACE WATER FOR THE PROPOSED HEADQUARTERS SOLID WASTE FACILITY

Prepared by:

Beak Consultants Incorporated
Portland, Oregon

June 1992

Project No. 73306

CALCULATION OF A POTENTIAL LEACHATE LINER LEAK TO SURFACE WATER FOR THE PROPOSED HEADQUARTERS SOLID WASTE FACILITY

Introduction

A leak through the bottom liner of the landfill, if it were to occur, could migrate to groundwater or contaminate surface water via end-of-pipe discharge from the Hydraulic Gradient Control System (HGCS). The impact to surface water quality was analyzed using a simple conservative mixing equation. Both a conservative leakage rate and a "prudent" (i.e., more realistic) leakage rate were assessed. Concentrations of several constituents were calculated for baseflow conditions in Southern Tributary just below the site and at the confluence of Southern Tributary and Sucker Creek.

Methods

Calculations of final constituent concentrations in the stream from leachate leakage were made according to a simple conservative mixing equation:

$$C_f = (C_l V_l + C_b V_b) / (V_l + V_b)$$

where C_f is the final constituent concentration in the stream; C_l is the constituent concentration in the leachate; V_l is the volume of leachate discharged to the stream; C_b is the initial constituent concentration of the stream during baseflow conditions; and V_b is the volume of initial discharge in the stream.

Constituent concentrations in the leachate were derived from waste leaching analysis data provided by EMCON Northwest (D. Atwood, pers. comm., April 24, 1992). Volume of leachate discharged to the stream was obtained by taking liner leakage estimates derived by EMCON Northwest (Attachment A) and conservatively assuming that all such leakage would discharge to surface water from the HGCS. Initial constituent concentrations in the stream and initial baseflow discharge assumptions were obtained from on-site water quality and hydrology data obtained during 1989-1990 (BEAK 1991).

Results

The probability of detrimental impacts to surface water quality from liner leakage is considered remote. Ammonia concentrations could potentially exceed the EPA chronic standard for freshwater aquatic biota (2.2 mg/l) only during lowest baseflow conditions at the conservatively-estimated leakage rate (Table 1). Under these same conditions, dissolved oxygen levels could also be reduced to below state standard of 9.5 mg/l depending on ambient stream concentrations. At higher base flow conditions or the more realistic leakage rate, a liner leak

would not significantly affect water quality or cause violation of standards (Table 2). Further downstream at the confluence of Southern Tributary and Sucker Creek, liner leak impacts to water quality would be insignificant, even at the lowest baseflow conditions or conservative leakage rate (Tables 3).

Table 1. Spreadsheet summarizing constituent concentrations resulting from leachate leakage to the Southern Tributary during baseflow conditions. Calculations assume the most conservative leakage rate of 18 gallons/acre/day (see Attachment A).

Scenario: Leachate Liner Leak Discharging to Southern Tributary during Baseflow Conditions

Vbf = Assumed Baseflow in Stream

	gpm	cfs	ft3/90 days
Vbf under "dry" conditions =	58	.13	1004846
Vbf under "ave" conditions =	212	.47	3672885
Vbf under "wet" conditions =	287	.64	4972254

Volume of leachate generated in 90 days (Vl) = 18 gal/day/acre * 90 days * 146 acres
Vl (ft3) = 31620

Mixture Equation:Final stream concentration (Cf) = (Cl*Vl + Cbf*Vbf)/(Vbf+Vl)

Constituent	Leachate (Cl)	Baseflow (Cbf)	Calculated Concentrations in Stream (Cf) Dry	Ave	Wet
	-----Concentrations (in mg/L except as noted) -----				
Nonmetals					
cyanide	.012a	.000f	.000	.000	.000
ammonia	92a	.08g	2.88	.86	.66
Metals					
antimony	.003a	.025d	.024	.025	.025
arsenic (pent)	.002a	.025d	.024	.025	.025
arsenic (tri)	.002a	.025d	.024	.025	.025
beryllium	.0005a	.0025d	.0024	.0025	.0025
cadmium	.01b	.002g	.002	.002	.002
chromium	.02b	.0025d	.0030	.0026	.0026
copper	.0005a	.005d	.0049	.0050	.0050
iron		3.23g	3.13	3.20	3.21
lead	.001a	.25d	.24	.25	.25
mercury	.0009b	0f	.000	.000	.000
nickel	.006a	.01d	.010	.010	.010
selenium	.001a	0f	.000	.000	.000
silver	.002a	.005d	.005	.005	.005
thallium	.001a	0f	.000	.000	.000
zinc	.02a	.005d	.005	.005	.005
Organics					
phenols	.006a	0f	.000	.000	.000
pentachlorophenol	.005a	0f	.000	.000	.000
Other Constituents					
pH	11.7b	7.9g	8.0	8.0	7.9
dissolved oxygen	.0f	6.0h	5.8	5.9	6.0
dissolved oxygen	.0f	8.0c	7.8	7.9	7.9
dissolved oxygen	.0f	10.0g	9.7	9.9	9.9

a - from Mount Solo Leachate analyses
b - from Solid waste leaching analyses
c - average measured surface water value used
d - not detected, 1/2 detection limit used
e - not tested
f - assumed value
g - measured maximum value
h - measured minimum value

Table 2. Spreadsheet summarizing constituent concentrations resulting from leachate leakage to the Southern Tributary during baseflow conditions. Calculations assume the more realistic leakage rate of 0.3 gallons/acre/day (see Attachment A).

Scenario: Leachate Liner Leak Discharging to Southern Tributary during Baseflow Conditions

Vbf = Assumed Baseflow in Stream	gpm	cfs	ft3/90 days
Vbf under "dry" conditions =	58	.13	1004846
Vbf under "ave" conditions =	212	.47	3672885
Vbf under "wet" conditions =	287	.64	4972254

Volume of leachate generated in 90 days (Vl) = 0.3 gal/day/acre * 90 days * 146 acres
Vl (ft3) = 527

Mixture Equation:Final stream concentration (Cf) = (Cl*Vl + Cbf*Vbf)/(Vbf+Vl)

Constituent	Leachate (Cl)	Baseflow (Cbf)	Calculated Concentrations in Stream (Cf) Dry	Ave	Wet
	-----Concentrations (in mg/L except as noted) -----				
Nonmetals					
cyanide	.012a	.000f	.000	.000	.000
ammonia	92a	.08g	.13	.09	.09
Metals					
antimony	.003a	.025d	.025	.025	.025
arsenic (pent)	.002a	.025d	.025	.025	.025
arsenic (tri)	.002a	.025d	.025	.025	.025
beryllium	.0005a	.0025d	.0025	.0025	.0025
cadmium	.01b	.002g	.002	.002	.002
chromium	.02b	.0025d	.0025	.0025	.0025
copper	.0005a	.005d	.0050	.0050	.0050
iron		3.23g	3.23	3.23	3.23
lead	.001a	.25d	.25	.25	.25
mercury	.0009b	0f	.000	.000	.000
nickel	.006a	.01d	.010	.010	.010
selenium	.001a	0f	.000	.000	.000
silver	.002a	.005d	.005	.005	.005
thallium	.001a	0f	.000	.000	.000
zinc	.02a	.005d	.005	.005	.005
Organics					
phenols	.006a	0f	.000	.000	.000
pentachlorophenol	.005a	0f	.000	.000	.000
Other Constituents					
pH	11.7b	7.9g	7.9	7.9	7.9
dissolved oxygen	.0f	6.0h	6.0	6.0	6.0
dissolved oxygen	.0f	8.0c	8.0	8.0	8.0
dissolved oxygen	.0f	10.0g	10.0	10.0	10.0

a - from Mount Solo Leachate analyses
b - from Solid waste leaching analyses
c - average measured surface water value used
d - not detected, 1/2 detection limit used
e - not tested
f - assumed value
g - measured maximum value
h - measured minimum value

Table 3. Spreadsheet summarizing constituent concentrations at the confluence of Southern Tributary and Sucker Creek resulting from leachate leakage to the Southern Tributary during baseflow conditions. Calculations assume the most conservative leakage rate of 18 gallons/acre/day (see Attachment A).

Scenario: Concentrations at Confluence of S. Trib. and Sucker Creek during Leachate Liner Leak

Vbf = Assumed Baseflow in Stream

	gpm	cfs	ft3/90 days
Vbf under "dry" conditions =	594	1.32	10291807
Vbf under "ave" conditions =	1800	4.01	31184870
Vbf under "wet" conditions =	2970	6.62	51455036

Volume of leachate generated in 90 days (Vl) = 18 gal/day/acre * 90 days * 337 acres
Vl (ft3) = 72987

Mixture Equation: Final stream concentration (Cf) = (Cl*Vl + Cbf*Vbf)/(Vbf+Vl)

Constituent	Leachate (Cl)	Baseflow (Cbf)	Calculated Concentrations in Stream (Cf) Dry	Ave	Wet
	-----Concentrations (in ug/L except as noted) -----				
Nonmetals					
cyanide	.012a	.000f	.000	.000	.000
ammonia	92a	.06g	.73	.29	.21
Metals					
antimony	.003a	.025d	.025	.025	.025
arsenic (pent)	.002a	.025d	.025	.025	.025
arsenic (tri)	.002a	.025d	.025	.025	.025
beryllium	.0005a	.0025d	.0025	.0025	.0025
cadmium	.01b	.002g	.002	.002	.002
chromium	.02b	.0025d	.0026	.0025	.0025
copper	.0005a	.005d	.0050	.0050	.0050
iron		3.23g	3.21	3.22	3.23
lead	.001a	.25d	.25	.25	.25
mercury	.009b	0f	.000	.000	.000
nickel	.026a	.01d	.010	.010	.010
selenium	.001a	0f	.000	.000	.000
silver	.002a	.005d	.005	.005	.005
thallium	.001a	0f	.000	.000	.000
zinc	.02a	.005d	.005	.005	.005
Organics					
phenols	.006a	0f	.000	.000	.000
pentachlorophenol	.005a	0f	.000	.000	.000
Other Constituents					
pH	11.7b	7.9g	7.9	7.9	7.9
dissolved oxygen	.0f	6.0h	6.0	6.0	6.0
dissolved oxygen	.0f	8.0c	7.9	8.0	8.0
dissolved oxygen	.0f	10.0g	9.9	10.0	10.0

a - from Mount Solo Leachate analyses
b - from Solid waste leaching analyses
c - average measured surface water value used
d - not detected, 1/2 detection limit used
e - not tested
f - assumed value
g - measured maximum value
h - measured minimum value

ATTACHMENT A

Liner Leakage Rate Estimates
by EMCON Northwest Inc.

LINER LEAKAGE RATE ESTIMATE 21-Aug-91

Weyerhaeuser Headquarters Site Project No. S4115.12

References:

1. Bonaparte, R., Giroud, J., and Gross, B. 1989. "Rates of Leakage Through Landfill Liners." Proceedings, Geosynthetics '89 Conf. IFIA.
2. Bonaparte, R., and Gross, B. 1990. "Field Behaviour of Double Liner Systems." Waste Containment Systems: Construction, Regulation, and Performance. ASCE Geotechnical Special Publication No. 26.
3. Giroud, J., and Bonaparte, B. 1989. "Leakage Through Liners Constructed With Geomembranes." Geotextiles and Geomembranes. Part I, Vol. 8, No. 1; Part II, Vol. 8, No. 2.
4. Jayawickrama, P., Brown, K., Thomas, J., and Lytton, R. 1988. "Leakage Rates Through Flaws in Membrane Liners." ASCE Journal of Environmental Engineering, Vol. 114, No. 6, Dec. 1988.
5. USEPA. 1987. Background Document on Proposed Liner and Leak Detection Rule. EPA/530-SW-87-015.

CALCULATION:

$Qb = 0.21*a(\text{exp } 0.1)*h(\text{exp } 0.9)*k(\text{exp } 0.74)$

NOTATION:

Qb = steady state leakage rate (cubic meters per second) subscript "b" stands for Bonaparte (1989) equation, "good" condition. "Good" condition was used to represent an initially poor condition subjected to a high overburden pressure (Giroud and Bonaparte, 1989).
a = hole area (square meters)
h = liquid head (meters)
k = soil hydraulic conductivity (meters per second)
(Note that the equation is independent of soil thickness)
(Units for parameters below converted for formula)
cm/sec = centimeters per second
gpd = gallons per day (per hole)
gpad = gallons per acre per day

hole diam. (in)	a (sq in)	h (ft)	k (cm/sec)	Qb (cfs)	Qb (gpd)	holes per acre	TOTAL FLOW (gpad)
PRUDENT PARMETERS FOR PERFORMANCE ANALYSIS PER GIROUD AND BONAPARTE (1989)							
0.08	0.005	0.5	1.0E-06	4.6E-07	0.30	1	0.3
CONSERVATIVE ANALYSIS FOR HEADQUARTERS SITE							
1.13	1.000	2.0	1.0E-06	2.7E-06	1.77	10	17.7

Appendix H

Impacts of Leachate Spill in Cowlitz River

Headquarters Camp
Solid Waste Disposal Facility

APPENDIX H

Introduction

In response to public comments on the DEIS, this appendix has been revised. Its purpose is to evaluate the potential impacts to human health and the environment of a hypothetical derailment of a rail tank car containing leachate. This worst-case scenario involved a derailment that resulted in a complete release 20,000 gallons of leachate from a rail tank car into the Cowlitz River.

In the original analysis presented in Appendix H of the DEIS, the ammonia water quality criteria were based on un-ionized ammonia rather than total ammonia. The leachate was analyzed, however, for total ammonia. This analysis has therefore been revised to compare the analytical results to total ammonia criteria. The results indicate there is no ammonia impact. Also, chemical concentrations were adjusted to account for river water flow, then compared to Washington state or federal maximum contaminant levels, whichever were most stringent, and to Washington state water quality criteria. In addition, the Cowlitz River water quality characteristics in Tables 1 and 2 were changed to reflect the analytical report received from the Longview Water Treatment Facility (LWTF, 1989; see Attachment C).

The process and methodology of this evaluation were, by design, conservative and cautious. For example, the evaluation does not take into account degradation into potentially more benign compounds, or attenuation due to further mixing. In addition, the modelled concentrations are compared to criteria (or standards) that are based on chronic exposures (e.g., maximum contaminant levels). Because the spill is a short duration event (10 to 200 minutes; acute exposure), comparing predicted concentrations to chronic criteria is also conservative. Therefore, actual impacts posed by this event are likely to be lower than those predicted.

The evaluation presented here was conducted in early 1990. An additional evaluation was conducted in early 1991 to assess both a derailment and a tanker truck accident. These hypothetical events, which also were worst cases, evaluated potential impacts to Sucker Creek, Ostrander Creek, Silver Lake, and the Cowlitz River. The latter evaluation can be found in Appendix B of the report *Environmental Technical Report for the Proposed Weyerhaeuser S.W. Washington Solid Waste Facility*.

EMCON
Northwest, Inc.

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December 17, 1992
Project 0141-015.12

Mr. Cal Palmer
Weyerhaeuser Company
Environmental Sciences and Technology
Tacoma, Washington 98477

Re: Cowlitz River Hypothetical Railcar Derailment: Projected Chemical Concentrations

Dear Mr. Palmer:

Projected chemical concentrations in the Cowlitz River from a hypothetical railcar derailment have been calculated. This hypothetical scenario assumes that rail tank cars carrying leachate are involved in a derailment on a trestle over the Cowlitz River. It further assumes that a single tank car empties its entire contents into the river.

Current concentrations of substances in the Cowlitz River were obtained from the Longview Water Treatment Facility and the Washington Department of Ecology. The model used to estimate the leachate concentrations in the Cowlitz River assumes rapid mixing. In addition, the modelled concentrations are compared to criteria (or standards) that are based on chronic exposures (e.g., maximum contaminant levels). Because the spill is a short duration event (10 to 200 minutes; acute exposure), comparing predicted concentrations to criteria that are based on chronic exposures is conservative.

For the purposes of this evaluation, the substances contained in the railcar leachate were assumed to be those found in leachate generated from Weyerhaeuser pulp mill waste disposed of at the Mt. Solo Landfill (see Attachment A). The laboratory leachate data that was obtained from an EPA-approved toxicity characteristic leaching procedure (TCLP), and used in the liner leak scenario, were not used. However, if these data were used, the concentrations of the substances that would result after mixing with the Cowlitz River would be below available water quality criteria.

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Results

The following results were obtained for this hypothetical scenario:

- Predicted concentrations do not measurably exceed the current concentrations in the Cowlitz River.

- The predicted concentrations in the Cowlitz River do not exceed Washington state or federal maximum contaminant levels. Therefore, assuming rapid mixing, the public water supplies for the cities of Longview and Kelso would not be affected. However, spill prevention and contingency planning will be incorporated into project operations to prudently safeguard public water supplies.

- The predicted concentrations in the Cowlitz River do not exceed Washington state surface water standards.

Methods and Results

As stated previously, the substances contained in the railcar leachate were assumed to be those found in leachate generated from Weyerhaeuser pulp mill waste disposed of at the Mt. Solo Landfill (see Attachment A). Minimum and maximum flow rates in the Cowlitz River used in this hypothetical scenario were 7,900 cfs and 22,000 cfs (DOE, 1990). Two leachate leakage rates from the derailed tank cars were used for the study: 100 gallons per minute (gal/min) and 2,000 gal/min (0.22 cubic feet per second [cfs] and 4.46 cfs, respectively). A railcar holding approximately 20,000 gallons of leachate would empty into the Cowlitz River in approximately 200 minutes and 10 minutes, respectively. The worst case considered assumes a typical flow rate in the Cowlitz River (7,900 cfs) and a relatively high leachate flow rate from the railcars (4.46 cfs).

The foregoing assumptions were used to calculate a simulated concentration for a substance in the Cowlitz River using the following equation:

$$C(r) = \frac{[F(b)\ C(b)] + [F(l)\ C(l)]}{F(b) + F(l)} \qquad \text{(Equation 1)}$$

where:

C(r) = Concentration of the substance in the Cowlitz River after the hypothetical railcar derailment (mg/L)

F(b) = Flow rate of the Cowlitz River (cfs) (see Attachment B)

C(b) = Current concentration of the substance in the Cowlitz River (mg/L) (DOE, 1990a; LWTF, 1989) (see Attachments B and C)

F(l) = Flow rate of the leachate from the railcars (cfs)

C(l) = Concentration of the substance in the leachate (mg/L) (see Attachment A)

The predicted concentrations from the hypothetical railcar derailment were compared to the following:

- Water characteristics tested in the Cowlitz River near Kelso, Washington from October 1988 to March 1990 (DOE, 1990a) (see Attachment B).
- Inorganic chemicals found in a raw water sample collected August 10, 1989, in the Cowlitz River (LWTF, 1989) (see Attachment C).
- Washington state or federal maximum contaminant levels (DOE, 1990b; EPA, 1992).
- Washington state Water Quality Criteria (Washington Administrative Code [WAC] 173-201; WAC, 1988).

The predicted concentrations of substances in the river after the hypothetical derailment were compared with those currently reported in the Cowlitz River (DOE, 1990a; LWTF, 1989). The modelled spill event did not measurably increase concentrations of the substances evaluated in the Cowlitz River for either high or typical river flows (see Tables 1 and 2).

Predicted concentrations in the Cowlitz River were compared with Washington state surface water standards (WAC, 1988). The predicted concentrations exceeded neither the state of Washington surface water standards, nor the Washington state or federal maximum contaminant levels (see Tables 1 and 2).

A laboratory study conducted by Weyerhaeuser supports the conclusions of this hypothetical railcar derailment. The laboratory study evaluated the impact of leachate on aquatic organisms. Ninety-six-hour static acute fish bioassays were conducted on ten samples of solid waste collected from the Weyerhaeuser facility at Longview, Washington (WEST, 1990). These bioassays were conducted on rainbow trout (*Salmo gairdneri*) at dilute leachate concentrations of 100 and 1,000 parts per million (ppm). No fish mortality was observed in the treated groups (see Attachment D).

If you have any questions, please call.

Sincerely,

EMCON Northwest, Inc.

Thomas L. Foster

Thomas L. Foster
Supervising Toxicologist

Attachments: A through D
References

Table 1. Projected Chemical Concentrations in the Cowlitz River Associated with a Hypothetical Railcar Derailment - Leachate Release Rate of 0.22 cfs.

Parameter	units	Concentration in Leachate /a/	Cowlitz River Water Quality Characteristics /b/	Cowlitz River Water Quality Characteristics /c/	Simulated Concentration in the Cowlitz River after Hypothetical Derailment /d/		Federal or State MCL /e/	Washington State Surface Water Standards /f/	
					low flow /g/	high flow/h/		acute	chronic
NH3-N	mg/l	92		0.01	0.013	0.011		25	2.2 /i/
NO2/NO3-N	mg/l	< 0.05	0.3	0.04	0.04	0.04	10		
CN	mg/l	0.01						22	5.2
phenols	mg/l	0.006							
Cl	mg/l	330	10		10.0	10.0		19	11
hardness CaCO3 equiv	mg/l	1060	90		90.0	90.0			
pH		7		6.7	6.7	6.7	6.5 - 8.5		
Ag	ug/l	2	<10				50	3.38	
As	ug/l	2	<10				50		
Be	ug/l	< 1					1		
Cd	ug/l	< 1	<2				5		
Cr	ug/l	4	<10				50	16	11
Cu	ug/l	< 1	<250				1000	16.05	10.82
Hg	ug/l	< 0.2	<0.5				2	2.4	0.012
Ni	ug/l	6					100	1297.30	144.22
Pb	ug/l	< 2	<2				15	71.40	2.78
Sb	ug/l	< 5							
Se	ug/l	< 2	<5				10	260	35
Tl	ug/l	< 2							
Zn	ug/l	20	<250				5000	107.03	96.94

Table 1 continued. Projected Chemical Concentrations in the Cowlitz River Associated with a Hypothetical Railcar Derailment:
Leachate Release Rate of 0.22 cfs.

Footnotes:

/a/ From Attachment A. If concentrations were reported as being below detection limits, these limits were used as the concentrations of the substances in the leachate.
/b/ From: LWTF, 1989. If concentrations were reported as being below detection limits, one-half of these limits were used as the concentrations of the substances in the Cowlitz River.
/c/ From: DOE, 1990a.
/d/ From Equation 1.
/e/ Maximum contaminant levels. From: EPA, 1992 or DOE, 1990b.
/f/ Water Quality Standards for Surface Waters of the State of Washington (freshwater standards). From: WAC, 1988.
/g/ Uses minimum flow rate measured in Cowlitz River. From Attachment B.
/h/ Uses maximum flow rate measured in Cowlitz River. From Attachment B.
/i/ Criteria using a temperature of 10 degrees centigrade, an annual average pH of 7.0, and salmonids present.

Table 2. Projected Chemical Concentrations in the Cowlitz River Associated with a Hypothetical Railcar Derailment - Leachate Release Rate of 4.46 cfs.

Parameter	units	Concentration in Leachate /a/	Cowlitz River Water Quality Characteristics /b/	Cowlitz River Water Quality Characteristics /c/	Simulated Concentration in the Cowlitz River after Hypothetical Derailment /d/		Federal or State MCL /e/	Washington State Surface Water Standards /f/	
					low flow /g/	high flow/h/		acute	chronic
NH3-N	mg/l	92		0.01	0.062	0.029		25	2.2 /i/
NO2/NO3-N	mg/l	< 0.05	0.3	0.04	0.04	0.04	10		
CN	mg/l	0.01						22	5.2
phenols	mg/l	0.006							
Cl	mg/l	330	10		10.2	10.1		19	11
hardness CaCO3 equiv	mg/l	1060	90		90.5	90.2			
pH		7		6.7	6.7	6.7	6.5 - 7.5		
Ag	ug/l	2	<10				50	3.38	
As	ug/l	2	<10				50		
Be	ug/l	< 1					1		
Cd	ug/l	< 1	<2				5		
Cr	ug/l	4	<10				50	16	11
Cu	ug/l	< 1	<250				1000	16.05	10.82
Hg	ug/l	< 0.2	<0.5				2	2.4	0.012
Ni	ug/l	6					100	1297.30	144.22
Pb	ug/l	< 2	<2				15	71.40	2.78
Sb	ug/l	< 5							
Se	ug/l	< 2	<5				10	260	35
Tl	ug/l	< 2							
Zn	ug/l	20	<250				5000	107.03	96.94

Table 2 continued. Projected Chemical Concentrations in the Cowlitz River Associated with a Hypothetical Railcar Derailment: Leachate Release Rate of 4.46 cfs.

Footnotes:

/a/ From Attachment A. If concentrations were reported as being below detection limits, these limits were used as the concentrations of the substances in the leachate.
/b/ From: LWTF, 1989. If concentrations were reported as being below detection limits, one-half of these limits were used as the concentrations of the substances in the Cowlitz River.
/c/ From: DOE, 1990a.
/d/ From Equation 1.
/e/ Maximum contaminant level. From: EPA, 1992 or DOE, 1990b.
/f/ Water Quality Standards for Surface Waters of the State of Washington (freshwater standards). From: WAC, 1988.
/g/ Uses minimum flow rate measured in Cowlitz River. From Attachment B.
/h/ Uses maximum flow rate measured in Cowlitz River. From Attachment B.
/i/ Criteria using a temperature of 10 degrees centigrade, an annual average pH of 7.0, and salmonids present.

REFERENCES

CFR. 1988. *Title 40 Code of Federal Regulations, Parts 141-143.* July 1.

DOE. 1990a. Summary of Parameters Tested in the Cowlitz River at Kelso, Washington from October 1988 to March 1990. Washington Department of Ecology.

DOE. 1990b. *Water Quality Standards for Ground Waters of the State of Washington.* Washington Department of Ecology. WAC Chapter 173-200. October 31

EPA. 1986. *Superfund Public Health Evaluation Manual.* Office of Emergency and Remedial Response, U.S. Environmental Protection Agency EPA/540-1-86/060. October.

EPA. 1992. *Drinking Water Regulations and Health Advisories.* Office of Drinking Water, U.S. Environmental Protection Agency. EPA/540-1-86/060. October.

Laws, Edward A. 1981. *Aquatic Pollution, An Introductory Text.* John Wiley and Sons, Inc.

LWTF. 1989. Inorganic Chemical Analysis Report from Raw Water Samples Collected August 10, 1989 in the Cowlitz River. Longview Water Treatment Facility

WAC. 1988. *Water Quality Standards for Surface Waters of the State of Washington.* Washington Administrative Code, Chapter 173-201. January 6.

WEST. 1990. Weyerhaeuser Company Solid Waste Characterization Sampling Report, Longview, Washington. Weyerhaeuser Environmental Sciences and Technology. February 9.

NOTE: Due to the volume of the attachments to the preceding letter report, only the most relevant attachments or portions thereof are included in this document. All attachments are available for review at the Cowlitz-Wahkiakum Health District office at 1516 Hudson, Longview, Washington.

Attachment B

SUMMARY OF WATER PARAMETERS TESTED IN THE COWLITZ RIVER AT KELSO, WASHINGTON FROM OCTOBER 1988 TO MARCH 1990

268070 15268070 14244200 541001
COWLITZ RIVER AT KELSO
46 08 44.0 122 54 47.0 3F 0 Elev= 0 ft
53015 Washington COWLITZ CO. PACIFIC NORTHWEST
LOWER COLUMBIA (Cowlitz-26) 131026
21540000 Reach= 0.000 Drg= 0 sqmi
Seg ID= 12-26-04 Class= A Miles= 0.00 to 0.00
AMBNT/STREAM/RMP

INDEX 1310001 000850
MILES 0068.00 0004.90 . . . . . .

SUMMARY OF ALL PARAMETERS FROM 88/10/ TO 99/99/99

PARM	PARAMETER NAME	UNITS	#OBS TOTL	#OBS USED	MEAN	STD DEV	MINIMUM	MAXIMUM	BEGIN PERIOD	END PERIOD
00008	LAB IDENT.	NUMBER	18	18	289996.3	169673.4	46109.	536109.	88/10/25	90/03/27
00010	WATER TEMP	CENT	18	18	8.71	2.93	4.8	14.5	88/10/25	90/03/27
00025	BAROMTRC PRESSURE	MM OF HG	18	18	765.2	8.0	747.	783.	88/10/25	90/03/27
00060	STREAM FLOW	CFS	10	10	12710.0	4984.1	7900.	22000.	88/11/29	90/02/27
00095	CNDUCTVY LAB @	25C UMHO	18	18	106.1	19.1	76.	148.	88/10/25	90/03/27
00300	DO	MG/L	17	17	11.49	0.74	10.0	13.0	88/11/29	90/03/27
00301	DO SATUR	PERCENT	17	17	91.10	22.99	0.0	103.7	88/11/29	90/03/27
00340	COD HI LEVEL	MG/L	14	12	8.8	2.8	4.	14.	88/10/25	90/03/27
00400	PH	SU	18	18	7.483	0.302	6.70	7.90	88/10/25	90/03/27
00530	RESIDUE TOT-NFLT	MG/L	16	16	32.06	31.28	5.0	120.0	88/10/25	90/03/27
00610	NH3+NH4- N TOTAL	MG/L	16	12	0.0167	0.0075	0.010	0.030	88/10/25	90/03/27
00630	NO2+NO3 N-TOTAL	MG/L	18	18	0.1839	0.1252	0.040	0.480	88/10/25	90/03/27
00665	PHOS-TOT	MG/L P	18	17	0.0529	0.0372	0.010	0.120	88/10/25	90/03/27
00671	PHOS-DIS ORTHO	MG/L P	18	2	0.0100	0.0000	0.010	0.010	88/10/25	90/03/27
31616	FEC COLI MFM-FCBR	/100ML LG	18	18	15.5	2.1	5.	78.	88/10/25	90/03/27
82079	TURBIDTY LAB	NIU	18	18	10.11	8.79	1.8	31.0	88/10/25	90/03/27

Note: #OBS USED, MEAN, STD DEV do not include values with remark codes: U K -- MIN & MAX include all values.

PCSTORET - EPA Seattle (Ver 88.6.28) Page 1
03-MAY-90

268070 15268070 14244200 541001
COWLITZ RIVER AT KELSO
46 08 44.0 122 54 47.0 3F 0 Elev= 0 ft
53015 Washington COWLITZ CO. PACIFIC NORTHWEST
COMPR COLUMBIA (Cowlitz-26) 131026
21540000 Reach= 0.000 Drg= 0 sqmi
Reg ID- 12-26-06 Class- A Miles= 0.00 to 0.00
AMBNT/STREAM/RMP

INDEX 1310001 000850
MILES 0068.00 0004.90

DATE FROM TO	TIME	DEPTH METER	8 LAB IDENT. NUMBER	10 WATER TEMP CENT	25 BAROMTRC PRESSURE MM OF HG	60 STREAM FLOW CFS	70 TURB JKSN JTU	80 COLOR PT-CO UNITS	95 CNDUCTVY LAB @ 25C UMHO	300 DO MG/L	301 DO SATUR PERCENT	340 COD HI LEVEL MG/L
88/10/25	1135		446109	11.8	769				127			10
88/11/29	1120		496109	8.4	783	22000			78	11.4	94.0	13
88/12/27	1055		536109	5.8	762	9000			100	12.3	97.8	7
89/01/24	1125		66109	4.9	772	15400			86	11.9	91.3	4
89/02/27	1050		96109	4.8	772	10100			94	13.0	99.5	5
89/03/28	1100		136109	6.8	768	10500			96	11.9	96.3	10
89/04/25	1040		176109	10.2	753	7900			110	11.5	102.9	10
89/05/23	1045		216109	9.9	762				120	11.3	99.2	4K
89/06/27	1105		266109	11.4	762				110	11.0	0.0	
89/07/25	1115		306109	12.6	765				110	10.4	96.7	
89/08/29	1135		356109	14.5	757				131	10.0	97.9	4K
89/09/26	1015		396109	12.0	757				130	10.4	96.2	8
89/10/24	1020		436109	10.6	765				148	11.7	103.7	14
89/11/28	1125		506080	7.9	770	9500			98	11.2	92.9	9
89/12/19	1030		516109	6.5	770	8600			95	12.0	96.2	
90/01/30	0950		56109	5.4	747	21600			76	11.9	95.6	
90/02/27	1015		96109	5.3	773	12500			88	12.2	94.5	9
90/03/27	1110		136109	7.9	767				112	11.3	94.0	7

DATE FROM TO	TIME	DEPTH METER	400 PH SU	405 CO2 MG/L	410 T ALK CACO3 MG/L	440 HCO3 ION HCO3 MG/L	445 CO3 ION CO3 MG/L	530 RESIDUE TOT-NFLT MG/L	605 ORG N N MG/L	610 NH3+NH4- N TOTAL MG/L	615 NO2-N TOTAL MG/L	620 NO3-N TOTAL MG/L
88/10/25	1135		7.60					21.0		0.010		
88/11/29	1120		7.40					51.0		0.010K		
88/12/27	1055		7.60					10.0		0.020		
89/01/24	1125		7.30					16.0		0.010		
89/02/27	1050		7.20					15.0		0.010		
89/03/28	1100		7.30					120.0		0.020		
89/04/25	1040		7.60					29.0		0.020		
89/05/23	1045		7.60					26.0		0.010		
89/06/27	1105		7.90					10.0		0.010		
89/07/25	1115		7.90					11.0		0.010K		
89/08/29	1135		7.70					5.0		0.010K		
89/09/26	1015		7.10					16.0		0.010K		

MORE DATES NEXT PAGE

Station:21540000 Z68070 COWLITZ RIVER AT KELSO PCSTORET -- 03-MAY-90 Page 2

DATE FROM TO	DEPTH TIME METER	400 PH SU	605 CO2 MG/L	410 T ALK CACO3 MG/L	440 HCO3 ION HCO3 MG/L	445 CO3 ION CO3 MG/L	530 RESIDUE TOT-NFLT MG/L	605 ORG N N MG/L	610 NH3+NH4- N TOTAL MG/L	615 NO2-N TOTAL MG/L	620 NO3-N TOTAL MG/L
89/10/24	1020	7.20					98.0		0.030		
89/11/28	1125	7.70					23.0		0.010		
89/12/19	1030	7.70									
90/01/30	0950	6.70					32.0		0.030		
90/02/27	1015	7.40					30.0		0.020		
90/03/27	1110	7.80									

DATE FROM TO	DEPTH TIME METER	625 TOT KJEL N MG/L	630 NO2+NO3 N-TOTAL MG/L	660 ORTHOPO4 PO4 MG/L	665 PHOS-TOT MG/L P	671 PHOS-DIS ORTHO MG/L P	680 T ORG C C MG/L	900 TOT HARD CACO3 MG/L	902 NC HARD CACO3 MG/L	915 CALCIUM CA,DISS MG/L	925 MGNSIUM MG,DISS MG/L
88/10/25	1135		0.040		0.020	0.010K					
88/11/29	1120		0.270		0.120	0.010K					
88/12/27	1055		0.240		0.090	0.010K					
89/01/24	1125		0.260		0.120	0.010K					
89/02/27	1050		0.290		0.030	0.010K					
89/03/28	1100		0.320		0.100	0.010					
89/04/25	1040		0.120		0.040	0.010					
89/05/23	1045		0.070		0.020	0.010K					
89/06/27	1105		0.070		0.010	0.010K					
89/07/25	1115		0.060		0.010K	0.010K					
89/08/29	1135		0.050		0.020	0.010K					
89/09/26	1015		0.050		0.020	0.010K					
89/10/24	1020		0.050		0.070	0.010K					
89/11/28	1125		0.290		0.030	0.010K					
89/12/19	1030		0.150		0.030	0.010K					
90/01/30	0950		0.480		0.100	0.010K					
90/02/27	1015		0.310		0.050	0.010K					
90/03/27	1110		0.190		0.030	0.010K					

DATE FROM TO	DEPTH TIME METER	930 SODIUM NA,DISS MG/L	935 PTSSIUM K,DISS MG/L	940 CHLORIDE CL MG/L	945 SULFATE SO4-TOT MG/L	950 FLUORIDE F,DISS MG/L	955 SILICA DISOLVED MG/L	1000 ARSENIC AS,DISS UG/L	1005 BARIUM BA,DISS UG/L	1020 BORON B,DISS UG/L	1025 CADMIUM CD,DISS UG/L

DATE FROM TO	DEPTH TIME METER	1030 CHROMIUM CR,DISS UG/L	1040 COPPER CU,DISS UG/L	1045 IRON FE,TOT UG/L	1049 LEAD PB,DISS UG/L	1075 SILVER AG,DISS UG/L	1090 ZINC ZN,DISS UG/L	1145 SELENIUM SE,DISS UG/L	31504 TOT COLI MFIM LES /100ML	31505 TOT COLI MPN CONF /100ML	31616 FEC COLI MPN-FCBR /100ML
											24
88/10/25	1135										24
88/11/29	1120										10
88/12/27	1055										

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	1030 CHROMIUM CR,DISS UG/L	1040 COPPER CU,DISS UG/L	1045 IRON FE,TOT UG/L	1049 LEAD PB,DISS UG/L	1073 SILVER AG,DISS UG/L	1090 ZINC ZN,DISS UG/L	1145 SELENIUM SE,DISS UG/L	31504 TOT COLI MFIN LES /100ML	31505 TOT COLI MPN CONF /100ML	31616 FEC COLI MFM-FCBR /100ML
89/01/24	1125											5
89/02/27	1050											5
89/03/28	1100											218
89/04/25	1040											10
89/05/23	1045											20
89/06/27	1105											6
89/07/25	1115											21
89/08/29	1135											30
89/09/26	1015											23
89/10/24	1020											61
89/11/28	1125											13
89/12/19	1030											105
90/01/30	0950											785
90/02/27	1015											10
90/03/27	1110											8

DATE FROM TO	TIME	DEPTH METER	31625 FEC COLI M-FCAGAD /100 ML	70300 RESIDUE DISS-180 C MG/L	71851 NITRATE DISS-NO3 MG/L	71900 MERCURY HG,TOTAL UG/L	82079 TURBIDTY LAB NTU
88/10/25	1135						5.0
88/11/29	1120						6.0
88/12/27	1055						4.0
89/01/24	1125						7.0
89/02/27	1050						6.0
89/03/28	1100						31.0
89/04/25	1040						10.0
89/05/23	1045						5.0
89/06/27	1105						3.0
89/07/25	1115						2.4
89/08/29	1135						1.8
89/09/26	1015						2.7
89/10/24	1020						22.0
89/11/28	1125						6.1
89/12/19	1030						12.0
90/01/30	0950						30.0
90/02/27	1015						15.0
90/03/27	1110						13.0

Attachment C

INORGANIC CHEMICAL ANALYSES REPORT FROM A RAW WATER SAMPLE COLLECTED AUGUST 10, 1989 IN THE COWLITZ RIVER

1610 N.E. 150th St., Seattle WA 98155

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSES

USE THIS FORM FOR THE COMPLETE CHEMICAL ANALYSIS ONLY

LAB. NUMBER	DATE RECEIVED	DATE COLLECTED	COLLECTED BY:
5 11 1874	8 11 89	8 10 89	LARRY COPLEN
SYSTEM I.D. NO.	SYSTEM NAME		Telephone 206 577-3360
48100R	CITY OF LONGVIEW		SYSTEM CLASS (circle one) 1 2 3 4
			COUNTY COWLITZ

SOURCE TYPE: X 1. Surface ___3. Well ___2. Spring ___4. Purchase

SOURCE NO. (Well No.): ___ ___

IF SOURCE IS LAKE OR STREAM, ENTER NAME: COWLITZ

THIS SAMPLE WAS TAKEN: X Before Treatment ___ After Treatment

IF SAMPLE WAS DRAWN FROM DISTRIBUTION SYSTEM IT WAS COLLECTED FROM SYSTEM AT: (Address)

IF TAKEN AFTER TREATMENT WAS IT ___FILTERED ___FLUORIDATED ___CHLORINATED ___WATER SOFTENER: TYPE USED ___

REMARKS: (Water quality problems, address for additional copies, etc.)

RAW WATER SAMPLE

FEES ARE CHARGED FOR CHEMICAL TESTING

A fee schedule is available from this department.

PARTY TO PAY FOR FEE FOR SERVICE TESTING

Larry Coplen (Signature of Purchaser) LARRY COPLEN (Print Full Name & Address)

CITY OF LONGVIEW Name

P.O. Box 128 Street

LONGVIEW City WA. 98632 Zip Code

Telephone: (206) 577-3360 Area Code

LABORATORY REPORT

(DO NOT WRITE BELOW THIS LINE)

TESTS	MCL	LESS THAN <	RESULTS	UNITS	Compliance YES	Compliance NO	CHEMIST INITIALS
Arsenic As	0.05*	<	0.010	mg/l	✓		PO
Barium Ba	1.0*	<	0.25	mg/l	✓		CRW
Cadmium Cd	0.01*	<	0.002	mg/l	✓		PO
Chromium Cr	0.05*	<	0.010	mg/l	✓		PO
Iron Fe	0.3		0.29	mg/l	✓		KK
Lead Pb	0.05*	<	0.002	mg/l	✓		PO
Manganese Mn	0.05		0.034	mg/l	✓		PO
Mercury Hg	0.002*	<	0.0005	mg/l	✓		KK
Selenium Se	0.01*	<	0.005	mg/l	✓		PO
Silver Ag	0.05*	<	0.010	mg/l	✓		PO
Sodium Na			15	mg/l			CRW
Hardness			40	mg/l AS CaCO3			AL
Conductivity	700		170	Micromhos/cm 25° C	✓		AL
Turbidity	1.0*		3.0	NTU		✓	AL
Color	15.0		10	Color Units	✓		AL
Fluoride F	2.0*	<	0.2	mg/l	✓		KK
Nitrate NO_3	10.0*		0.3	mg/l	✓		CRW
Chloride Cl	250		10	mg/l	✓		CRW
Alkalinity CO_3	250			mg/l			
TDS	500			mg/l			
Copper Cu	1.0	<	0.25	mg/l	✓		CRW
Zinc Zn	5.0	<	0.25	mg/l	✓		CRW

DATE OF FINAL REPORT: 1/14/89

LABORATORY SUPERVISOR (Name or Initials)

CHARGE: $195.00

REMARKS: CRW

MCL is the Maximum Contaminant Level Allowed * Primary Standard

AL

HS 4-92F (Rev. 7/85) -873- DSHS Laboratory & Data Processing Copy DSHS Billing Copy Water Supplier Copy District Engineer Copy Local Health Dept. Copy

Attachment D

WEYERHAEUSER COMPANY SOLID WASTE CHARACTERIZATION SAMPLING REPORT

Appendix B

Fish Bioassay Results

Weyerhaeuser

Date January 11, 1990

From Clyde Patterson

Location WTC 2H4

Subject FISH TOXICITY TESTS ON LONGVIEW MILL WASTE SAMPLES

To Stan Duncan - WTC 2H4

Per your request, 96 hour static acute fish bioassays were conducted on ten (10) waste samples from the Longview Mill complex collected by Dave Parker on October 12 and 30 and submitted to the Aquatic Toxicology Laboratory for determination of Washington State waste designation (WAC 173-303).

The rainbow trout (Salmo gairdneri) acute bioassays were completed on the samples in triplicate concentrations of 100 and 1000 ppm. Ten juvenile fish in each test concentration were exposed to the waste samples for a period of 96 hours. No fish mortality was observed in any of the treatments or the control. These results show that the waste samples were not acutely toxic to rainbow trout at these concentrations. The results of the bioassay testing are summarized in Table 1 and on the Aquatic Toxicology Laboratory data sheets (attached).

The bioassay procedure for this testing followed guidelines established by the Washington State Department of Ecology, "Biological Testing Methods - Part A, Static Acute Fish Toxicity Test" DOE 80-12, revised July 1981.

If you have any questions regarding these results, call me at extension 6590 (fish lab).

Clyde Patterson

Clyde Patterson
Environmental Technician
dcw/d69/0111

Attachments

cc: Barry Firth - WTC 2H4
Dan Sjolseth - WTC 2H2

TABLE 1

LONGVIEW MILL WASTE SAMPLES
RAINBOW TROUT 96 HOUR ACUTE BIOASSAYS
SAMPLE DATES OCTOBER 12 AND 30

	SAMPLE	ID	% SURVIVAL 100 ppm	% SURVIVAL 1000 ppm
1)	PAPER MILL BOILER FLY ASH	38003	100	100
2)	PAPER MILL BOILER WET ASH	38004	100	100
3)	PAPER MILL BOILER BOTTOM ASH	38005	100	100
4)	MILK CARTON EXTRUDER SLUDGE	38006	100	100
5)	CLARIFIER SLUDGE	38010	100	100
6)	POWER HOUSE FLY ASH 2	39188	100	100
7)	EAST POWERHOUSE BOTTOM ASH	38002	100	100
8)	GRITS AND DREGS (CAUSTIC)	38007	100	100
9)	GRITS AND DREGS MIXED	38008	100	100
10)	GREEN LIME MUD	38009	100	100

dcw/d69/0111-2 01/11/90

WEYERHAEUSER TECHNOLOGY CENTER

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

AMPLE ORGINATOR STAN DUNCAN — TEST INITIATION DATE 12-12-89 TIME 1430

DDRESS WTC 2H4 — TEST COMPLETION DATE 12-16-89 TIME 1430

OLLECTOR DAVE PARKER — TEST ORGANISM RAINBOW TROUT — TEST METHOD D.O.E. 80-12

ATE SAMPLE COLLECTED 10-12-89 — REQUIRED TEST TEMPERATURE RANGE 12°C ± 1.0° — ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES					TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L)					pH 25°C					TEMPERATURE (C)					COMMENTS
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
SAMPLE # 38003	①	100 ppm	0	0	0	0	0	8.6	9.0	9.2	9.3	9.6	7.3	8.0	8.2	8.2	8.2	12	12	12	12	12	
LONGVIEW PAPER MILL	②	100 ppm	0	0	0	0	0	8.9	9.2	9.3	9.5	9.6	7.4	8.0	8.2	8.2	8.2	12	12	12	12	12	
BOILER FLY ASH	③	100 ppm	0	0	0	0	0	9.0	9.4	9.4	9.6	9.8	7.4	8.0	8.2	8.2	8.2	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	9.0	9.3	9.5	9.5	9.7	7.2	8.0	8.2	8.3	8.3	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	8.8	9.3	9.5	9.7	9.8	7.6	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	8.8	9.1	9.3	9.5	9.6	7.4	8.1	8.3	8.3	8.3	12	12	12	12	12	
CONTROL			0	0	0	0	0	9.0	9.4	9.6	9.8	10.0	7.0	8.1	8.2	8.2	8.2	12	12	12	12	12	
			T	W	T	F	S																

AMPLE DESCRIPTION(S) DARK/BLACK COLORED MATERIAL

EST ORGANISM:

VERAGE WEIGHT 0.40 GM MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT)

UMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.40 GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS

ILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L ($CaCO_3$)

OMMENTS WASTE DESIGNATION BIOASSAY

DATA VERIFIED BY Barr A. Ford

DATE 12-19-89

FINAL > 10 MM/SEC

(2)

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN — TEST INITIATION DATE 12-12-89 TIME 1440
ADDRESS WTC 2HA — TEST COMPLETION DATE 12-16-89 TIME 1440
COLLECTOR DAVE PARKER — TEST ORGANISM RAINBOW TROUT — TEST METHOD D.O.E. 80-12
DATE SAMPLE COLLECTED 10-12-89 — REQUIRED TEST TEMPERATURE RANGE 12°C ± 1.0° — ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES					TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L)					pH 25°C					TEMPERATURE (C)					COMMENTS
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
SAMPLE # 38004	①	100 ppm	0	0	0	0	0	9.1	9.3	9.5	9.6	9.8	7.5	8.0	8.2	8.2	8.3	12	12	12	12	12	
LONGVIEW PAPER MILL	②	100 ppm	0	0	0	0	0	8.6	9.0	9.2	9.5	9.6	7.4	8.0	8.2	8.3	8.3	12	12	12	12	12	
BOILER WET ASH	③	100 ppm	0	0	0	0	0	8.6	9.1	9.2	9.3	9.5	7.2	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	8.8	9.2	9.5	9.6	9.6	7.3	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	8.6	9.0	9.3	9.5	9.7	7.3	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	9.1	9.4	9.5	9.7	9.7	7.5	8.0	8.2	8.3	8.3	12	12	12	12	12	
			T	W	T	F	S																

SAMPLE DESCRIPTION(S) DARK/BLACK COLORED MATERIAL

TEST ORGANISM:
AVERAGE WEIGHT 0.40 GM. MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT) ____
NUMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.40 GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS
DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L (CaCO
COMMENTS WASTE DESIGNATION BIOASSAY
DATA VERIFIED BY [signature]
DATE 12-19-89

EHW > 10 MORTS/30 AT 100 ppm
DW > 11 [illegible]

③

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN — TEST INITIATION DATE 12-12-89 — TIME 1450

ADDRESS WTC 2HA — TEST COMPLETION DATE 12-16-89 — TIME 1450

COLLECTOR DAVE PARKER — TEST ORGANISM RAINBOW TROUT — TEST METHOD D.O.E. 80-12

DATE SAMPLE COLLECTED 10-12-89 — REQUIRED TEST TEMPERATURE RANGE 12°C ± 1.0° — ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES					TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L)					pH 25°C					TEMPERATURE (C)					COMMENTS
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
SAMPLE # 38005	①	100 ppm	0	0	0	0	0	9.0	9.3	9.5	9.7	9.9	7.3	8.0	8.2	8.2	8.2	12	12	12	12	12	
LONGVIEW PAPER MILL	②	100 ppm	0	0	0	0	0	8.6	9.0	9.3	9.5	9.6	7.6	8.1	8.3	8.3	8.3	12	12	12	12	12	
BOILER BOTTOM ASH	③	100 ppm	0	0	0	0	0	8.6	8.9	9.2	9.6	9.8	7.6	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	8.8	9.2	9.5	9.7	9.8	7.7	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	9.1	9.4	9.6	9.6	9.8	7.4	8.1	8.2	8.3	8.3	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	8.7	9.1	9.3	9.5	9.6	7.5	8.1	8.3	8.3	8.3	12	12	12	12	12	
			T	W	T	F	S																

SAMPLE DESCRIPTION(S) DARK/BLACK COLORED MATERIAL

TEST ORGANISM:

AVERAGE WEIGHT 0.40 GM. MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT) ____

NUMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.40 GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS

DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L (CaCO

COMMENTS WASTE DESIGNATION BIOASSAY

DATA VERIFIED BY Barry K. Lamb

DATE 12-19-89

EHW > 10 MORTS/30 AT 100 ppm

DW

④

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN — TEST INITIATION DATE 12-12-89 TIME 1500
ADDRESS WTC 2HA — TEST COMPLETION DATE 12-16-89 TIME 1500
COLLECTOR DAVE PARKER — TEST ORGANISM RAINBOW TROUT — TEST METHOD D.O.E. 80-12
DATE SAMPLE COLLECTED 10-12-89 — REQUIRED TEST TEMPERATURE RANGE 12°C ± 1.0° — ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES 0	24	48	72	96	TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L) 0	24	48	72	96	pH 25°C 0	24	48	72	96	TEMPERATURE (C) 0	24	48	72	96	COMMENTS
SAMPLE # 38006	①	100 ppm	0	0	0	0	0	9.2	9.5	9.4	9.5	9.7	7.5	8.0	8.2	8.2	8.2	12	12	12	12	12	
LONGVIEW MILK CARTON	②	100 ppm	0	0	0	0	0	8.8	9.1	9.3	9.5	9.8	7.2	8.0	8.2	8.2	8.3	12	12	12	12	12	
EXTRUDER SLUDGE	③	100 ppm	0	0	0	0	0	8.6	9.0	9.3	9.6	9.8	7.2	8.0	8.2	8.3	8.3	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	8.9	9.3	9.5	9.6	9.6	7.4	8.0	8.1	8.2	8.2	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	8.5	9.1	9.4	9.7	9.6	7.6	8.1	8.2	8.3	8.3	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	8.9	9.3	9.4	9.5	9.8	7.1	8.1	8.3	8.3	8.3	12	12	12	12	12	
			T	W	T	F	S																

SAMPLE DESCRIPTION(S) DARK/BLACK COLORED MATERIAL

TEST ORGANISM:
AVERAGE WEIGHT 0.40 GM. MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT) ____
NUMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.40 GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS
DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L (CaCO
COMMENTS WASTE DESIGNATION BIOASSAY — DATA VERIFIED BY Barr N. Finch
DATE 12-19-89

EHW > 10 MORTS/30 AT 100 ppm

(5)

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN — TEST INITIATION DATE 12-12-89 — TIME 1510
ADDRESS WTC 2HA — TEST COMPLETION DATE 12-16-89 — TIME 1510
COLLECTOR DAVE PARKER — TEST ORGANISM RAINBOW TROUT — TEST METHOD D.O.E. 80-12
DATE SAMPLE COLLECTED 10-12-89 — REQUIRED TEST TEMPERATURE RANGE 12°C ± 1.0° — ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES 0	24	48	72	96	TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L) 0	24	48	72	96	pH 25°C 0	24	48	72	96	TEMPERATURE (C) 0	24	48	72	96	COMMENTS
SAMPLE # 38010	①	100 ppm	0	0	0	0	0	9.1	9.4	9.6	9.6	9.9	7.5	8.0	8.2	8.3	8.3	12	12	12	12	12	
LONGVIEW	②	100 ppm	0	0	0	0	0	9.0	9.3	9.5	9.6	9.9	7.1	8.1	8.3	8.3	8.3	12	12	12	12	12	
CLARIFIER SLUDGE	③	100 ppm	0	0	0	0	0	9.0	9.4	9.5	9.7	9.8	7.6	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	8.9	9.3	9.7	9.7	9.9	7.5	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	8.8	9.2	9.3	9.5	9.6	7.4	8.0	8.2	8.3	8.3	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	9.1	9.4	9.6	9.6	9.8	7.6	8.1	8.3	8.3	8.3	12	12	12	12	12	
			T	W	T	F	S																

SAMPLE DESCRIPTION(S) DARK/BLACK COLORED MATERIAL

TEST ORGANISM:
AVERAGE WEIGHT 0.40 GM. MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT) ____
NUMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.40 GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS
DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L (CaCO
COMMENTS WASTE DESIGNATION BIOASSAY
DATA VERIFIED BY [signature]
DATE 12-19-89

EHW > 10 MORTS/30 AT 100 ppm

(6)

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN
ADDRESS WTC 2HA
COLLECTOR DAVE PARKER
DATE SAMPLE COLLECTED 10-30-89

TEST INITIATION DATE 12-12-89 TIME 1520
TEST COMPLETION DATE 12-16-89 TIME 1520
TEST ORGANISM RAINBOW TROUT TEST METHOD D.O.E. 80-12
REQUIRED TEST TEMPERATURE RANGE 12°C ± 1.0° ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES 0	24	48	72	96	TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L) 0	24	48	72	96	pH 25°C 0	24	48	72	96	TEMPERATURE (C) 0	24	48	72	96	COMMENTS
SAMPLE # 39188	①	100 ppm	0	0	0	0	0	8.8	9.2	9.6	9.6	9.8	7.6	8.1	8.3	8.3	8.3	12	12	12	12	12	
LONGVIEW POWER HOUSE	②	100 ppm	0	0	0	0	0	8.7	9.2	9.4	9.6	9.7	7.6	8.1	8.2	8.3	8.3	12	12	12	12	12	
FLY ASH 2	③	100 ppm	0	0	0	0	0	9.1	9.4	9.3	9.5	9.8	7.5	8.1	8.2	8.3	8.3	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	9.0	9.3	9.5	9.5	9.6	7.3	8.0	8.2	8.3	8.3	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	9.0	9.3	9.4	9.8	9.7	7.6	8.1	8.3	8.3	8.3	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	9.1	9.4	9.5	9.8	10.1	7.4	8.0	8.2	8.2	8.3	12	12	12	12	12	
			T	W	T	F	S																

SAMPLE DESCRIPTION(S) DARK/BLACK COLORED MATERIAL

TEST ORGANISM:
AVERAGE WEIGHT 0.40 GM MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT) ____
NUMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.40 GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS
DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L ($CaCO_3$)
COMMENTS WASTE DESIGNATION BIOASSAY
DATA VERIFIED BY [signature]
DATE 12-19-89

EHW > 10 MORTS/30 AT 100 ppm

(7)

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN — TEST INITIATION DATE 1-2-90 — TIME 1145

ADDRESS WTC 2H4 — TEST COMPLETION DATE 1-6-90 — TIME 1145

COLLECTOR DAVE PARKER — TEST ORGANISM RAINBOW TROUT — TEST METHOD D.O.E. 80-12

DATE SAMPLE COLLECTED 10-12-89 — REQUIRED TEST TEMPERATURE RANGE 12°C ± 1.0° — ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES					TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L)					pH 25°C					TEMPERATURE (C)					COMMENTS
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
SAMPLE # 38002	①	100 ppm	0	0	0	0	0	9.0	9.2	9.4	9.5	9.7	7.5	8.1	8.1	8.1	8.1	12	12	12	12	12	
LONGVIEW	②	100 ppm	0	0	0	0	0	8.6	8.9	9.1	9.3	9.8	7.4	8.1	8.1	8.2	8.2	12	12	12	12	12	
EAST POWER HOUSE BOTTOM ASH	③	100 ppm	0	0	0	0	0	8.5	8.8	9.1	9.5	9.9	7.3	8.2	8.2	8.2	8.2	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	8.8	9.0	9.2	9.6	10.1	7.6	8.2	8.2	8.3	8.3	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	8.5	8.8	9.1	9.5	10.0	7.6	8.2	8.3	8.3	8.3	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	8.8	9.0	9.3	9.6	10.0	7.4	8.2	8.3	8.3	8.3	12	12	12	12	12	
CONTROL			0	0	0	0	0	9.0	9.2	9.4	9.7	10.2	7.1	8.2	8.2	8.2	8.2	12	12	12	12	12	
			T	W	T	F	S																

SAMPLE DESCRIPTION(S) _____

TEST ORGANISM:

AVERAGE WEIGHT 0.46 GM — MEAN LENGTH 33 mm — LONGEST 38 mm — SHORTEST 28 mm — RATIO (LONG:SHORT) _____

NUMBER OF ORGANISMS PER CHAMBER 10 — TEST ORGANISM LOADING DENSITY 0.46 GM/L — DILUTION WATER SOURCE FEDERAL WAY WELLS

DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) — DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) — DILUENT ALKALINITY 70 mg/L (CaCO

COMMENTS WASTE DESIGNATION BIOASSAY

DATA VERIFIED BY 1/8/90 Bartling

DATE 1/8/90

FINAL > 10 MGTS/L @ AT 100%

(8)

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN — TEST INITIATION DATE 1-2-90 — TIME 1130

ADDRESS WTC 2H4 — TEST COMPLETION DATE 1-6-90 — TIME 1130

COLLECTOR DAVE PARKER — TEST ORGANISM RAINBOW TROUT — TEST METHOD D.O.E 80-12

DATE SAMPLE COLLECTED 10-12-89 — REQUIRED TEST TEMPERATURE RANGE 12°C ± 1.0° — ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES					TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L)					pH 25°C					TEMPERATURE (C)					COMMENTS
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
SAMPLE # 38007	①	100 ppm	0	0	0	0	0	8.5	8.9	9.1	9.5	9.9	7.8	8.3	8.3	8.3	8.3	12	12	12	12	12	
LONGVIEW	②	100 ppm	0	0	0	0	0	9.1	9.2	9.4	9.6	9.9	7.7	8.3	8.3	8.3	8.3	12	12	12	12	12	
GRITS & DREGS (CAUSTIC)	③	100 ppm	0	0	0	0	0	8.8	9.0	9.2	9.6	10.0	7.5	8.3	8.3	8.3	8.3	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	9.1	9.2	9.3	9.4	9.8	7.6	9.2	9.2	9.3	9.0	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	9.0	9.3	9.5	9.8	10.2	7.6	9.2	9.2	9.2	9.0	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	8.9	9.1	9.3	9.6	10.2	7.4	9.2	9.3	9.3	8.9	12	12	12	12	12	

SAMPLE DESCRIPTION(S) _____

TEST ORGANISM:

AVERAGE WEIGHT 0.46 GM. MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT) _____

NUMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.46 GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS

DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L (CaCO

COMMENTS WASTE DESIGNATION BIOASSAY

DATA VERIFIED BY Ray H Zinn

DATE 1/8/90

(9)

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN
ADDRESS WTC 2H4
COLLECTOR DAVE PARKER
DATE SAMPLE COLLECTED 10-12-89

TEST INITIATION DATE 1-2-90 TIME 1115
TEST COMPLETION DATE 1-6-90 TIME 1115
TEST ORGANISM RAINBOW TROUT TEST METHOD D.O.E. 80-12
REQUIRED TEST TEMPERATURE RANGE 12°C ±1.0° ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES					TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L)					pH 25°C					TEMPERATURE (C)					COMMENTS
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
SAMPLE # 38008	①	100 ppm	0	0	0	0	0	9.1	9.3	9.5	9.7	10.2	7.5	8.2	8.2	8.2	8.3	12	12	12	12	12	
LONGVIEW	②	100 ppm	0	0	0	0	0	9.0	9.2	9.6	9.8	10.2	7.5	8.2	8.2	8.2	8.3	12	12	12	12	12	
GRITS & DREGS MIXED	③	100 ppm	0	0	0	0	0	8.6	9.0	9.4	9.5	9.9	7.4	8.2	8.2	8.3	8.3	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	8.5	8.9	9.3	9.6	10.1	7.6	8.6	8.6	8.6	8.7	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	8.8	9.2	9.5	9.8	10.2	7.3	8.6	8.6	8.6	8.7	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	8.8	9.3	9.6	9.9	10.4	7.5	8.6	8.6	8.7	8.7	12	12	12	12	12	

SAMPLE DESCRIPTION(S)

TEST ORGANISM:
AVERAGE WEIGHT 0.46 GM. MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT)
NUMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.46GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS
DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L ($CaCO_3$)
COMMENTS WASTE DESIGNATION BIOASSAY
DATA VERIFIED BY Ray H. Zuel
DATE 1/8/90

FHW > 10 MMTS/70 AT 100%

(10)

AQUATIC TOXICOLOGY LABORATORY

DATA SHEET FOR STATIC ACUTE FISH BIOASSAY TOXICITY TEST

SAMPLE ORGINATOR STAN DUNCAN
ADDRESS WTC 2H4
COLLECTOR DAVE PARKER
DATE SAMPLE COLLECTED 10-12-89

TEST INITIATION DATE 1-2-90 TIME 1100
TEST COMPLETION DATE 1-6-90 TIME 1100
TEST ORGANISM RAINBOW TROUT TEST METHOD D.O.E.80-12
REQUIRED TEST TEMPERATURE RANGE 12°C ±1.0° ANALYST CLYDE PATTERSON

SAMPLE REFERENCE NUMBER / NAME	TEST CONTAINER NO.	TEST CONC.	BIOASSAY DATA: NUMBER OF CUMULATIVE MORTALITIES					TEST CHAMBER DATA: DISSOLVED OXYGEN (mg/L)					pH 25°C					TEMPERATURE (C)					COMMENTS
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
SAMPLE # 38009	①	100 ppm	0	0	0	0	0	8.9	9.2	9.5	9.8	10.1	7.5	8.3	8.3	8.3	8.3	12	12	12	12	12	
LONGVIEW	②	100 ppm	0	0	0	0	0	8.8	9.1	9.5	9.7	10.4	7.5	8.3	8.3	8.3	8.4	12	12	12	12	12	
GREEN LIME MUD	③	100 ppm	0	0	0	0	0	9.1	9.3	9.4	9.9	10.5	7.3	8.3	8.3	8.4	8.4	12	12	12	12	12	
11	①	1000 ppm	0	0	0	0	0	8.6	9.0	9.3	9.5	9.9	7.7	8.4	8.4	8.4	8.5	12	12	12	12	12	
11	②	1000 ppm	0	0	0	0	0	8.8	9.1	9.3	9.5	10.1	7.3	8.4	8.4	8.5	8.5	12	12	12	12	12	
11	③	1000 ppm	0	0	0	0	0	8.5	9.1	9.5	9.7	10.3	7.5	8.4	8.4	8.5	8.5	12	12	12	12	12	
			T	W	T	F	S																

SAMPLE DESCRIPTION(S)

TEST ORGANISM:
AVERAGE WEIGHT 0.46 GM. MEAN LENGTH 33 mm LONGEST 38 mm SHORTEST 28 mm RATIO (LONG:SHORT)
NUMBER OF ORGANISMS PER CHAMBER 10 TEST ORGANISM LOADING DENSITY 0.46 GM./L DILUTION WATER SOURCE FEDERAL WAY WELLS
DILUTION WATER CONDUCTIVITY 190 (µMHOS/cm) DILUTION WATER HARDNESS 71 mg/L ($CaCO_3$) DILUENT ALKALINITY 70 mg/L (CaCO
COMMENTS WASTE DESIGNATION BIOASSAY
DATA VERIFIED BY Ray H Lund
DATE 1/8/90

EHW >10 MORTS/30 AT 100 ppm

Appendix I

May 1992 Addendum/Wetland Boundary Flagging

Headquarters Camp
Solid Waste Disposal Facility

MAY 1992 ADDENDUM/WETLAND BOUNDARY FLAGGING

for the

March 1990 Wetland Determination and Delineation Report for Weyerhaeuser's SW Washington Solid Waste Facility

Prepared for:

Weyerhaeuser Company

Prepared by:

Beak Consultants Incorporated

73306.063

Wetland Biologist

Project Principal

MAY 1992 ADDENDUM - WETLAND BOUNDARY FLAGGING

March 1990 Wetland Determination and Delineation Report for Weyerhaeuser's SW Washington Solid Waste Facility

In February 1992 all wetland boundaries within the landfill footprint, ancillary facilities and the proposed diversion channel were flagged for wetland boundary verification conducted by the U.S. Army Corps of Engineers in March 1992. The wetland boundaries as shown in Figure 1 for the February 1992 surveys were determined from aerial photograph interpretation and field maps prepared during the wetland boundary flagging. The wetland boundary flag points have not been professionally surveyed. For the November 1989 and October 1990 wetland determination surveys, wetland boundaries were also determined through aerial photograph interpretation (black and white stereo aerial pairs and infrared photography) based on field observations and data collected during the field surveys. No wetland boundaries were flagged during the November 1989 or October 1990 surveys.

The verification/flagging surveys conducted in February 1992 were more detailed than the 1989 survey. The additional effort in February 1992 resulted in adjusted wetland boundaries which are a more accurate representation of wetland habitat location than determined through the aerial photography interpretation conducted in 1989. The primary differences between the survey results are; 1) in the configuration of the Central "Isolated" Wetland and 2) reduction of wetland habitat associated with the drainages (Figure 1). During the February 1992 survey wetland hydrology could be directly observed, unlike the October 1990 and November 1989 surveys where wetland hydrology in some locations was assumed based on observed soil conditions, vegetation and local topography (e.g., associated with drainage channel or within a swale). Additionally, the high clay content and soil matrix color made wetland determination based on soils condition somewhat difficult in certain areas without direct observation of hydrologic conditions during the early spring growing period.

Approximately 3.0 fewer acres of wetland habitat were delineated within the proposal footprint (Table 1 and Figure 1). Portions of Drainage E, most of Drainage C and the upper sections of Drainages D, F and G did not support wetland hydrology during the February 1992 survey. No saturated soil conditions were observed to depths of 18 to 20 inches in these areas. Additionally, a small side tributary on the western tributary of Drainage A, originally identified through the aerial photo interpretation, was found to be a swale area dominated by salal which did not support wetland hydrology. Scrub-shrub habitat dominated by salmonberry was found to be present in Drainages D, E and F, as well as Drainage A, during the February 1992 survey.

Drainage H wetland habitat was found to be located slightly further west than originally identified, and was found not to be as extensive in the vicinity of the railroad berm as previously determined. Wetland habitat associated with Drainage H was delineated and flagged all the way to the confluence of Drainage H with Southern Tributary, as this entire reach could be influenced by the proposed stream relocation plan.

The Central "Isolated" Drainage was determined to contain similar acreage of wetland habitat as identified in the 1989 survey, although the exact configuration was found to be different from the original survey. Several small pockets of wetland were delineated between the main body of the

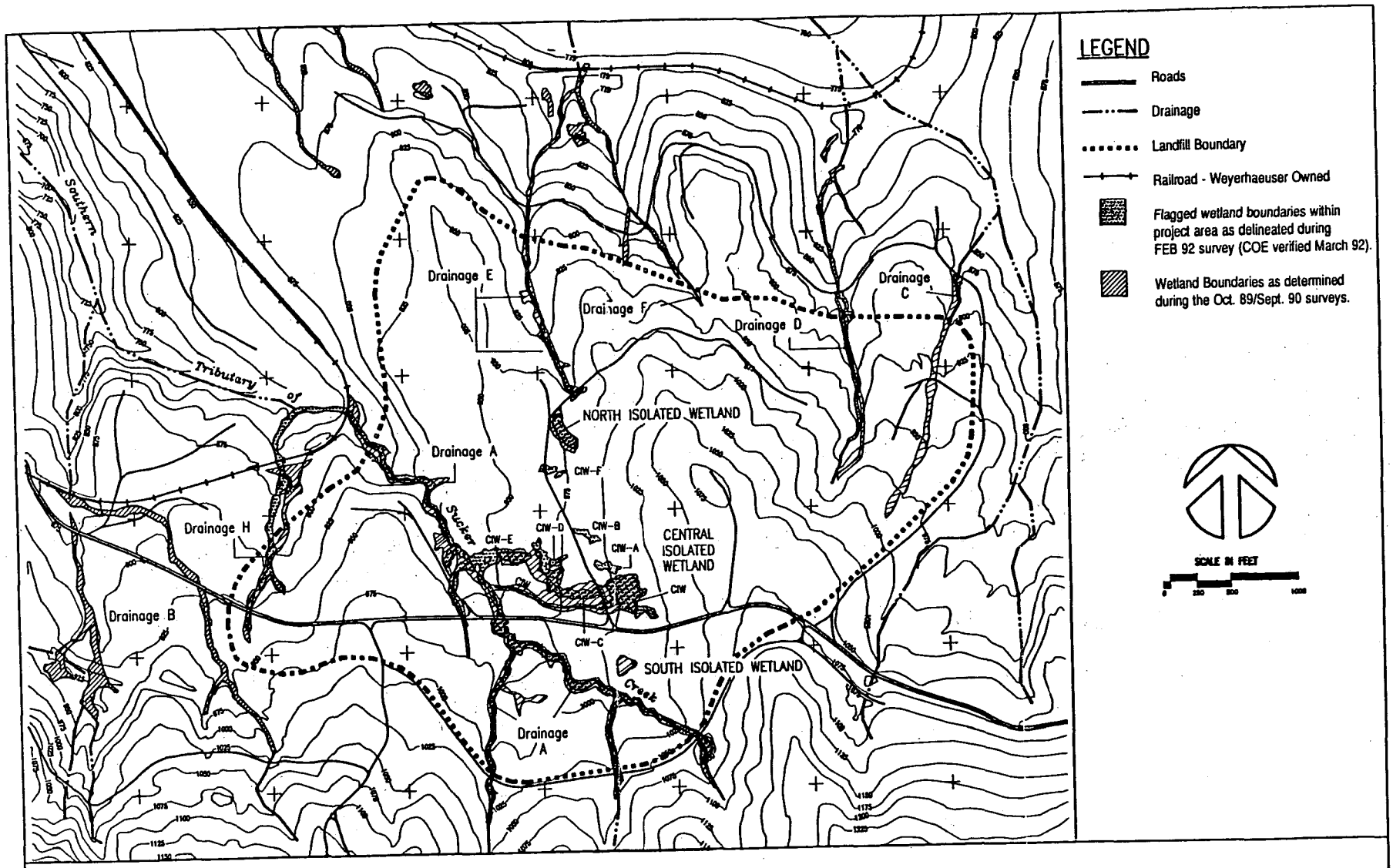


Figure 1. Comparison of February 1992 flagged wetland boundaries and the wetland boundaries based on the October 1989/September 1990 field surveys and aerial photograph interpretation. All surveys followed the 1989 Unified Federal Methodology.

Table 1. Comparison of wetland acreage between the 1989/90 surveys and the 1992 wetland delineation survey.

Wetland Area	Emergent Wetland (Ac) 1989	Emergent Wetland (Ac) 1992	Scrub-Shrub Wetland (Ac) 1989	Scrub-Shrub Wetland (Ac) 1992	Total (Ac) 1989	Total (Ac) 1992
Drainage A	3.1	2.8	3.1	2.7	6.2	5.5
Drainage C	1.4	0.09	0.0	0.0	1.4	0.09
Drainage D	0.7	0.33	0.0	0.33	0.7	0.66
Drainage E	1.2	0.49	0.0	0.21	1.2	0.70
Drainage F	0.2	0.0	0.0	0.18	0.2	0.18
Drainage G	0.2	0.0	0.0	0.0	0.2	0.0
Drainage H[1]	1.1	1.1	0.0	0.0	1.1	1.1
South Isolated Wetland	0.3	0.02	0.0	0.0	0.3	0.02
North "Isolated" Wetland	0.6	0.52	0.0	0.0	0.6	0.52
Central "Isolated" Wetland	4.3	4.07	0.0	0.19	4.3	4.26
TOTAL	**13.1**	**9.42**	**3.1**	**3.61**	**16.2**	**13.03**

[1] Drainage H is not included in Weyerhaeuser's preferred landfill footprint boundary. Consequently Drainage H acreage was not included in the 404 permit public notice Therefore, the wetland impact acreage in the public notice is 11.93 acres.

Central Wetland and the North "Isolated" Wetland area. These small wet areas did not appear to support wetland hydrology during the 1989 survey, but were found to have a seasonal water table above 15 inches below the surface during the February 1992 survey. In addition, the northern portion of the main body of the Central Wetland was found to extend to Drainage A (Southern Tributary to Sucker Creek). Wetland acreage listed by habitat type per wetland area, including the seven Central Wetland locations, is provided in Table 2 for the February 1992 survey results.

The South Isolated Wetland was determined to be a 20-foot by 40-foot wetland area. The original aerial photo interpretation had determined a 0.3 acre emergent wetland area to be present at this general location. This non-forested area was found to be primarily well-drained, with the dominant vegetation consisting of Oregon grape, salal and sword fern. Only the extreme eastern edge of this area was found to be wet, supporting wet grasses, soft rush and several willows.

TABLE 2. FEBRUARY 1992 SURVEY WETLAND ACREAGE SUMMARY FOR THE HEADQUARTER SITE

WETLAND AREA	ACRES PER HABITAT TYPE			FUNCTION AND VALUE	
	Emergent	Shrub–Scrub	TOTAL	Biological	Physical
Drainage A	2.80	2.70	5.50 AC	Wildlife habitat – limited diversity; pool/riffle habitat supports resident trout	Stream bank stabilization; biofiltration
Drainage C	0.09		0.09 AC	Small area, little diversity	Limited biofiltration
Drainage D	0.33	0.33	0.66 AC	Little wildlife habitat in upper drainage, moderate diversity in lower drainage	Bank stabilization, limited biofiltration in upper drainage
Drainage E	0.49	0.21	0.70 AC	Deer forage in upper drainage, dense scrub–shrub limits large animal movement in lower drainage but provides some passerine bird habitat	Significant biofiltration in upper drainage
Drainage F		0.18	0.18 AC	Dense scrub–shrub, limited diversity, passerine bird habitat	Bank stabilization
Drainage H	1.10		1.10 AC	Limited diversity, year–round water source.	Spring–fed system, signifcant biofiltration and recharge.
South Isolated Wetland	0.02		0.02 AC	Small isolated patch of wetland habitat; does not provide any significant/unique function	
North "Isolated" Wetland	0.52		0.52 AC	Limitied diversity, deer forage observed.	Moderate recharge and biofiltration
Central "Isolated" Wetland	4.07	0.19	4.26 AC	Limitied diversity, deer forage observed.	Moderate recharge and biofiltration
CIW	*1.76*				
CIW–A	*0.23*				
CIW–B		*0.19*			
CIW–C	*0.54*				
CIW–D	*0.60*				
CIW–E	*0.76*				
CIW–F	*0.18*				
TOTAL	9.42 AC	3.61 AC	13.03 AC		

Appendix J

Supporting Information on Likelihood of Spill from Leachate Tank Car

Headquarters Camp
Solid Waste Disposal Facility

Jean Garber

8436 - 129th Pl. SE
Renton, WA 98056
(206) 277-9327

October 7, 1992

Chester Southern
Regional Director
Federal Railroad Administration
1500 SW First Avenue
Crown Plaza Annex, Suite 250
Portland, OR 97201-5871

Dear Mr. Southern:

I am a consultant assisting the Cowlitz-Wahkiakum Health District in preparing an environmental impact statement (EIS) on Weyerhaeuser's proposed Headquarters Camp industrial solid waste landfill. The landfill would accept only forest products manufacturing waste and construction and demolition waste. No dangerous, hazardous, or municipal solid waste would be accepted.

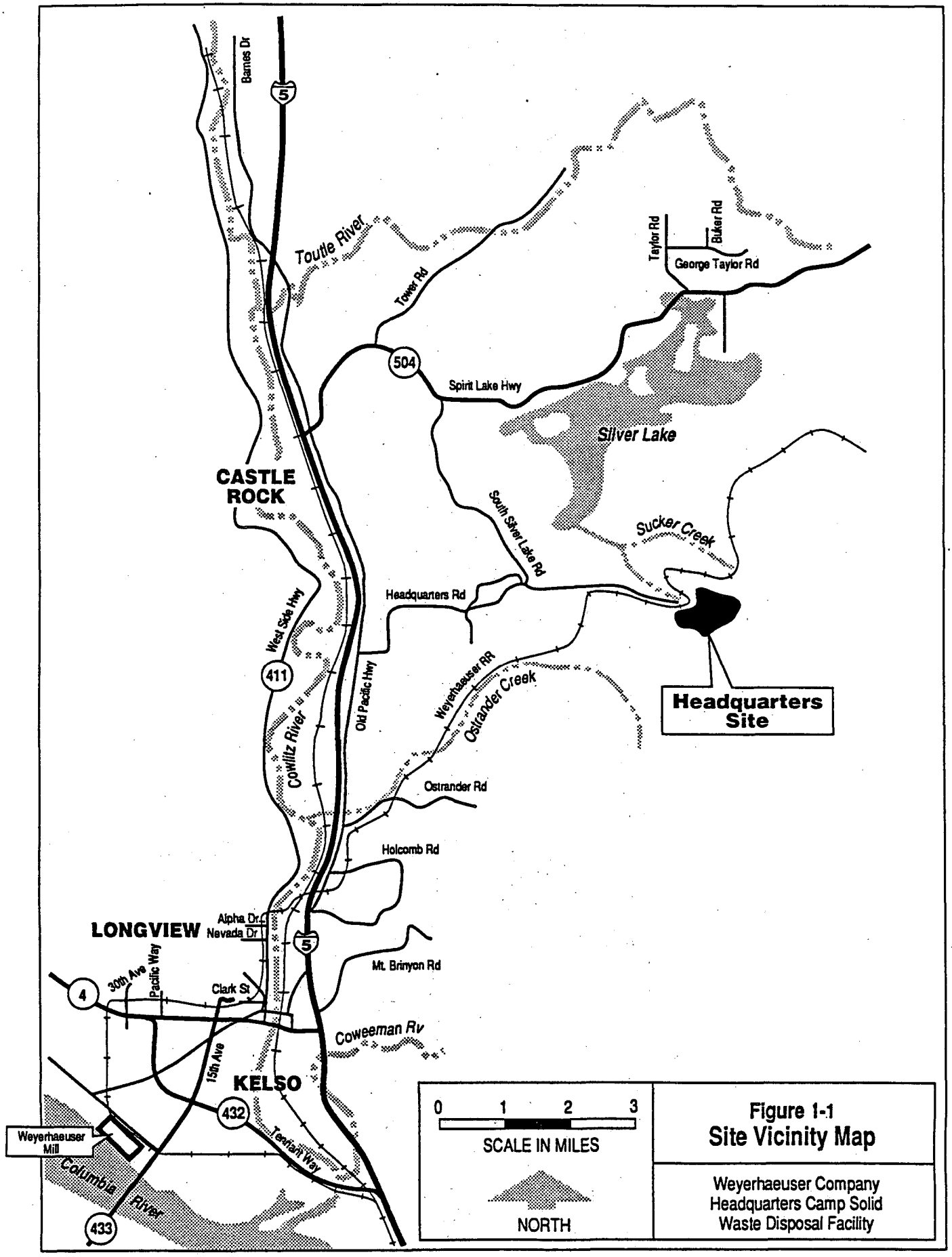
Weyerhaeuser proposes to use the Cowlitz & Columbia and Woods rail lines to transport industrial solid waste from its Longview Mill and other operations in the region to the landfill site (see attached figure). Similarly, leachate from the landfill would be transported by rail from the Headquarters Camp site to the wastewater treatment plant at the Longview Mill.

One of the issues raised in comment letters on the Draft EIS is the potential for derailments that would result in a leachate spill from one or more tank cars into one of the small creeks crossed by the rail line, or into the Cowlitz River. Although the leachate does not test as a dangerous or hazardous waste, Weyerhaeuser proposes to use "105" type tank cars with shelf couplers for rail transport, and to enforce a maximum speed limit of 12 mph.

To obtain information on the likelihood of failure of a "105" type tank car in a derailment at this speed, I called Hank Jacobs of your office on September 30, 1992. He provided information that I intend to use in the analysis of this issue in the Final EIS, as well as general information related to FRA's jurisdiction and function. The purpose of this letter is to express my understanding of the information received and ask FRA for written confirmation or correction. Mr. Jacobs felt that I should address the letter to you, since you were the appropriate person to speak for the agency.

My understanding of the information provided by Mr. Jacobs is as follows:

1. Both the Columbia & Cowlitz and Woods lines are regulated by FRA.


Barnes Dr
5
Toutle River
Tower Rd
Taylor Rd
Buker Rd
George Taylor Rd
504
Spirit Lake Hwy
Silver Lake
CASTLE ROCK
South Silver Lake Rd
Sucker Creek
Headquarters Rd
West Side Hwy
411
Old Pacific Hwy
Weyerhaeuser RR
Ostrander Creek
Headquarters Site
Cowlitz River
Ostrander Rd
Holcomb Rd
LONGVIEW
Alpha Dr
Nevada Dr
5
Mt. Brinyon Rd
4
30th Ave
Pacific Way
Clark St
Coweeman Rv
15th Ave
KELSO
432
Weyerhaeuser Mill
Columbia River
Tennant Way
433
0 1 2 3
SCALE IN MILES
NORTH
Figure 1-1
Site Vicinity Map
Weyerhaeuser Company
Headquarters Camp Solid
Waste Disposal Facility

2. FRA inspects all aspects of rail operations, including tracks, locomotives, and cars. In particular, it inspects air brakes (air brakes must be controllable from the locomotive and all air brakes must be functioning); inspects the contents of rail cars to make sure materials are being transported in appropriate containers; checks on the licensing and training of engineers; and monitors noise emissions from locomotives to ensure compliance with the FRA noise standards specified in 49CFR Part 210.29. These are the same as the noise standards promulgated by EPA in 40CFR Part 201.

3. The "105" type tank cars proposed by Weyerhaeuser to haul leachate are the best tank cars available. They were developed to provide safe transportation for chlorine gas and other hazardous materials. The key advantages to "105" tank cars compared to the standard "111" tanks cars are:

   - "Head shields", which are steel jackets on the ends of the tank car, protect the tank car from the impacts of other tank cars in a derailment. Hank Jacobs estimates that over 90 percent of the punctures in tank cars used to occur in the ends of the cars. Head shields such as those specified for "105" tank cars have resolved this problem.

   - "Shelf couplers", which consist of a metal "shelf" above and below the coupling, prevent the end of a tank car from being lifted and uncoupled in a derailment.

   - Unlike "111" cars, "105" cars have no bottom outlet valves. (Damage to bottom outlet valves has historically been a common contributor to spills from tank cars). The manway where the valves are located on a "105" tank car is surrounded by a 1/2-inch plate steel housing with a plate steel lid.

4. Most derailments of trains operating in the 10 mph range don't result in damage to rail cars.

5. Given that Weyerhaeuser plans to use "105" tank cars with the above features, to enforce a maximum 12 mph speed limit, and to have trains with full tank cars attended at all times, the probability of a leachate spill from a tank car in a derailment incident is remote. In the 16 years that Hank Jacobs has been with FRA in Portland, he can recall no incident in the eight-state region over which the Portland office has jurisdiction in which a "105" tank car ruptured and spilled its contents. (The eight states are Washington, Oregon, Alaska, Idaho, Montana, Wyoming, and North and South Dakota.)

6. The probability of a spill from more than one tank car in a single derailment incident is extremely remote. The only situation Mr. Jacobs can recall involving leaks from multiple tank cars in a single accident resulted when an explosion of a "111" tank car transporting flammable materials led to explosions of other tank cars.

7. Hank Jacobs cited the following incidents as evidence of the low likelihood of a spill from a "105" tank car.

   a. A wheel came off a "105" tank car carrying chlorine and the axle broke, derailing the entire train. The train was traveling at 48 mph, a total of about ten cars piled up, and the chlorine tank car was dragged about 250 feet on its top, with the manway housing dragging along the hard ground surface. Despite the severity of the accident, there was no failure of the tank cars and no leakage.

   b. Vandalism of unattended "105" tank cars filled with herbicide resulted in a runaway train, which derailed at 70 mph. Again, there was no leakage.

* * *

I would appreciate a brief letter from you confirming that the above information is accurate or correcting any misunderstanding I may have. We are proceeding toward a review draft of the Final EIS, so a timely response from you would most helpful.

Thank you for your assistance, and please thank Hank Jacobs again for his patience in answering my many questions about FRA's function and the design and performance characteristics of the "105" tank car.

Sincerely,

Jean Garber
Consultant to Cowlitz-Wahkiakum Health District

cc: Health District

Jean Garber

8436 - 129th Pl. SE
Renton, WA 98056
(206) 277-9327

October 7, 1992

J.R. Chapman
Federal Railroad Administration
1500 SW First Avenue
Crown Plaza Annex, Suite 250
Portland, OR 97201-5871

Dear J.R.:

Thank you for talking with me on October 5, 1992 about FRA track inspections of the Woods rail line. As we discussed, Weyerhaeuser proposes to use the Cowlitz & Columbia and Woods rail lines to haul solid waste to its proposed Headquarters Camp landfill, as well as to haul leachate from the landfill to the wastewater treatment plant at the Longview Mill.

The purpose of this letter is to express my understanding of the information your provided in our phone conversation and request written confirmation or correction. I will be using the information in preparing the final environmental impact statement on the proposed landfill for the Cowlitz-Wahkiakum Health District.

My understanding of the information you provided is as follows:

1. FRA has not yet performed a full inspection of the tracks on the Woods line. Although the line is regulated by FRA, it has not been determined to be a high priority line from the standpoint of track structure, because its use is limited to the hauling of logs. However, FRA has been monitoring the general status of the track through its locomotive inspectors. Also, Weyerhaeuser is required to make track inspections and keep the reports on file in Longview. These are reviewed by FRA on an annual basis.

2. At least 30 days before any movement of solid waste or leachate on the Woods line, FRA would conduct a full track inspection and require Weyerhaeuser to make any modifications necessary to bring the track to FRA standards.

I would appreciate a brief letter from you confirming that this information is correct or pointing out any misunderstandings I may have. Thank you again for your help.

Sincerely,

Jean Garber
Consultant to Cowlitz-Wahkiakum Health District

U.S. Department
of Transportation
**Federal Railroad
Administration**

400 Seventh St., S.W.
Washington, D.C. 20590

500 S. W. First Avenue
Suite 250
Portland, Oregon 97201

October 27, 1992

Ms. Jean Garber
8436 - 129th Place S.E.
Renton, Washington 98056

Dear Ms. Garber:

This is in regards to your letters of October 7, 1992 (two letters) and October 24, 1992, concerning the transportation of a non-hazardous solid waste material, Leachate, on the Weyerhaeuser Woods Railroad.

The information presented in your letters is basically correct as written. Some of the issues addressed in your letters are very complex. The answers provided by Mr. Jacobs and Mr. Chapman, although correct, may be simplification of complicated issues. I would like to expound on several of these points for clarification.

In your October 7, 1992, letter addressed to me:

Item 3. Specification DOT 105 tank cars are the best cars available in the general tank car fleet. Special commodity cars or cars for special purposes do exist that have higher ratings than the DOT 105. A good example would be the cast cars used to transport high level Radioactive Materials.

Item 4. Most derailments in trains operating in the 10 mph range don't result in damage to "the tanks on tank cars". These derailments often result in damage to wheels, bearings, brake rigging, and certain safety appurtenances on the car.

Item 6. The reference to a tank car which "exploded" should have cited "Specification DOT 112." Generally the types of products transported in Specification DOT 111 tank cars do not explode. The type of tank car referred by Mr. Jacobs was a DOT 112 pressure car similar to the DOT 105 but without insulation or jacketing.

Item 7 b. The vandalism referenced in the runaway train was to an "operating" train. The crew was at the controls and a transient interfered with the brake system while the train was operating on a descending grade. These were not unattended cars.

The Federal Railroad Administration will inspect the track of the Weyerhaeuser Woods Railroad at least 30 days prior to implementation of the solid waste shipments.

I appreciate your concern in this matter and if I can be any further assistance, please call.

Sincerely,

Chester Southern

Chester Southern
Regional Director

HLJ/hj

Jean Garber

8436 - 129th Pl. SE
Renton, WA 98056
(206) 277-9327

October 7, 1992

Gary Harder, Rail Carrier Plant Specialist
Washington Utilities and Transportation Commission
Chandler Plaza Building
1300 South Evergreen Park Drive SW
Olympia, WA 98504-7250

Dear Gary:

Thank you for talking with me on October 2, 1992 about Weyerhaeuser's proposal to transport leachate by rail from their proposed Headquarters Camp industrial solid waste landfill to the Longview Mill wastewater treatment plant.

As we discussed, one of the issues raised during the public comment period on the Draft Environmental Impact Statement (EIS) is the potential for a tank car to rupture in a derailment incident and spill leachate into one of the small creeks crossed by the rail line, or into the Cowlitz River. The purpose of this letter is to express my understanding of the information you provided relevant to this issue, and to request your written confirmation or correction.

My understanding of the information you provided is as follows:

1. Most train derailments result in little or no damage to rail cars.

2. Given that Weyerhaeuser proposes to use "105" type tank cars with shelf couplers, and to enforce a maximum speed limit of 12 mph, the probability of a tank car rupturing and spilling its contents in a derailment incident is extremely low. Although a puncture could theoretically happen, it would require a combination of improbable events.

3. Nationwide statistics on releases of hazardous materials from tank cars would overestimate the probability of occurrence of a leachate spill, because most of the historical incidents resulting in damage to tank cars have occurred at high speeds.

4. The probability of a spill from more than one tank car in the same incident is extremely remote. You cited an incident involving the high-speed (48 mph) derailment of three "105" type tank cars carrying butane gas. Although the head shield of one car was gashed by a coupler, there was no explosion of the damaged car and no damage to the other tank cars.

5. Safe rail operations, including the number of cars pulled per locomotive, will be key to the safe transport of solid waste and leachate. With the proposed 20 cars per train, the probability of pulling the train off the track on curves, as has happened in previous derailments on the Woods line, is remote.

I would appreciate a brief letter from you confirming that the above information is accurate, or pointing out any misunderstandings I may have. We are proceeding toward a review draft of the Final EIS, so a timely response from you would be most helpful.

Thank you again for your assistance.

Sincerely,

Jean Garber

Jean Garber
Consultant to Cowlitz-Wahkiakum Health District

Sharon L. Nelson, Chairman
Richard D. Casad, Commissioner
A. J. "Bud" Pardini, Commissioner

STATE OF WASHINGTON

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

1300 S. Evergreen Park Dr. S.W., P.O. Box 47250 • Olympia, Washington 98504-7250 • (206) 753-6423• (SCAN) 234-6423

RR3-6434

November 5, 1992

Jean Garber
8436 129th Pl. SE
Renton, WA 98056

Dear Mrs. Garber:

Your letter of October 7, 1992, which addressed your conversation with Gary Harder, closely reiterated what was discussed. However, we would suggest a clarification or addition to the sentence in item one, the words "slow speed" need to be inserted. Item one should read, "Most slow speed train derailments result in little or no damage to rail cars."

A search of our derailment accident files for the first three months of 1992 was conducted. This search revealed one reportable accident in February involving one car carrying hazardous materials, and one accident in March involving three cars carrying hazardous materials. Both derailments occurred in yards at slow speeds; no tanks were punctured and no hazardous materials were released. To clarify, a reportable accident is one that is required to be reported to the Federal Railroad Administration, and exceeds the threshold of $6,100.

The other four points accurately reflect the content of the phone conversation. If you have any further questions, please contact Gary Harder, Rail Carrier Compliance Specialist, at (206) 753-6434.

Sincerely,

Paul Curl

Paul Curl VE
Secretary

Weyerhaeuser

Corporate Headquarters
Tacoma, Washington 98477
Tel (206) 924 2345

October 19, 1992

Jean Garber
8436 - 129th Place Southeast
Renton, Washington 98056

Dear Ms. Garber:

You recently requested additional information on Weyerhaeuser's railroad operations. In addition several comments received on the Draft EIS raised the issue of multiple tank cars derailing and leaking. I have enclosed with this letter sample calculations for estimating the frequency of releases and a rail summary that supplements my March 25, 1991, memorandum. I believe this information and the information you have collected from the Federal Railroad Administration will allow you to respond to the issues raised by the public comments.

Please call if you have any questions or need additional information.

Sincerely,

Chris A Haynes

Chris A. Haynes

•RAIL SUMMARY

This summary is written to supplement my memo of March 25, 1991 (attachment no.1). That memo and the attachments to it documented the possibility of a rail accident that would result in a spill of leachate or solid waste. The Draft Plan of Operation, provided to you earlier, includes information on our cleanup response to a spill. I have reviewed the March 25 memorandum and more current information now available from the Federal Railroad Administration (FRA) and conclude that the estimate of one accident resulting in the release of leachate every two hundred years is still a good estimate. It is probably high, that is , accidents that result in a spill will occur less frequently than estimated. The primary reasons for this are: a) The type of tank car used for hauling the leachate and b) The low speed of the trains, less than 12 mph. I have found no evidence of a multiple car release accident and suggest that the worst case scenario of one complete car emptying it's contents is still valid. The remainder of this memorandum summarizes the information that is available on our rail operations.

Operations of both the Woods and Columbia Cowlitz railroads are governed by the rules shown in attachments 2-4. The FRA administers these regulations and inspects the Weyerhaeuser rail operations. Regulations used for car and track inspection are included as attachments 5 and 6 respectively. For the hauling of leachate Weyerhaeuser will use the safest cars available which are currently the "105" type of car. I have also attached an example inspection report for the Columbia and Cowlitz Railroad as attachment 7.

At the first indication that waste would be hauled by rail Weyerhaeuser started an ambitious effort to asses the condition of the railroad and upgrade any noted deficiencies. This effort is documented in attachment 8. As a result of that effort Weyerhaeuser has completed capital improvements totaling $2,000,000. This work is outlined in attachments 9-11, and consist of new rail ties , new rail, new ballast, and spiking and gage ties as needed. In addition to this capital improvement work the railroads are spending approximately 3.0 million dollars per year on maintenance. Operational improvements have also been made the most significant of which is speed control and walking inspection of the track.. Trains are now limited to 10-12 mph and that speed is enforced with regular use of a radar gun. The track is inspected once per week as documented in attachment 12.

The condition of the rail system is excellent as documented in the trip report prepared by Mr. Bob Carn of URS and dated September 1991 (attachment 13).

I have also reviewed more recent accident incident information than that which was available when I wrote my earlier memo. That information (attachment 14) shows that for a "105" type car my estimate of one leak in two hundred years is very overstated. An incident that results in a spill from a "105" type car is very unlikely (only 2 have occurred nation wide in the last 5 years).

Sample Calculations - Rail Accidents Involving Hazardous Materials

First, calculate the accident rate per million car miles of hazardous materials.

$$3489 \text{ accidents}^{1} \times \frac{1}{974{,}000{,}000 \text{ miles}^{2}} = 3.58 \text{ accidents / million car miles}$$

Second, calculate the accident rate that results in releases of hazardous materials.

$$84 \text{ releases}^{1} \times \frac{1}{974{,}000{,}000 \text{ miles}^{2}} = 0.086 \text{ releases / million car miles}$$

This same information is not available for Class II track and railroads, so I used information obtained by phone from Chris Barker, Association of American Railroads, March 21, 1991. Chris Barker said this information was somewhat dated but probably over estimated the current accident releases because of the improved equipment that is in use now. A comparison of the data available for all railroads with that from Chris Barker is shown below.

	Accident Rate (per million car miles)	Release Rate (per million car miles)
All Railroads	3.58	0.086
Class II [3]	1.84	0.368

I used the information from Chris Barker because it was more conservative, that is results in more releases per car mile. Calculations for leachate and solid waste releases are shown below.

Leachate:

680 cars per year x 17 miles = 11,560 car miles / year

$$11{,}560 \text{ car miles per year} \times \frac{1}{1{,}000{,}000} \times 0.368 \text{ releases per million miles} = 0.0043 \text{ releases per year}$$

or 1 release every 200 years.

Solid Waste:

4940 cars per year x 17 miles = 83,980 car miles per year

$$83{,}980 \text{ car miles per year} \times \frac{1}{1{,}000{,}000} \times 0.368 \text{ releases per million miles} = 0.03 \text{ releases per year}$$

or 1 release every 33 years.

As noted in my memorandum of March 25, 1991, these estimates probably overstate the frequency of releases from a leachate tank car and understate the releases of solid waste.

1Table 25, Page 39. Rail Accident Bulletin No. 158. 1989 data, published 1990.
2Obtained from Eric Wolf, Association of American Railroads, by phone March 21, 1991.
3Obtained from Chris Barker, Association of American Railroads, by phone March 21, 1991.

NOTE: Due to the volume of the attachments to the preceding Rail Summary, only the most relevant attachments or portions thereof are included in this document. All attachments are available for review at the Cowlitz-Wahkiakum Health District office at 1516 Hudson, Longview, Washington.

Attach no. 2

Interoffice Communication

Date March 25, 1991

From Chris Haynes CAH

Subject Rail Accident Summary

To Cal Palmer

As you know transportation of waste and leachate to and from the proposed Headquarters Camp landfill is being addressed in the EIS. Paul Whitney requested that some additional research be done to assess the possibility of a rail accident resulting in a release of leachate. This memo is written to document the results of the research. In addition I've talked to two consultants to assess their ability to provide additional information on the likelihood of an accident. I have used data on hazardous material (hazmat) for this analysis because no data exist for solid waste or leachate.

Recommendation and Conclusion

I recommend that we retain consultant services to inspect the Woods and the Columbia & Cowlitz Railroads to confirm that work previously identified has been completed. The consultant should also assess the ability of these rail operations to continue to maintain their lines and operational procedures to insure the safest possible operations.

The likelihood of a release of leachate to the environment is extremely low. Non-accident releases will be controlled by spill containment facilities at the loading and unloading areas. Accident-caused releases of leachate to the environment can be expected about once every 200 years. Solid waste accident-caused releases can be expected about once every 30 years. This assumes that:

* The rail lines are maintained at FRA Class II standards
* Rolling stock is also well maintained
* Operational practices are consistent with industry standards (car weight, speed, train configuration, ect.)

We will respond to any accident caused-releases according to the spill plan. Rapid and effective spill response will minimize any environmental effect of a leachate or solid waste spill. A spill

response plan will be a prepared for this facility to direct the spill response.

Background

The history and current operations of the Woods and the Columbia & Cowlitz Railroads are described in the attached reports. I've also attached some railroad industry information that I recieved from the Assocation of American Railroads that may be useful for the EIS.

Discussion

Rail accidents caused-releases and other releases of hazmat are caused by human factors, mechanical and electrical failures, track defects, and other uncertain causes. Most releases of hazmat are not the result of an accident.[1] They are typically small and caused by a valve or fitting failure or human error. These types of releases generally occur in the loading or unloading operations. Our proposed project will have spill containment around the areas where both these operations occur. Therefore releases of this type are sufficiently controled to prevent any adverse environmental impact.

Accident-caused releases are also generally small. In more than 60% of the accident related releases less than 20% of the car volume is released. Less than 20% of the time greater than 80% of the car volume is released.[2] In addition it is commonly accepted that rail transportation is safer than truck transportation although there is not agreement on how much safer it is.

It should also be noted that there are some differences in the data that I cannot explain. For example one source lists the number of cars of hazardous waste moved as 1,092,000, another as 1,523,774. There is a potential bias to the data that could understate the frequency of spills of solid waste and over state the frequency of spills of leachate. This bias is built in because the release data is for all forms of rail transportation (tank car and other) and tank cars are less likely to spill in an accident. I don't believe this bias is significant.

Rail accident causes and the causes of rail accidents involving environmentally sensitive material are shown in Table 1 "Accident Causes".

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[1]"Annual Report of Hazardous Materials Transported by Rail", Association of American Railroads, June 30, 1990.

[2]Barken, Chris; Association of American Railroads; phone conversation March 21, 1991.

Table 1
Accident Causes[3]

Factors	Rail Accidents %	Accidents Involving Hazmat %	Accidents Releasing Hazmat %
Human	32	20	20
Mechanical and Electrical	16	25	25
Track Defects	33	38	39
Other	19	17	16
Total	100	100	100

As easily seen from Table 1 all factors are important to consider to minimize accidents. We will need to insure continued operation and maintenance of both the Woods and Columbia & Cowlitz Railroads at or above the industry standard to limit the number of accidents to the predicted level.

Table 2 "Accident Caused Releases of Hazmat" presents data from 1989 on the frequency of releases to the environment.

Table 2
Accident Caused Releases of Hazmat

Track Class	Accidents	Accident Caused Releases	Car Miles X 1000	Accident Rate Per Million Car Miles	Release Rate Per Million Car Miles
All	3489	84	974,000[4]	3.58	0.086
Class II	----	----	----	1.84[5]	0.368

Table 3 presents the projected releases of solid waste and leachate from the proposed operations in Longview. I think it is better to use the Class II rail projections for our project. Although unpublished the Class II information more closely reflects our

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[3]"Accident/Incident Bulletin No. 158 Calendar Year 1989", U.S. Department of Transportation, June 1990.

[4]Wolf, Eric; Association of American Railroads; phone conversation March 21, 1991.

[5]Barken, Chris; Association of American Railroads; phone conversation March 21, 1991.

proposed project. The information for all track classes is donimated by the higher class tracks where mast of the mileage occures. Using the Class II projections there would be an estimated spill of solid waste 3 times every 100 years and a spill of leachate 1 time every 200 years.

Table 3
Projected Releases to the Environment

Track Class	Waste Type	Cars Per Year	Car Miles Per Year	Release Rate	Releases Per Year
All	Solid Waste	4940	83,980	0.086	0.0072
All	Leachate	680	11,560	0.086	0.001
Class II	Solid Waste	4940	83,980	0.368	0.03
Class II	Leachate	680	11,560	0.368	0.043

COLUMBIA & COWLITZ RAILROAD

HISTORY

The Columbia & Cowlitz Railroad was incorporated under the laws of the state of Washington on April 9, 1925. The Interstate Commerce Commission authorized operations May 8, 1926 in cowlitz County, Washington. The Columbia & Cowlitz Railway is a wholly owned subsidiary of Weyerhaeuser Company. This company's track spans from Columbia Junction, Washington to Ostrander Junction, Washington, approximately 8.2 miles, with connections involving the main lines, Union Pacific Railroad and Burlington Northern Railroad at Rock Point, Washington. This railroad also connects with Weyerhaeuser Woods Railroad at Ostrander. This short line railroad is a line-haul common carrier railroad with 15.19 miles of track, 8.2 miles of main line and 6.99 miles of yard and passage tracks. The main line consists of six major bridges (The largest bridge spans the Cowlitz River and is 2,801 feet long), and ten railroad crossings, eight of which are protected with automatic signals.

OPERATIONS

The Columbia & Cowlitz presently operates eleven engine assignments per week, two train crews run the locomotives twice daily to the Rocky Point Interchange for pick-up and delivery of rail cars to the Burlington Northern and Union Pacific. Two car men inspect the inbound and outbound cars daily, enforcing strict safety regulations.

The main purpose of the Columbia & Cowlitz railway is to supply Weyerhaeuser Mill with raw materials needed in the manufacturing of lumber and paper products and then to distribute, by rail car, the marketable products as required. It also performs all switching services for the Longview millsite, NORPAC, Paperboard, Chemicals, Hog Fuel, R-W, Interox and Brae Northwest car shop.

This railway employs 8 trainmen, 2 car inspectors, 1 track inspector, and 5 office staff.

Columbia & Cowlitz handles over 21,000 cars in and out over a one year period.

1989 Operating Statistics (number of cars)

Commodity	Outbound	Inbound
Coal	0	521
Sand	0	2
Starch	0	171
Lumber & Chips	598	3971
Pulp & Paper	2413	216
Chemicals	1389	384
Clay	1	216
Fab Metal Products	1	0
Transp. Equip. Mty.	0	0
Waste & Scrap Paper	0	151
Subtotal	4402	5732
Empties In & Out	11014	
Total Cars In & Out (Loads & Empties)	21048	

SAFETY RECORD

The Columbia & Cowlitz railway has had NO train derailments during its long history. The railroad is a class III FRA standards operation and is inspected by the FRA inspectors on a regular basis. Needless to say, any and all deviations from FRA standards are immediately corrected.

In addition to the FRA inspectors, the management on a periodic basis has retained other outside consultants to conduct an inspection of the operations, including inspection of existing track, bridges, sidings, culverts, road crossings and its rolling stock. Copies of the latest reports are attached.

Rail maintenance and rehabilitation expenditures over the next two years are estimated to $939,000, including 10% rail replacement, 8% cross tie and switch tie replacement, 80% of all joints tightened and 70% of all rail line to be surfaced.

WEYERHAEUSER LONGVIEW - WOODS RAILROAD

HISTORY

The Woods Railroad was started by Weyerhaeuser Timber Company on December 28, 1928. The Woods railroad operates as a logging railroad and connects with the Columbia & Cowlitz railway at Ostrander Junction.

The main purpose for the Woods railroad was to supply the large lumber mill at Longview with logs and other raw materials from its timber lands. The Timber Company owned engines, cars and logging equipment, and was in a position to transport logs and other forest products from the woods to its mill over the rail, without interfering with or endangering public service.

The Columbia & Cowlitz granted the Woods railroad the right to haul logs, poles, ties, pulpwood, lumber, other forest products and miscellaneous other materials with its own trains manned by its own crews, over C&C's trackage between Ostrander Junction and the Longview mill.

The Woods is a class II FRA regulated railroad with 22.5 miles of track in addition to approximately 7 miles of yard and passage tracks. The main line consists of 6 bridges, and 11 railroad crossings, none of which are protected with automatic signals, most of the crossings are on Weyerhaeuser property.

OPERATIONS

The Woods presently operates 2 trains per day; prior to the Mt. St. Helens eruption, it operated 5 trains per day on 3 shifts. It now has approximately 65 cars per train, average speed is 10-12 mph, and the maximum train length is 80 cars. The general operating hours are 8 a.m. from Green Mountain to Longview mill and 11:30 a.m. from the mill complex, back to Green Mountain; with a stop at Headquarters to pick up a log load, if necessary. All cars are interchangeable per FRA standards.

The estimated annual volumes are (number of cars):

Commodity	Annual	Monthly	Daily
Lumber	5,432	452	21
Chips	5,432	452	21
Hog Fuel	2,080	173	8
Logs	3,900	325	15
Total	**33,689**	**1,402**	**65**

SAFETY

The following is a summary of the safety problems that the Woods Railroad has experienced over the past years:

- 1979 through 1981 - no derailments
- 1982 through 1987 - 4 derailments - caused primarily by heavy hog fuel cars in wet weather, excessive speed, old equipment, conditions and some shifting of road bed due to extremely heavy rains for an extended period of time.
- 1988 through 1990 - 6 derailments - caused again by locomotive problems (age) and excessive wet weather (fill/slope instability), 1 due to overweight and 2 due to speed.

As a result of the above, a team of consultants was hired to perform a complete rail inspection and operational audit. Their recommendations were implemented in 1989, resulting in only one derailment since then (due to fill settling during a period of high rainfall). The recommendations implemented included:

- speed reduced to 10 mph maximum
- reduction of hog fuel car weights
- major track up-grade from the mill to Headquarters camp, including replacing most huck bolts, double spiking curves, replacement of worn ties, replacement of rail at some of the curves and adding ballast to the road bed. Considerable ditching work is also planned.

At the request of the Solid Waste project, SALM Construction Company, railroad safety and operations consultant were retained in May 1990 to update the past audit findings and review the progress that had been made during this time. This team of consultants completely walked-inspected both railroads (C&C and Woods) from the millsite to the proposed landfill site. Their findings and recommendations included making some rail repairs and upgrades, responding to specific erosion and slope stability issues and suggestions on possible equipment replacement.

Both C&C and Woods are/have responded to the consultants recommendations - C&C has nearly completed their rehabilitation work, they expect to be in complete compliance of FRA class II standards by end of 1990.

The Woods management is currently working on most of the recommendations listed for either upgrade or repair. Two major capital projects, a bridge repair and a track replacement/erosion control project are in the capital request phase - we expect the capital funding to be approved and the working started by first quarter 1991.

In addition to the above, and as a suggestion of the consultants, the Burlington Northern Railroad's Detector car was hired to provide an ultrasonic inspection of the C&C mainline track and the Woods line between Columbia Junction and Green Mountain. This inspection did not identify any new or unknown problem areas, it merely confirmed the prior inspectors findings and recommendations.

We expect to have the Woods railroad fully within the FRA class II standards by early 1991. The estimated rehabilitation costs for the next two years are in excess of $2.0 million. As a percentage of total Woods railroad, the two year program will replace 11% of the rail, 15% of cross ties, 5% switch tees, 7% replacement of all bolts, 32% of ballast and 30% of all rail will be surfaced and lined.

MAINTENANCE PROGRAM

A brief outline of maintenance programs is as follows:

Routine Track Maintenance

- Perform weekly track inspection from Columbia Junction to 503 yard with 3 inspectors looking for defects and repairs. Inspections are documented from Columbia Junction to Ostrander using FRA inspection sheets.
- Regular follow-up repairs on inspections and major track rebuild and repair with 12-man Weyerhaeuser crew.
- Presently working Columbia Junction to Ostrander replacing bolts, double spiking curves and replacing ties as needed.
- Spend approximately 600,000 annually on track and roadbed maintenance.

Loci Maintenance

- Regular 6-man crew performs maintenance on 9 Loci's
- Perform FRA documented inspection every 3 months
- Perform Weyerhaeuser Company Preventive Maintenance documented inspection every 6 weeks.
- Every Loci is inspected by mechanic each morning prior to leaving station and repair performed
- Train crew performs walking inspection on all cars before leaving Headquarters each day coming west
- Car knockers perform inspection before leaving Longview each day
- Rail car repair shop recently inspected and certified by AAR
- Most welders in our shop recently certified, meeting all AAR requirements

Source - Association of American Railroads National Ass...
Chris Barker 3/25/91

CATEGORY: RAILROAD ENVIRONMENTAL ISSUES

ISSUE: EMISSIONS

ATA ARGUMENT:[1] ATA states that motor carriers are subject to Environmental Protection Agency (EPA) fuel emission controls, but that railroads are not. ATA proposes that railroads be made subject to EPA regulations on emissions and fuel similar to those on heavy trucks and to any EPA regulatory fees therefor.[2]

THE FACTS: The new Clean Air Act provides for EPA regulation of railroad emissions, a result which the railroads supported.[3] But even without regulation, railroad locomotives emit far fewer pollutants per ton-mile than trucks do.[4] Trucks spew out about ten times as much hydro-carbons and particulate matter and almost three times as much carbon-monoxide and nitrous-oxide. It should also be noted that on a ton-mile basis, railroads consume only one-third the fuel consumed by motor carriers.[5]

ATM ⇒ American Trucking Assoc.

Source of this material
Assoc of American Railroads.

November 27, 1990

ENDNOTES

1. American Trucking Associations, Inc., A Program of Railroad Reform, undated draft [hereinafter ATA Program or Program].

2. Id. at 6.

3. Letter from William H. Dempsey, President, Association of American Railroads to John Dingell, Chairman, Committee on Energy and Commerce, U.S. House of Representatives, July 13, 1990 regarding S. 1630, Clean Air Restoration and Standards Attainment Act, §222, 101st Cong., 2d Sess. (1990).

4. The table below shows emissions per billion ton-miles for locomotives and heavy-duty diesel trucks. Although this comparison may favor the rail mode (a better comparison would be between rail and truck movements of competitive traffic, for which data are not presently available), the size of the difference strongly suggests that the rail mode is far less polluting.

LOCOMOTIVE VERSUS TRUCK EMISSIONS
(1984)

	Heavy-Duty Trucks	Locomotives	Truck/ Rail Ratio
	(tons of emissions per billion ton-miles)		
Hydro-carbons	321.4	33.2	9.7
Carbon-monoxide	921.6	330.5	2.8
Nitrogen-oxides	2836.7	961.7	2.9
Particulate matter	394.4	39.6	10.0

Revenue ton-miles for locomotives taken from Railroad Facts, 1986, Association of American Railroads,at 32. 1984 ton-miles for diesel trucks weighing 26,000 lbs. or more were derived by calculating 1982 ton-miles from 1982 Census of Transportation, Truck Inventory and Use Survey, U.S. Department of Commerce (1985) and inflating by the percentage growth in truck vehicle miles travelled (VMT) taken from Highway Statistics, 1982 and Highway Statistics, 1984, U.S. Department of Transportation (1983) and (1985). Emissions estimates taken from unpublished report to the U.S. Environmental Protection Agency, Feasibility and Cost-Effectiveness of Controlling Emissions from Diesel Engines in Rail, Marine, Construction, Farm, and Other Mobile Off-Highway Equipment, Table 9-2, prepared by Radian Corporation, EPA contract No. 68-01-7288 (February 1988). Only heavy-duty vehicle emissions were used.

5. Double Stack Versus Twin 48 Fuel Efficiency, Competitive Policy Reporter, Vol.I, No. 10, September 14, 1990, 2.

CATEGORY: RAILROAD ENVIRONMENTAL ISSUES

ISSUE: HAZARDOUS MATERIALS CLEAN-UP

ATA ARGUMENT:[1] ATA notes that motor carriers are responsible for environmental clean-ups and that the federal railroad hazmat program is underfunded and poorly enforced, with no contribution by the railroads. ATA suggests that the federal program should be enhanced and user fees established; states would be allowed to regulate and impose railroad user fees.[2]

THE FACTS: Cleanup of spills of hazardous substances are governed by numerous laws such as the Comprehensive Environmental Response, Cleanup, and Liability Act(Superfund),[3] Solid Waste Disposal Act(RCRA),[4] the Clean Water Act,[5] and other laws. Railroads and motor carriers are equally subject to and responsible under these laws. ATA states that motor carriers are dependent on the states to conduct clean-ups (thus necessitating the payment of fees). Railroads, on the other hand, conduct their own clean-ups, utilizing railroad personnel and retained clean-up experts. Obviously, no state clean-up contribution from the railroads is warranted when the railroad incurs its own costs.

ATA also states that the railroads should pay user fees for

hazmat programs. The federal budget for fiscal year 1991 provides that the railroads must pay to support the Federal Railroad Administration safety program, which includes the principal federal hazmat enforcement program.[6] The Federal Highway Administration safety program, similar in purpose and size to FRA's safety (and hazmat) program, continues to be funded by general revenues.

Finally, ATA suggests that the states be allowed to regulate movements of hazardous materials by rail. The Federal Railroad Safety Act incorporates the Congressional intent that the federal government shall have the primary role as overseer of railroad safety and hazmat transportation.[7] The states may regulate purely local situations and issue citations for violations of federal regulations, but additional involvement would be inconsistent with Congressional intention and the interstate nature of railroad operations.[8]

ENDNOTES

1. American Trucking Associations, Inc., A Program of Railroad Reform, undated draft [hereinafter ATA Program or Program].

2. Id. at 6.

3. 42 U.S.C. §9601 et seq. (1988).

4. 42 U.S.C. §6901 et seq. (1988).

5. 33 U.S.C. §1251 et seq. (1988).

6. H.R. 5835, Omnibus Budget Reconciliation Act of 1990, 101st Cong., 2d Sess. §10501 (1990).

7. 45 U.S.C. §431 et seq. (1988).

8. 45 U.S.C. §§434, 435. Rail transportation is largely interstate. Each haul averages 697 miles (per ton). Railroad Facts, 1989 Edition, 31, Association of American Railroads.

CATEGORY: RAILROAD SAFETY

ISSUE: MOVEMENTS OF HAZARDOUS MATERIALS

ATA ARGUMENT:[1] ATA notes that the movement of hazardous materials by motor carrier is regulated by federal and state government programs funded by highway user fees. ATA alleges that railroad transportation of hazardous materials is inadequately regulated and funded at both the federal and state levels, that single trains are improperly permitted to transport more than one class of hazardous materials, and that the railroads have resisted additional regulation in this area. ATA suggests that rail user fees be established to fund rail hazmat enforcement and that the states be authorized to enforce federal regulations. Finally, ATA proposes that trains carrying large quantities of hazardous materials be required to have cabooses.[2]

THE FACTS: The principal allegation by ATA regarding rail transportation of hazardous materials - that federal regulation and enforcement is inadequate - has absolutely no basis. Even the government watchdog, the General Accounting Office, believes that a reallocation of FRA inspection resources towards shipper facilities is in order since the greater risk of hazmat releases is not at railroad facilities but at the shipper facilities they serve.[3]

Railroad accident and injury rates from all operations including, but not limited to, transportation of hazardous materials have decreased significantly from the early 1980's.[4] For example, Federal Railroad Administration (FRA) statistics show that from 1980 through 1984, train accidents per million train miles averaged 8.4, while from 1985 through 1989, the average was only 5.08, a decrease of 37%.[5] Similarly, the number of employee injuries per 200,000 man-hours from 1980 to 1984 averaged 9.3, while the average in the last five years was 7.4, a 20% decrease.[6]

The statistics for rail transportation of hazardous materials are impressive when compared to the safety of transportation of hazardous materials by motor carriers. In 1987, railroads had 21.1 hazmat incidents involving tank cars per billion ton-miles, while for-hire tank trucks had 57.8, almost three times as many. In the same year, railroads had .6 hazmat-related injuries per billion ton-miles, while for-hire tank trucks had 8.9.[7]

ATA suggests that the states be permitted to enforce federal hazmat standards. This suggestion is inconsistent with the essentially interstate nature of railroad operations and Congress has so agreed. The Federal Railroad Safety Act establishes the primary role of the federal government as the overseer of railroad safety.[8] The states are permitted to regulate purely local situations and to issue citations for violations of federal regulations, but any additional involvement would constitute a

burden on interstate commerce.[9]

ATA suggests that the railroads be permitted to carry only one class of hazardous materials in a single train. No basis exists for such a suggestion. The Research and Special Programs Administration (RSPA) of the U.S. Department of Transportation has adopted regulations detailing requirements for the transportation of hazardous materials by rail, including the separation of hazardous materials in a rail car,[10] separation of rail cars containing certain hazardous materials,[11] prohibitions on the switching of cars containing certain hazardous materials,[12] and location in trains of cars containing certain hazardous materials.[13]

The ATA suggestion contains safety drawbacks. If no more than one class of hazardous materials could be hauled in a single train, there would either have to be many more trains in operation or, because costs would increase, traffic would be diverted to trucks. Either way, more vehicles would be in operation with an attendant increased risk of accidents to move the same traffic.

ATA also suggests that trains containing hazardous materials have cabooses. However, ATA offers no authority in support of the proposition that these very expensive additions would improve safety. Indeed, a three-year study comparing the accident rates of trains with and without cabooses revealed no statistically significant differences in train accident rates or accident

severity.[14] There is no FRA requirement for cabooses on any kind of freight train, since that agency has concluded that it "does not consider the lack of a caboose to be a safety issue per se".[15]

Finally, ATA alleges, without source identification, that the railroad industry has actively resisted hazmat regulation. In fact, railroads today are subject to substantial hazmat regulation, much of it of their own design.[16] Indeed, today the AAR continues to administer industry safety rules that are in addition to DOT rules.[17] The railroad industry has been concerned that federal regulation be pre-emptive to avoid the burden on interstate commerce that disparate state enforcement might impose. But once the industry was assured of preemption, the industry withdrew its prior objection to passage of legislation to amend the Hazardous Materials Transportation Act.[18]

ATA conveniently omits reference to the railroad industry's own initiatives in this area. Research conducted by the railroads has led to safety-related improvements in the components of freight cars, such as the heat-treated curved plate wheel which resists thermal and mechanical damage better than its predecessor.[19] The railroad industry also maintains its own research center, operated and paid for by the AAR, to improve rail safety.[20] Included in the work of the research center is the training of emergency personnel to cope with emergency situations.[21]

ENDNOTES

1. American Trucking Associations, Inc., A Program of Railroad Reform, undated draft [hereinafter ATA Program or Program].

2. Id. at 3.

3. Testimony of Kenneth M. Mead, Director, Transportation Issues, Resources, Community, and Economic Development Division, U.S. General Accounting Office, before the House Committee on Energy and Commerce, Subcommittee on Transportation and Hazardous Materials, 3 (November 7, 1989).

4. Federal Railroad Administration, Accident/Incident Bulletin, Calendar year 1980 to 1988 editions. FRA Bulletin for 1989 is not yet available, but data was obtained over the telephone in October, 1990 by A. Harvey of the Association of American Railroads from R. Finkelstein and S. Ellis of FRA's Office of Safety.

5. Id. at Table H6 for years 1980-1982 and Table 4 for years 1983-1989.

6. Id. at Table R10 for years 1980-1982 and Table 43 for years 1983-1989.

7. Rail ton-mile data are for railroad tank cars and are taken from Federal Railroad Administration and Association of American Railroads, 1987 Carload Waybill Sample Overview, Report TD-1, January 1989, STCC:49, Hazardous Mtls, p.2. Truck ton-mile data are for interstate for-hire tank trucks and are from AAR analysis of U.S. Department of Commerce, Bureau of the Census, 1987 Census of Transportation, Truck Inventory and Use Survey data base. Data tapes supplied by Bureau of the Census. The number of incidents and injuries for interstate for-hire tank trucks is taken from a computer printout from the U.S. Department of Transportation, Research and Special Programs Administration, Hazardous Materials Information System, sent to the Association of American Railroads on Nov. 5, 1990 (available in the office of the General Solicitor, Law Department, Association of American Railroads, 50 F Street, N.W., Washington, D.C. 20001). The number of railroad tank car incidents was supplied by Arthur D. Little, Inc., from Research and Special Programs data on railroad hazardous materials incidents. The number of injuries is for all railroad transportation of hazardous materials and is taken from Hazardous Materials Releases, a computer printout from the U.S. Department of Transportation, Research and Special Programs Administration, Hazardous Materials Information System, Oct. 9, 1990. The term "incident" is defined in 49 C.F.R. §§171.15 and 16 to mean any unintentional release of hazardous materials. Data for for-hire tank trucks is used because the Truck Inventory and Use Survey data base does not contain mileage data for

private interstate tank trucks or for interstate movements of hazardous materials by all trucks.

8. 45 U.S.C. §431 et seq.

9. A state may regulate local safety hazards pursuant to 45 U.S.C. §434 and may issue citations for violations of federal regulations pursuant to 45 U.S.C. §435. The interstate nature of rail operations is evidenced by the fact that the average haul per ton in 1988 was 697 miles. Railroad Facts, 1989, Association of American Railroads, 31.

10. 49 C.F.R. §174.81.

11. 49 C.F.R. §174.90 and 92.

12. 49 C.F.R. §174.83.

13. 49 C.F.R. §174.85, .86, .88, .89, .91, and .93.

14. See National Railway Labor Conference, The Caboose as an Influence on the Safety of Train Operations in Through Freight Service in the United States, at 4 and 7 (August 1987).

15. 51 Fed. Reg. 17300 at 301 (1986).

16. For example, 49 C.F.R. Part 179: Specifications for Tank Cars, originally appeared as a report to the former Master Car Builders' Association in 1903. The report was later adopted by the American Railway Association in 1925. The Interstate Commerce Commission adopted the specifications in 1927. They were then published as part of the Hazardous Materials Regulations after passage of the Department of Transportation Act in 1966. Association of American Railroads, Manual of Standards and Recommended Practices, Section C - Part III, Specifications for Tank Cars, at C-II-1.

17. For example, the industry recently endorsed a set of practices recommended by the Inter-Industry Task Force on the Safe Transportation of Hazardous Materials by Rail. This Task Force is composed of representatives of the railroad industry, the chemical industry, and railway supply companies. The Task Force recommendations on railroad operating practices addressed such areas as speed and passing restrictions on "key" trains and also required that such trains be equipped with roller bearings. The rules also include restrictions on the coupling of rail cars containing hazardous materials, minimum separation between mainline tracks and rail cars containing hazardous materials stored on rail lines, and employee training requirements. See testimony of William H. Dempsey, President, Association of American Railroads, before the U.S. House Committee on Energy and Commerce, Subcommittee on Transportation and Hazardous Materials (October 2, 1990).

18. Letter to Thomas A. Luken, Chairman, Subcommittee on Transportation and Hazardous Materials, House Committee on Energy and Commerce from William H. Dempsey, President, Association of American Railroads (October 25, 1990), re: S. 2936, 101st Cong., 2d Sess.

19. Stone, An Interpretative Review of Wheel Failure Performance With Respect to Design and Heat-Treatment, American Society of Mechanical Engineers, Proceedings of the 1988 Joint ASME/EEE Railroad Conference 43 (1988).

20. Testimony of William H. Dempsey, President, Association of American Railroads, before the House Committee on Energy and Commerce, Subcommittee on Transportation and Hazardous Materials, 7 (October 2, 1990).

21. Testimony of William H. Dempsey, President, Association of American Railroads, before the House Committee on Government Operations, Subcommittee on Government Activities and Transportation, 7 (February 28, 1990).

Attachment 12

INTEROFFICE COMMUNICATION

Weyerhaeuser

Date: September 24, 1992

From: A. Macs

Location: CC II-102

Subject: RAIL INSPECTION - WOODS RAILROAD

To: Cal Palmer

On August 25, I met Ray Weine (Headquarters section chief) at Headquarters Camp and proceeded to inspect part of the rail, with his two "walking inspectors". The "walking inspectors" are a direct result of our last problem/derailment we had in July.

Gary Sweet has identified two of his section guys to walk the rail - one starting at Rocky Point and the other goes Headquarters to Green Mountain Mill.

The two inspectors started at Headquarters, one heading towards Rocky Point, while the other goes towards Green Mt. Mill. They have a "bag of tools" with them, see attached, and they inspect segments of the track daily...an eight hour days work during the week will get them to Rocky Point and Green Mountain Mill by Friday of that week.

The inspectors check track gauge, spikes, buck bolts and loose/old ties. They also look at ballast needs.

If the problem can be fixed, the two will do so "on the spot". If not, a message is sent to the maintenance section crew to schedule the work ASAP. The problem areas are indicated by yellow spray paint.

All in all, a very good effort to keep on top of things...it should have been done "without the July derailment". In general, however, the track is in excellent shape, from Headquarters to Rocky Point.

C&C also has a walking inspector, spending all his time on the same sort of workday/works Rocky Point to Mill site and back. The track here also is in good shape!

Let's discuss!

cc: ISWM Team

Attachment 14 part 2

U.S. Department of Transportation
Federal Railroad Administration
Office of Safety

Accident/Incident Bulletin

No. 160

Calendar Year 1991

July 1992



4. ACCIDENTS INVOLVING CONSISTS TRANSPORTING HAZARDOUS MATERIALS

The information in this section represents only those accidents involving consists that contained at least one car carrying hazardous materials. The number of accidents, resulting damages, or casualties may or may not be attributable to the presence of these cars in the consists. While this does not represent a complete accounting of all hazardous materials releases, it does provide some insight into the extent of hazardous materials car involvement in train accidents.

TABLE 25. TRAIN ACCIDENTS INVOLVING HAZARDOUS MATERIALS

Type Of Accident	Consists Carrying	Cars: In Consist	Cars: Containing Hazmat	Cars: Damaged W/Hazmat	Cars: Releasing Hazmat	People Evacuated	Damage To Equipment
Derailment	396	27,111	3,221	634	71	6,017	35,394,334
Head on collision	5	397	123	10	5	12	4,118,112
Rear end collision	2	222	40	1	---	---	35,120
Side collision	47	2,282	316	40	4	---	1,811,317
Raking collision	10	314	29	8	---	---	3,629,937
Broken train collision	2	297	61	---	---	---	123,000
Hwy-rail crossing	19	1,424	102	6	1	230	1,669,776
RR grade crossing	---	---	---	---	---	---	---
Obstruction	7	443	27	---	---	---	413,510
Explosion-detonation	---	---	---	---	---	---	---
Fire or violent rupture	2	187	12	---	---	---	19,200
Other	55	2,351	234	52	3	200	2,117,987
Total	545	35,028	4,165	751	84	6,459	49,332,293

TABLE 26. TRAIN ACCIDENTS INVOLVING CONSISTS TRANSPORTING HAZARDOUS MATERIALS

Year	Total Number Of Accidents	Accidents In Which A Hazmat Car Was Damaged Or Derailed	Accidents In Which There Was A Release of Hazardous Materials	Accidents Which Resulted In Evacuation
1986	364	185	51	32
1987	352	186	50	28
1988	475	237	44	32
1989	517	251	55	28
1990	466	236	35	20
1991	525	293	47	28

— Attachment 19 Part 3

09/21/1992

U.S. DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS INCIDENTS
(BY YEAR AND MODE)

INCIDENTS INVOLVING ACCIDENTS

INCIDENTS BY MODE AND INCIDENT YEAR

MODE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTAL
AIR	0	1	1	0	1	0	0	0	0	0	3
HIGHWAY	314	269	271	302	297	251	261	273	246	247	2731
RAILWAY	67	59	59	61	62	65	75	67	48	54	617
WATER	0	0	0	0	0	0	0	0	0	0	0
FREIGHT FOWARDER	0	0	1	1	2	0	0	2	0	0	6
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	381	329	332	364	362	316	336	342	294	301	3357

DEATHS BY MODE AND INCIDENT YEAR

MODE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTAL
AIR	0	0	0	0	0	0	0	0	0	0	0
HIGHWAY	11	5	4	7	14	9	14	8	7	10	89
RAILWAY	0	0	0	0	1	0	0	0	0	0	1
WATER	0	0	0	0	0	0	0	0	0	0	0
FREIGHT FOWARDER	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	11	5	4	7	15	9	14	8	7	10	90

INJURIES BY MODE AND INCIDENT YEAR

MODE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTAL
AIR	0	0	0	0	0	0	0	0	0	0	0
HIGHWAY	19	6	11	9	12	21	30	15	9	27	159
RAILWAY	6	0	23	7	3	5	5	3	9	13	74
WATER	0	0	0	0	0	0	0	0	0	0	0
FREIGHT FOWARDER	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	25	6	34	16	15	26	35	18	18	40	233

DAMAGES BY MODE AND INCIDENT YEAR

MODE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTAL
AIR	0	0	40	0	10000	0	0	0	0	0	10040
HIGHWAY	8223728	5504000	7301116	10174834	9577064	11589060	12894308	11978822	14044962	23901303	115189197
RAILWAY	1053805	798926	2868690	10093567	2911967	7085160	1910288	9078833	10659969	6231038	52692243
WATER	0	0	0	0	0	0	0	0	0	0	0
FREIGHT FOWARDER	0	0	993	50	88000	0	0	5000	0	0	94043
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	9277533	6302926	10170839	20268451	12587031	18674220	14804596	21062655	24704931	30132341	167985523

TABLE 27. TRAIN ACCIDENTS INVOLVING HAZARDOUS MATERIALS BY CAUSE

Cause	Consists Carrying	Cars: In Consist	Cars: Containing Hazmat	Cars: Damaged W/Hazmat	Cars: Releasing Hazmat	People Evacuated	Damage To Equipment
TRACK, ROADBED AND STRUCTURES							
Roadbed defects	7	237	25	10	1	---	1,586,588
Track geometry defects	73	4,818	683	131	5	995	3,933,366
Rail and joint bar defects	46	2,970	408	127	16	50	4,613,764
Frogs, switches and track appliances	51	3,281	383	67	2	50	1,561,945
Other way and structure	1	74	1	1	---	---	5,800
Signal and communication failures	6	314	56	3	---	---	210,900
Subtotal.....	184	11,694	1,556	339	24	1,095	11,912,363
MECHANICAL AND ELECTRICAL FAILURES							
Brakes	10	793	53	7	5	815	1,238,586
Trailer or container on flat car	1	30	1	---	---	---	14,500
Body	5	344	12	2	---	---	422,276
Coupler and draft system	20	1,804	146	10	1	---	1,170,071
Truck components	22	1,509	280	39	5	600	1,520,281
Axles and journal bearings	20	1,508	203	50	19	525	4,307,221
Wheels	15	1,214	136	16	4	212	3,213,277
Locomotives	2	193	10	---	---	---	90,800
Doors	1	77	1	1	---	---	177,650
General mechanical and electrical failures	---	---	---	---	---	---	---
Subtotal.....	96	7,472	842	125	34	2,152	12,154,662
TRAIN OPERATION - HUMAN FACTORS							
Brakes, use of	46	2,211	202	61	9	16	4,838,523
Employee physical condition	2	135	4	---	---	---	3,379,387
Flagging, fixed, hand and radio signals	3	221	100	5	2	12	453,162
Other rules and instructions	50	2,207	334	52	4	200	4,048,766
Speed	12	813	66	13	---	---	326,353
Switches, use of	18	1,145	125	13	---	30	213,390
Miscellaneous	41	2,966	364	43	4	---	1,185,911
Subtotal.....	172	9,698	1,195	187	19	258	14,445,492
MISCELLANEOUS FACTORS							
Collision with highway user at crossing site	19	1,424	102	6	1	230	1,669,776
Emergency brake application to avoid accident	2	299	20	2	---	---	108,500
Vandalism	15	888	75	11	---	4	3,807,441
Interference with rr operation, not vandals	2	137	11	3	---	2,300	639,686
Load shifted	5	402	13	3	---	100	416,138
Load fell from car	1	55	21	5	1	---	176,700
Overloaded car	1	30	1	1	---	---	11,680
Improperly loaded car	3	130	40	1	---	---	137,700
Oversized load, misrouted	---	---	---	---	---	---	---
Object on or fouling track	6	415	25	1	1	---	635,500
Equipment on or fouling track	---	---	---	---	---	---	---
Trail/contain tiedown eqp impr applied	---	---	---	---	---	---	---
Overload/improper loaded container etc.	---	---	---	---	---	---	---
Interaction of lateral/vertical forces	20	1,325	204	40	3	---	1,408,450
Failure to control car spd with hand brk	---	---	---	---	---	---	---
Snow, ice, or mud on track	1	9	1	---	---	---	8,122
Other acts of God	2	128	5	1	---	---	1,022,920
Fire, not due to vandalism	---	---	---	---	---	---	---
Hump retarder failed to slow car	7	116	7	6	---	---	135,100
Switch fouled by lading chains, etc.	---	---	---	---	---	---	---
Other causes	9	806	47	20	1	320	642,063
Subtotal.....	93	6,164	572	100	7	2,954	10,819,776
GRAND TOTAL.....	545	35,028	4,165	751	84	6,459	49,332,293

Attachment 14 part C

REPORT_NUMBER	DATE_OF_INCIDENT	CARRIER_NAME	ESTIMATED_SPEED
89110472	10/12/1989	SPRINGFIELD TERMINAL	10
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90020464	01/08/1990	UNION PACIFIC RAILROAD CO	52
90040054	02/17/1990	BURLINGTON NORTHERN RR CO	54
90040456	03/17/1990	CSX TRANSPORTATION	45
90040487	02/09/1990	UNION PACIFIC RAILROAD CO	43
90040487	02/09/1990	UNION PACIFIC RAILROAD CO	43
90040526	12/12/1989	TENNESSEE SOUTHERN RAILROAD	10
90040644	03/15/1990	UNION PACIFIC RAILROAD CO	5
90040650	02/02/1990	UNION PACIFIC RAILROAD CO	5
90040691	04/19/1990	ILLINOIS CENTRAL GULF RAILROAD	4
90040725	04/20/1990	SOUTHERN RAILWAY SYSTEM	47
90040725	04/20/1990	SOUTHERN RAILWAY SYSTEM	47
90050077	04/28/1990	CSX TRANSPORTATION	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90050650	04/22/1990	BUFFALO & PITTSBURGH RAILROAD	20
90060190	05/07/1990	CSX TRANSPORTATION	5
90060359	03/19/1990	UNION PACIFIC RAILROAD CO	50
90070157	06/16/1990	SOUTHERN PACIFIC TRANSP CO	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070205	05/28/1990	ALASKA RAILROAD	35
90070846	07/23/1990	SOUTHERN RAILWAY SYSTEM	2
90070847	07/23/1990	SOUTHERN RAILWAY SYSTEM	2
90070891	07/08/1990	PORT TERMINAL RAILROAD ASSN	10
90080404	07/19/1990	CONSOLIDATED RAIL CORP	6
90080483	07/13/1990	CSX TRANSPORTATION	5
90080972	07/17/1990	BURLINGTON NORTHERN RR CO	20

90100295	09/12/1990	SOUTHRAIL CORP	6
90100757	10/09/1990	SOUTHERN RAILWAY SYSTEM	4
90101123	09/15/1990	BURLINGTON NORTHERN RR CO	45
90101123	09/15/1990	BURLINGTON NORTHERN RR CO	45
90101173	01/06/1987	COPPER BASIN RAILWAY INC	15
90101173	01/06/1987	COPPER BASIN RAILWAY INC	15
90101177	08/07/1989	BURLINGTON NORTHERN RR CO	45
90101179	01/27/1989	SOUTHERN PACIFIC TRANSP CO	5
90101180	12/09/1987	SOUTHERN PACIFIC TRANSP CO	55
90110121	09/17/1990	UNION PACIFIC RAILROAD CO	22
90110347	10/02/1990	BURLINGTON NORTHERN RR CO	2
90110457	10/22/1990	CONSOLIDATED RAIL CORP	4
90110500	10/11/1990	CSX TRANSPORTATION	25
90110500	10/11/1990	CSX TRANSPORTATION	25
90110500	10/11/1990	CSX TRANSPORTATION	25
90110500	10/11/1990	CSX TRANSPORTATION	25
90110500	10/11/1990	CSX TRANSPORTATION	25
90110500	10/11/1990	CSX TRANSPORTATION	25
90110521	10/19/1990	CSX TRANSPORTATION	35
90110521	10/19/1990	CSX TRANSPORTATION	35
90110523	10/15/1990	CSX TRANSPORTATION	58
90110523	10/15/1990	CSX TRANSPORTATION	58
90110638	09/17/1990	UNION PACIFIC RAILROAD CO	22
90110638	09/17/1990	UNION PACIFIC RAILROAD CO	22
90110638	09/17/1990	UNION PACIFIC RAILROAD CO	22
90110638	09/17/1990	UNION PACIFIC RAILROAD CO	22
90120594	11/13/1990	UNION PACIFIC RAILROAD CO	15
91010472	12/22/1990	UNION PACIFIC RAILROAD CO	5
91010558	01/12/1991	UNION PACIFIC RAILROAD CO	44
91020187	01/02/1991	BURLINGTON NORTHERN RR CO	49
91020258	12/29/1990	UNION PACIFIC RAILROAD CO	20
91020293	01/14/1991	CSX TRANSPORTATION	8
91030217	02/09/1991	ILLINOIS CENTRAL GULF RAILROAD	12
91040026	02/27/1991	CONSOLIDATED RAIL CORP	10
91040302	03/19/1991	SOUTHERN PACIFIC TRANSP CO	40
91040328	03/22/1991	UNION PACIFIC RAILROAD CO	5
91040621	04/05/1991	CONSOLIDATED RAIL CORP	3
91040678	04/01/1991	UNION PACIFIC RAILROAD CO	38
91040703	03/29/1991	BURLINGTON NORTHERN RR CO	47
91040703	03/29/1991	BURLINGTON NORTHERN RR CO	47
91040703	03/29/1991	BURLINGTON NORTHERN RR CO	47
91040703	03/29/1991	BURLINGTON NORTHERN RR CO	47
91040765	02/20/1991	UNION PACIFIC RAILROAD CO	50
91040765	02/20/1991	UNION PACIFIC RAILROAD CO	50
91050293	05/04/1991	ILLINOIS CENTRAL GULF RAILROAD	8
91050490	04/12/1991	UNION PACIFIC RAILROAD CO	29
91050490	04/12/1991	UNION PACIFIC RAILROAD CO	29
91050490	04/12/1991	UNION PACIFIC RAILROAD CO	29
91050584	05/12/1991	WISCONSIN CENTRAL LTD	5
91060006	05/18/1991	NORFOLK & WESTERN RAILWAY CO	5
91060844	11/26/1990	ATCHISON TOPEKA & SANTA FE RY	43
91060844	11/26/1990	ATCHISON TOPEKA & SANTA FE RY	43
91070252	05/26/1991	BURLINGTON NORTHERN RR CO	42
91070362	05/06/1991	BURLINGTON NORTHERN RR CO	3
91070452	06/23/1991	UNION PACIFIC RAILROAD CO	40
91070453	07/01/1991	UNION PACIFIC RAILROAD CO	5
91070489	06/05/1991	CSX TRANSPORTATION	45
91070489	06/05/1991	CSX TRANSPORTATION	45
91070490	06/12/1991	CSX TRANSPORTATION	50
91070740	07/14/1991	UNION PACIFIC RAILROAD CO	40

91080654	07/30/1991	BURLINGTON NORTHERN RR CO	20
91080654	07/30/1991	BURLINGTON NORTHERN RR CO	20
91080654	07/30/1991	BURLINGTON NORTHERN RR CO	20
91080782	08/18/1991	TERMINAL RAILROAD ASSOCIATION	7
91081080	07/28/1991	SOUTHERN PACIFIC TRANSP CO	56
91090251	07/17/1991	CHICAGO CENTRAL & PACIFIC RR	5
91090290	03/16/1991	UNION PACIFIC RAILROAD CO	4
91090451	07/08/1991	BURLINGTON NORTHERN RR CO	4
91090689	08/25/1991	UNION PACIFIC RAILROAD CO	27
91090739	08/28/1991	BURLINGTON NORTHERN RR CO	45
91090739	08/28/1991	BURLINGTON NORTHERN RR CO	45
91090739	08/28/1991	BURLINGTON NORTHERN RR CO	45
91090739	08/28/1991	BURLINGTON NORTHERN RR CO	45
91100408	09/22/1991	UNION PACIFIC RAILROAD CO	18
91110479	10/21/1991	UNION PACIFIC RAILROAD CO	5
91110560	10/27/1991	CSX TRANSPORTATION	36
91110726	01/12/1991	UNION PACIFIC RAILROAD CO	44
92010349	12/28/1991	CONSOLIDATED RAIL CORP	3
92010436	12/23/1991	BURLINGTON NORTHERN RR CO	37
92010569	12/20/1991	CSX TRANSPORTATION	27
92010569	12/20/1991	CSX TRANSPORTATION	27
92010569	12/20/1991	CSX TRANSPORTATION	27
92030462	12/30/1991	GATEWAY WESTERN RAILWAY	27

Attachment 14 part D

U.S. DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS SAFETY
HAZARDOUS MATERIALS INFORMATION SYSTEM

ACCIDENTS INVOLVING 105 SERIES TANK CARS -- 1987 - 1991

CARRIER / SHIPPER / CONTAINER-1 FAILURE CODES	INCIDENT LOCATION / SHIPMENT ORIGIN	DATE / MODE D E	COMMODITY NAME & CLASS / CONT-1 CONT-2 CAPACITY / CONTAINER-2 FAILURE CODES	MJ-INJ-MN SHIPD FAILD	DEAD AMT	RESULTS RELEASE	$DAMAGES / REPORT # / CONT-3?
DELAWARE & HUDSON RAILWAY CO PETROMONT INC 1,4,26,45	TAYLOR, PA VARENNES,PQCN, ZZ	01/07/87 R *	METHYLACETELYNE F. G. 105AW NONE 11090.00 GAL NO CONTAINER-2	0 0 1 1	0 0.00	S	$0 87010193A NO
CSX TRANSPORTATION CARDOX DIV CHEMTRON 1,2	PRAIRIE JUNCTION, FL DONALDSONVILLE, LA	06/28/88 R *	CARBON DIOXIDE NONF.G. 105AW NONE 0.00 NO CONTAINER-2	0 0 1 1	0 6.69	S CFT	$0 88070039A NO
CONSOLIDATED RAIL CORP LIQUID CARBONICS CORP 1,30	SELKIRK, NY HOPEWELL, VA	07/15/88 R *	CO2 LIQUIFIED NONF.G. 105AW NONE 13340.00 GAL NO CONTAINER-2	0 0 1 1	0 12.50	S GAL	$50 88080096A NO
CSX TRANSPORTATION VIRGINIA CHEMICALS INC 15,26,30,45,46	ATHENS, AL LEEDS, SC	08/13/88 R * #	SULFUR DIOXIDE NONF.G. 105AW NONE 0.00 NO CONTAINER-2	0 0 1 1	0 0.12	SV GAL	$0 88100053A NO
CSX TRANSPORTATION VIRGINIA CHEMICALS INC 15,26,30,45,46	ATHENS, AL LEEDS, SC	08/13/88 R * #	SULFUR DIOXIDE NONF.G. 105AW NONE 0.00 NO CONTAINER-2	0 0 1 1	0 0.12	SV GAL	$0 88100053B NO
CSX TRANSPORTATION MARYSVILLE UNDERGROUND 1,13	AKRON, OH MARYSVILLE, MI	02/26/89 R * #	LP GAS F. G. 105AW NONE 0.00 NO CONTAINER-2	0 0 1 1	0 10121.00	F GAL	$0 89030279A NO
CONSOLIDATED RAIL CORP OCCIDENTAL CHEMICAL CO 1	RUTHERFORD, PA REYBOLD, DE	07/14/89 R *	CARBON DIOXIDE REFR NONF.G. 105AW NONE 20104.00 GAL NO CONTAINER-2	0 0 1 1	0 3.00	SV GAL	$1500 89070693B NO
CSX TRANSPORTATION DOW CORNING CORP 1,13	FREELAND, MI CARROLLTON, KY	07/22/89 R *	FLAMMABLE LIQUID N. F. L. 105AW NONE 0.00 NO CONTAINER-2	0 0 1 1	0 20300.00	F GAL	$0 89080235B NO
UNION PACIFIC RAILROAD CO SHELL CHEMICAL CO 2,18,27,35,43,51	ST LOUIS, MO NORTH SEADRIFT, TX	07/01/91 R * #	PROPYLENE F. G. 105 NONE 33433.00 GAL NO CONTAINER-2	0 0 1 1	0 0.00	SON	$80200 91070453A NO
UNION PACIFIC RAILROAD CO PIONEER CHLORALKALI CO INC 7,27,35,43,51	HENDERSON, NV HENDERSON, NV	07/20/91 R *	CHLORINE POI GAS 105AW NONE 17369.00 GAL NO CONTAINER-2	0 0 1 1	0 0.00	SV	$0 92050652A NO

Appendix K

Fish Community Analysis

Headquarters Camp
Solid Waste Disposal Facility

Fish Community Analysis

Project No. 73306

Prepared for:

Weyerhaeuser Company

July 1992

Prepared by:

Beak Consultants Incorporated
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Paul H. Whitney, Project Manager

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Project Task: Weyerhaeuser Solid Waste Facility
Fish Community Analysis
BEAK Project No. 73306

Date: September 18, 1992

Date of Survey: 7/8 - 7/9/1992

Personnel: Robert Ellis, Andrew Gude, Jonathan Adkins

Introduction:

The National Marine Fishery Service (NMFS) review of the 404 Permit Application (letter from Merrit Tuttle to Walter Cunningham, May 21, 1992) included a recommendation that a fish survey be conducted in the Southern Tributary and Sucker Creek. The purpose of the survey was to determine the current fish use above and below a culvert (under #1310 road) on the Southern Tributary that was recently replaced and upgraded.

Methods:

Several sections of Sucker Creek and the Southern Tributary were sampled. One pass was made with a backpack electrofisher through each of the sections sampled. All individuals captured were identified to the species level and fork lengths were taken. All fish were released alive except for five specimens that were retained to verify field identifications. Capture location, species and fork length data were collected for salmonid species. Other species (salamanders, lamprey) were recorded as incidental observations.

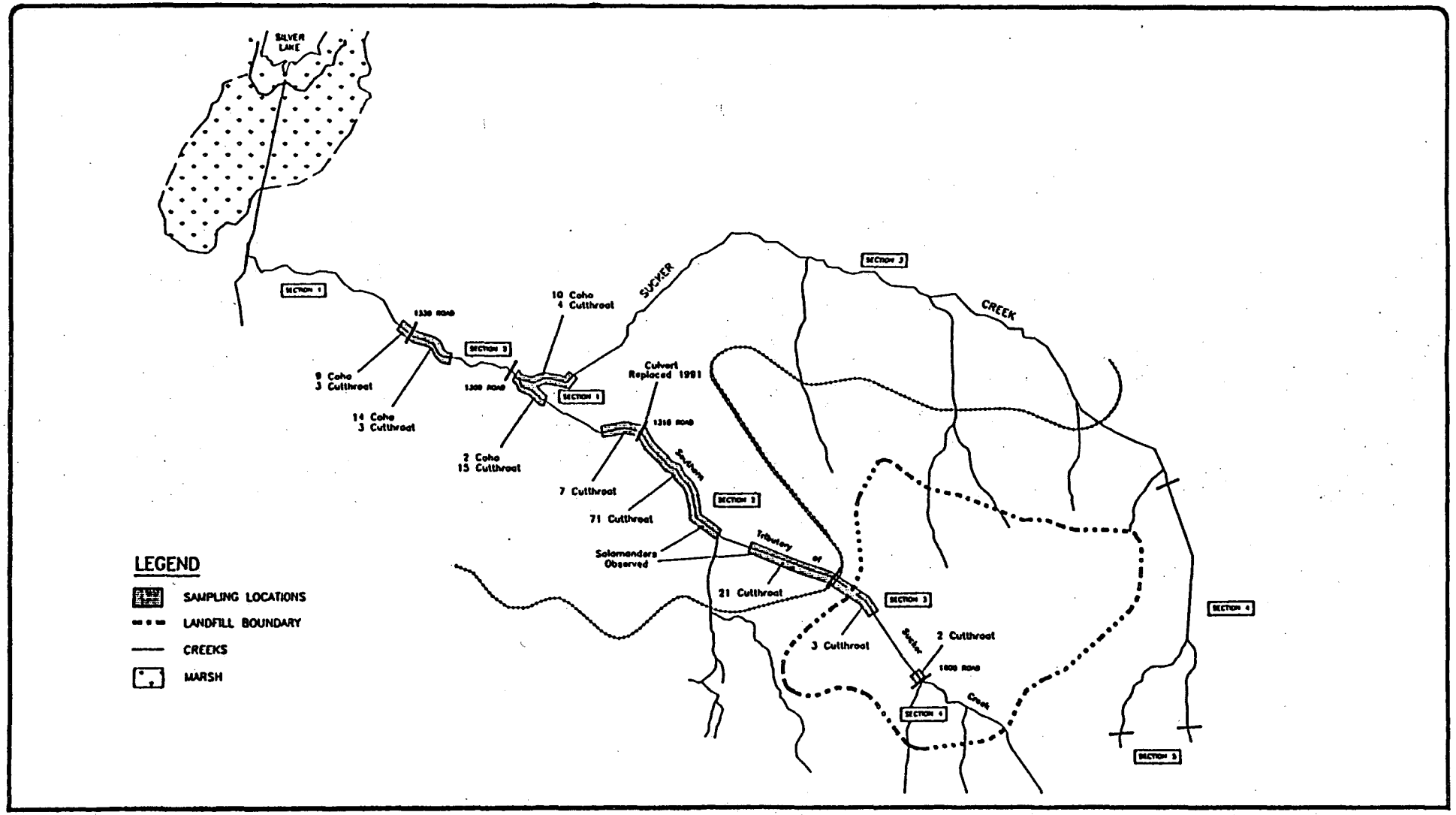
Results:

The results will be presented in order, from Section 1 to Section 3 of Sucker Creek, and Section 1 to Section 3 of the Southern Tributary (Figure 1). The pool directly below the culvert under #1330 road (Section 1 of Sucker Creek) was electrofished for 30 seconds. Nine coho salmon (Oncorhynchus kisutch) (55mm - 72mm) and three cutthroat trout (Salmo clarkii) (101 mm - 135mm) were captured.

Section 2 of Sucker Creek, 1200 feet of the stream above the #1330 road culvert, was electrofished for 102 seconds. Fourteen coho (52mm - 67mm) and three cutthroat trout (47 mm - 140mm) were captured. Sucker Creek was electrofished from the confluence with the Southern Tributary (Section 3) to 600 feet upstream for 149 seconds. Ten coho (55mm - 75mm) and four cutthroat (50mm - 128mm) were captured.

The Southern Tributary, from the confluence with Sucker Creek, 300 feet upstream to the second beaver pond (Section 1) was electrofished for 261 seconds. Two coho (66mm and 71mm) and fifteen cutthroat (52mm - 132mm) were captured. Two adult western brook lamprey (Lampetra richardsoni) were recorded as incidental observations in the first beaver pond. Also in Section 1 of the Southern Tributary, a 400 foot section downstream of the #1310 road culvert was electrofished for 152 seconds. Seven cutthroat (43mm - 155mm) were captured.

Section 2, above the #1310 road culvert to the first small tributary that empties into the Southern Tributary (approximately 2200 feet) was electrofished for 1240 seconds. Seventy-one



Location of fish sampling sites with number and species captured.

FIGURE NO. 1

WEYERHAEUSER
S.W. WASHINGTON
SOLID WASTE FACILITY

cutthroat (30mm - 202mm) were captured. One salamander of unknown species was captured and several others were observed in this section. The 1800 foot stretch of the Southern Tributary directly below the railroad crossing was electrofished for 381 seconds. Twenty-one cutthroat (40mm - 152mm) were captured. Eight salamanders were recorded as incidental observations in this sampling area.

Section 3 of the Southern Tributary, from the railroad crossing to approximately 800 feet upstream was electrofished for 127 seconds. Three cutthroat trout (91mm - 150mm) were captured. Five salamanders were observed in this sampling area. The pool just below the #1600 road culvert was electrofished for 15 seconds and yielded two cutthroat trout that were not measured.

Discussion

The primary objective of this survey was to determine the relative abundance of anadromous salmonids, particularly coho salmon above and below a new culvert under the #1310 road. At the time of the previous survey in 1990, the culvert at the #1310 road crossing presented a barrier to upstream migration and was scheduled to be replaced in 1991. The culvert has been replaced and no longer prevents upstream migration of fish. Small, probably young of the year, coho salmon were found in the Southern Tributary just above the confluence with Sucker Creek. This suggests that spawning has occurred, since there has been no stocking of coho into this system in the last two years (WDW, pers. comm. 30 June 1992). No coho were found above the new culvert. It is possible that habitat was either not suitable above the culvert or that the beaver ponds in the lower Southern Tributary are a barrier to coho upstream movement.

Instream habitat characteristics did not differ substantially from those described in the 1990 survey. Riparian vegetation did seem to have become more dense since the 1990 survey.

During the course of electrofishing the Southern Tributary, five salamanders of undetermined species were captured. It is estimated that an additional 10 to 15 salamanders eluded capture but were seen fleeing the electrical current. Most incidental observations of salamanders occurred in the upper portion of Section 2 and the lower portion of Section 3 of the Southern Tributary. Escapement was high, due in large part, to the high habitat complexity.

A comparison of length data for cutthroat trout was made to determine if there was any obvious difference in the length frequency distributions of trout measured during the 1990 survey and trout captured during the 1992 survey. There was no obvious difference in the length frequency distributions between the two sets of data.

References:

Washington Department of Wildlife. 30 June 1992. Personal communication. Telephone conversation between Katie Campbell for Lee Van Tussenbrook (Area Biologist) and Jon Adkins (Beak Consultants).

National Marine Fisheries Service. 21 May 1992. Letter from Brian J. Brown to Walter J. Cunningham (Army Corps of Engineers).

RAW DATA
July 1991 Electrofishing Survey

Sucker Creek - Section 1
Pool below culvert at #1330 road Crossing of Sucker Creek below confluence.
Sampling distance: 20 feet
Electrofishing time: 30 seconds

Species	Length (mm)
Coho	72
Coho	62
Coho	66
Coho	65
Coho	55
Coho	56
Coho	56
Coho	58
Coho	70
CT	135
CT	118
CT	101

RAW DATA
July 1991 Electrofishing Survey

Sucker Creek - Section 2
Section above #1330 road crossing of Sucker Creek, below confluence with Southern Tributary.
Sampling distance: 1200 feet
Electrofishing time: 102 seconds

Species	Length (mm)
Coho	60
Coho	67
Coho	55
Coho	63
Coho	55
Coho	63
Coho	52
Coho	55
Coho	67
Coho	56
Coho	62
Coho	55
Coho	65
Coho	52
CT	140
CT	102
CT	47

RAW DATA
July 1991 Electrofishing Survey

Sucker Creek - Section 3
From the confluence with Southern Tributary to 600 feet upstream
Sampling distance: 600 feet
Electrofishing time: 149 seconds

Species	Length (mm)
Coho	64
Coho	59
Coho	67
Coho	65
Coho	68
Coho	56
Coho	55
Coho	75
Coho	70
Coho	59
CT	118
CT	128
CT	50
CT	64

RAW DATA
July 1991 Electrofishing Survey

Southern Tributary - Section 1
Southern Tributary from confluence up to second beaver pond.
Sampling distance: 300 feet
Electrofishing time: 261 seconds

Species	Length (mm)
Coho	66
Coho	71
CT	90
CT	108
CT	112
CT	110
CT	132
CT	105
CT	112
CT	55
CT	57
CT	62
CT	56
CT	68
CT	60
CT	52
CT	54

RAW DATA
July 1991 Electrofishing Survey

Southern Tributary - Section 1
Southern Tributary #1310 road culvert to 400 ft downstream
Sampling distance: 400 feet
Electrofishing time: 152 seconds

Species	Length (mm)
CT	63
CT	142
CT	155
CT	132
CT	115
CT	43
CT	47

RAW DATA
July 1991 Electrofishing Survey

Southern Tributary - Section 2
Above #1310 road culvert to first small tributary entering Southern Tributary
Sampling distance: 2200 feet
Electrofishing time: 1240 seconds

Species	Length (mm)	Species	Length (mm)
CT	175	CT	53
CT	180	CT	40
CT	51	CT	38
CT	112	CT	65
CT	44	CT	202
CT	47	CT	131
CT	55	CT	50
CT	126	CT	52
CT	108	CT	57
CT	60	CT	51
CT	55	CT	50
CT	45	CT	62
CT	62	CT	138
CT	51	CT	191
CT	30	CT	158
CT	57	CT	146
CT	64	CT	38
CT	55	CT	53
CT	158	CT	41
CT	187	CT	59
CT	190	CT	50
CT	164	CT	54
CT	104	CT	55
CT	48	CT	40
CT	69		
CT	60		
CT	60		
CT	60		
CT	55		
CT	55		
CT	92		
CT	125		
CT	61		
CT	50		
CT	50		
CT	54		
CT	55		
CT	46		

RAW DATA
July 1991 Electrofishing Survey

Southern Tributary - Section 2
Railroad crossing to 1800 feet downstream on Southern Tributary
Sampling distance: 1800 feet
Electrofishing time: 381 seconds

Species	Length (mm)
CT	108
CT	98
CT	116
CT	66
CT	50
CT	44
CT	92
CT	40
CT	54
CT	46
CT	50
CT	90
CT	40
CT	140
CT	130
CT	45
CT	48
CT	140
CT	130
CT	152
CT	109

RAW DATA
July 1991 Electrofishing Survey

Southern Tributary - Section 3
Railroad crossing on Southern Tributary to 800 feet upstream
Sampling distance: 800 feet
Electrofishing time: 127 sec.

Species	Length (mm)
CT	150
CT	113
CT	91

RAW DATA
July 1991 Electrofishing Survey

Southern Tributary - Section 3
Pool below #1600 road crossing Southern Tributary
Sampling distance: 10 feet
Electrofishing time: 15 seconds

Species	Length (mm)
CT	not measured
CT	not measured

Appendix L

Air Quality Revisions based on URS Review of Beak *Environmental Technical Report*

Headquarters Camp
Solid Waste Disposal Facility

Air Quality Revisions Based on URS Consultants' Review Weyerhaeuser Solid Waste Disposal Landfill Report

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10074 Southwest Arctic Drive
Beaverton, Oregon 97005

November 21, 1991

20421.04

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1. Introduction

OMNI Environmental Services, Inc. was contracted by Beak Consultants Inc. to prepare the air section of the "Environmental Technical Report for the Proposed Weyerhaeuser S.W. Washington Solid Waste Facility" (reference 1). To support the preparation of the Washington State Environmental Policy Act (SEPA) environmental impact statement (EIS), URS Consultants, Inc. reviewed this document under contract with the Cowlitz-Wahkiakum County Health District. URS requested clarification on several air quality issues. These issues were discussed with URS, Beak, and Sweet-Edwards/EMCON, Inc. on September 13, 1991. Also during that meeting, Sweet-Edwards/EMCON provided some revisions in the proposed landfill design and operations.

The issues raised by URS regarding the air quality impacts and the revisions in landfill design and operations are addressed herein. In addition, particulate impacts were recalculated using a new and more appropriate dispersion model specifically designed for fugitive dust sources (reference 2).

2. Task 1—Documentation of Insignificant NO_X and SO_2 Production by Flares

This task consisted of: (1) reviewing the engineering specifications supplied by Sweet-Edwards/EMCON for flare systems proposed for use at the landfill, (2) reviewing oxides of nitrogen (NO_X) and sulfur dioxide (SO_2) emissions from similar flare systems reported in Environmental Protection Agency (EPA) documents, (3) estimating the sulfur content of the landfill gas and the corresponding worst-case impact to ambient air of SO_2 produced by the combustion of landfill gas in the flare systems, and (4) estimating NO_X emissions from the flares and their corresponding worst-case impacts to ambient air. It should be noted that the source of SO_2 will be the combustion (oxidation) of the reduced sulfur compounds that are contained in the landfill gas, whereas the primary source of NO_X will be the oxidation of atmospheric nitrogen in the high temperature flare environment, not the oxidation of volatile nitrogen containing compounds contained in the landfill gas.

2.1. Flare Systems

The engineering specifications on landfill flares were provided by Sweet-Edwards/EMCON (Appendix A). As indicated by Sweet-Edwards/EMCON, either an open-flame or an enclosed-flame system will be used, depending on the gas generation rate. An enclosed cylindrical ground flare has a higher flame temperature (760 - 980 °C [1400 - 1800 °F]) than an open-flame system. Consequently, an enclosed cylindrical ground flare will produce greater amounts of NO_X. Therefore, the use of an enclosed-flame system was assumed in this analysis to provide the worst-case impact.

2.2. Sulfur Content of Landfill Gas and SO_2 Impacts from Flares

The Mt. Solo landfill contains material similar to that which Weyerhaeuser plans to dispose of at the proposed landfill. Dimethyl sulfide at a concentration of 11.6 ppm was the only sulfur-containing compound measured above detection limits in a landfill gas sample collected at the Mt. Solo landfill (Appendix B). Assuming that all the sulfur contained in the dimethyl sulfide is converted to SO_2 in the flare, the SO_2 emission rate would be 0.0153 g/s (see Appendix C for calculations). Using the SCREEN model (which assumes worst-case meteorological conditions), the highest hourly average ambient concentration of SO_2 would be 1.18 $\mu g/m^3$ or 4.52×10^{-4} ppm (ppm is parts per million by volume for gaseous species) at the residence nearest the landfill.

In addition to estimating an SO_2 emission rate and ambient impact based on the oxidation of dimethyl sulfide contained in the Mt. Solo landfill gas, an emission rate and ambient impact were calculated based on EPA municipal waste landfill data (reference 3). This emission rate and the corresponding highest hourly average concentration at the nearest residence were 0.024 g/s and 1.86 $\mu g/m^3$ (7.09×10^{-4} ppm), respectively. These values are approximately 50% of those determined from the oxidation of dimethyl sulfide. However, this variability is insignificant. As can be seen in Table 1, the values calculated by either method are many orders of magnitude below applicable ambient standards.

Table 1
Ambient NO_X and SO_2 Air Quality Standards and Impacts from the Flare System.

Pollutant	Standards			Calculated Ambient Impacts[a]
	National Primary	National Secondary	Washington State	
Sulfur Dioxide				
Annual Average	0.03 ppm	—	0.02 ppm	
24-hr Average	0.14 ppm	—	0.1 ppm	
3-hr Average	—	0.50 ppm	—	
1-hr Average	—	—	0.4 ppm[b]	0.00045 ppm (0.00071 ppm)[c]
Nitrogen Dioxide				
Annual Average	0.05 ppm	0.05 ppm	0.05 ppm	0.00163 ppm[d]

a. Concentrations based on 1-hour average SCREEN model output at the residence nearest to the landfill. 3-hour, 24-hour, and annual concentrations would be lower.
b. This is not a standard; rather, it is to be used as a guide in assessing whether implementation plans will achieve the 24-hour standard.
c. The value in parentheses was calculated from a U.S. EPA emission factor for municipal waste (reference 3).
d. Sum of all oxides of nitrogen.

2.3. Oxides of Nitrogen from Flares and Ambient Impacts

The EPA-published emission factor for NO_X from enclosed flares at municipal landfills is 4.9 lb of NO_X per million cubic feet of landfill gas (7.9×10^{-2} g/m^3) (reference 3). It should again be emphasized that the primary factor in NO_X production is not the concentration of nitrogen compounds in the landfill gas (within reason), but flare combustion conditions. By multiplying the EPA emission factor by the estimated volume of landfill gas generated each year, an emission rate of 0.039 g/s can be calculated. Using this emission factor, the maximum hourly average ambient concentration of NO_X at the residence nearest the landfill, as determined by the SCREEN model, is 3.07 μg/m^3 or 1.63×10^{-3} ppm. As can be seen in Table 1, this will produce annual average values many times lower than the 0.05 ppm annual standards.

3. Task 2—Review of Vapor Analysis Data from Mt. Solo Landfill

A soil gas sample taken at the Mt. Solo landfill was analyzed for reduced sulfur and volatile organic compounds (Appendix B). As previously mentioned, the Mt. Solo landfill contains much of the same material that is planned for disposal at the new solid waste landfill. It is generally recognized that landfill gas is primarily composed of methane and carbon dioxide. Analysis was not conducted for those two major and relatively benign constituents; however, other gases that are traditionally associated with landfills at trace or minor levels and are considered environmentally injurious were analyzed. These were benzene, carbon tetrachloride, chloroform, perchloroethene (tetrachloroethene), 1,1-dichloroethylene, methylene chloride, trichloroethene, vinyl chloride, and 1,1-dichloroethene. The concentration of each of these compounds was below the EPA Method 8240 detection limit. Among the 42 compounds for which analysis was conducted by Method 8240, only four had concentrations measured above detection limits. Those were bromomethene (methyl bromide), toluene, 2-butanone (methyl ethyl ketone [MEK]), and total xylene (o, m, and p isomers). Chapter 173-460 of the Washington Administrative Code (WAC) "Controls for New Sources of Toxic Air Pollutants" (promulgated since the initial air quality work for the proposed landfill) lists methyl bromide, 2-butanone, toluene, and xylene as Class B air pollutants and specifies acceptable source impact levels (ASIL). The SCREEN modeling previously conducted to determine the worst-case impact of total landfill gases predicted a maximum hourly average concentration of 25,600 $\mu g/m^3$ at the nearest residence, which corresponds to a predicted maximum 24-hour average concentration of 10,240 $\mu g/m^3$ for total landfill gas. The concentrations of methyl bromide, 2-butanone, toluene, and total xylene at the nearest residence can be calculated based on the predicted atmospheric concentration of total landfill gas and the respective compounds' volume fraction in the landfill gas. Table 2 lists their concentrations in the landfill gas as determined by the Method 8240 analysis, their concentrations at the nearest residence, and their respective ASIL. As can be seen in Table 2, their predicted atmospheric concentrations are well below ASIL.

In addition to air toxics analyzed by Method 8240, the landfill gas was also analyzed for the four common reduced sulfur compounds (hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide) which are associated with the odor from pulp and paper mill wastes and landfill gases produced under anaerobic conditions. Among the four, only dimethyl sulfide had a measurable concentration (11.6 ppm) above the method's detection limit. The detection limit for hydrogen sulfide, methyl mercaptan, and dimethyl disulfide is 5 ppm. As with the air toxics measured by Method 8240, the atmospheric concentration of each of these four reduced sulfur compounds can be calculated from their respective concentrations in the landfill gas and the predicted total ambient landfill gas concentration at a given receptor (at the nearest residence in this case). Table 3 compares their predicted maximum 24-hour concentrations at the nearest residence with ASIL. Table 4 compares their predicted maximum one-hour concentrations with 50 percent odor levels (50% of people detect odor at that level). The one-hour maximum average, rather than the 24-hour average, was used in the latter comparison because odor is an instantaneous response rather than a time-averaged (24-hour) standard.

As can be seen in Tables 3 and 4, modeling predicts that the reduced sulfur compound concentrations will be below ASIL and olfactory levels. It should be emphasized that the one-hour and 24-hour average values used in this comparison are the highest predicted by the model and that the SCREEN model predicts worst-case meteorological conditions. In addition, the 50% olfactory levels used in this comparison have been recently published (reference 4) and are much more conservative than the odor levels referenced in the original technical report, which were apparently older odor annoyance level data rather than odor threshold level data.

Table 2
Air Toxics Concentrations in Landfill Gas, Maximum 24-Hour Average Atmospheric Concentrations at the Nearest Residence, and ASIL.

Compound	Concentration in Landfill Gas (ppm)	Atmospheric Concentration at Nearest Residence[a] ($\mu g/m^3$)	ASIL[b] ($\mu g/m^3$)
methyl bromide	4	2×10^{-1}	66.6
2-butanone	138	6×10^{-1}	1964.7
toluene	0.7	4×10^{-2}	1248.8
total xylenes	0.3	2×10^{-2}	1448.6

a. highest 24-hour average
b. 24-hour average

Table 3
Reduced Sulfur Compound Concentrations in Landfill Gas, Maximum 24-Hour Average Atmospheric Concentrations at the Nearest Residence, and ASIL.

Compound	Concentration in Landfill Gas (ppm)	Atmospheric Concentration at Nearest Residence[a] ($\mu g/m^3$)	ASIL[b] ($\mu g/m^3$)
hydrogen sulfide	< 5	< 0.1	46.6
methyl mercaptan	< 5	< 0.2	3.3
dimethyl sulfide	11.6	0.44	—
dimethyl disulfide	< 5	< 0.3	—

a. highest 24-hour average
b. 24-hour average

Table 4
Reduced Sulfur Compound Concentrations in Landfill Gas, Maximum 1-Hour Average Atmospheric Concentrations at the Nearest Residence and 50% Odor Detection Levels.

Compound	Concentration in Landfill Gas (ppm)	Atmospheric Concentration at Nearest Residence[a] ($\mu g/m^3$)	50% Odor Detection Level[b] ($\mu g/m^3$)
hydrogen sulfide	<5	<0.3	5.5
methyl mercaptan	<5	<0.4	2.4
dimethyl sulfide	11.6	1.1	51
dimethyl disulfide	<5	<0.7	66

a. highest 1-hour average
b. data from reference 4

4. Task 3—Discussion of Worst-Case Annual TSP and PM_{10} Concentrations and Soil Size Distribution

A worst-case "annual" average ambient concentration value was prepared in the original technical report for total suspended particles (TSP) and for particles with aerodynamic diameters of less than 10 microns (PM_{10}). The calculations of the annual averages were based on summer and early fall meteorological data and generic soil particle size distribution data. The 24-hour PM_{10} values were also calculated with these data. The objective of Task 3 was to clarify the assumptions that were inherent in using these data.

4.1. Averaging Period and Emission Factors

During the spring, late fall, and winter, soil moisture is higher at the proposed landfill site and dust (particulate) emission factors are dramatically lower than in the summer and early fall. Occasional snow cover and frozen conditions also reduce winter particulate emissions. Average rainfall during the months of July, August, and September accounts for only 4.7% of the annual rainfall (Table 5). The total rainfall that occurred during the meteorological monitoring period of August 10, 1990 to October 11, 1990 was 4.15 inches (105 mm) and only 0.9 inches (23 mm) occurred during July and the first ten days of August preceding the monitoring. In addition to rainfall being lower in the summer, the relative humidity is lower, the solar insolation is higher, and the cloud cover is less, all of which tend to increase the evaporation rate and lower the soil moisture content. A high-volume particulate sampler was operated at the Headquarters site near a dirt road and parking lot. Figure 1 is a plot of TSP versus three-day cumulative rainfall. This figure graphically illustrates the effect of soil moisture on particulate emissions.

The "annual" mean TSP and PM_{10} concentration values were predicted by using the August 10 through October 11, 1990 meteorological data. Highest and second-highest 24-hour means were also predicted from these data. Since particulate emission rates were at near-highest levels during the monitoring time period, the annual mean values calculated in this fashion are expected to be much higher than the true annual means. The highest 24-hour values are also expected to occur during this time period.

It should be noted that these high estimates of annual means are well below standards at property boundaries and even below standards at the margins of the landfill footprint itself (see Section 5). Consequently, the averaging period used to predict annual means is not a significant issue.

4.2. Soil/Particulate Size Distribution

In the modeling conducted for the original technical report, TSP emission factors were calculated from AP-42 (reference 5) and were used in the ISC model to calculate TSP concentrations. PM_{10} concentrations were then estimated based on the average size distribution typical of most soils (reference 6 and 7) and size-dependant settling velocities. Coincidentally, PM_{10} averaged almost exactly 50% of TSP (less than approximately 38 μ) in the soils studied in references 6 and 7. In the revised modeling (see Section 5) both PM_{10} and TSP emission factors from AP-42 were used. The FDM model and actual size distribution data (converted to aerodynamic sizes) determined for subsurface soils by Sweet-Edwards/EMCON (reference 8) were used in the modeling. Figure 2 is an example grain size analysis plot of subsurface (2 - 4 feet [0.6 - 1.2 m]) material from reference 8. There was considerable variability between the grain size analyses of the various subsurface materials collected at the site by Sweet-Edwards/EMCON. Assuming a cut-off for TSP of 38 μ (actual size, not aerodynamic), spherical particles, and a soil particulate density of 2.5 g/cm^3, PM_{10} averaged 66% of the TSP with a standard deviation of 6% among the four materials analyzed (reference 8).

Table 5
Monthly Total Precipitation at the Headquarters Site, 1990.

Month	Total Precipitation (inches)
January	14.31
February	7.88
March	4.41
April	4.84
May	2.44
June	3.46
July	0.90
August	1.98
September	0.25
October	8.44
November	12.99
December	4.12
Total	66.02

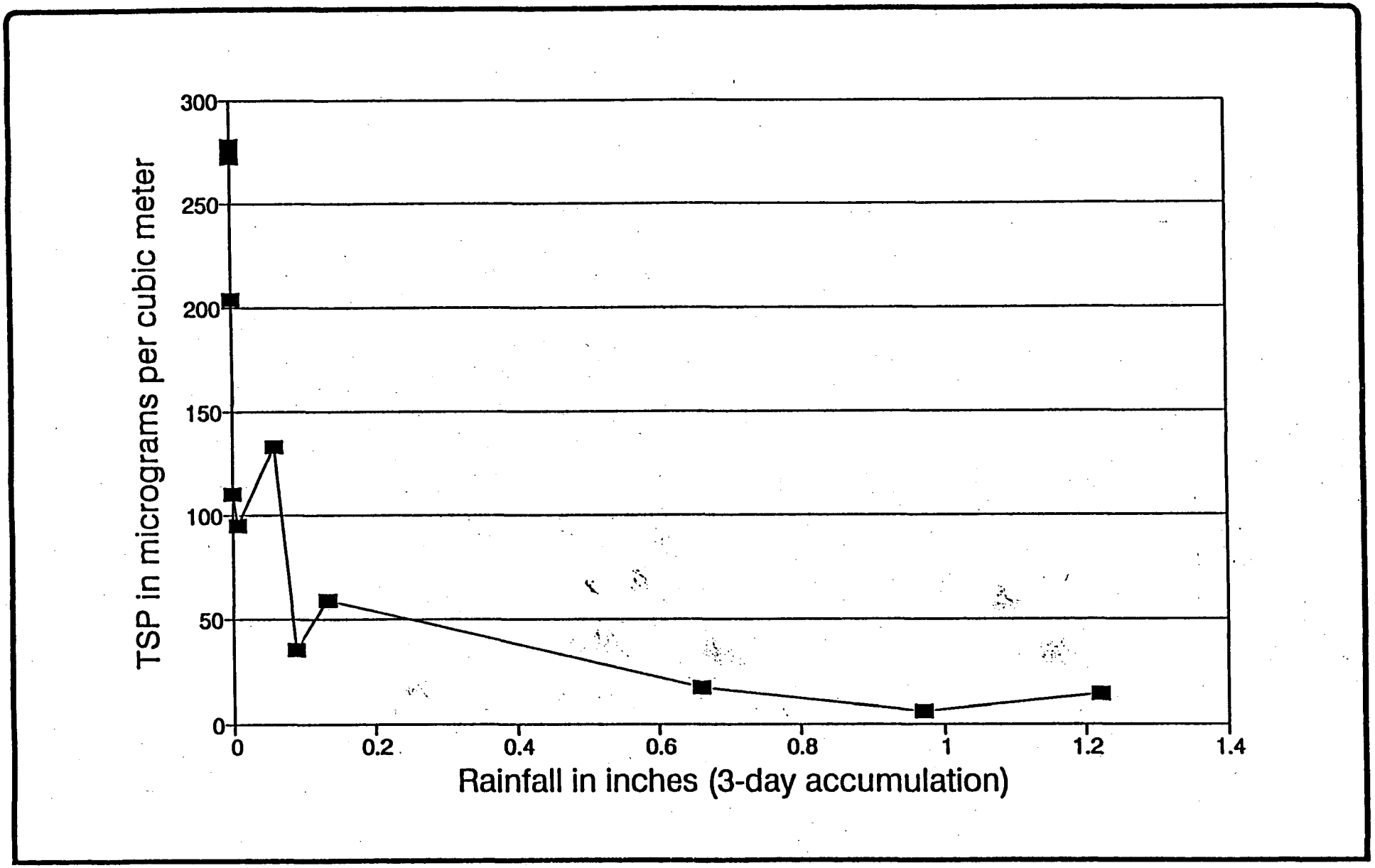


Figure 1. Suspended particulate concentrations versus 3-day accumulated rainfall.

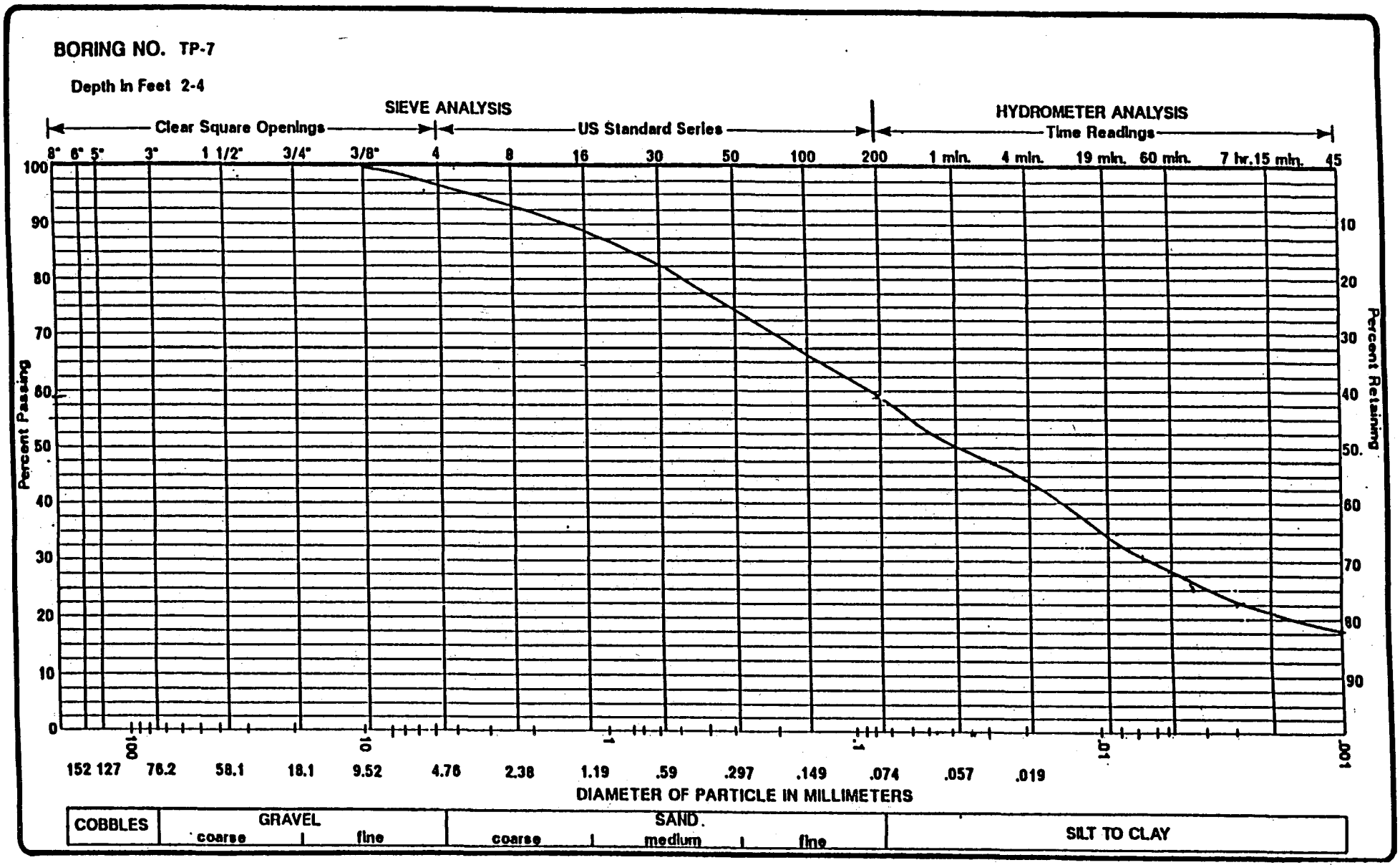


Figure 2. Grain size analysis of soil collected at the Headquarters Site (from reference 8).

5. Task 4—Modeling

Controlled (50% nominal efficiency) and uncontrolled emissions were modeled using the new U.S. EPA Fugitive Dust Model (FDM), more accurate soil (particulate) size distribution data (see Section 4), and new information regarding site operations and design (reference 9). Modeling was conducted for the operation of cells that were closest to the resident nearest the landfill to again produce the worst-case impact scenario. (This residence is directly adjacent to Weyerhaeuser's property boundary.) A new storage pile near the material transfer point and a plastic covering over the areas that have been filled with waste and are temporarily inactive are the two key changes that impact particulate emissions and have been taken into consideration in the modeling. Emission factors were calculated for the storage pile and the plastic-covered area as well as for paved and unpaved roads, the active cell working face, a cell under construction, and the remaining portion of the active cell exclusive of the working face. The uncontrolled modeling scenario assumes no control, including no plastic covering. The controlled modeling scenario assumes 50% particulate control with the exception of the area covered with plastic, which was conservatively assumed to be 70% efficient in reducing emissions. This 70% value is used in the "50%" controlled modeling runs. The assumptions, methods, and control efficiencies used in determining emission rates are provided in Appendices D and E.

The FDM output files are provided in Appendices F and G and the results are summarized in Tables 6 and 7. The results shown in Tables 6 and 7 demonstrate that neither the PSD Class II increments nor state and federal air quality standards will be exceeded at the nearest residence (nearest property boundary) under realistic worst-case conditions.

Table 6
Annual TSP and PM_{10} Standards and Predicted Worst-Case Annual Average Concentrations

Receptor Description	Atmospheric Concentration 50% Controlled		Atmospheric Concentration 0% Controlled	
	TSP ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	TSP ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
North Landfill Footprint	7.6	3.38	17.3	7.7
South Landfill Footprint	1.3	0.6	3.0	1.3
West Landfill Footprint[a]	27.8	12.7	62.1	28.2
East Landfill Footprint	0.55	0.25	1.2	0.6
Residence Headquarters/ Property Boundary	1.4	0.67	3.2	1.5
Timber Point/Property Boundary	0.03	0.02	0.07	0.03
Walden Island	0.08	0.04	0.20	0.09

Standard	TSP ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
NAAQS (primary, secondary)	75, 60	50, 60
Washington State	60	50
PSD, Class II Increment	19	—[b]

a. Highest concentrations possible due to modeling westernmost cell.
b. Not yet promulgated.

Table 7
Twenty-Four Hour TSP and PM_{10} Standards and
Predicted Second-Highest 24-Hour Average Concentrations

Receptor Description	Atmospheric Concentration[a] 50% Controlled		Atmospheric Concentration[a] 0% Controlled	
	TSP ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	TSP ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
North Landfill Footprint	44.7	20.0	102.0	45.3
South Landfill Footprint	9.96	4.52	22.7	10.3
West Landfill Footprint	117.6	52.8	262.6	117.4
East Landfill Footprint	5.9	2.65	13.0	5.8
Residence Headquarters/ Property Boundary	7.9	3.66	16.7	7.7
Timber Point/Property Boundary	0.25	0.12	0.57	0.27
Walden Island	1.1	0.49	2.47	1.2
Standard			TSP ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
NAAQS (primary, secondary)			260, 150	150, 150
Washington State			150	150
PSD, Class II Increment			37	--[b]

a. Second-highest 24-hour average, except PSD increment.
b. Not yet promulgated

6. References

1. Beak Consultants Incorporated, 1991, Environmental Technical Report for the Proposed Weyerhaeuser S.W. Washington Solid Waste Facility, report prepared for the Weyerhaeuser Company, 3 volumes.

2. United States Environmental Protection Agency, 1990, Fugitive Dust Model (FDM) User's Guide, EPA-910/9-88-202R.

3. United States Environmental Protection Agency, 1990 (Draft), Air Emissions from Municipal Solid Waste Landfills—Background Information for Proposed Standards and Guidelines.

4. Nagy, G. Z., 1991, The Odor Impact Model, *Journal of the Air and Waste Management Association*, v. 41, n. 10, pp. 1360-1362.

5. United States Environmental Protection Agency, 1985, Compilation of Air Pollutant Emission Factors, Vol. I: Stationary Point and Area Sources, AP-42, fourth edition, OAQPS, Research Triangle Park, North Carolina.

6. Houck, J. E., J. C. Chow, J. G. Watson, C. A. Simons, L. C. Pritchett, J. M. Goulet, and C. A. Frazier, 1989, Determination of Particle Size Distribution and Chemical Composition of Particulate Matter from Selected Sources in California, 3 volumes and executive summary, report to California Air Resources Board, NTIS PB 89 232805.

7. Houck, J. E., L. C. Pritchett, R. B. Roholt, J. G. Watson, J. C. Chow, J. M. Goulet, and C. A. Frazier, 1990, Determination of Particle Size Distribution and Chemical Composition of Particulate Matter from Selected Sources in the San Joaquin Valley, report to California Air Resources Board, contract 88-11.

8. Sweet-Edwards/EMCON, Inc., 1990, Weyerhaeuser Southwest Washington Solid Waste Disposal Facility Headquarters Site, Solid Waste Handling Facility Permit Application, submitted to Cowlitz-Wahkiakum Health District for the Weyerhaeuser Company.

9. Thiel, R., August 29, 1991, letter to Grant Bailey, URS Consultants, Seattle, Washington.

Appendix A

Engineering Specifications—Landfill Flare

Sweet-Edwards/EMCON, Inc.

15055 S.W. Sequoia Parkway, Suite 140
P.O. Box 231269
Portland, Oregon 97224
(503) 624-7200
FAX (503) 620-7658

RECEIVED SEP 1 9 1991

September 18, 1991
Project S4115.12

Jim Houck
OMNI Environmental
10950 SW 5th Street
Suite 160
Beaverton, Oregon 97005

Re: Weyco Headquarters Landfill Gas

Dear Jim:

Enclosed are the gas analysis results I promised from a sample we obtained from the Mt. Solo landfill. The sample was obtained from a drive-point hole into the waste. I'm not sure how old the waste was in that area. If that information is important, I may be able to obtain an estimate.

The types of gas glares we typically include in our designs depends on the amount of gas being generated by the landfill. For low gas generation rates, an open-flame torch is generally the most effective. Temperatures on these types of torches generally range between 1,000 and 1,200°F. For high gas generation rates an enclosed cylindrical ground flare is usually used. Enclosed flare temperatures generally run between 1,400 and 1,800°F.

Since we do not expect gas generation rates would support cylindrical enclosed flares, I would say that the open-flame type burners would be used if we are required to incinerate the landfill gas.

Please call if you have questions.

Sincerely,

Sweet-Edwards/EMCON, Inc.

Rick Thiel

Richard S. Thiel, P.E.
Senior Project Engineer

Enclosure

P/WEYCO-L.918-91/2(wp)

Appendix B

Mt. Solo Landfill Gas Analysis

COLUMBIA ANALYTICAL SERVICES, C.

CLIENT: Sweet - Edwards/EMCON
SUBMITTED BY: Dale Berndt
PROJECT: Mt. Solo L.F./#S4121.03
SAMPLE DESCRIPTION: Air

DATE RECEIVED: 11/06/90
DATE ANALYZED: 11/07/90
WORK ORDER #: K904246

Volatile Organic Analytes
EPA Method 8240
µL/L (ppm)

Sample Name:		MSG3-116	Method Blank
Lab Code:		4246-3	4246-MB
Compound	MRL		
Chloromethane	0.2	ND	ND
Vinyl Chloride	0.2	ND	ND
Bromomethane	0.2	4	ND
Chloroethane	0.2	ND	ND
Trichlorofluoromethane	0.2	ND	ND
Freon 113	3	ND	ND
1,1-Dichloroethene	0.2	ND	ND
Acetone	3	ND	ND
Carbon Disulfide	0.2	ND	ND
Methylene Chloride	3	ND	ND
Trans 1,2-Dichloroethene	0.2	ND	ND
Cis 1,2-Dichloroethene	0.2	ND	ND
2-Butanone (MEK)	3	138	ND
1,1-Dichloroethane	0.2	ND	ND
Chloroform	0.2	ND	ND
1,1,1-Trichloroethane	0.2	ND	ND
Carbon Tetrachloride	0.2	ND	ND
Benzene	0.2	ND	ND
1,2-Dichloroethane	0.2	ND	ND
Vinyl Acetate	3	ND	ND
Trichloroethene	0.2	ND	ND
1,2-Dichloropropane	0.2	ND	ND
Bromodichloromethane	0.2	ND	ND
2-Chloroethylvinyl ether	3	ND	ND
Trans 1,3-Dichloropropene	0.2	ND	ND
2-Hexanone	3	ND	ND
4-Methyl-2-Pentanone (MIBK)	3	ND	ND
Toluene	0.2	0.7	ND
Cis 1,3-Dichloropropene	0.2	ND	ND
1,1,2-Trichloroethane	0.2	ND	ND
Tetrachloroethene	0.2	ND	ND
Dibromochloromethane	0.2	ND	ND
Chlorobenzene	0.2	ND	ND
Ethylbenzene	0.2	ND	ND
Styrene	0.2	ND	ND
Total Xylenes	0.2	0.3	ND
Bromoform	0.2	ND	ND
1,1,2,2-Tetrachloroethane	0.2	ND	ND
1,3-Dichlorobenzene	0.2	ND	ND
1,4-Dichlorobenzene	0.2	ND	ND
1,2-Dichlorobenzene	0.2	ND	ND

MRL means Method Reporting Limit
ND means None Detected at or above the MRL

Approved by B.S.L. Date 11/13/90

1317 South 13th Avenue • P.O. Box 479 • Kelso, Washington 98626 • Telephone 206/577-7222 • Fax 206/636-[illegible]

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

CLIENT: Sweet - Edwards/EMCON
SUBMITTED BY: Dale Berndt
PROJECT: Mt. Solo L.F./#S4121.03
SAMPLE DESCRIPTION: Air

DATE RECEIVED: 11/07/90
DATE ANALYZED: 11/08/90
WORK ORDER #: K904246

Sulfur Gas Analyses
µL/L (ppm)

Sample Name: / Lab Code:	MRL	MSG1-116 4246B-1	Method Blank 4246B-MB
Hydrogen Sulfide	5	ND	ND
Methyl Mercaptan	5	ND	ND
Dimethyl Sulfide	5	11.6	ND
Dimethyl Disulfide	5	ND	ND

MRL means Method Reporting Limit
ND means None Detected at or above the MRL

Approved by R. Scanlan Date 11/13/90

4247 South 42th Avenue • P.O. Box 479 • Kelso, Washington 98626 • Telephone 206/577-7222 • Fax 206/636-1C

Appendix C

Calculation of SO_2 and NO_X Emissions and Concentrations at the Nearest Residence

1. From the previous landfill gas analysis†, we assume that the maximum landfill gas emissions are 5.6×10^8 ft^3/yr or 329.6 g/s. This produces a 1-hour concentration of 25,600 μg/m^3 at the nearest residence. The SO_2 emission concentration is based on landfill gas analysis.‡ Assuming 11.6 ppm dimethyl sulfide, we have:

$$\frac{11.6}{1\times10^6} \times 5.6\times10^8 \text{ ft}^3/\text{yr} = 6496 \text{ ft}^3/\text{yr of dimethyl sulfide} \quad (1)$$

That is:

$$6496 \text{ ft}^3/\text{yr} \times 28.3 \text{ L/ft}^3 \times \frac{1 \text{ mol}}{24.4 \text{ L}} = \begin{matrix}7523 \text{ mol/yr of dimethyl sulfide} \\ \text{(at 25 °C and 1 atm pressure)}\end{matrix} \quad (2)$$

Assuming every sulfur atom in dimethyl sulfide converts to SO_2, then we have 8207 moles of SO_2. The corresponding SO_2 emission rate is then:

$$\frac{7534 \text{ mol/yr} \times 64.06 \text{ g/mol}}{3.15\times10^7 \text{ s/yr}} = 0.0153 \text{ g/s} \quad (3)$$

The ambient impact (1-hour average case) of SO_2 at the nearest residence on headquarters road would then be:

$$C_{mass} = 2.56\times10^4 \,\mu\text{g/m}^3 \times \frac{0.0153 \text{ g/s}}{329.6 \text{ g/s}} = 1.18 \,\mu\text{g/m}^3 \quad (4)$$

From the equation*, we have:

$$C_{mass} = 40.9 \times M_w \times C_{ppm} \text{ (at 25 °C and 1 atm pressure)} \quad (5)$$

Where:

C_{mass} = mass concentration (μg/m^3) and
C_{ppm} = volume concentration (ppm).
M_w = molecular weight

For SO_2, $M_w = 64.06$, so we have:

$$C_{ppm} = \frac{1.18}{40.9 \times 64.06} = 4.52\times10^{-4} \text{ ppm} \quad (6)$$

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† OMNI Environmental Services, Inc. *Technical Report: Air Quality and Climate, Baseline, Impact, and Mitigation, Weyerhaeuser Solid Waste Disposal Landfill Project*. December 1990.

‡ Columbia Analytical Services, letter dated November 13, 1990, re Mt. Solo Landfill/project 354121.03.

* C. David Cooper and F.C. Alley. *Air Pollution Control—A Design Approach*. Waveland Press, Inc. 1990.

2. By using the SO_2 emission concentration based on the emission factors for enclosed flares from EPA computations†, $SO_2 = 3.0\times10^{-6}$ lb/ft^3, we have:

$$\frac{3\times10^{-6}\,\text{lb}}{\text{ft}^3}\times\frac{5.6\times10^{8}\,\text{ft}^3}{\text{yr}}\times\frac{453.59\,\text{g}}{\text{lb}}\times\frac{1\,\text{yr}}{3.15\times10^{7}\,\text{s}} = 0.024\,\text{g/s of SO}_2 \quad (7)$$

and

$$C_{\text{mass}} = 2.56\times10^{4}\,\mu\text{g/m}^3\times\frac{0.024\,\text{g/s}}{329.6\,\text{g/s}} = 1.86\,\mu\text{g/m}^3 \quad (8)$$

So, we get

$$C_{\text{ppm}} = \frac{1.86}{40.9\times64.06} = 7.09\times10^{-4}\,\text{ppm} \quad (9)$$

3. By using the NO_2 emission concentration based on the emission factors for enclosed flares from EPA computations†, $NO_2 = 4.9\times10^{-6}$ lb/ft^3 of landfill gas, we have:

$$\frac{4.9\times10^{-6}\,\text{lb}}{\text{ft}^3}\times\frac{5.6\times10^{8}\,\text{ft}^3}{\text{yr}}\times\frac{453.59\,\text{g}}{\text{lb}}\times\frac{1\,\text{yr}}{3.15\times10^{7}\,\text{s}} = 0.0395\,\text{g/s of NO}_2 \quad (10)$$

and

$$C_{\text{mass}} = \frac{2.56\times10^{4}\,\mu\text{g/m}^3\times0.0395\,\text{g/s}}{329.6\,\text{g/s}} = 3.07\,\mu\text{g/m}^3 \quad (11)$$

For NO_2, $M_w = 46.01$. So, we get

$$C_{\text{ppm}} = \frac{3.07}{40.9\times46.01} = 1.63\times10^{-3}\,\text{ppm} \quad (12)$$

† U.S. EPA. *Air Emissions from Municipal Solid Waste Landfills—Background Information for Proposed Standards and Guidelines*. March 1988.

Appendix D

Emission Inventory—Uncontrolled Emissions

Emission Inventory with 0% Dust Control

++++++

Paved Roads

For Medium and Heavy Trucks
Emission Factor = (k)*.090*I*(4/n)*(s/10)*(L/1000)*((w/3)^.7) from Pg. 11.2.6Source:
Where:

k= 0.45 PM10
k= 0.86 TSP
I= 7 Industrial Aug. Factor
n= 2 Traffic Lanes
s= 58 % Silt From Sweet-Edward Report
L= 250 lb/mile surface dust loading
w= average vehicle weight tons

Road	Vehicle Type	# of Wheels	Veh. Weight (Tons)	Veh Speed (mph)	Emission Factor PM10 (lb/VMT)	Emission Factor TSP (lb/VMT)	Dist per Trip (ft)	Number of Trips Per Day	Uncontrolled Emissions Daily PM10 (Tons/dy)	Uncontrolled Emissions Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Controlled Emissions Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m	Emission Rate TSP g/s/m
Entrance Road	Water Truck	10	20	10	3.10	5.93	2500	6	4.41E-03	8.42E-03	0.00%	4.41E-03	8.42E-03	9.25E-02	1.77E-01	1.21E-04	2.32E-04
	Maint. Veh.	10	20	10	3.10	5.93	2500	1	7.34E-04	1.40E-03	0.00%	7.34E-04	1.40E-03	1.54E-02	2.95E-02	2.02E-05	3.87E-05
	Pickup	4	4	10	1.01	1.92	2500	6	1.43E-03	2.73E-03	0.00%	1.43E-03	2.73E-03	3.00E-02	5.73E-02	3.94E-05	7.52E-05
	Tran. Truck	18	35	10	4.59	8.77	2500	83	9.02E-02	1.72E-01	0.00%	9.02E-02	1.72E-01	1.89E+00	3.62E+00	2.49E-03	4.75E-03
Totals									9.68E-02	1.85E-01		9.68E-02	1.85E-01	2.03E+00	3.88E+00	2.67E-03	5.10E-03

Fugitive Emissions
From Storage Piles

Emission Factor for Active Storage Piles

6.3 lb/acre/day for PM10
13.2 lb/acre/day for TSP

Calculations:

(Area of Pile[sqft] * Active EF[lb/acre/dy] * 2.3e-5 [acres/sqft])/2000 = Tons/dy

(Area of Pile[sqft] * Active EF[lb/acre/dy] * 2.3e-5 [acres/sqft] * Active Days)/20
+(Area of Pile[sqft] * Inactive EF[lb/acre/dy] * 2.3e-5 [acres/sqft] * Inactive Day

= Tons/yr

Emission Factor for Inactive days

1.7 lb/acre/day for PM10
3.5 lb/acre/day for TSP

Includes:

Loading of aggregrate onto piles
Equipment traffic in storage area
Wind erosion
12 hours per working day

	Area	Area (sqft)	Percentage Active Area	Percentage Inactive Area	Adjusted Emission Factor PM10 (lb/acre/dy)	Adjusted Emission Factor TSP (lb/acre/dy)	Uncontrolled Emissions Daily PM10 (Tons/dy)	Uncontrolled Emissions Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Controlled Emissions Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m2	Emission Rate TSP g/s/m2
North Stockpile	6.3	274,428	10%	90%	2.16	4.47	0.0068	0.0141	0.00%	0.0068	0.0141	0.1429	0.2957	5.60E-06	1.16E-05
Northwest Stockpile	22.7	988,812	10%	90%	2.16	4.47	0.0245	0.0507	0.00%	0.0245	0.0507	0.5148	1.0654	5.60E-06	1.16E-05
Totals							0.0313	0.0648		0.0313	0.0648	0.6577	1.3611	1.12E-05	2.32E-05

Emission Factor for Inactive Portion of the Active Cell 1

1.7 lb/acre/day for PM10
3.5 lb/acre/day for TSP

Includes:

Wind erosion

Area (Acres)	Area (sqft)	Percentage Active Area	Percentage Inactive Area	Adjusted Emission Factor PM10 (lb/acre/dy)	Adjusted Emission Factor TSP (lb/acre/dy)	Uncontrolled Emissions Daily PM10 (Tons/dy)	Uncontrolled Emissions Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Controlled Emissions Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m2	Emission Rate TSP g/s/m2
15.4	670,824	0%	100%	1.7	3.5	0.0131	0.0270	0.00%	0.0131	0.0270	0.2749	0.5659	4.41E-06	9.08E-06

Footnote: Totals are rounded sums of actual values.

Module Construction Cell 2

Emission Factor = k*(5.9)*(s/12)*(S/30)*((W/3)^.7)*((w/4)^.5)((365-p)/365) from Pg. 11.2.1-1
Where:

k= 0.36 for PM10
k= 0.8 for TSP
s= 58.0 % Silt from Sweet-Edward Report
S= Mean Vehicle Speed
W= Mean Vehicle Weight
w= Mean Number of Wheels
p= 180 # of Days with >= .01 in. precip., NWS Data

Area Module under const. Size of area in acres	Vehicle Type	# of Wheels	Veh. Weight (Tons)	Veh Speed (mph)	Emission Factor PM10 (lb/VMT)	Emission Factor TSP (lb/VMT)	Dist per Trip (ft)	Number of Uncontrolled Emissions Trips Per Day	Daily PM10 (Tons/dy)	Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m2	Emission Rate TSP g/s/m2
8.95	Dozer	6	32.5	1	1.1260	2.5022	5280	12	0.0068	0.0150	0.00%	0.0068	0.0150	0.1419	0.3153	3.92E-06	8.70E-06
8.95	Grader	6	27	2	1.9779	4.3953	5280	24	0.0237	0.0527	0.00%	0.0237	0.0527	0.4984	1.1076	1.38E-05	3.06E-05
8.95	Water Tank	10	20	5	5.1741	11.4980	1500	2	0.0015	0.0033	0.00%	0.0015	0.0033	0.0309	0.0686	8.52E-07	1.89E-06
8.95	Maint.	10	20	5	5.1741	11.4980	1500	1	0.0007	0.0016	0.00%	0.0007	0.0016	0.0154	0.0343	4.26E-07	9.47E-07
8.95	Pickup	4	4	5	1.0607	2.3571	1500	2	0.0003	0.0007	0.00%	0.0003	0.0007	0.0063	0.0141	1.75E-07	3.88E-07
8.95	tipper	4	40	5	5.3160	11.8134	2000	83	0.0836	0.1857	0.00%	0.0836	0.1857	1.7548	3.8997	4.84E-05	1.08E-04
Totals									0.1166	0.2590		0.1166	0.2590	2.4478	5.4395	6.76E-05	1.50E-04

Working Face

Emission Factor = k*(5.9)*(s/12)*(S/30)*((W/3)^.7)*((w/4)^.5)((365-p)/365) from Pg. 11.2.1-1
Where:

k= 0.36 for PM10
k= 0.86 for TSP
s= 58.0 % Silt from Sweet-Edward Report
S= Mean Vehicle Speed
Wv= Mean Vehicle Weight
w= Mean Number of Wheels
p= 185 # of Days with >= .01 in. precip., NWS Data

Area Working Face of Landfill Size of Area in acres	Vehicle Type	# of Wheels	Veh. Weight (Tons)	Veh Speed (mph)	Emission Factor PM10 (lb/VMT)	Emission Factor TSP (lb/VMT)	Dist per Trip (ft)	Number of Uncontrolled Emissions Trips Per Day	Daily PM10 (Tons/dy)	Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m2	Emission Rate TSP g/s/m2
5	Compactors	4	45	5	5.6169	13.4181	84173	1	0.0448	0.1070	0.00%	0.0448	0.1070	0.9402	2.2460	4.64E-05	1.11E-04
5	Transtruck	18	35	5	9.9931	23.8723	17536	1	0.0166	0.0396	0.00%	0.0166	0.0396	0.3485	0.8325	1.72E-05	4.11E-05
5	PickupTruck	4	4	5	1.0320	2.4654	5260	1	0.0005	0.0012	0.00%	0.0005	0.0012	0.0108	0.0258	5.33E-07	1.27E-06
5	MaintVeh	10	20	5	5.0343	12.0263	2455	1	0.0012	0.0028	0.00%	0.0012	0.0028	0.0246	0.0587	1.21E-06	2.90E-06
5	WatTanTruc	10	20	5	5.0343	12.0263	3507	1	0.0017	0.0040	0.00%	0.0017	0.0040	0.0351	0.0839	1.73E-06	4.14E-06
5	D8CrawTract	6	32.5	5	5.4778	13.0859	17536	1	0.0091	0.0217	0.00%	0.0091	0.0217	0.1910	0.4563	9.44E-06	2.25E-05
5	MotorGrade	6	27	5	4.8111	11.4932	8768	1	0.0040	0.0095	0.00%	0.0040	0.0095	0.0839	0.2004	4.14E-06	9.90E-06
5	Tipper	4	40	5	5.1723	12.3561	9119	1	0.0045	0.0107	0.00%	0.0045	0.0107	0.0938	0.2241	4.63E-06	1.11E-05
Totals									0.0823	0.1966		0.0823	0.1966	1.7278	4.1276	8.54E-05	2.04E-04

Footnote: Totals are rounded sums of actual values.

Appendix E

Emissions Inventory—50% Control Efficiency

Emission Inventory with 50% Dust Control

++++++

Paved Roads

For Medium and Heavy Trucks
Emission Factor = (k)*.090*I*(4/n)*(s/10)*(L/1000)*((w/3)^.7) from Pg. 11.2.6Source:
Where:

k= 0.45 PM10
k= 0.86 TSP
I= 7 Industrial Aug. Factor
n= 2 Traffic Lanes
s= 58 % Silt from Sweet-Edward Report
L= 250 lb/mile surface dust loading
w= average vehicle weight tons

Road	Vehicle Type	# of Wheels	Veh. Weight (Tons)	Veh Speed (mph)	Emission Factor PM10 (lb/VMT)	Emission Factor TSP (lb/VMT)	Dist per Trip (ft)	Number of Trips Per Day	Uncontrolled Emissions Daily PM10 (Tons/dy)	Uncontrolled Emissions Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Controlled Emissions Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m	Emission Rate TSP g/s/m
Entrance Road	Water Truck	10	20	10	3.10	5.93	2500	6	4.41E-03	8.42E-03	54.00%	2.03E-03	3.87E-03	4.26E-02	8.14E-02	5.59E-05	1.07E-04
	Maint. Veh.	10	20	10	3.10	5.93	2500	1	7.34E-04	1.40E-03	54.00%	3.38E-04	6.46E-04	7.09E-03	1.36E-02	9.31E-06	1.78E-05
	Pickup	4	4	10	1.01	1.92	2500	6	1.43E-03	2.73E-03	54.00%	6.57E-04	1.26E-03	1.38E-02	2.64E-02	1.81E-05	3.46E-05
	Tran. Truck	18	35	10	4.59	8.77	2500	83	9.02E-02	1.72E-01	54.00%	4.15E-02	7.93E-02	8.71E-01	1.67E+00	1.14E-03	2.19E-03
Totals									9.68E-02	1.85E-01		4.45E-02	8.51E-02	9.35E-01	1.79E+00	1.23E-03	2.34E-03

Fugitive Emissions
From Storage Piles

Emission Factor for Active Storage Piles

6.3 lb/acre/day for PM10
13.2 lb/acre/day for TSP

Calculations:

(Area of Pile[sqft] * Active EF[lb/acre/dy] * 2.3e-5 [acres/sqft])/2000 = Tons/dy

Emission Factor for inactive days

1.7 lb/acre/day for PM10
3.5 lb/acre/day for TSP

(Area of Pile[sqft] * Active EF[lb/acre/dy] * 2.3e-5 [acres/sqft] * Active Days)/20
+(Area of Pile[sqft] * Inactive EF[lb/acre/dy] * 2.3e-5 [acres/sqft] * Inactive Day

= Tons/yr

Includes:
Loading of aggregrate onto piles
Equipment traffic in storage area
Wind erosion
12 hours per working day

	Area (Acres)	Area (sqft)	Percentage Active Area	Percentage Inactive Area	Adjusted Emission Factor PM10 (lb/acre/dy)	Adjusted Emission Factor TSP (lb/acre/dy)	Uncontrolled Emissions Daily PM10 (Tons/dy)	Uncontrolled Emissions Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Controlled Emissions Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m2	Emission Rate TSP g/s/m2
North Stockpile	6.3	274,428	10%	90%	2.16	4.47	0.0068	0.0141	70.00%	0.0020	0.0042	0.0429	0.0887	1.68E-06	3.48E-06
Northwest Stockpile	22.7	988,812	10%	90%	2.16	4.47	0.0245	0.0507	70.00%	0.0074	0.0152	0.1544	0.3196	1.68E-06	3.48E-06
Totals							0.0313	0.0648		0.0094	0.0194	0.1973	0.4083	3.36E-06	6.96E-06

Emission Factor for Inactive Portion of the Active Cell 1

1.7 lb/acre/day for PM10
3.5 lb/acre/day for TSP

Includes:
Wind erosion

Area (Acres)	Area (sqft)	Percentage Active Area	Percentage Inactive Area	Adjusted Emission Factor PM10 (lb/acre/dy)	Adjusted Emission Factor TSP (lb/acre/dy)	Uncontrolled Emissions Daily PM10 (Tons/dy)	Uncontrolled Emissions Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Controlled Emissions Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m2	Emission Rate TSP g/s/m2
15.4	670,824	0%	100%	1.7	3.5	0.0131	0.0270	50.00%	0.0065	0.0135	0.1374	0.2830	2.20E-06	4.54E-06

Footnote: Totals are rounded sums of actual values.

Module Construction Cell 2

Emission Factor = k*(5.9)*(s/12)*(S/30)*((W/3)^.7)*((w/4)^.5)((365-p)/365) from Pg. 11.2.1-1
Where:

k= 0.36 for PM10
k= 0.8 for TSP
s= 58.0 % Silt from Sweet-Edwards Report
S= Mean Vehicle Speed
W= Mean Vehicle Weight
w= Mean Number of Wheels
p= 180 # of Days with >= .01 in. precip., NWS Data

Area Module under const. Size of area in acres	Vehicle Type	# of Wheels	Veh. Weight (Tons)	Veh Speed (mph)	Emission Factor PM10 (lb/VMT)	Emission Factor TSP (lb/VMT)	Dist per Trip (ft)	Number of Trips Per Day	Uncontrolled Emissions Daily PM10 (Tons/dy)	Uncontrolled Emissions Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Controlled Emissions Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m2	Emission Rate TSP g/s/m2
8.95	Dozer	6	32.5	1	1.1260	2.5022	5280	12	0.0068	0.0150	50.00%	0.0034	0.0075	0.0709	0.1576	1.96E-06	4.35E-06
8.95	Grader	6	27	2	1.9779	4.3953	5280	24	0.0237	0.0527	50.00%	0.0119	0.0264	0.2492	0.5538	6.88E-06	1.53E-05
8.95	Water Tank	10	20	5	5.1741	11.4980	1500	2	0.0015	0.0033	50.00%	0.0007	0.0016	0.0154	0.0343	4.26E-07	9.47E-07
8.95	Maint.	10	20	5	5.1741	11.4980	1500	1	0.0007	0.0016	50.00%	0.0004	0.0008	0.0077	0.0171	2.13E-07	4.73E-07
8.95	Pickup	4	4	5	1.0607	2.3571	1500	2	0.0003	0.0007	50.00%	0.0002	0.0003	0.0032	0.0070	8.73E-08	1.94E-07
8.95	tipper	4	40	5	5.3160	11.8134	2000	83	0.0836	0.1857	50.00%	0.0418	0.0929	0.8774	1.9498	2.42E-05	5.38E-05
Totals									0.1166	0.2590		0.0583	0.1295	1.2239	2.7197	3.38E-05	7.51E-05

Working Face

Emission Factor = k*(5.9)*(s/12)*(S/30)*((W/3)^.7)*((w/4)^.5)((365-p)/365) from Pg. 11.2.1-1
Where:

k= 0.36 for PM10
k= 0.86 for TSP
s= 58.0 % Silt from Sweet-Edwards Report
S= Mean Vehicle Speed
Wv= Mean Vehicle Weight
w= Mean Number of Wheels
p= 185 # of Days with >= .01 in. precip., NWS Data

Area Working Face of Landfill Size of Area in acres	Vehicle Type	# of Wheels	Veh. Weight (Tons)	Veh Speed (mph)	Emission Factor PM10 (lb/VMT)	Emission Factor TSP (lb/VMT)	Dist per Trip (ft)	Number of Trips Per Day	Uncontrolled Emissions Daily PM10 (Tons/dy)	Uncontrolled Emissions Daily TSP (Tons/dy)	Control Efficiency	Controlled Emissions Daily PM10 (Tons/dy)	Controlled Emissions Daily TSP (Tons/dy)	Emission Rate PM10 g/s	Emission Rate TSP g/s	Emission Rate PM10 g/s/m2	Emission Rate TSP g/s/m2
5	Compactors	4	45	5	5.6169	13.4181	84173	1	0.0448	0.1070	70.00%	0.0134	0.0321	0.2821	0.6738	1.39E-05	3.33E-05
5	Transtruck	18	35	5	9.9931	23.8723	17536	1	0.0166	0.0396	70.00%	0.0050	0.0119	0.1045	0.2497	5.16E-06	1.23E-05
5	PickupTruck	4	4	5	1.0320	2.4654	5260	1	0.0005	0.0012	70.00%	0.0002	0.0004	0.0032	0.0077	1.60E-07	3.82E-07
5	MaintVeh	10	20	5	5.0343	12.0263	2455	1	0.0012	0.0028	70.00%	0.0004	0.0008	0.0074	0.0176	3.64E-07	8.70E-07
5	WatTanTruc	10	20	5	5.0343	12.0263	3507	1	0.0017	0.0040	70.00%	0.0005	0.0012	0.0105	0.0252	5.20E-07	1.24E-06
5	D8CrawTract	6	32.5	5	5.4778	13.0859	17536	1	0.0091	0.0217	70.00%	0.0027	0.0065	0.0573	0.1369	2.83E-06	6.76E-06
5	MotorGrade	6	27	5	4.8111	11.4932	8768	1	0.0040	0.0095	70.00%	0.0012	0.0029	0.0252	0.0601	1.24E-06	2.97E-06
5	Tipper	4	40	5	5.1723	12.3561	9119	1	0.0045	0.0107	70.00%	0.0013	0.0032	0.0281	0.0672	1.39E-06	3.32E-06
Totals									0.0823	0.1966		0.0247	0.0590	0.5184	1.2383	2.56E-05	6.12E-05

Footnote: Totals are rounded sums of actual values.

Appendix F

FDM Model Output Files—Highest 24-Hour Means

This appendix contains four FDM output files (PM_{10}, 0% controlled; TSP, 0% controlled; PM_{10}, 50% controlled; and TSP, 50% controlled). Each file contains input parameters, sources, and receptor locations.

Sources in each file include:

1. Paved road from the transfer point to gravel road.
2. Gravel road to active cell.
3. Road across active cell to working face.
4. Working face of active cell.
5. Active cell (Cell 1)
6. Active cell (Cell 1)
7. Active cell (Cell 1)
8. Active cell (Cell 1)
9. Cell under construction (Cell 2)
10. Cell under construction (Cell 2)
11. NW storage pile
12. East storage pile

Receptors in each file include:

x	y	Location
870	700	North landfill footprint boundary
870	-376	South landfill footprint boundary
1647	319	East landfill footprint boundary
149	-66	West landfill footprint boundary
-2014	685	First house on Headquarters road (nearest residence)
-2298	766	Second house on Headquarters road
-2714	-995	Western boundary, point 1
-3530	-995	Western boundary, point 2
-2714	614	Western boundary, point 3
-1917	1436	Western boundary, point 4
-3530	1436	Western boundary, point 5
-3030	2309	Western boundary, point 7
-2699	1904	Western boundary, point 8
-1998	3005	Western boundary, point 9
-1074	495	Headquarters site
-2464	2873	Boundary point NW
1312	-1833	Boundary point west
-1856	4173	Timber point, to NW boundary
-815	5659	Waldon Island, first house north of landfill
4428	4005	First house on Moore Road northeast of landfill

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
FDM for Weyerhaeuser Solid Waste Disposal (PM10, 0% controlled)

INPUT FILE NAME: pm10un.in
OUTPUT FILE NAME: pm10un.out

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	2
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
NUMBER OF SOURCES PROCESSED	12
NUMBER OF RECEPTORS PROCESSED	20
NUMBER OF PARTICLE SIZE CLASSES	4
NUMBER OF HOURS OF MET DATA PROCESSED	1512
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	.05
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	6.0000000	**	**	.2250
2	12.5000000	**	**	.0750
3	13.5000000	**	**	.0500
4	80.7000000	**	**	.6500

** COMPUTED BY FDM

RECEPTOR COORDINATES (X,Y,Z)

(870.,	700.,	0.)	(870.,	-376.,	0.)	(1647.,	319.,	0.)
(149.,	-66.,	0.)	(-2014.,	685.,	0.)	(-2298.,	766.,	0.)
(-2714.,	-995.,	0.)	(-3530.,	-995.,	0.)	(-2714.,	614.,	0.)
(-1917.,	1436.,	0.)	(-3530.,	1436.,	0.)	(-3030.,	2309.,	0.)
(-2699.,	1904.,	0.)	(-1998.,	3005.,	0.)	(-1074.,	495.,	0.)
(-2404.,	2873.,	0.)	(1312.,	-1833.,	0.)	(-1856.,	4173.,	0.)
(-815.,	5659.,	0.)	(4428.,	4005.,	0.)	(		

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	.002670000	1.98405	.000	183.	546.	-238.	1158.	7.50	10.00
2	.001030000	.25615	.000	183.	546.	384.	399.	7.50	7.00
2	.011700000	.96636	.000	384.	399.	317.	351.	7.50	7.00
3	.000085400	1.72201	.000	317.	351.	142.	142.	7.50	-38.00
3	.000004410	.02642	.000	21.	65.	46.	131.	7.50	.00
3	.000004410	.05019	.000	91.	223.	55.	207.	7.50	-38.00
3	.000004410	.05019	.000	219.	381.	55.	207.	7.50	-38.00
3	.000004410	.14679	.000	146.	177.	98.	341.	7.50	-38.00
3	.000067600	.82856	.000	442.	262.	134.	91.	7.50	-20.00
3	.000067600	1.62723	.000	342.	104.	213.	113.	7.50	-20.00
3	.000005600	.51505	.000	-165.	1341.	152.	604.	7.50	40.00
3	.000005600	.14283	.000	329.	665.	137.	186.	7.50	.00
TOTAL EMISSIONS		8.31583							

24 HOUR AVERAGE FOR HOUR ENDING 1368
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	47.042)	(870.,	-376.,	2.231)	(1647.,	319.,	.970)
(149.,	-66.,	.752)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.103)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	1.081)	(		

24 HOUR AVERAGE FOR HOUR ENDING 216
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	2.487)	(870.,	-376.,	10.874)	(1647.,	319.,	2.632)
(149.,	-66.,	7.114)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.001)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.693)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.653)	(1312.,	-1833.,	2.861)	(-1856.,	4173.,	.319)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 768
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	135.686)	(-2014.,	685.,	.007)	(-2298.,	766.,	.002)
(-2714.,	-995.,	.451)	(-3530.,	-995.,	.124)	(-2714.,	614.,	.002)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	1.509)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 432
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	41.120)	(870.,	-376.,	.018)	(1647.,	319.,	9.261)
(149.,	-66.,	4.236)	(-2014.,	685.,	.014)	(-2298.,	766.,	.014)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.002)
(-1917.,	1436.,	.287)	(-3530.,	1436.,	.044)	(-3030.,	2309.,	.265)
(-2699.,	1904.,	.260)	(-1998.,	3005.,	.068)	(-1074.,	495.,	.043)
(-2404.,	2873.,	.180)	(1312.,	-1833.,	.049)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	1.563)	(		

24 HOUR AVERAGE FOR HOUR ENDING 552
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.811)	(870.,	-376.,	3.398)	(1647.,	319.,	.648)
(149.,	-66.,	66.446)	(-2014.,	685.,	7.984)	(-2298.,	766.,	5.692)
(-2714.,	-995.,	.968)	(-3530.,	-995.,	1.342)	(-2714.,	614.,	4.794)
(-1917.,	1436.,	1.915)	(-3530.,	1436.,	2.443)	(-3030.,	2309.,	.065)
(-2699.,	1904.,	.456)	(-1998.,	3005.,	.000)	(-1074.,	495.,	18.810)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.142)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 528
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	2.976)	(870.,	-376.,	1.520)	(1647.,	319.,	.455)
(149.,	-66.,	7.311)	(-2014.,	685.,	.838)	(-2298.,	766.,	.558)
(-2714.,	-995.,	.001)	(-3530.,	-995.,	.068)	(-2714.,	614.,	.537)
(-1917.,	1436.,	.143)	(-3530.,	1436.,	.157)	(-3030.,	2309.,	.050)
(-2699.,	1904.,	.098)	(-1998.,	3005.,	.002)	(-1074.,	495.,	1.297)
(-2404.,	2873.,	.001)	(1312.,	-1833.,	1.473)	(-1856.,	4173.,	1.784)
(-815.,	5659.,	1.985)	(4428.,	4005.,	.086)	(		

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
FDM for Weyerhaeuser Solid Waste Disposal (PM10, 50% controlled)

INPUT FILE NAME: pm1050.in
OUTPUT FILE NAME: pm1050.out

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	2
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
NUMBER OF SOURCES PROCESSED	12
NUMBER OF RECEPTORS PROCESSED	20
NUMBER OF PARTICLE SIZE CLASSES	4
NUMBER OF HOURS OF MET DATA PROCESSED	1512
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	.05
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	6.0000000	**	**	.2250
2	12.5000000	**	**	.0750
3	13.5000000	**	**	.0500
4	80.7000000	**	**	.6500

** COMPUTED BY FDM

RECEPTOR COORDINATES (X,Y,Z)

(870.,	700.,	0.)	(870.,	-376.,	0.)	(1647.,	319.,	0.)
(149.,	-66.,	0.)	(-2014.,	685.,	0.)	(-2298.,	766.,	0.)
(-2714.,	-995.,	0.)	(-3530.,	-995.,	0.)	(-2714.,	614.,	0.)
(-1917.,	1436.,	0.)	(-3530.,	1436.,	0.)	(-3030.,	2309.,	0.)
(-2699.,	1904.,	0.)	(-1998.,	3005.,	0.)	(-1074.,	495.,	0.)
(-2404.,	2873.,	0.)	(1312.,	-1833.,	0.)	(-1856.,	4173.,	0.)
(-815.,	5659.,	0.)	(4428.,	4005.,	0.)	(		

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	.001230000	.91400	.000	183.	546.	-238.	1158.	7.50	10.00
2	.000513000	.12758	.000	183.	546.	384.	399.	7.50	7.00
2	.005840000	.48235	.000	384.	399.	317.	351.	7.50	7.00
3	.000025600	.51620	.000	317.	351.	142.	142.	7.50	-38.00
3	.000002200	.01318	.000	21.	65.	46.	131.	7.50	.00
3	.000002200	.02504	.000	91.	223.	55.	207.	7.50	-38.00
3	.000002200	.02504	.000	219.	381.	55.	207.	7.50	-38.00
3	.000002200	.07323	.000	146.	177.	98.	341.	7.50	-38.00
3	.000033800	.41428	.000	442.	262.	134.	91.	7.50	-20.00
3	.000033800	.81362	.000	342.	104.	213.	113.	7.50	-20.00
3	.000001680	.15452	.000	-165.	1341.	152.	604.	7.50	40.00
3	.000001680	.04285	.000	329.	665.	137.	186.	7.50	.00
TOTAL EMISSIONS		3.60188							

24 HOUR AVERAGE FOR HOUR ENDING 1368
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	20.253)	(870.,	-376.,	1.052)	(1647.,	319.,	.442)
(149.,	-66.,	.375)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.045)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.475)	(		

24 HOUR AVERAGE FOR HOUR ENDING 216
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	1.103)	(870.,	-376.,	4.687)	(1647.,	319.,	1.143)
(149.,	-66.,	3.313)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.291)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.288)	(1312.,	-1833.,	1.251)	(-1856.,	4173.,	.143)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 768
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	60.646)	(-2014.,	685.,	.002)	(-2298.,	766.,	.001)
(-2714.,	-995.,	.191)	(-3530.,	-995.,	.046)	(-2714.,	614.,	.001)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.538)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 432
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	17.208)	(870.,	-376.,	.008)	(1647.,	319.,	3.776)
(149.,	-66.,	1.848)	(-2014.,	685.,	.007)	(-2298.,	766.,	.007)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.001)
(-1917.,	1436.,	.127)	(-3530.,	1436.,	.020)	(-3030.,	2309.,	.116)
(-2699.,	1904.,	.114)	(-1998.,	3005.,	.028)	(-1074.,	495.,	.021)
(-2404.,	2873.,	.076)	(1312.,	-1833.,	.021)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.670)	(		

1 24 HOUR AVERAGE FOR HOUR ENDING 552
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.352)	(870.,	-376.,	1.480)	(1647.,	319.,	.278)
(149.,	-66.,	30.798)	(-2014.,	685.,	3.444)	(-2298.,	766.,	2.476)
(-2714.,	-995.,	.427)	(-3530.,	-995.,	.616)	(-2714.,	614.,	2.014)
(-1917.,	1436.,	.792)	(-3530.,	1436.,	1.046)	(-3030.,	2309.,	.019)
(-2699.,	1904.,	.145)	(-1998.,	3005.,	.000)	(-1074.,	495.,	7.925)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.066)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 528
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	1.319)	(870.,	-376.,	.689)	(1647.,	319.,	.222)
(149.,	-66.,	3.270)	(-2014.,	685.,	.370)	(-2298.,	766.,	.228)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.034)	(-2714.,	614.,	.229)
(-1917.,	1436.,	.062)	(-3530.,	1436.,	.069)	(-3030.,	2309.,	.020)
(-2699.,	1904.,	.041)	(-1998.,	3005.,	.001)	(-1074.,	495.,	.582)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.641)	(-1856.,	4173.,	.747)
(-815.,	5659.,	.854)	(4428.,	4005.,	.037)	(		

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
FDM for Weyerhaeuser Solid Waste Disposal (TSP, 0% controlled)

INPUT FILE NAME: tsp0.in
OUTPUT FILE NAME: tsp0.out

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	2
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
NUMBER OF SOURCES PROCESSED	12
NUMBER OF RECEPTORS PROCESSED	20
NUMBER OF PARTICLE SIZE CLASSES	4
NUMBER OF HOURS OF MET DATA PROCESSED	1512
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	.05
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	6.0000000	**	**	.2250
2	12.5000000	**	**	.0750
3	13.5000000	**	**	.0500
4	80.7000000	**	**	.6500

** COMPUTED BY FDM

RECEPTOR COORDINATES (X,Y,Z)

(870.,	700.,	0.)	(870.,	-376.,	0.)	(1647.,	319.,	0.)
(149.,	-66.,	0.)	(-2014.,	685.,	0.)	(-2298.,	766.,	0.)
(-2714.,	-995.,	0.)	(-3530.,	-995.,	0.)	(-2714.,	614.,	0.)
(-1917.,	1436.,	0.)	(-3530.,	1436.,	0.)	(-3030.,	2309.,	0.)
(-2699.,	1904.,	0.)	(-1998.,	3005.,	0.)	(-1074.,	495.,	0.)
(-2404.,	2873.,	0.)	(1312.,	-1833.,	0.)	(-1856.,	4173.,	0.)
(-815.,	5659.,	0.)	(4428.,	4005.,	0.)	(		

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	.005100000	3.78976	.000	183.	546.	-238.	1158.	7.50	10.00
2	.002280000	.56700	.000	183.	546.	384.	399.	7.50	7.00
2	.026000000	2.14746	.000	384.	399.	317.	351.	7.50	7.00
3	.000204000	4.11346	.000	317.	351.	142.	142.	7.50	-38.00
3	.000009080	.05440	.000	21.	65.	46.	131.	7.50	.00
3	.000009080	.10334	.000	91.	223.	55.	207.	7.50	-38.00
3	.000009080	.10334	.000	219.	381.	55.	207.	7.50	-38.00
3	.000009080	.30224	.000	146.	177.	98.	341.	7.50	-38.00
3	.000150000	1.83851	.000	442.	262.	134.	91.	7.50	-20.00
3	.000150000	3.61073	.000	342.	104.	213.	113.	7.50	-20.00
3	.000011600	1.06689	.000	-165.	1341.	152.	604.	7.50	40.00
3	.000011600	.29586	.000	329.	665.	137.	186.	7.50	.00
TOTAL EMISSIONS		17.99299							

24 HOUR AVERAGE FOR HOUR ENDING 1368
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	106.668)	(870.,	-376.,	4.955)	(1647.,	319.,	2.170)
(149.,	-66.,	1.547)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.222)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	2.220)	(		

24 HOUR AVERAGE FOR HOUR ENDING 216
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	5.064)	(870.,	-376.,	24.104)	(1647.,	319.,	5.960)
(149.,	-66.,	14.713)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.001)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.001)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	1.456)	(-1074.,	495.,	.000)
(-2404.,	2873.,	1.431)	(1312.,	-1833.,	6.300)	(-1856.,	4173.,	.676)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 768
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	305.173)	(-2014.,	685.,	.014)	(-2298.,	766.,	.005)
(-2714.,	-995.,	.899)	(-3530.,	-995.,	.253)	(-2714.,	614.,	.004)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	3.041)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 432
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	92.439)	(870.,	-376.,	.040)	(1647.,	319.,	21.211)
(149.,	-66.,	9.051)	(-2014.,	685.,	.031)	(-2298.,	766.,	.030)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.004)
(-1917.,	1436.,	.637)	(-3530.,	1436.,	.098)	(-3030.,	2309.,	.574)
(-2699.,	1904.,	.569)	(-1998.,	3005.,	.144)	(-1074.,	495.,	.093)
(-2404.,	2873.,	.382)	(1312.,	-1833.,	.109)	(-1856.,	4173.,	.001)
(-815.,	5659.,	.000)	(4428.,	4005.,	3.379)	(		

24 HOUR AVERAGE FOR HOUR ENDING 552
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	1.571)	(870.,	-376.,	7.515)	(1647.,	319.,	1.349)
(149.,	-66.,	147.252)	(-2014.,	685.,	17.753)	(-2298.,	766.,	12.624)
(-2714.,	-995.,	2.025)	(-3530.,	-995.,	2.973)	(-2714.,	614.,	10.762)
(-1917.,	1436.,	3.749)	(-3530.,	1436.,	5.146)	(-3030.,	2309.,	.134)
(-2699.,	1904.,	.937)	(-1998.,	3005.,	.000)	(-1074.,	495.,	41.649)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.304)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 528
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	6.619)	(870.,	-376.,	3.369)	(1647.,	319.,	1.009)
(149.,	-66.,	15.415)	(-2014.,	685.,	1.656)	(-2298.,	766.,	1.133)
(-2714.,	-995.,	.002)	(-3530.,	-995.,	.150)	(-2714.,	614.,	1.060)
(-1917.,	1436.,	.299)	(-3530.,	1436.,	.346)	(-3030.,	2309.,	.102)
(-2699.,	1904.,	.203)	(-1998.,	3005.,	.005)	(-1074.,	495.,	2.554)
(-2404.,	2873.,	.001)	(1312.,	-1833.,	3.259)	(-1856.,	4173.,	3.866)
(-815.,	5659.,	4.275)	(4428.,	4005.,	.185)	(		

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
FDM for Weyerhaeuser Solid Waste Disposal (TSP, 50% controlled)

INPUT FILE NAME: tsp50.in
OUTPUT FILE NAME: tsp50.out

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	2
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
NUMBER OF SOURCES PROCESSED	12
NUMBER OF RECEPTORS PROCESSED	20
NUMBER OF PARTICLE SIZE CLASSES	4
NUMBER OF HOURS OF MET DATA PROCESSED	1512
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	.05
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	6.0000000	**	**	.2250
2	12.5000000	**	**	.0750
3	13.5000000	**	**	.0500
4	80.7000000	**	**	.6500

** COMPUTED BY FDM

RECEPTOR COORDINATES (X,Y,Z)

(870.,	700.,	0.)	(870.,	-376.,	0.)	(1647.,	319.,	0.)
(149.,	-66.,	0.)	(-2014.,	685.,	0.)	(-2298.,	766.,	0.)
(-2714.,	-995.,	0.)	(-3530.,	-995.,	0.)	(-2714.,	614.,	0.)
(-1917.,	1436.,	0.)	(-3530.,	1436.,	0.)	(-3030.,	2309.,	0.)
(-2699.,	1904.,	0.)	(-1998.,	3005.,	0.)	(-1074.,	495.,	0.)
(-2404.,	2873.,	0.)	(1312.,	-1833.,	0.)	(-1856.,	4173.,	0.)
(-815.,	5659.,	0.)	(4428.,	4005.,	0.)	(		

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	.002340000	1.73883	.000	183.	546.	-238.	1158.	7.50	10.00
2	.001140000	.28350	.000	183.	546.	384.	399.	7.50	7.00
2	.013000000	1.07373	.000	384.	399.	317.	351.	7.50	7.00
3	.000061200	1.23404	.000	317.	351.	142.	142.	7.50	-38.00
3	.000004540	.02720	.000	21.	65.	46.	131.	7.50	.00
3	.000004540	.05167	.000	91.	223.	55.	207.	7.50	-38.00
3	.000004540	.05167	.000	219.	381.	55.	207.	7.50	-38.00
3	.000004540	.15112	.000	146.	177.	98.	341.	7.50	-38.00
3	.000075100	.92048	.000	442.	262.	134.	91.	7.50	-20.00
3	.000075100	1.80777	.000	342.	104.	213.	113.	7.50	-20.00
3	.000003480	.32007	.000	-165.	1341.	152.	604.	7.50	40.00
3	.000003480	.08876	.000	329.	665.	137.	186.	7.50	.00
TOTAL EMISSIONS		7.74884							

24 HOUR AVERAGE FOR HOUR ENDING 1368
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	45.617)	(870.,	-376.,	2.330)	(1647.,	319.,	.986)
(149.,	-66.,	.773)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.097)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.969)	(		

24 HOUR AVERAGE FOR HOUR ENDING 216
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	2.245)	(870.,	-376.,	10.322)	(1647.,	319.,	2.572)
(149.,	-66.,	6.823)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.001)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.608)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.626)	(1312.,	-1833.,	2.739)	(-1856.,	4173.,	.301)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 768
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	135.697)	(-2014.,	685.,	.004)	(-2298.,	766.,	.001)
(-2714.,	-995.,	.377)	(-3530.,	-995.,	.093)	(-2714.,	614.,	.001)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	1.074)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 432
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	38.378)	(870.,	-376.,	.018)	(1647.,	319.,	8.577)
(149.,	-66.,	3.908)	(-2014.,	685.,	.015)	(-2298.,	766.,	.014)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.002)
(-1917.,	1436.,	.279)	(-3530.,	1436.,	.045)	(-3030.,	2309.,	.249)
(-2699.,	1904.,	.249)	(-1998.,	3005.,	.058)	(-1074.,	495.,	.046)
(-2404.,	2873.,	.160)	(1312.,	-1833.,	.047)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	1.437)	(		

24 HOUR AVERAGE FOR HOUR ENDING 552
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.676)	(870.,	-376.,	3.254)	(1647.,	319.,	.574)
(149.,	-66.,	68.059)	(-2014.,	685.,	7.613)	(-2298.,	766.,	5.468)
(-2714.,	-995.,	.890)	(-3530.,	-995.,	1.361)	(-2714.,	614.,	4.493)
(-1917.,	1436.,	1.535)	(-3530.,	1436.,	2.182)	(-3030.,	2309.,	.040)
(-2699.,	1904.,	.296)	(-1998.,	3005.,	.000)	(-1074.,	495.,	17.399)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.141)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 528
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	2.921)	(870.,	-376.,	1.526)	(1647.,	319.,	.493)
(149.,	-66.,	6.839)	(-2014.,	685.,	.727)	(-2298.,	766.,	.460)
(-2714.,	-995.,	.001)	(-3530.,	-995.,	.075)	(-2714.,	614.,	.449)
(-1917.,	1436.,	.128)	(-3530.,	1436.,	.151)	(-3030.,	2309.,	.040)
(-2699.,	1904.,	.085)	(-1998.,	3005.,	.002)	(-1074.,	495.,	1.140)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	1.411)	(-1856.,	4173.,	1.611)
(-815.,	5659.,	1.828)	(4428.,	4005.,	.079)	(		

Appendix G

FDM Model Output Files—Annual Means and Second-Highest 24-Hour Means

This appendix contains four FDM output files (PM_{10}, 0% controlled; TSP, 0% controlled; PM_{10}, 50% controlled; and TSP, 50% controlled). Each file contains input parameters, sources, and receptor locations.

Sources in each file include:

1. Paved road from the transfer point to gravel road.
2. Gravel road to active cell.
3. Road across active cell to working face.
4. Working face of active cell.
5. Active cell (Cell 1)
6. Active cell (Cell 1)
7. Active cell (Cell 1)
8. Active cell (Cell 1)
9. Cell under construction (Cell 2)
10. Cell under construction (Cell 2)
11. NW storage pile
12. East storage pile

Receptors in each file include:

x	y	Location
870	700	North landfill footprint boundary
870	-376	South landfill footprint boundary
1647	319	East landfill footprint boundary
149	-66	West landfill footprint boundary
-2014	685	First house on Headquarters road (nearest residence)
-2298	766	Second house on Headquarters road
-2714	-995	Western boundary, point 1
-3530	-995	Western boundary, point 2
-2714	614	Western boundary, point 3
-1917	1436	Western boundary, point 4
-3530	1436	Western boundary, point 5
-3030	2309	Western boundary, point 7
-2699	1904	Western boundary, point 8
-1998	3005	Western boundary, point 9
-1074	495	Headquarters site
-2464	2873	Boundary point NW
1312	-1833	Boundary point west
-1856	4173	Timber point, to NW boundary
-815	5659	Waldon Island, first house north of landfill
4428	4005	First house on Moore Road northeast of landfill

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
FDM for Weyerhaeuser Solid Waste Disposal (PM10, 0% controlled)

INPUT FILE NAME: pm10un.in
OUTPUT FILE NAME: pm10un.out

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	2
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
NUMBER OF SOURCES PROCESSED	12
NUMBER OF RECEPTORS PROCESSED	20
NUMBER OF PARTICLE SIZE CLASSES	4
NUMBER OF HOURS OF MET DATA PROCESSED	1512
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	.05
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	6.0000000	**	**	.2250
2	12.5000000	**	**	.0750
3	13.5000000	**	**	.0500
4	80.7000000	**	**	.6500

** COMPUTED BY FDM

RECEPTOR COORDINATES (X,Y,Z)

(870.,	700.,	0.)	(870.,	-376.,	0.)	(1647.,	319.,	0.)
(149.,	-66.,	0.)	(-2014.,	685.,	0.)	(-2298.,	766.,	0.)
(-2714.,	-995.,	0.)	(-3530.,	-995.,	0.)	(-2714.,	614.,	0.)
(-1917.,	1436.,	0.)	(-3530.,	1436.,	0.)	(-3030.,	2309.,	0.)
(-2699.,	1904.,	0.)	(-1998.,	3005.,	0.)	(-1074.,	495.,	0.)
(-2404.,	2873.,	0.)	(1312.,	-1833.,	0.)	(-1856.,	4173.,	0.)
(-815.,	5659.,	0.)	(4428.,	4005.,	0.)	(		

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	.002670000	1.98405	.000	183.	546.	-238.	1158.	7.50	10.00
2	.001030000	.25615	.000	183.	546.	384.	399.	7.50	7.00
2	.011700000	.96636	.000	384.	399.	317.	351.	7.50	7.00
3	.000085400	1.72201	.000	317.	351.	142.	142.	7.50	-38.00
3	.000004410	.02642	.000	21.	65.	46.	131.	7.50	.00
3	.000004410	.05019	.000	91.	223.	55.	207.	7.50	-38.00
3	.000004410	.05019	.000	219.	381.	55.	207.	7.50	-38.00
3	.000004410	.14679	.000	146.	177.	98.	341.	7.50	-38.00
3	.000067600	.82856	.000	442.	262.	134.	91.	7.50	-20.00
3	.000067600	1.62723	.000	342.	104.	213.	113.	7.50	-20.00
3	.000005600	.51505	.000	-165.	1341.	152.	604.	7.50	40.00
3	.000005600	.14283	.000	329.	665.	137.	186.	7.50	.00
TOTAL EMISSIONS		8.31583							

24 HOUR AVERAGE FOR HOUR ENDING 312
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	45.281)	(870.,	-376.,	5.201)	(1647.,	319.,	1.300)
(149.,	-66.,	1.210)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.296)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	1.529)	(		

24 HOUR AVERAGE FOR HOUR ENDING 720
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.369)	(870.,	-376.,	10.259)	(1647.,	319.,	.281)
(149.,	-66.,	54.446)	(-2014.,	685.,	.198)	(-2298.,	766.,	.019)
(-2714.,	-995.,	1.594)	(-3530.,	-995.,	.412)	(-2714.,	614.,	.010)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	1.707)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.476)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1104
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.054)	(870.,	-376.,	7.517)	(1647.,	319.,	.004)
(149.,	-66.,	117.407)	(-2014.,	685.,	.178)	(-2298.,	766.,	.012)
(-2714.,	-995.,	2.070)	(-3530.,	-995.,	.544)	(-2714.,	614.,	.006)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	3.154)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.338)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1128
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	18.443)	(870.,	-376.,	4.153)	(1647.,	319.,	5.779)
(149.,	-66.,	1.617)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	2.503)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.551)	(		

24 HOUR AVERAGE FOR HOUR ENDING 336
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	6.667)	(870.,	-376.,	.017)	(1647.,	319.,	.268)
(149.,	-66.,	25.916)	(-2014.,	685.,	2.868)	(-2298.,	766.,	2.735)
(-2714.,	-995.,	.544)	(-3530.,	-995.,	.263)	(-2714.,	614.,	.643)
(-1917.,	1436.,	5.212)	(-3530.,	1436.,	2.594)	(-3030.,	2309.,	1.817)
(-2699.,	1904.,	2.515)	(-1998.,	3005.,	.604)	(-1074.,	495.,	7.770)
(-2404.,	2873.,	3.274)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.166)	(4428.,	4005.,	.237)	(		

24 HOUR AVERAGE FOR HOUR ENDING 192
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	1.972)	(-2014.,	685.,	1.054)	(-2298.,	766.,	.483)
(-2714.,	-995.,	.437)	(-3530.,	-995.,	2.151)	(-2714.,	614.,	.474)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.004)	(-1074.,	495.,	2.441)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.266)
(-815.,	5659.,	.352)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1320
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	.000)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.001)
(-815.,	5659.,	1.150)	(4428.,	4005.,	.000)	(		

1512 HOUR AVERAGE FOR HOUR ENDING 1512
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	7.679)	(870.,	-376.,	1.347)	(1647.,	319.,	.559)
(149.,	-66.,	28.220)	(-2014.,	685.,	.476)	(-2298.,	766.,	.344)
(-2714.,	-995.,	.487)	(-3530.,	-995.,	.269)	(-2714.,	614.,	.258)
(-1917.,	1436.,	.207)	(-3530.,	1436.,	.133)	(-3030.,	2309.,	.051)
(-2699.,	1904.,	.082)	(-1998.,	3005.,	.044)	(-1074.,	495.,	1.552)
(-2404.,	2873.,	.072)	(1312.,	-1833.,	.368)	(-1856.,	4173.,	.034)
(-815.,	5659.,	.093)	(4428.,	4005.,	.235)	(		

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
FDM for Weyerhaeuser Solid Waste Disposal (PM10, 50% controlled)

INPUT FILE NAME: pm1050.in
OUTPUT FILE NAME: pm1050.out

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	2
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
NUMBER OF SOURCES PROCESSED	12
NUMBER OF RECEPTORS PROCESSED	20
NUMBER OF PARTICLE SIZE CLASSES	4
NUMBER OF HOURS OF MET DATA PROCESSED	1512
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	.05
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	6.0000000	**	**	.2250
2	12.5000000	**	**	.0750
3	13.5000000	**	**	.0500
4	80.7000000	**	**	.6500

** COMPUTED BY FDM

RECEPTOR COORDINATES (X,Y,Z)

(870.,	700.,	0.)	(870.,	-376.,	0.)	(1647.,	319.,	0.)
(149.,	-66.,	0.)	(-2014.,	685.,	0.)	(-2298.,	766.,	0.)
(-2714.,	-995.,	0.)	(-3530.,	-995.,	0.)	(-2714.,	614.,	0.)
(-1917.,	1436.,	0.)	(-3530.,	1436.,	0.)	(-3030.,	2309.,	0.)
(-2699.,	1904.,	0.)	(-1998.,	3005.,	0.)	(-1074.,	495.,	0.)
(-2404.,	2873.,	0.)	(1312.,	-1833.,	0.)	(-1856.,	4173.,	0.)
(-815.,	5659.,	0.)	(4428.,	4005.,	0.)	(		

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	.001230000	.91400	.000	183.	546.	-238.	1158.	7.50	10.00
2	.000513000	.12758	.000	183.	546.	384.	399.	7.50	7.00
2	.005840000	.48235	.000	384.	399.	317.	351.	7.50	7.00
3	.000025600	.51620	.000	317.	351.	142.	142.	7.50	-38.00
3	.000002200	.01318	.000	21.	65.	46.	131.	7.50	.00
3	.000002200	.02504	.000	91.	223.	55.	207.	7.50	-38.00
3	.000002200	.02504	.000	219.	381.	55.	207.	7.50	-38.00
3	.000002200	.07323	.000	146.	177.	98.	341.	7.50	-38.00
3	.000033800	.41428	.000	442.	262.	134.	91.	7.50	-20.00
3	.000033800	.81362	.000	342.	104.	213.	113.	7.50	-20.00
3	.000001680	.15452	.000	-165.	1341.	152.	604.	7.50	40.00
3	.000001680	.04285	.000	329.	665.	137.	186.	7.50	.00
TOTAL EMISSIONS		3.60188							

24 HOUR AVERAGE FOR HOUR ENDING 312
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	19.971)	(870.,	-376.,	2.494)	(1647.,	319.,	.567)
(149.,	-66.,	.602)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.130)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.644)	(		

24 HOUR AVERAGE FOR HOUR ENDING 720
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.154)	(870.,	-376.,	4.523)	(1647.,	319.,	.127)
(149.,	-66.,	24.018)	(-2014.,	685.,	.059)	(-2298.,	766.,	.006)
(-2714.,	-995.,	.647)	(-3530.,	-995.,	.181)	(-2714.,	614.,	.003)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.735)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.218)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1104
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.023)	(870.,	-376.,	3.420)	(1647.,	319.,	.001)
(149.,	-66.,	52.819)	(-2014.,	685.,	.054)	(-2298.,	766.,	.004)
(-2714.,	-995.,	.850)	(-3530.,	-995.,	.224)	(-2714.,	614.,	.002)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	1.273)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.147)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1128
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	8.160)	(870.,	-376.,	1.798)	(1647.,	319.,	2.655)
(149.,	-66.,	.804)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	1.100)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.240)	(		

24 HOUR AVERAGE FOR HOUR ENDING 336
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	3.035)	(870.,	-376.,	.008)	(1647.,	319.,	.117)
(149.,	-66.,	11.747)	(-2014.,	685.,	1.333)	(-2298.,	766.,	1.242)
(-2714.,	-995.,	.247)	(-3530.,	-995.,	.102)	(-2714.,	614.,	.319)
(-1917.,	1436.,	2.318)	(-3530.,	1436.,	1.143)	(-3030.,	2309.,	.778)
(-2699.,	1904.,	1.084)	(-1998.,	3005.,	.197)	(-1074.,	495.,	3.666)
(-2404.,	2873.,	1.383)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.067)	(4428.,	4005.,	.099)	(		

24 HOUR AVERAGE FOR HOUR ENDING 192
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	.986)	(-2014.,	685.,	.410)	(-2298.,	766.,	.150)
(-2714.,	-995.,	.218)	(-3530.,	-995.,	1.005)	(-2714.,	614.,	.158)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.002)	(-1074.,	495.,	1.123)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.117)
(-815.,	5659.,	.151)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1320
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	.000)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.493)	(4428.,	4005.,	.000)	(		

1512 HOUR AVERAGE FOR HOUR ENDING 1512
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	3.383)	(870.,	-376.,	.598)	(1647.,	319.,	.246)
(149.,	-66.,	12.697)	(-2014.,	685.,	.205)	(-2298.,	766.,	.149)
(-2714.,	-995.,	.208)	(-3530.,	-995.,	.117)	(-2714.,	614.,	.109)
(-1917.,	1436.,	.087)	(-3530.,	1436.,	.056)	(-3030.,	2309.,	.022)
(-2699.,	1904.,	.034)	(-1998.,	3005.,	.018)	(-1074.,	495.,	.670)
(-2404.,	2873.,	.031)	(1312.,	-1833.,	.162)	(-1856.,	4173.,	.015)
(-815.,	5659.,	.040)	(4428.,	4005.,	.102)	(		

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
FDM for Weyerhaeuser Solid Waste Disposal (TSP, 0% controlled)

INPUT FILE NAME: tsp0.in
OUTPUT FILE NAME: tsp0.out

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	2
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
NUMBER OF SOURCES PROCESSED	12
NUMBER OF RECEPTORS PROCESSED	20
NUMBER OF PARTICLE SIZE CLASSES	4
NUMBER OF HOURS OF MET DATA PROCESSED	1512
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	.05
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	6.0000000	**	**	.2250
2	12.5000000	**	**	.0750
3	13.5000000	**	**	.0500
4	80.7000000	**	**	.6500

** COMPUTED BY FDM

RECEPTOR COORDINATES (X,Y,Z)

(870.,	700.,	0.)	(870.,	-376.,	0.)	(1647.,	319.,	0.)
(149.,	-66.,	0.)	(-2014.,	685.,	0.)	(-2298.,	766.,	0.)
(-2714.,	-995.,	0.)	(-3530.,	-995.,	0.)	(-2714.,	614.,	0.)
(-1917.,	1436.,	0.)	(-3530.,	1436.,	0.)	(-3030.,	2309.,	0.)
(-2699.,	1904.,	0.)	(-1998.,	3005.,	0.)	(-1074.,	495.,	0.)
(-2404.,	2873.,	0.)	(1312.,	-1833.,	0.)	(-1856.,	4173.,	0.)
(-815.,	5659.,	0.)	(4428.,	4005.,	0.)	(		

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	.005100000	3.78976	.000	183.	546.	-238.	1158.	7.50	10.00
2	.002280000	.56700	.000	183.	546.	384.	399.	7.50	7.00
2	.026000000	2.14746	.000	384.	399.	317.	351.	7.50	7.00
3	.000204000	4.11346	.000	317.	351.	142.	142.	7.50	-38.00
3	.000009080	.05440	.000	21.	65.	46.	131.	7.50	.00
3	.000009080	.10334	.000	91.	223.	55.	207.	7.50	-38.00
3	.000009080	.10334	.000	219.	381.	55.	207.	7.50	-38.00
3	.000009080	.30224	.000	146.	177.	98.	341.	7.50	-38.00
3	.000150000	1.83851	.000	442.	262.	134.	91.	7.50	-20.00
3	.000150000	3.61073	.000	342.	104.	213.	113.	7.50	-20.00
3	.000011600	1.06689	.000	-165.	1341.	152.	604.	7.50	40.00
3	.000011600	.29586	.000	329.	665.	137.	186.	7.50	.00
TOTAL EMISSIONS		17.99299							

24 HOUR AVERAGE FOR HOUR ENDING 312
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	101.956)	(870.,	-376.,	11.533)	(1647.,	319.,	2.576)
(149.,	-66.,	2.487)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.640)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	3.309)	(		

24 HOUR AVERAGE FOR HOUR ENDING 720
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.747)	(870.,	-376.,	22.696)	(1647.,	319.,	.633)
(149.,	-66.,	119.880)	(-2014.,	685.,	.409)	(-2298.,	766.,	.039)
(-2714.,	-995.,	3.511)	(-3530.,	-995.,	.804)	(-2714.,	614.,	.021)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	3.313)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	1.041)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1104
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.117)	(870.,	-376.,	16.755)	(1647.,	319.,	.008)
(149.,	-66.,	262.609)	(-2014.,	685.,	.370)	(-2298.,	766.,	.026)
(-2714.,	-995.,	4.507)	(-3530.,	-995.,	1.069)	(-2714.,	614.,	.012)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	6.206)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.736)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1128
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	40.493)	(870.,	-376.,	9.194)	(1647.,	319.,	12.971)
(149.,	-66.,	3.324)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	5.476)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	1.228)	(		

24 HOUR AVERAGE FOR HOUR ENDING 336
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	14.872)	(870.,	-376.,	.036)	(1647.,	319.,	.560)
(149.,	-66.,	58.125)	(-2014.,	685.,	6.406)	(-2298.,	766.,	6.140)
(-2714.,	-995.,	1.048)	(-3530.,	-995.,	.522)	(-2714.,	614.,	1.417)
(-1917.,	1436.,	10.767)	(-3530.,	1436.,	5.692)	(-3030.,	2309.,	3.842)
(-2699.,	1904.,	5.110)	(-1998.,	3005.,	1.243)	(-1074.,	495.,	16.741)
(-2404.,	2873.,	7.018)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.328)	(4428.,	4005.,	.512)	(		

24 HOUR AVERAGE FOR HOUR ENDING 192
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	4.375)	(-2014.,	685.,	2.088)	(-2298.,	766.,	.996)
(-2714.,	-995.,	.970)	(-3530.,	-995.,	4.813)	(-2714.,	614.,	.966)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.008)	(-1074.,	495.,	4.664)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.565)
(-815.,	5659.,	.753)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1320
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.001)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	.000)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.001)
(-815.,	5659.,	2.473)	(4428.,	4005.,	.000)	(		

1512 HOUR AVERAGE FOR HOUR ENDING 1512
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	17.264)	(870.,	-376.,	2.987)	(1647.,	319.,	1.249)
(149.,	-66.,	62.076)	(-2014.,	685.,	.997)	(-2298.,	766.,	.726)
(-2714.,	-995.,	1.054)	(-3530.,	-995.,	.574)	(-2714.,	614.,	.542)
(-1917.,	1436.,	.427)	(-3530.,	1436.,	.288)	(-3030.,	2309.,	.108)
(-2699.,	1904.,	.172)	(-1998.,	3005.,	.093)	(-1074.,	495.,	3.198)
(-2404.,	2873.,	.153)	(1312.,	-1833.,	.808)	(-1856.,	4173.,	.073)
(-815.,	5659.,	.197)	(4428.,	4005.,	.509)	(		

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
FDM for Weyerhaeuser Solid Waste Disposal (TSP, 50% controlled)

INPUT FILE NAME: tsp50.in
OUTPUT FILE NAME: tsp50.out

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	2
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	2
NUMBER OF SOURCES PROCESSED	12
NUMBER OF RECEPTORS PROCESSED	20
NUMBER OF PARTICLE SIZE CLASSES	4
NUMBER OF HOURS OF MET DATA PROCESSED	1512
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	.05
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	6.0000000	**	**	.2250
2	12.5000000	**	**	.0750
3	13.5000000	**	**	.0500
4	80.7000000	**	**	.6500

** COMPUTED BY FDM

RECEPTOR COORDINATES (X,Y,Z)

(870.,	700.,	0.)	(870.,	-376.,	0.)	(1647.,	319.,	0.)
(149.,	-66.,	0.)	(-2014.,	685.,	0.)	(-2298.,	766.,	0.)
(-2714.,	-995.,	0.)	(-3530.,	-995.,	0.)	(-2714.,	614.,	0.)
(-1917.,	1436.,	0.)	(-3530.,	1436.,	0.)	(-3030.,	2309.,	0.)
(-2699.,	1904.,	0.)	(-1998.,	3005.,	0.)	(-1074.,	495.,	0.)
(-2404.,	2873.,	0.)	(1312.,	-1833.,	0.)	(-1856.,	4173.,	0.)
(-815.,	5659.,	0.)	(4428.,	4005.,	0.)	(		

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	.002340000	1.73883	.000	183.	546.	-238.	1158.	7.50	10.00
2	.001140000	.28350	.000	183.	546.	384.	399.	7.50	7.00
2	.013000000	1.07373	.000	384.	399.	317.	351.	7.50	7.00
3	.000061200	1.23404	.000	317.	351.	142.	142.	7.50	-38.00
3	.000004540	.02720	.000	21.	65.	46.	131.	7.50	.00
3	.000004540	.05167	.000	91.	223.	55.	207.	7.50	-38.00
3	.000004540	.05167	.000	219.	381.	55.	207.	7.50	-38.00
3	.000004540	.15112	.000	146.	177.	98.	341.	7.50	-38.00
3	.000075100	.92048	.000	442.	262.	134.	91.	7.50	-20.00
3	.000075100	1.80777	.000	342.	104.	213.	113.	7.50	-20.00
3	.000003480	.32007	.000	-165.	1341.	152.	604.	7.50	40.00
3	.000003480	.08876	.000	329.	665.	137.	186.	7.50	.00
TOTAL EMISSIONS		7.74884							

24 HOUR AVERAGE FOR HOUR ENDING 312
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	44.695)	(870.,	-376.,	5.524)	(1647.,	319.,	1.114)
(149.,	-66.,	1.239)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.279)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	1.383)	(		

24 HOUR AVERAGE FOR HOUR ENDING 720
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.311)	(870.,	-376.,	9.958)	(1647.,	319.,	.286)
(149.,	-66.,	52.529)	(-2014.,	685.,	.123)	(-2298.,	766.,	.012)
(-2714.,	-995.,	1.411)	(-3530.,	-995.,	.350)	(-2714.,	614.,	.006)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	1.414)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.477)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1104
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.050)	(870.,	-376.,	7.590)	(1647.,	319.,	.003)
(149.,	-66.,	117.575)	(-2014.,	685.,	.111)	(-2298.,	766.,	.008)
(-2714.,	-995.,	1.829)	(-3530.,	-995.,	.436)	(-2714.,	614.,	.004)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	2.478)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.319)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1128
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	17.843)	(870.,	-376.,	3.968)	(1647.,	319.,	5.935)
(149.,	-66.,	1.656)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	2.391)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.000)	(4428.,	4005.,	.532)	(		

24 HOUR AVERAGE FOR HOUR ENDING 336
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	6.742)	(870.,	-376.,	.018)	(1647.,	319.,	.244)
(149.,	-66.,	26.230)	(-2014.,	685.,	2.967)	(-2298.,	766.,	2.774)
(-2714.,	-995.,	.472)	(-3530.,	-995.,	.200)	(-2714.,	614.,	.703)
(-1917.,	1436.,	4.755)	(-3530.,	1436.,	2.491)	(-3030.,	2309.,	1.642)
(-2699.,	1904.,	2.192)	(-1998.,	3005.,	.404)	(-1074.,	495.,	7.902)
(-2404.,	2873.,	2.943)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.000)
(-815.,	5659.,	.132)	(4428.,	4005.,	.212)	(		

24 HOUR AVERAGE FOR HOUR ENDING 192
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.000)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	2.190)	(-2014.,	685.,	.804)	(-2298.,	766.,	.308)
(-2714.,	-995.,	.484)	(-3530.,	-995.,	2.241)	(-2714.,	614.,	.319)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.004)	(-1074.,	495.,	2.136)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.246)
(-815.,	5659.,	.321)	(4428.,	4005.,	.000)	(		

24 HOUR AVERAGE FOR HOUR ENDING 1320
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	.001)	(870.,	-376.,	.000)	(1647.,	319.,	.000)
(149.,	-66.,	.000)	(-2014.,	685.,	.000)	(-2298.,	766.,	.000)
(-2714.,	-995.,	.000)	(-3530.,	-995.,	.000)	(-2714.,	614.,	.000)
(-1917.,	1436.,	.000)	(-3530.,	1436.,	.000)	(-3030.,	2309.,	.000)
(-2699.,	1904.,	.000)	(-1998.,	3005.,	.000)	(-1074.,	495.,	.000)
(-2404.,	2873.,	.000)	(1312.,	-1833.,	.000)	(-1856.,	4173.,	.001)
(-815.,	5659.,	1.055)	(4428.,	4005.,	.000)	(		

1512 HOUR AVERAGE FOR HOUR ENDING 1512
CONCENTRATIONS IN MICROGRAMS/M**3

(870.,	700.,	7.563)	(870.,	-376.,	1.319)	(1647.,	319.,	.546)
(149.,	-66.,	27.782)	(-2014.,	685.,	.427)	(-2298.,	766.,	.312)
(-2714.,	-995.,	.448)	(-3530.,	-995.,	.248)	(-2714.,	614.,	.227)
(-1917.,	1436.,	.178)	(-3530.,	1436.,	.121)	(-3030.,	2309.,	.045)
(-2699.,	1904.,	.070)	(-1998.,	3005.,	.038)	(-1074.,	495.,	1.371)
(-2404.,	2873.,	.065)	(1312.,	-1833.,	.353)	(-1856.,	4173.,	.031)
(-815.,	5659.,	.084)	(4428.,	4005.,	.220)	(		

Appendix M

Waste Import and Landfill Capacity Requirements

Headquarters Camp
Solid Waste Disposal Facility

Weyerhaeuser

Corporate Headquarters
Tacoma, Washington 98477
Tel (206) 924 2345

October 13, 1992

Jean Garber
8436 129th Pl. SE
Renton, Washington 98056

Dear Ms. Garber:

RE: Additional Information on Waste Importation and Capacity Requirements

You recently requested more information concerning the above two topics for possible inclusion in the Final Environmental Impact Statement for the proposed Headquarters Camp solid waste disposal facility. Although we understand additional information is not required under the State Environmental Policy Act, Weyerhaeuser is pleased to provide more clarification and detail on its solid waste plans. We hope this information may be helpful in further educating the responsible decision makers about our project.

I am providing the information in two enclosures, one on waste importation and the second regarding disposal capacity requirements. Please feel free to contact me for discussion or clarification of the enclosures.

Very truly yours,

C.L.R. Palmer

Calvin R. Palmer, General Manager
Integrated Waste Management
WEYERHAEUSER COMPANY

cc: David Riggs, Cowlitz Wahkiakum Health District
Pat Lee, Ecology
Jonathan Smith, Corps of Engineers
Charles A. Findley, EPA
Bryan Cowan, Wildlife

IMPORTATION OF SOLID WASTE FROM WESTERN WASHINGTON TO THE PROPOSED HEADQUARTERS CAMP DISPOSAL FACILITY

October 9, 1992

Weyerhaeuser has filed an application to the Cowlitz Wahkiakum Health District (CWHD) for a permit to develop and operate a solid waste disposal facility near Headquarters Camp in Cowlitz County (the "Proposal"). Pursuant to the State Environmental Policy Act (SEPA), an environmental impact statement is being prepared by CWHD. Although not required to under SEPA, Weyerhaeuser provides this background on the Proposal for the benefit of the decision makers for various permits the Proposal requires.

From its inception in 1990, the Proposal has included the disposal of Weyerhaeuser forest products wastes generated outside of Cowlitz and Wahkiakum counties at Headquarters Camp. However, when SEPA review was initiated in 1991, the Health District determined it could only review that portion of the Proposal which was in clear conformance with the existing solid waste comprehensive plan, i.e., the disposal of waste which was generated within Cowlitz and Wahkiakum counties.

Subsequently, the Cowlitz County prosecutor and the Solid Waste Advisory Committee have recommended that waste importation be allowed under certain circumstances, including the scenario posed by Weyerhaeuser's Proposal. As a result, the Health District intends to include analysis of waste importation within its SEPA review as it prepares the Final Environmental Impact Statement. The summary below is provided to the Health District to assist it in that analysis.

Background Weyerhaeuser operates more than thirty forest products facilities in western Washington, as shown on the map at the end of this discussion. These facilities vary greatly in type and size, but all generate some amount of solid waste.[1] Historically, each facility has arranged for its own waste management services, including waste disposal. After all reuse and recycling opportunities are exploited, the remaining wastes are, for the most part, landfilled at 16 non-Company sites in the state. Most of these disposal facilities have no provisions for leachate collection and several have little or no environmental monitoring.

The state's standards for municipal and limited purpose landfills have become much more stringent in recent years, with a major revision occurring as of late 1989, generally requiring leachate collection, enhanced environmental monitoring, post-closure care and other improvements. Most landfills were unable to achieve compliance with these standards by the required date, and are operating under short-term variances while striving to comply or to formally close. While wood waste landfills have not yet been subject to such revised state standards, they are expected to be held to higher standards within the next few years.

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[1](Longview facilities represent more than 20% of Weyerhaeuser's manufacturing assets worldwide, are thus the largest in the state, and generate approximately 75% of all Weyerhaeuser solid wastes in Washington.)

The new design and operational standards have greatly increased the fixed costs of landfill disposal, particularly in meeting the leachate management, gas management, monitoring and post-closure requirements. Recognizing the need to direct our solid wastes to facilities that achieve or exceed the state standards, and after evaluating these much higher costs and other issues associated with disposal in the current era, Weyerhaeuser determined it would construct its own regional facility for disposal of all its wastes generated in the state which could not be reused or recycled. The Headquarters Camp facility is a result of that determination. For more information, the reader is referred to the Proposal's "Alternatives Analysis" submitted to the Corps of Engineers under section 404 of the Clean Water Act.

Imported Wastes As Weyerhaeuser developed its Proposal for the Headquarters Camp facility, it identified three categories of waste. The highest priority is to provide for disposal of Weyerhaeuser industrial solid wastes generated within Cowlitz and Wahkiakum counties. The next priority is to accommodate Weyerhaeuser wastes generated elsewhere in the region outside these counties. The final category is wastes of the same type and character generated by companies in Cowlitz/Wahkiakum counties other than Weyerhaeuser.[2]

Weyerhaeuser's facilities in two-county area are generally larger but are similar in type to those located elsewhere in the state. Consequently, the wastes which would be imported are of the same type and quality as those arising within counties which have been described in the Draft Environmental Impact Statement. Major waste types include wastewater treatment solids, boiler ash, log yard debris, wood wastes and demolition/construction debris.

As required under WAC 173-303, all our wastes are subject to state designation procedures which clearly differentiate solid wastes from dangerous wastes under state law, and from hazardous wastes under federal law. The imported wastes will be subject to the same waste screening, acceptance and control procedures as those wastes within Cowlitz County.

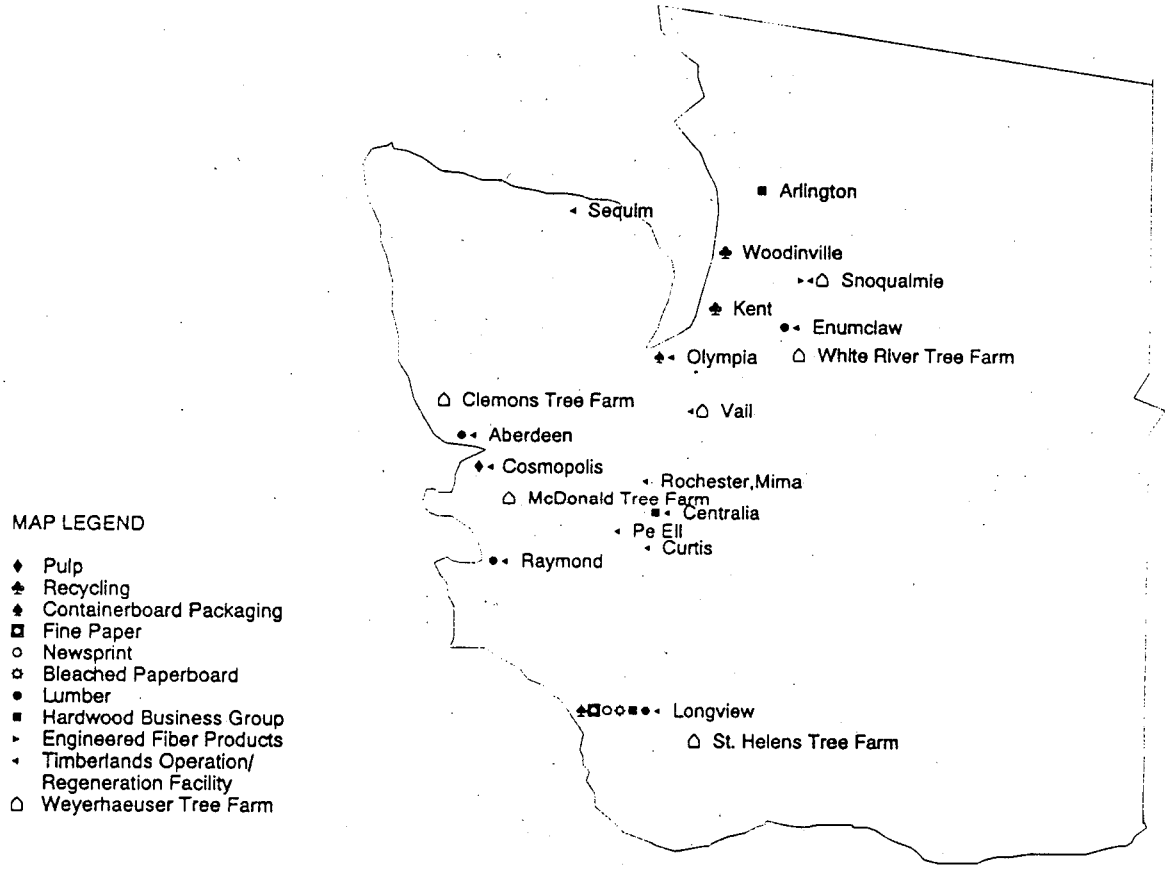
Current waste volumes from our facilities outside Cowlitz/Wahkiakum counties are estimated to total about 150 thousand cubic yards per year. They principally arise from the pulp mill at Cosmopolis, the sort yards and mills in Aberdeen, and the saw mill in Raymond. The Enumclaw mill and log yard operations in Tacoma may also be future contributors, though most of their solid waste is currently recycled into the metropolitan marketplace.

The current wastes generated outside the two-county area would probably arrive at the Material Recovery and Transfer Facility at the Longview mill by both rail and truck. The mix between these two travel modes is not known at this time, but where practical rail will generally be used to minimize transportation impacts and to avoid double handling. If half the volume were transported by rail, then on average two rail cars and six trucks would bring out-of-county waste to Longview each day. For transport from the mill to the disposal site, up to an additional four rail cars per day would be required. This would not require an increase in the maximum number of trains (two/day) or total cars (forty) assessed in the DEIS.

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[2]Specifically, Weyerhaeuser would consider accepting selected non-Weyerhaeuser wastes from within these two counties as a service to the community (diverting it from the over-taxed municipal facility), to the extent an acceptable waste screening and certification process could be implemented with the generator.

To the extent new facilities are constructed or acquired in the region, their residuals would require disposal at Headquarters Camp as well. Volumes cannot be predicted, but waste types would be similar to those already geenrated by the current facilities.



DISPOSAL CAPACITY REQUIREMENT
Headquarters Camp Solid Waste Disposal Facility

October 9, 1992

Although not required by SEPA, Weyerhaeuser has prepared additional information on its disposal requirement associated with its integrated solid waste management plan for the Western Washington region. This summary is adjunct to previous submittals (i.e., letter from Calvin R. Palmer to Grant Bailey, URS, October 10, 1991; letter from Calvin R. Palmer to Charles A. Findley, June 8, 1992; both are attached). It is hoped this additional information is useful to decision makers on the several permits the Headquarters Camp Proposal will require.

Estimating average annual waste volumes from a variety of manufacturing facilities over a long time period is problematic,[3] and mostly involves considering the business and environmental forces and uncertainties that would drive future decisions. Some of those forces would tend to increase waste volumes requiring disposal, while others would tend to decrease volumes. The prior submittals described the kinds of uncertainties involved, and summarized how those uncertainties were accommodated in our analysis. This discussion will elaborate some of them, which in our view demonstrates the reasonableness of the assumptions used. In particular, it suggests that the disposal volumes are as likely under-estimated as over-estimated.

UNCERTAINTIES WHICH COULD INCREASE WASTE VOLUMES

Facility Expansions and Additions Weyerhaeuser Company has frequently added manufacturing capacity to its production complex. Overall pulp production at Longview, for example, has increased from 1400 tpd to 3600 tpd since 1978. The NORPAC complex at Longview, including the recent old newsprint (ONP) de-inking facility and third paper machine have been added in the last two years. The addition of Pacific Veneer in Aberdeen a few years ago is another example. Just months ago, two pulp mills and three saw mills were acquired from another company deciding to cease its primary conversion operations.

The Northwest forest products industry is undergoing a major structural change in response to changes in timber availability, increasing energy prices, and other macroeconomic forces. Companies which are largely dependent on public lands for timber supply will be particularly vulnerable. These changes could cause some forest products companies to invest elsewhere, and perhaps reduce or eliminate their manufacturing operations in the Northwest. However, such a change can create opportunities for expansion by other companies, especially large timberland owners such as Weyerhaeuser, as the mill acquisition example mentioned above illustrates. Hence, mill expansion, acquisition and new construction are clearly feasible and potentially strategic for Weyerhaeuser in the future.

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[3]Municipal solid wastes are, for example, relatively more easily forecast since volumes tie most directly to population. On the other hand, industrial wastes are more directly dependent on the number, nature and scale of facilities operating at any given time, as well as marketplace issues, general state of the economy and other more variable factors.

Another macro trend that may significantly increase our production opportunities is the increasing demand for recycled fiber products. Weyerhaeuser is well-positioned nationally and in the Northwest to become a major factor in the recovery, de-inking and remanufacturing of paper and related products. We are already one of the largest paper recyclers in the nation, and it may be in our core business interests to expand that area significantly. Paper recycling has a solid waste impact, however, in that the binders, inks and short rejected fibers cannot be reused in the paper making process. This "reject fiber waste" represents about 15% of the feed material in the case of ONP and up to 50% or greater for other grades of paper.

Some expansion projects are already at a serious stage of development. Most importantly, the kraft mill at Longview must be modernized to become both competitive and to comply with future environmental regulations. In the process, the mill is being designed to increase its production by about 35%. Another Longview expansion possibility is the addition of a second ONP de-inking facility at NORPAC, which in itself would increase solid waste volumes by approximately 140 thousand cubic yards per year. A major recycling facility for fine (e.g., office grade) paper is also being evaluated for either Longview or another location in Washington. This facility would add an incremental 100 to 200 thousand cubic yards per year of solid waste, depending on final process design and recycling capacity.

Regulatory Changes Environmental regulation of industry is advancing at a pace far greater than at any time in history. Many existing statutes and associated regulations are being strengthened, and many new statutes are being considered by both federal and state government. Some of these are particularly noteworthy in terms of how they may constrain our waste management options or may inadvertently increase the amount of solid waste produced by a given manufacturing facility.

Possible effects of the reauthorized Clean Air Act on incineration using industrial boilers was discussed in the October 10, 1991, letter. Apart from the Federal statute, the state of Washington's air toxics program and RACT review could impact a boiler's ability to utilize alternative fuels. These regulatory uncertainties, coupled with political risk and practical operational considerations, led us to assume traditional incineration practices may not continue throughout the thirty year forecast period.

Another requirement of the Clean Air Act is a drastic reduction of air toxics emissions as well as fugitive emissions of conventional pollutants. We see these forces impacting some recycling facilities in the future (e.g., composting). More importantly for a pulp mill, it is possible that use of open aerated lagoons for secondary wastewater treatment would become less practical in the future. The effect of this outcome would be that secondary biological solids would also have to be managed as a production waste, whereas now only primary solids are typically landfilled.

While we do not forecast the need for tertiary wastewater treatment, to the extent more restrictive effluent standards are promulgated in the future incremental solid waste volumes could result. We would approach such requirements first within our manufacturing processes, attempting to further reduce effluent loads at the source. However, if additional wastewater treatment had to be used, additional biosolids or other solid wastes might result.

Landfill locational, design and operating standards is another area of change. In particular, we believe the state's current regulation for wood wastes may change, which currently allows wood waste disposal under less stringent requirements than municipal wastes. Even if these regulations do not change, the state's recent groundwater regulations (WAC 173-200) probably mean more wood wastes will flow to lined landfills in the future than in the past.

Finally, there is increasing pressure to reduce/eliminate the use of controlled burning to reduce logging "slash". To the extent this causes more forest residuals to be removed from the forest (to avoid excessive fuel build-up) an excess supply of woody debris may develop. The degree to which such an increased supply would be used for fuel or other uses, versus being landfilled, is speculative.

Other Uncertainties A number of other forces and factors could increase future solid waste volumes. Some recycling options may be found to be either economically, environmentally or politically less desirable than they appear today (e.g., composting and land application may be at risk).

Future energy demands at an integrated facility like Longview may dictate that solid fuel boilers burn only the highest-quality fuels, which would mean wastewater treatment solids and reject fiber wastes would need to be managed in a different way.

Finally, while public timber supplies seem sure to decline even further, Weyerhaeuser's mature timber inventory in both Washington and Oregon is forecast to actually increase above today's level during the period 10-30 years in the future. While this doesn't necessarily mean an increased manufacturing level, it could in fact occur if marketplace and other conditions permit.

UNCERTAINTIES WHICH COULD DECREASE VOLUME

Process Improvements As part attempting to achieve greater manufacturing competitiveness, as well as a direct result of our waste reduction efforts, we are attempting to retain more fiber, chemicals and other raw materials in our products which in turn reduces waste volume and chemical character. Better spill prevention and response, sump screening equipment, and bleach plant upgrades are all examples of such waste reduction strategies. Other process changes may be identified in the future which would reduces wastes further.

New Technology Some recycling opportunities currently have marginal or highly volatile economics, which make them unreliable as long-term strategy options. New technology could emerge which would provide stable economics, and permanently divert a waste flow from disposal or incineration to a more preferred use.

Paved Log Yards There is a trend toward more yard paving, which allows log yard debris to remain cleaner, more amenable for use as fuel, and less residual debris for disposal. Countering this trend, however, is increasing attention to stormwater quality from paved surfaces, and in particular the contribution of metals from greater abrasion of the rubber tires on operating equipment.

Facility Closures To the degree the company reduces its production capacity in the region, solid wastes would be reduced as well. The Everett pulp mill was recently closed since it could not be competitive in its markets even with a major capital renovation. We do not, however, predict a major reduction in Weyerhaeuser's presence in the Northwest. If anything, the opposite would be true as discussed above.

SUMMARY

Each of the above forces is characterized by relatively large uncertainties during the thirty year forecast period. We therefore assumed waste disposal at the current rate without assuming incineration in existing boilers, due to its high degree of regulatory, operational and political uncertainty.

This assumption implies that all future waste increases (including those from relatively well known possibilities) will be offset by corresponding additional successes in waste reduction or recycling efforts, which are largely unidentified at this point.

It is not possible to know what actual waste volume will require disposal during the next three decades or so. Based on the above discussion and the previous information supplied to the agencies, we believe we have made an adequate demonstration that our Proposal purpose, including capacity projection, is both reasonable and prudent.

Since landfill capacity is built in small increments, and since Weyerhaeuser has absolutely no incentive to use the capacity at a rate greater than the minimum necessary, the environmental downside of this analysis is minimal compared to seeking a shorter term or smaller capacity landfill. This discussion shows it is at least as likely that actual volumes will exceed the projection as otherwise. If actual volumes are in fact less than the projection, the landfill life would exceed its projected life -- which is generally considered an environmental "positive" in today's world. On the other hand, if volumes were grossly underestimated, the incremental impacts and costs beyond this landfill are potentially large: multiple smaller sites consume more land and resources for a given disposal volume; fixed landfill infrastructure costs are independent of landfill capacity; "public" costs of additional landfill sitings; and, regulatory costs and time for permitting are becoming prohibitively large.

Attachments: Letter, C. R. Palmer to Grant Bailey, URS, October 10, 1991
Letter, C. R. Palmer to Charles A. Findley, EPA, June 8, 1992

Weyerhaeuser

Corporate Headquarters
Tacoma, Washington 98477
Tel (206) 924 2345

October 10, 1991

Grant Bailey
URS Consultants
1100 Olive Way, Suite 200
Seattle, Washington 98101

Re: Weyerhaeuser Southwest Washington Solid Waste Disposal Facility

Dear Mr. Bailey:

In your recent review of our permit application and environmental reports, you requested additional background concerning the basis for our projected capacity requirement for a new solid waste disposal facility. I have enclosed a summary of some of the considerations that went into our projection.

I hope this information meets your needs. Please do not hesitate to contact me at 924-6535 if you have any questions.

Sincerely,

C. R. Palmer

Calvin R. Palmer, Manager
Environmental Systems

Attachment

cc: David Riggs, Cowlitz Wahkiakum Health District
Dick Jones, CWHD
Jean Garber, Consultant

WEYERHAEUSER FIFTY YEARS America's First Tree Farm

SUMMARY OF CAPACITY REQUIREMENT
Weyerhaeuser Southwest Washington Solid Waste Disposal Facility

October 9, 1991

BACKGROUND Like many companies, in the past few years Weyerhaeuser has come to better appreciate the complexity, difficulty and costs of solid waste management. The company has traditionally managed solid waste much like other utility services, and in particular has made use of contractor services. Also, historically each Weyerhaeuser facility has typically managed its waste separately from its sister facilities. No significant corporate-level planning and execution have been applied to solid waste management.

As regulations have evolved and the true costs and liabilities of solid waste management have come into better focus, we have come to believe longer-term and regional (multi-facility) planning is important. We also believe taking direct control of our waste, with less reliance on contractors, is more in line with the strict and potentially perpetual responsibility we have for our wastes.

These beliefs have led to a decision to develop an integrated solid waste management system (ISWM), including a regional disposal facility at Headquarters Camp, to serve our operations in the western Washington region. This ISWM system goes well beyond disposal, including waste reduction and recycling, and in fact it mirrors that State's prioritized approach to solid waste management. The ISWM system is described in a recent report previously submitted.[1] This summary, however, addresses only the requirement for a disposal facility, and in particular discusses the basis for and considerations in determining what disposal capacity is needed.

Prior to solidifying the ISWM decision in mid-1989, the Longview mill complex and other facilities had independently initiated feasibility studies and site selection processes for solid waste disposal facilities, going back to the early 1980's. Once the ISWM decision was made a new site selection study was conducted using the previous work and in light of new regulations and company requirements dictated by the ISWM criteria. Due to the nature and magnitude of our forest products operations in Cowlitz County, the solid waste from those facilities tends to be much greater in volume than that from our other facilities. Thus the geographic region around Longview became the focus for the search.

FACILITY PURPOSE AND CRITERIA To meet our explicit objectives, the proposed disposal facility must meet the disposal needs of the Company's operations in the region for a minimum of thirty years. Environmentally protective disposal is required for the residual forest

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[1] "Environmental Technical Report for the Proposed Weyerhaeuser Southwest Washington Solid Waste Facility", Volume 1, June 1991, BEAK Consultants, Inc., for Weyerhaeuser Company.

products solid waste (including demolition/construction waste)[2] that remains after all reasonable and protective waste reduction and recycling efforts have been applied. While Longview's waste volume dominates, the facility must be able also to serve the needs of our pulp mills in Grays Harbor and Snohomish counties, and the solid-wood and forest operations in Grays Harbor, Pacific, Lewis, Thurston, Pierce, King and Snohomish counties.

Given this purpose, a minimum disposal capacity needed to be projected. Several factors, mostly uncertainties, have been taken into account to develop this minimum capacity which we have determined to be thirty million cubic yards. The composition of the annual waste flow is summarized in Table 1. The following sections describe some of the more important factors that affect capacity requirements.

Facility Lifetime Thirty years' disposal capacity is the minimum facility life dictated by prudent planning associated with other capital investments already made or currently being contemplated. These investments represent literally billion-dollar assets in the region. The company's manufacturing infrastructure is aged at many locations, and economic competitiveness, environmental enhancements and other factors are driving major modernization and expansion investments at many locations.

At Longview, for example, between 1981 and 1991 we have invested more than 1 billion dollars in new plant and equipment, such as the second and third newsprint machines and a major newsprint recycling facility. An additional $300 million kraft mill modernization project is currently before the board of directors for authorization. These capital improvements have lifetimes of at least thirty years from an accounting perspective, and significantly longer practical production lives. Stable, environmentally protective, and cost-effective solid waste management systems must be in place for a corresponding period to assure the returns on those production assets. These systems must emphasize waste reduction and recycling, but must also assure disposal capacity for the residual wastes that inevitably remain.

Multiple Facility Requirement The current Cowlitz Wahkiakum Solid Waste Comprehensive Plan does not explicitly allow waste importation from other counties for disposal. Weyerhaeuser Company is applying to Cowlitz County requesting recognition of its right to import solid waste residuals generated at its facilities outside the county for disposal at the Headquarters Camp facility. This is an important issue to the company, since the cost and difficulty of complying with the state's new standards for solid waste dictate regionalization to some degree. Waste volumes at each of our facilities elsewhere do not warrant state-of-the-art disposal facility investments on their own, but nevertheless should be managed in a way that provides maximum protection.

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[2] Solid wastes as differentiated from "hazardous wastes" under federal RCRA regulations, or "dangerous wastes" or "extremely hazardous wastes" as defined by Washington State regulations (WAC 173-303).

We have also agreed to accept a limited amount of similar wastes from non-Weyerhaeuser sources in the Cowlitz Wahkiakum region. This will provide an appropriate and secure facility for smaller companies and thereby divert the waste from already over-taxed municipal facilities. In addition, any recoverable wood fiber or other recyclables in this waste stream will also be recovered at a Material Recovery and Transfer Facility located at our Longview mill, a complement to the proposed disposal facility.

Our strategy involving regionalized waste management is consistent with Washington's solid waste management priorities. Our facilities outside Cowlitz County are currently relying on in-county disposal for the most part, although some long-haul disposal in eastern Washington and elsewhere does occur from time to time. Those facilities' solid waste management plans are still evolving, so disposal requirements cannot be accurately forecast at this time. However, their aggregate waste volumes are currently relatively small compared to the wastes from the Longview complex. We estimate that, if Headquarters Camp were allowed to receive these wastes, they total no more than 15% of the permitted annual capacity of the disposal facility.

Availability of Other Disposal Capacity Another factor affecting the minimum capacity for Headquarters is the uncertainty associated with the capacity and timing of alternative disposal sites for a variety of solid wastes. For example, many of our facilities continue to rely on nearby wood waste landfills which, under both DNR's regulations and DOE's minimum functional standards, do not require liners and leachate collection. It is questionable whether these facilities can continue to operate under proposed standards for both landfills and for ground water protection. If importation is allowed as discussed above, Headquarters Camp represents a fully protective option for those relatively inert wastes that may be displaced by future regulation, landfill closures or other factors.

Uncertainty of Reduction/Recycling Success Weyerhaeuser Company is committed to maximum waste reduction and recycling progress as economics and prudent environmental protection will permit. A significant portion of our capital improvement plans at Longview and elsewhere target source reduction and recycling opportunities, and we have accomplished 20-40% waste reductions already in many operations. Our efforts range from in-process modifications to reduce waste volumes and chemical concentrations, to log sort yard debris beneficiation, to composting, to land application of lime wastes and ash. We also are attempting to incinerate and recover energy from organic wastes that cannot be otherwise reduced or eliminated. Incineration is practiced to the degree consistent with the capabilities of our steam generating boilers and other environmental requirements, such as air pollution regulations.

However, the feasibility and sustainability of waste reduction and recycling projects are often highly uncertain. Many times regulatory permitting activities can slow or prevent implementation, and recycle markets are poorly developed and/or volatile. Sometimes a project can be successfully opposed by special interest groups who take exception to the recycling technology that is used. Stable disposal capacity is a critical contingency necessary to underpin

our aggressive waste reduction/recycling efforts.

Future Facility Expansions and New Facilities In an effort to become more globally competitive, Weyerhaeuser Company continually reviews its business plans and adjusts facility or capital allocations to reflect changing market conditions. The fiber-based industries, especially pulp and paper, have been and will continue to be in a very dynamic phase due to a variety of trends, including increased environmental regulation, endangered species protection, and other macro economic considerations. While we desire to develop and implement a solid waste management system which assures stable capacity for at least thirty years, it is difficult to predict what new manufacturing or recycling facilities we may install in the region during that period. Such new facilities would likely have a significant impact on the types and volumes of solid waste that the company generates.

A good example of this uncertainty is the evolution of our Longview facility plan during the past six years. When original studies to find a disposal site were conducted by the Longview mill in the mid-1980's, the Company had no specific plans to build a newsprint de-inking facility and third paper machine at Longview. However, markets and other factors have changed, the company responded by adding $400 million in capital improvements at Longview, and both facilities have started up this year. While these facilities are a major factor in achieving a net reduction of solid waste volume in the region by recycling 600 tons/day of newsprint, they have created an additional 20% (100 tpd) solid waste volume as reject fiber waste for the Longview mill to manage.

Future Environmental Control Technologies While we do not forecast additional environmental control technologies that would generate significant additional waste volumes, we are certainly cognizant of this potential. Sometimes there is tension among the various regulatory efforts to protect environmental media (air, water, land), wherein increased protection of one can exacerbate efforts to protect another.

Examination of water quality protection regulations in the past two decades illustrates this issue. Prior to the Clean Water Act and other related statutes, wastewater treatment generally did not involve secondary treatment. Today, however, a significant portion of our solid waste volume results from further wastewater processing following primary clarification. Addition of secondary treatment has clearly benefitted the receiving water environment, but has to some degree shifted the environmental burden to either landfills, incinerators, land application, or some combination of these approaches.

Improved particulate removal from boiler offgas through additional scrubbers or precipitators is another example of this issue. This kind of secondary effect of increasing solid waste volume from additional environmental regulation may occur in the future, since at no time in history has public and agency pressure on industry for reduced air and water emissions been more intense.

FACILITY CAPACITY REQUIREMENT Our disposal capacity projection has not projected increases in waste volumes due to more restrictive disposal regulations, new or expanded facilities, environmental regulation, or other factors discussed above. Instead we have assumed that any such increases will be offset during the next thirty years by incremental waste reduction/recycling successes, such that no net increase in annual waste volume occurs. Our goal is to do much better than the zero-sum, i.e., we hope to significantly reduce net volumes sent to landfill. However, to safeguard our manufacturing investments and our potentially perpetual responsibility for environmentally protective solid waste disposal, we must be conservative in capacity planning to assure disposal capacity is available to meet changing markets and regulatory forces.

Finally, it is important to note that the proposed landfill is not constructed so as to immediately provide the ultimate capacity needed. Instead, it is a phased project wherein relatively small cells provide incremental disposal capacity on a 2-3 year cycle. If we are very successful in waste reduction strategies and do not have offsetting increases in waste volume from other sources, the facility will be developed more slowly, and last much longer, than the current planning assumption. This would be Weyerhaeuser's goal, as its business interest is exactly aligned with the State's solid waste management priority of minimizing waste requiring disposal.

Table 1. Summary of Annual Solid Waste Flow to Headquarters Camp Disposal Facility

Waste Type	Description	Volume (yd^3)
Wood chips and fines	Dirty wood chips, bark, sawdust	15,000
Log sort yard debris	Bark, wood chips, rocks, soil	75,000
Boiler ash	Inorganic ash, carbon from solid fuel boilers	100,000
Pulp mill lime waste	Calcium carbonate, carbon from recovery operations	15,000
Wastewater treatment solids	Dewatered fibrous and biological solids	350,000
Pulp chip washer fines	Fine wood particles	18,000
Paper recycling reject fiber	Short fiber, clay binder, ink from newsprint recycling	120,000
Box dump waste	Various solid wastes	3,000
Polyethylene waste	Waste plastic from milk carton stock extrusion	8,000
Miscellaneous waste	Miscellaneous mill solid waste	38,000
Construction/demolition waste	Non-recyclable debris from building and pavement demolition or construction	Variable
SUBTOTAL LONGVIEW		742,000
Out-of-county Weyerhaeuser waste	Same types as above	150,000
In-county non-Weyerhaeuser waste	Same types as above	150,000
TOTAL WASTE VOLUME		1,000,000

Weyerhaeuser

Corporate Headquarters
Tacoma, Washington 98477
Tel (206) 924 2345

June 18, 1992

Charles A. Findley, Director
Water Division
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101

Re: Section 404 Permit Application No. OYB-4-013812, Weyerhaeuser Company

Dear Mr. Findley:

The Weyerhaeuser Company has reviewed the comments made by EPA in your May 22, 1992, letter to the U.S. Army Corps of Engineers regarding the above permit application. We will respond to all of EPA's comments, and those of other agencies and the public, in the normal course of the permit application process as directed by the Corps. The purpose of this letter is to provide a preliminary reply to some of the points made in the EPA comment letter that we believe may have been based on an inadequate opportunity to review the extensive documentation submitted with our application. We did have the opportunity to discuss some of these points with your staff recently, and I think the discussions were productive.

Let me first say we appreciate your efforts to understand and assess our proposal, and we look forward in the coming weeks to working through all issues and concerns your office and the other agencies may have. We are committed to accomplishing an environmentally excellent project, and believe we can only do so through the technical dialogue and collaboration with the agencies at the local, state and federal levels. We have taken our obligations extremely seriously in this proposal: specifically, we have avoided wetland impacts to the maximum extent practicable, minimized impacts with the facility design to the greatest degree possible, and are dedicated to a model mitigation package to fully compensate for the inevitable wetlands impacts that remain. Your comment letter indicates we have more to do to demonstrate the project qualities we believe we have achieved. However, we are confident that the Corps process near-term, scientist to scientist, will accomplish this goal.

Now to briefly comment on a few specific points in your letter, namely disposal capacity, project purpose, hydrology, and the Barnes Drive alternative site.

Capacity One area of apparent misunderstanding is the basis on which Weyerhaeuser determined the minimum capacity requirements for the proposed facility. EPA stated in its comment letter that the company had established

capacity requirements on the basis of assumptions that probably overestimated the amount of solid waste that the facility would actually need to accommodate. We believe the facts show otherwise.

In general we used the actual, current rate of waste generation at our facilities in projecting future needs. The company varied from the current rate in only one significant respect, consisting of an upward adjustment reflecting the several uncertainties associated with reducing organic-waste volume via incineration in industrial boilers. In addition to technical, economic and political uncertainties surrounding this issue, a primary consideration here is the impact of implementing the reauthorized Clean Air Act in the next few years, with its associated permitting processes. We believe it could become much more difficult for Weyerhaeuser to continue its current practices, although we believe they remain fully protective of human health and the environment. Incineration has been the primary means we have used to reduce landfill volumes of wastewater treatment solids and reject fiber wastes from our large newsprint recycling.

We did not base our capacity requirements on projected increases in waste volumes, even though many factors can conspire to cause such increases. The addition of new or expanded facilities can add new solid waste streams previously unanticipated, even while accomplishing waste recycling or other environmental objectives in a larger sense. For example, the company recently announced it is considering a large fine (e.g., office grade) paper recycling plant for western Washington. Also, the Longview Kraft mill is proposed to be expanded by 35% by 1995. We did not increase our projected waste volumes, however, to take into account such additional factors. The company instead has assumed that future successes in our waste reduction/recycling programs will offset such added wastes.

Taken together, the above considerations indicate that Weyerhaeuser has just as likely underestimated as overestimated its disposal needs. The company to some extent has discounted impacts from known factors such as mill expansion, and on the other hand has assumed that currently unknown waste minimization projects will be successfully implemented. This presents what we believe is a reasoned and prudent approach to long-term projections involving many uncertainties.

Project Purpose A second issue raised in your letter concerns the definition of our project purpose. As stated in our permit application, the company is undertaking this project to: 1) achieve direct control over the environmental risks that waste management can create for a generator; 2) assure stable long-term

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FIFTY YEARS
America's First Tree Farm

disposal capacity for the solid wastes generated by our western Washington facilities; and 3) stabilize and reduce our solid waste disposal costs. We hope to achieve these goals in a manner that is consistent with and furthers the overall goals of the integrated solid waste management system designed for our Washington operations.

EPA rejected these purposes, finding that they are only "amenities," and took the view that the project purpose is simply one of finding a means to dispose of the company's solid wastes. Weyerhaeuser must strongly disagree with the narrow substitute purpose the EPA has suggested. The company's stated objectives reflect legitimate economic and environmental goals, and the company's business judgment that these goals can best be achieved through operation of its own landfill facility. None of the company's stated purposes arbitrarily excluded potential alternative sites. None attempted to justify optional components of the project. These are fundamental project purposes that must guide the section 404(b)(1) alternatives analysis.

Site Wetlands Hydrology This issue, and a number of others contained in the EPA comment letter, are addressed at least in part by the materials Weyerhaeuser submitted with its permit application. The issue is the hydrologic function served by the wetlands at the Headquarters site. EPA's preliminary review was that the wetlands provide recharge to Sucker Creek and to the ground water in the area. Hydrologic data provided with the application, however, indicate the opposite; that is, these wetlands are points of ground water discharge rather than recharge. The hydraulic gradients associated with this discharge would add a further level of redundancy to the project's surface water and ground water protection systems. Weyerhaeuser will be happy to assist EPA as appropriate in its further review of these hydrologic data.

Barnes Drive EPA suggested Barnes Drive might be a practicable and preferred alternative site for this project. It does not appear from the comment letter that EPA took into account three serious environmental issues associated with the site as a long-term disposal facility:

- the substantial number of residences within a 1 mile radius from the site boundary (all of which obtain their domestic water from ground water wells, springs or surface water);
- the proximity of a highly used rest area on I-5 (3.5 million travelers per year) which transportation officials desire, as a traffic safety matter, to maintain as aesthetically attractive as possible; and,

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- the lack of any buffer area around the landfill footprint from adjacent (some would say incompatible) land use.

We believe these considerations make the Headquarters Camp site a far superior site from an strictly environmental point of view. In addition, these and other factors make it very uncertain whether a landfill at that site would ultimately be permitted, and even more unlikely it could continue to operate for its required 30 year design life.

We hope this information is useful to EPA in its continued review of the company's permit application. This is an extremely important project to Weyerhaeuser Company and its operations throughout the state. We think it is equally important to the people and businesses of Cowlitz County. I would like to offer to you and any of your staff a field briefing and visit to the Headquarters Camp site, as well as to Barnes Drive and/or any of the other alternatives available to us. I believe a first-hand view of our proposal and the other possibilities could be of great value to you as you consider the environmental and permit information that has been submitted and that which will be developed as part of the Corps process. I will follow up with your office in a week or so to determine whether such a tour would be of use to you.

In the meantime, I appreciate your consideration of the comments I have offered. Please don't hesitate to contact me or Chris Haynes in this office if you have any questions or comments on any aspect of the proposed project.

Sincerely,

Calvin R. Palmer, Manager
Integrated Waste Management

cc: Jonathan Smith, U.S. Corps of Engineers
Bob Bicknell, State Department of Wildlife
Judy Lantor, U.S. Fish and Wildlife Service
Valerie Elliot, National Marine Fisheries Service
David Riggs, Cowlitz Wahkiakum Health District
Bill Leonard, State Department of Ecology
Pat Lee, State Department of Ecology

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BCC:

Duane Woods - Heller Ehrman
Dave Heineck - Heller Ehrman
Paul Whitney - BEAK Consultants
Rick Thiel - EMCON, NW
Don Stark - Gogerty & Stark
Don Cordell - EMCON, NW
Grant Bailey - URS Consultants
Tom Eaton - Ecology
Mike Wilson - Ecology
Avery Wells - Ecology
Norm Johnson - CH 5
Pete Belluschi - CH 3D29
Gary Healea - Longview 43
Mark Hehnen - CC II-102
Mike Bickford - CH 3H33
Rullie Harris - Longview 43
Jim Freiberg - Longview 43
Mike Karnofski - Longview 43
Ken Johnson - CH 1L28
Jack Larson - CH 1L28
ISWM Team (route)

Appendix N

Draft Plan of Operation

Headquarters Camp
Solid Waste Disposal Facility

DRAFT
PLAN OF OPERATION

Waste Characterization

The Headquarters Camp facility is proposed to meet the solid waste disposal needs of our operations in the region. The dominant need is driven by our manufacturing activities in Longview. In addition, the facility could serve other generators of identical solid wastes in the immediate Cowlitz and Wahkiakum vicinity. Weyerhaeuser understands that our need to serve regional facilities cannot be met without an amendment to the County comprehensive Solid Waste Management Plan. We are currently working with Cowlitz County to achieve such a revision.

Our solid wastes derive from a variety of forest products operations, such as log sort yards, pulping, papermaking, solid wood milling, and miscellaneous demolition/construction projects. The only wastes subject to acceptance at Headquarters Camp will be: (i) from these kinds of operations; and (ii) confirmed to be solid, non-hazardous or non-dangerous under federal and state regulation. No other industrial or municipal wastes will be allowed at the facility.

Table 1 is representative of the kinds of solid waste intended for the facility. Under state law we are required to designate our wastes using a variety of physical, chemical and biological tests to determine which are solid versus dangerous or hazardous wastes. In compliance with this requirement we have performed extensive tests, including chemical analysis for metals and organics, EPA's "TCLP" leaching protocol, and fish and rat bioassays. Every test on every waste sample has conclusively demonstrated these wastes are non-dangerous solid wastes. These results are on file with the CWHD and the Washington Department of Ecology (Ecology).

Table 1

Solid Waste Type and Projected Volumes

Waste Type	Description	Projected Volume (cubic yards)
Wood chips and fines	Raw wood chips, bark, and sawdust	15,000
Log sort yard debris	Bark, wood chips, rocks, and soil	75,000
Boiler ash	Ash from solid fuel boilers	100,000
Pulp mill lime waste	Untreated calcium carbonate and carbon	15,000
Wastewater treatment solids	Dewatered fibrous material and biological solids	350,000
Pulp chip washer fines	Fine wood particles	18,000
Paper recycling reject fiber	Reject fiber clay binder and ink	120,000
Box dump waste	Various waste in large metal boxes	3,000
Polyethylene waste	Waste plastic from milk carton manufacture	8,000
Miscellaneous waste	Miscellaneous mill waste and construction debris	38,000
Demolition debris	Non-recovered debris from buildings and pavement	N/A
Total		742,000

Estimated maximum annual waste volumes for our Longview operations are indicated in Table 1, which total slightly more than 700 thousand yd^3 per year. We are designing the disposal facility to accept a maximum of one million yd^3 annually, with the additional waste coming from our facilities in other counties (150-200 thousand yd^3/yr), and from other generators in the Longview area (100-150 thousand yd^3/yr).

Waste Handling Logistics

All waste destined for the disposal facility will either originate at or pass through our Longview mill for inspection. A Material Recovery and Transfer Facility (MRF) has been created to provide a single point of waste receipt, recycling, inspection/testing and transfer to a dedicated rail transport system. All wastes will be shipped by rail from the MRF to the disposal site, except in the rare event of a prolonged rail shutdown (e.g., labor strike).

Wastes which contain no significant recyclables will normally be placed in covered solid waste containers at the location the waste is generated. When recyclables are present wastes will be hauled to the MRF for processing prior to containerizing the residual for disposal. Waste inspection and certification will generally occur prior to arrival at the MRF, but will be further inspected and evaluated against waste acceptance criteria at the MRF prior to rail loading.

Waste containers will be transferred from rail cars to shuttle vehicles at the disposal facility. The covered containers will be delivered to the active landfill cell, emptied at the face, and spread/compacted by bulldozers in thin layers. These layers will accumulate into lifts of 10 to 20 feet in height, and lifts will be separated by operations layers of soil and/or rock. No daily cover will be required since these solid wastes are not putrescible and do not attract birds, vermin or emit significant odors.

Waste Inspection and Acceptance Program

Preventing unacceptable waste from entering the disposal facility is an essential goal of Weyerhaeuser. One of our principal objectives is to eliminate the commingling of our relatively inert solid wastes with higher-hazard wastes that either designate as dangerous/hazardous, such as municipal waste or other industrial waste. We will implement a stringent waste inspection and acceptance program to assure this goal is achieved.

The program will hinge on a clear set of waste acceptance criteria. These criteria will be established by Weyerhaeuser and will be more restrictive than those allowed by the State's minimum functional standards for solid waste handling. Weyerhaeuser will not accept any waste until the generator has complied with all waste control criteria. Implementation of these criteria will involve five major components:

- Pre-qualification and training of waste generators
- Waste characterization and designation
- Waste inspection
- Random waste stream audits
- Records keeping

<u>Pre-Qualification and Training</u> All generating sources

of solid wastes, whether within Weyerhaeuser operations or third-party, will be advised of our waste acceptance criteria and asked to pre-qualify their waste and management procedures to conform to our operating requirements and permit conditions. Information will be supplied to generators describing acceptable and restricted wastes, and training in waste characterization and designation will be provided.

Waste Characterization and Designation All our current solid wastes have been extensively evaluated and designated per state regulations. Any new wastes and any changes to existing wastes will be similarly designated, and periodically all wastes will be re-evaluated to assure continued conformance to regulations and acceptance criteria. Any third-party generators will be required to show evidence of diligent efforts to characterize and designate, and no wastes will be accepted without this showing.

Waste Inspection Physical inspection of pre-qualified wastes will occur at three locations: at the generating source; at the MRF; and at the disposal facility. Operations personnel at all three locations will be provided training to: (i) differentiate between conforming and non-conforming waste and to identify typical unacceptable wastes; (ii) to understand the implications to the Company and themselves of allowing unacceptable wastes; and (iii) to implement waste rejection procedures should a waste be in question. A well-trained cadre of workers at waste sources, at the MRF and at the disposal site is the backbone of the waste control program.

If unacceptable wastes are identified, they will be handled in accordance with regulatory requirements for that class of waste. The waste will be either returned to the source, or shipped to a proper disposal facility permitted to accept the waste. Follow-up with the personnel at the generating location will assure such waste is properly managed in the future.

Waste Audit In addition to routine inspection at these locations, the solid waste regulatory compliance manager will periodically inspect wastes to assure the inspection program is effective. Wastes will continue to be sampled periodically and evaluated against both state and federal requirements for determining compliance with solid waste regulations. In addition, the annual solid waste compliance audit[1] will include focus on the inspection and testing programs.

Record Keeping Records will be maintained for all important waste characterization and operational information, as

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[1]In addition to Company and regulatory agency audits, an independent environmental firm will be retained to audit all our solid waste procedures, operations, records keeping and training programs to assure both regulatory and Company requirements are being met.

well as compliance monitoring data. Information to be maintained include: container and load data (e.g., volume, mass, type, condition); waste non-conformance and rejection reports; event reports (e.g., emergencies, safety violations, injuries and other special incidents); training and personnel action records; environmental monitoring results; and other reports required under either permit conditions or regulation.

Operating Hours

The Headquarters Camp disposal facility will be in operation from 7:00 am thru 7:00 pm Monday thru Saturday.

Operator Certification and Training

All scale, MRF, rail, and disposal facility operators will receive training as described in the waste control section to insure that unacceptable waste are excluded from the facility. The disposal facility operators will be certified and trained as required by Washington State law and regulation.

Contingency Plan

The Plan of Operation will be modified periodically to remain current throughout the life of the Headquarters facility. It is important to note that landfill and the material recovery facility operators will be trained and certified to insure an effective response in the event an accident occurs.

Fire Response

Routine fire prevention measures will be employed in buildings and maintenance facilities. Most of the waste stream will not present a Significant fire hazard because it will be ash or have a high moisture content. In addition, fire prevention measures such as proper landfill gas management and waste handling practices will be incorporated into our Plan of Operation. Weyerhaeuser's response to a fire includes:

* An on site water tank as a source of fire control water will be maintained.

* Use of the Weyerhaeuser forest fire control resources currently housed at Headquarters Camp. These resources are described in "Weyerhaeuser Forest Products Company Southwest Washington 1991 Woods Fire Plan". This document is on file with the Department of Natural Resources.

* A properly trained and equipped landfill operations crew.

Leachate Spill Response

Spill prevention will be a major part of the Headquarters Camp operations. Equipment selection, maintenance, operator training and inspections will all be conducted to prevent spills. Facility design will include appropriate containment systems and back-up capabilities. In the event of a spill Weyerhaeuser would:

* Spill response equipment will be maintained on site as detailed in the Plan of Operation.

* Trained personnel will be available at all times from the landfill operations, the Longview Mill and the railroad operations.

* Additional contractor supplied backup is available in the event it is required.

* Immediate spill site control will be established.

* The source of the spill will be stopped as quickly as possible.

* Any pooled fluids will be contained, collected, and removed for treatment in an approved manner.

* Ecology and other spill response authorities will be notified.

* Contaminated soils will be removed an disposed of in an approved manner.

* Monitoring will be conducted as determined by the responsible agency such as Cowlitz County Fire Department, CWHD, and Ecology.

Solid Waste Spill Response

Again spill prevention will be emphasized. In response to a solid waste spill Weyerhaeuser would:

* Spill response equipment will be maintained on site as detailed in the Plan of Operation.

* Trained personnel will be available at all times from the land fill operations, the Longview Mill and the railroad operations.

* Additional contractor supplied backup is available in the event it is required.

* Immediate spill site control will be established.

* Ecology and other spill response authorities will be notified.

* The waste and any contaminated soils will be collected, removed and disposed of in an approved manner.

* Monitoring will be conducted as determined by the responsible agency such as Cowlitz County Fire Department, and Ecology.

Liner leak Response

In response to a liner leak Weyerhaeuser would:

* Notify the proper agencies.

* Verify the data.

* Attempt to quantify the leakage flow rate, concentration, and any ground or surface water impact.

* Attempt to locate the general area of the leak.

* Determine the appropriate action from among the following:

  acceleration of the closure of the leaking area.

  intercept and pump and treat the affected ground and surface water.

  install a cutoff system to isolate the contaminated plume and treat the contaminated water.

  dig out and reconstruct the leaking area.

Site Safety and Security

Site safety is enhanced by the generally remote location of the Headquarters Camp disposal facility. The nearest residence is over 1.5 miles away. Weyerhaeuser also maintains a caretaker full time at the Headquarters Camp facility. Additional safeguards will include fencing the area along the 1600 road, facility operators on site during all daylight hours six days a week, and no direct public access to the facility. All waste received at the facility will be transported by rail from the MRF located at the Longview Mill.

Recordkeeping and Reporting

In addition to the records required as part of the waste inspection and acceptance program records will be maintained for: all permit compliance monitoring, leachate quality and quantity, ground water quality, rainfall, surface water quality and quantity, reports of site inspections including any erosion and condition of all facilities, all complaints received and the response to the complaint, any spills and the spill response, any derailments and

the cause and corrective action.

References:

Letter from John C. Glaub, P.E. EMCON Associates May, 1991.

Prohibited Waste Control Programs: A Deterrent to Improper Disposal of Hazardous Waste in Solid Waste Landfills, G. Karpinski and J. Gaub, October 1989.

Final Design Report for the Regional Landfill in Klickitat County, Parametrix Inc. December 1989.

Appendix O

Correspondence between Ecology and EMCON Northwest relevant to Site Geology and Hydrogeology

Headquarters Camp
Solid Waste Disposal Facility

CHRISTINE O. GREGOIRE
Director

cc Rick Thiel
Paul Whitney
Steve Duncan
Chris Hoagland
Dennis Wolbrecht
Don Crandall
Dorothy Atwood

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504-8611 • (206) 753-2353

FYI.
Neel
DFA
file: 54115.09
(include in Correspondence Index)

February 7, 1992

Mr. David Riggs
Director
Environmental Health Division
1516 Hudson
P.O. Box 458
Longview, WA 98632-0046

Dear Mr. Riggs:

This letter provides comments on the Proposed Weyerhaeuser Southwest Washington Solid Waste Facility: Headquarters Road Site.

I. Solid Waste Permit Application Part 1: Site Characterization; dated June 12, 1991.

The above document has been viewed and reviewed primarily as the geotechnical assessment of the proposed facility (landfill). It is therefore expected to provide fundamental data and information regarding engineering properties of the site soil representative of the entire site, so to develop a landfill design that accommodates existing and expected site soil conditions. However, the essential parts of the required information; site settlement and stability analyses (page 10), seismic design, earthquake impact, soil balance estimate, have been referenced to Part 2 of the permit application which is yet to be submitted to the Department of Ecology. It is therefore not possible to make a final comment on the geotechnical assessment of the site.

The comments below should be considered in preparing the Part 2 of the permit application.

Pages 6 and 13, Site Geology/Seismicity.

It is stated on the reference page that "locally the (site) rocks contain fractures and minor fault structures..... and inactive landslides." It is also observed on page 13 that site "seismic design consideration will be addressed in Part 2 of the permit application."

Site specific investigation including geophysical methods and determination of the extent of the faults within the landfill footprint will be expected in Part 2 of the application.

Pages 8 and 9 Test Pits.

Refer to figure 3-1. It appears the 1989 test pits (TP) outside the landfill foot print are concentrated north-south compared to east-west. What is the rationale for not locationing test pits in an east-west trend?

Pages 8-10, Refer to table 3-1, "Proctor Data"

Only four (4) soil samples were used for proctor test and only two (2) samples out of the four are within the landfill footprint. The number of samples does not seem sufficient to fully characterize a 330-acre site.

From the scale on figure 3-1, the horizontal distance (east-west) of the landfill footprint is about 3,281 feet. However, the test pits TP-7, 9, 10, and 14, from which the soil samples were taken are located north and south, about a third of the horizontal distance from the east.

As the results of proctor test are essential to specify the degree of compaction, the number of soil sample points should be distributed to be representative of the soil conditions for the entire site.

Particular area(s) for soil liner borrow should be identified on the site map and this should be based on geologic exploration and soil test results.

As a quality assurance measure, in situ test(s) should be performed to support or verify laboratory soil test results. Such field test(s) may include in place density determination. Sand cone density method (ASTM D1556) or nuclear densiometer method (ASTM D2992) could be used.

Appendix B, Hydrogeologic Assessment

"This appendix is available.....upon request." All field data and laboratory readings or measurements relevant in characterizing and expecting site conditions, design and construction of the landfill should be included in the appendix for each manual or report, or referenced to a companion document, if the data had already been supplied elsewhere.

Appendix C, Test Pit Logs

10 out of the 22 test pits show refusal depths of about 9 feet on the average. Will the depth of excavation to bottom of the landfill exceed the average refusal depth? What will be the depth of excavation relative to the 250 feet "maximum waste depth" proposed for the landfill on page 2 of "Solid Waste Handling Facility Permit Application" dated August 13, 1990.

Reference to test method should identify the type of test or what parameter is being tested for; for example, ASTM D 2216 (water content), ASTM D 1586 (standard penetration test) instead of ASTM D 2216 or ASTM D 1586.

II. Solid Waste Handling Facility Permit Application, dated August 13, 1990

Page 20, Liner Design

Composite liner design has been proposed for this facility. Ecology recommends the inclusion of Leak Detection System, particularly, in the areas with hydraulic gradient control. This system will be more accurate in detecting if leachate leaks into the underdrain system and to ground water. Monitoring the water from the underdrain alone is unlikely to reveal the actual magnitude of contamination because of dilution.

Page 24, Construction Quality Assurance (CQA)

This section should also address quality control (QC) procedures for construction materials, including soil, by the contractor.

III. Geology and Hydrogeology, dated June 12, 1991

Under verbal agreement with the Cowlitz-Wahkiakum Health Department and the Weyerhaeuser Company, Kirk Cook has conducted a preliminary review of several reports which contain items necessary to fulfill the requirements of a hydrogeologic assessment under WAC 173-304-600. The purpose of this section is to provide the results of the review of the Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington - June 12, 1991, the Weyerhaeuser Southwest Washington Solid Waste Facility Solid Waste Permit Application Part 1: Site Characterization (June 12, 1991) and the Weyerhaeuser Southwest Washington Solid Waste Disposal Facility Headquarters Site, Solid Waste Handling Facility Permit Application- August 13, 1990.

General Comments

The fact that items required under WAC 173-304-600(3)(b)(i) were contained in three separate documents greatly complicated the review. In the revision of the hydrogeologic assessment, I would like to see all relevant data and conclusion contained in one stand alone document.

Adequacy of Assessment

WAC 173-304-600(3)(b)(i)(A) and (B) Local/Regional Geology and Hydrology Evaluation of Bedrock and Soil Types

The major comment on this section of the assessment is that it is unnecessarily split between the Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington - June 12, 1991, and the Weyerhaeuser Southwest Washington Solid Waste Facility Solid Waste Permit Application Part 1: Site Characterization (June 12, 1991). This complicates review of these portions of the assessment.

The two cross-sections contained in Figure 3-3 of the Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington - June 12, 1991 carries the geological interpretation beyond the extent to which any of the piezometers or wells were drilled. The lack of data beyond relatively shallow depths makes site specific characterization of a deeper aquifer system impossible. This lack of data is of major concern given the presence of a fairly uniform layer of moderately weathered basalt and andesite across the site which appears to be encountered by both water supply wells currently used by the Headquarters Camp facility. Further investigation of this basalt/andesite layer should be under taken or additional information provided in order to determine its relationship with the shallow aquifer system.

WAC 173-304-600(3)(b)(i)(C) Depths to Groundwater

Section 4.3.3 of the Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington - June 12, 1991 discusses seasonal fluctuations of the shallow aquifer system. The impact the of the noted fluctuations in modifications to the groundwater flow direction presented in Figure 4-1 of the Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington - June 12, 1991 should be discussed. We recommend presenting at least one additional ground water contour map for the wet portion of the year. We suggest that this map be based on water level information collected in February or early March.

The interaction between precipitation and groundwater level fluctuations need to be investigated and results included in the hydrogeologic assessment. The results of this work will have significant bearing on both design of both the gradient control system and the leachate and storm water holding facilities.

WAC 173-304-600(3)(b)(i)(D) Direction and Flow Rate of Local Groundwater

This portion of the regulation requires that the facility proponent adequately characterize the direction and flow rate of local ground water. Generally this is accomplished through geotechnical and hydrogeologic testing to determine such properties as hydraulic conductivity, porosity, ground water flow velocity, and preferential flow paths. The testing and analysis conducted during the site characterization and presented in the Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington - June 12, 1991 appears to be inadequate.

Groundwater Flow Rate

The hydraulic conductivity of the 330 acre site is based on four slug (rising head) tests. These type of tests have been shown to be of limited value in providing accurate hydrogeologic information over a large area. Because of this limitation, Ecology has required limited pump testing of aquifers underlying proposed facilities (LRI and WIDCO) as a method of verifying slug test results.

Flow velocities were calculated using results stemming from the analysis of four slug tests, assumptions on differences between vertical and horizontal conductivities, assumptions of both porosity and effective porosity, and gradients based on a single water level measurement taken in August 1990. Furthermore, it appears that consideration was not given to the effect existing drainage patterns may have on flow velocities. Without collection of further data to reduce or eliminate the number of assumptions included in the determination of ground water flow velocity, Ecology cannot consider this portion of the hydrogeologic assessment to be complete.

The calculation of hydraulic conductivity contained in Appendix E, is confusing and incomplete. After review of the 1951 paper by Hvorslev it is apparent that the author did not present all his assumptions nor did he present a complete calculation of hydraulic conductivities for wells MW-1, MW-2, BW-1, and P-6.

Groundwater Flow Direction

Figure 4-1 provides a water level contour map, based on measurements collected in August 1990. Water level elevations for each well are presented on the map. However, because depth to water data from this sampling round, and reference elevations of the sampling points on the casings are not included in the report, the accuracy of Figure 4-1 cannot be verified.

There does not appear to be analysis of the possibility of deeper aquifer systems underlying the facility. Furthermore the interaction, if any, the deeper system referenced on page 13, paragraph three has with the shallow groundwater has not been adequately addressed in any of the reports.

There is a statement contained on page 13, paragraph three regarding vertical flow and the classifying of this site as a recharge area. Supporting data for this statement is lacking in the report.

A revision of the report must include a table of the surveyed reference points on each casing from which the water level measurements are taken. Furthermore, depth to water data from the August sampling (on which Figure 4-1 is based) must be included in the report as should data from which any other contour map is based.

WAC 173-304-600(3)(b)(i)(E) **Direction of Regional Groundwater**

The assessment is confined to an analysis of the local aquifer system. The revision of the assessment should provide a determination of the regional groundwater vertical flow direction with supporting documentation for that determination. Sources cited in for the determination of horizontal flow direction are sufficient.

WAC 173-304-600(3)(b)(i)(F) and (G) **Private and Public Wells/Water Rights**

The Weyerhaeuser wells appear to be on the fringe of the two thousand radius for the facility. Therefore, we would suggest that the location and construction details as well as a tabulation of the associated water rights be included in the revision of the hydrogeologic assessment.

WAC 173-304-600(3)(b)(i)(H) **Identification and Description of Surface Water**

Page 14 of the Weyerhaeuser Southwest Washington Solid Waste Facility Solid Waste Permit Application Part 1: Site Characterization (June 12, 1991) contains a brief description of surface water features within one mile of the proposed facility. The description is inadequate in that it does not present data on the seasonal and mean annual flow for the identified features.

WAC 173-304-600(3)(b)(i)(I) **Background Ground and Surface Water Quality**

Background surface water quality data is presented in the Weyerhaeuser Southwest Washington Solid Waste Facility Solid Waste Permit Application Part 1: Site Characterization (June 12, 1991). However, there is no indication as to when these samples were taken or how many samples were taken between January and November 1990. Background groundwater quality data is presented in the Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington - June 12, 1991 appears to be adequate.

WAC 173-304-600(3)(b)(i)(J) **Calculation of Site Water Balance**

The method utilized to calculate the site water balance is not cited in either the Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington - June 12, 1991, or the Weyerhaeuser Southwest Washington Solid Waste Facility Solid Waste Permit Application Part 1: Site Characterization (June 12, 1991).

We have concerns regarding the use of discharge measurements from the southern tributary of Sucker Creek as a factor in the water balance. Use of surface water monitoring site S-4 to collect stream flows will provide greater runoff factors which should result in lowering both infiltration to shallow and deeper aquifer systems. Use of this number to base leakage model inputs could result in errorenous values for leachate volumes, hydraulic control system discharges, and landfill leakage concentrations found in a leakage detection system.

WAC 173-304-600(3)(b)(i)(K) **Conceptional Design of Ground and Surface Water Monitoring Systems**

The Weyerhaeuser Southwest Washington Solid Waste Disposal Facility Headquarters Site, Solid Waste Handling Facility Permit Application- August 13, 1990 proposes a ground water monitoring system consisting of one upgradient and three downgradient monitoring wells. BW-1 is designated as the upgradient well while wells MW-1 through MW-4 are the designated downgradient monitoring wells. Given the size of the facility and the variation of lithologic units in which the wells are installed, the proposed system is inadequate to provide for complete monitoring of the groundwater. Additionally, there appears to be a problem in using BW-1 as the statistical basis by which to compare the three downgradient wells. BW-1, consistently shows higher levels of ammonia, iron, sodium, and manganese than do the downgradient wells.

WAC 173-304-600(3)(b)(i)(L) **Land Use in the Area**

In the three documents which were reviewed to determine adequacy of the hydrogeologic assessment, there did not exist a complete discussion of land use in the surrounding area. This section must be included in the revision of the assessment and must include a discussion of all nearby residences located west of the facility boundary.

WAC 173-304-600(3)(b)(i)(M) **Topography of the Site**

This requirement has been met in each of the reviewed documents.

Recommendations

In order to complete the hydrogeologic assessment such that it will meet the requirements outlined in WAC 173-304-600(3)(b)(i), the document must include the following data and revise the following sections:

* Further investigation of this basalt/andesite layer should be under taken to determine its relationship with the shallow aquifer system. If additional data currently exists to support the conclusions of the reports, it should be provided to Ecology;

2 * An additional ground water contour map for the period of February/March should be constructed to accompany Figure 4-1. Additionally, the interaction between precipitation and groundwater level fluctuations need to be investigated and results included in the hydrogeologic assessment;

* Ecology will required additional aquifer testing for the shallow aquifer system underlying proposed facility in order to verify slug test results. If additional support data exists to confirm the results of the slug testing, that data should be supplied to Ecology for evaluation. However, given the current level of investigation it is likely that at least four additional slug tests should be conducted. Based of the results of Ecology's evaluation of additional information, pump tests may be recommended for the proposed facility;

* Complete calculations using the methodology outlined in the 1951 paper by Hvorslev should be included. Furthermore, a complete list of assumptions on which the calculations were based should be presented;

* A revision of the report must include a table of the surveyed reference points on each casing from which the water level measurements are taken. Furthermore, depth to water data from the August sampling (on which Figure 4-1 is based) must be included in the report;

* The revision of the assessment should provide a determination of the regional groundwater vertical flow direction with supporting documentation for that determination;

* A presentation of the location and construction details as well as a tabulation of the associated water rights should be included in the revision of the hydrogeologic assessment;

* The seasonal discharge and well as the mean annual discharges for identified steams should be presented;

* An assessment should be made of the impact stream flow outside the facility area, but measured at S-4, has on the water balance calculation;

* A revision of the assessment must include a discussion of all nearby residences located west and within two miles of the facility boundary in order to complete the land use portion of the report;

If you have further questions regarding these comments, please telephone me at (206) 753-0144 or Kirk Cook at (206) 586-6484.

Sincerely,

ROU

Roland O. Ugochuku, Ph.D.
Regional Engineer
Solid and Hazardous Waste Section

RU:dc(8/shw1)

EMCON
Northwest, Inc.

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March 13, 1992
Project S4115.09

Dr. Roland Ugochuku, Ph.D.
Regional Engineer
Solid and Hazardous Waste Section
Department of Ecology, SW Regional Office
7272 Cleanwater Lane, LU-11
P.O. Box 47775
Olympia, WA 98504-6811

Re: Response to February 7, 1992 Letter from Ecology Regarding Headquarters Part 1 Solid Waste Permit Application

Dear Dr. Ugochuku:

The Washington Department of Ecology (Ecology) provided comments on Weyerhaeuser Company's *Southwest Washington Solid Waste Facility Solid Waste Permit Application Part 1: Site Characterization* (Part 1 Application) in a letter dated February 7, 1992 to Mr. David Riggs of the Cowlitz-Wahkiakum Counties Environmental Health Division. EMCON Northwest, Inc (EMCON), formerly Sweet-Edwards/EMCON (SE/E), prepared the Part 1 Application and on behalf of Weyerhaeuser Company has prepared this response to Ecology's comments. It is EMCON's understanding from Ecology that any earlier comments on the Part 1 Application have been incorporated into or superceded by the February 7, 1992 letter.

In the course of preparing this response, Ecology and EMCON have participated in several teleconferences and met to discuss Ecology's concerns regarding the Part 1 Application. The permit application was divided into two parts, based on discussions with Ecology over a year ago. The first part, which was the subject of this review, presents basic site background data for site characterization. The second part, which will be prepared and submitted later this year, presents the preliminary site design and monitoring programs. It appears that many of Ecology's concerns on completeness and adequacy resulted in miscommunications and misunderstanding regarding which part of the application information would

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be presented. As discussed with Ecology, outstanding data that pertains to site design, will be presented in the Part 2 Application.

There was also concern regarding the availability of technical data to substantiate the information in the Part 1 Application. Most of this backup data is available in existing reports that have been referenced in this letter. EMCON has provided the remaining requested data as attachments to this letter.

EMCON believes that this letter with its references and attachments satisfies all Ecology's concerns pertaining to the Part 1 Application. In our professional opinion, the level of detail presented in the Part 1 Application with this addendum is appropriate and is complete for the site background and characterization aspect of the permit application process.

Site Geology and Seismicity (Page 1, first comment)

For the purposes of landfill design, a geotechnical evaluation is necessary. Background information was presented in the Part 1 Application which met the baseline site characterization requirements. More detailed evaluations concerning stability and soil balance regarding design will be presented in Part 2 of the application.

With regard to the extent of faults within the landfill, the site evaluation and literature review indicate that the minor faulting observed on site is associated with ancient volcanic activity and did not occur in recent geologic time. The regional historical geologic setting is provided as part of the overall site geologic characterization. Geophysical testing performed in an earlier investigation does not indicate any evidence of active Holocene faulting (see Attachment 1). We believe our understanding of the site geology is sufficient for environmentally sound landfill design and monitoring and that additional geophysical testing is not warranted.

Number and Distribution of Test Pits (Page 2, first three comments)

The purpose of the soil characterization information relative to permitting the site is to aid in the geologic and hydrogeologic characterization and interpretation of other field data, and to evaluate settlement and stability

concerns. Our understanding of the site geology indicates that additional test pits would not provide any new data regarding site settlement and stability issues. Therefore, the test pit information, in conjunction with the bore hole information, is deemed adequate for site characterization.

Weyerhaeuser has provided the required data for evaluating settlement and geologic stability concerns for permitting in the Part 1 Application, and will provide more detailed analyses for critical issues such as landfill static and seismic stability in Part 2 of the application.

The Ecology comments indicate there is a lack of data for characterizing and delineating specific borrow sources on site. We agree with this statement since the test pit program was not intended to delineate borrow areas. This work will be accomplished immediately, before and during construction.

There are several approaches that can be taken to performing soil resource investigation programs to identify borrow areas and other soil sources:

- A large, detailed investigation can be performed at the outset (e.g, Hidden Valley Municipal Solid Waste Landfill, Pierce County)

- A phased approach can be used where there is a preliminary investigation followed by several small investigations or one large detailed investigation (e.g., ECOS Hazardous Waste Landfill Permit Application, Adams County)

- The design can be specified regardless of the site soils and responsibility left to the contractor to meet the specifications using either on-site soils or imported soils (e.g., Cowlitz County, Tenant Way Landfill)

All three of these approaches have been used and accepted in landfill designs in Washington and other states, and the decision on which method to use is primarily a function of cost, site characteristics, project size, and project life. EMCON and Ecology have experience with each of these methods, and all three should be acceptable from a permitting point of view.

Weyerhaeuser is taking a phased approach to soil investigations for the Headquarters project. In the early stages of the project feasibility evaluation the primary concerns during the test pit exploration program were settlement potential, unusual stability concerns, and a preliminary evaluation of the types of soils available. Results of field tests indicate that there are no settlement or unusual stability considerations for the site, and that there is a significant amount of soil available for use at least in general earthfill and covers, and potentially even low-permeability soil liners.

Test pit locations for the 1986 and 1989 studies were based on site coverage, landforms, potential borrows areas, unusual areas, and site access. The number of test pits excavated, and the number and types of laboratory tests performed, were based on the level of detail of information required for evaluating site feasibility. We believe this is same level of detail appropriate for site characterization.

During final design of each landfill cell and prior to construction, Weyerhaeuser intends on performing detailed field exploration programs to identify specific soil resources. The primary purpose of this is to minimize contractor bid costs and allow for uniform bid estimates based on the geotechnical findings. The field explorations would be limited to providing information for the current construction project under consideration. It is important to realize that this project will develop over several decades, and it is not efficient or prudent to conduct a detailed borrow source investigation for the entire site at one time. If it happened that an adequate quantity or quality of low-permeable soils were not available on site for use in a soil liner, Weyerhaeuser would either locate an off-site borrow source or make it a responsibility of the contractor to provide a material that meets the specifications.

In conclusion, we regard the information gained in the test pit and other field exploration programs technically sound and sufficient for the permit application of the landfill because:

- The data gained by the test pit program substantiate and augment the hydrogeologic investigation and interpretations
- There is adequate data to state that there are no foundation settlement concerns

- There is adequate data to state that there are no unusual stability concerns (detailed stability analyses, primarily concerned with stability on the liner during landfill operations, will be presented in Part 2 of the Application)

The data go beyond the level of detail provided by some projects at the permit application stage where information regarding soil resources has been left up to the contractor during final construction bidding.

Number of Proctor Tests Performed (Page 2, fourth comment)

The sole purpose of performing the Proctor tests during the preliminary soil resource evaluation was to establish relative densities and moisture contents for performing the permeability tests. It was not the intent, and is inappropriate at this time, to establish soil compaction parameters for the on-site soils. Proctor testing for evaluating compaction during construction will be performed immediately before and during construction so that specific soils being tested in the field can be correlated to laboratory test Proctor curves. Tests performed one or more years in advance of construction could not be confidently correlated with a specific soil during construction.

Identification of Specific Borrow Areas (Page 2, fifth comment)

The limits of the borrow areas are intended to be within the landfill footprint. Specific limits of borrow for different types of soils during each construction phase will be provided with the construction plans and specifications that will be provided to Ecology before each construction phase.

In Situ Tests (Page 2, sixth comment)

In situ moisture and density tests will be performed as a quality assurance measure on compacted earthfill. This information will be included in a construction quality assurance manual that will be provided with each set of construction contract documents, and will also be addressed in Part 2 of the application.

Hydrogeologic Assessment (Page 2, seventh comment)

Since the Hydrogeologic Assessment (Appendix B of the Permit Application) is often requested by many parties as a stand-alone document we printed it under separate cover, which we provided to Ecology. If Ecology wishes a copy with all the appendices bound into the main report we will be happy to provide one.

Test Pit Logs (Page 2, last comment)

The comment states that the average refusal depth in the test pits was about 9 feet. The average excavation depth for the site is 5 to 6 feet. Much of the site will actually receive fill to obtain the required base grades. The area that will receive the deepest excavation (approximately 35 feet at the knoll on the highest portion of the site) appears to contain easily excavatable material to that depth as indicated by boring P-10.

The maximum waste depth of approximately 250 feet is achieved primarily by filling above existing grade. As stated above, the maximum excavation depth will be about 35 feet, with an average of 5 to 6 feet.

ASTM Test Number Designations (Page 3, first comment)

The comment implies that the ASTM test designation numbers were not clearly associated with a test name. Since the test name was included in each case as the bold face title of the paragraph wherein the ASTM number appeared, we believed the association was clear. We will be happy to directly associate the test name and number in the same sentence in the future.

Liner Design (Page 3, second comment)

The proposed liner design exceeds Washington Minimum Functional Standards (MFS) requirements for industrial waste landfills and meets or exceeds all requirements for municipal waste landfills. By interpretation of the regulations as well as examples set elsewhere in the state (e.g., Cowlitz County Municipal Solid Waste Landfill-Tenant Way and two Port Angeles

industrial wood products manufacturing waste facilities), the design exceeds the state standards for the types of industrial wastes intended for the site.

Sump areas where leachate head could be formed, and the leachate holding pond, will receive an additional geomembrane liner and leak detection system below the primary composite liner.

The proposed hydraulic gradient control system (HGCS) will be used as an integral part of the ground water monitoring and protection system. The system will be able to indicate the magnitude of any potential contamination regardless of dilution by allowing measurement of the concentration of chemical constituents, thus allowing an estimate of the rate (e.g. milligrams per day) that any particular constituent is being released to the environment. In any case, what is important is that it will allow detection of potential releases in a manner much more effective than many other permitted landfills in the state of Washington and in excess of MFS requirements. The system also allows for capture and potential treatment of the liquids flowing beneath the landfill, which is not provided for by typical leak detection systems.

We are including a worst case liner leak scenario and aquifer impact analysis which demonstrate no significant impacts and support the validity of our proposed design (Attachment 2).

Construction Quality Assurance (Page 3, third comment)

Elements of contractor construction quality control (CQC) will be included in the design specifications of the final contract documents. Most of the relevant specifications will be included in Part 2 of the Application.

General Comments (Page 3, last comment)

In a telephone conversation with EMCON on February 6, 1992, Mr. Cook stated that it was not necessary to reissue the application in one stand alone document. It was agreed that any additional information could be submitted in a letter as an supplement to the original permit document. We consider this letter a supplement to the original permit document. If another format is preferable, please let us know.

WAC 173-304-600(3)(b)(i)(A)and (B) - Local/Regional Geology and Hydrology (Page 4, first comment)

Ecology expresses concern about the split of the information into two documents. The Part 1 application contains the information required for the permit. The *Geology and Hydrogeology of the Proposed Headquarters Solid Waste Facility Cowlitz County, Washington* (SE/E, June 1991) is Appendix B which provides supporting information to the permit application.

The two cross sections contained in Figure 3-3 were prepared using standard geologic techniques. The information below the depths of the wells was based on surface geologic mapping and geologic structural interpretation which allowed projecting the geologic information deeper than the total depth of the wells on site.

Information regarding the presence of a "fairly uniform layer of moderately weathered basalt and andesite across the site," is from the two water supply wells at the Headquarters Camp, which are over one-half mile to the west of the proposed facility. Geologic structural mapping at the site (see Appendix B) indicates a shallow dip to the northeast which would place the basalt and andesite layer noted in the well logs over 200 feet below lowest point in the landfill and below the bottom of the geologic cross sections presented in Figure 3-3. At this depth the layer would not significantly affect the shallow aquifer system.

WAC 173-304-600(3)(b)(i)(C) - Depths to Ground Water (Page 4, second comment)

Seasonal fluctuations in ground water do not change the ground water flow direction at the proposed landfill site. There are some very minor changes in the ground water contours but the overall direction of flow does not change seasonally. We have included two ground water contour maps based on August 1990 and March 1991 water levels which document this fact (see Attachment 3).

Preliminary data on the interaction between precipitation and ground water levels has been provided in Attachment 4. The fluctuations will be useful in determining the highest potential ground water levels. The final landfill

subgrade will be designed to be a minimum of five feet above this level. The fluctuations themselves do not affect design of the hydraulic gradient control system. Ecology suggests that the design of the leachate and storm water systems will benefit from data on the ground water and precipitation interaction. The design of leachate and storm water holding facilities do not depend on the ground water fluctuations and precipitation interaction.

WAC 173-304-600(3)(b)(I)(D) - Direction and Flow Rate of Local Ground Water (Page 4, last comment)

EMCON's assessment of flow rate and direction of ground water in the permit application is adequate. The evaluation of flow rate and direction of ground water presented in the permit was based on geotechnical and hydrogeologic testing at the site. The ground water flow rate is not a critical value for the design of a landfill or ground water monitoring system. The purpose for this value is to obtain a baseline evaluation of the hydrogeologic flow regime. The degree of detail for the flow rate presented in the Part 1 application is at an appropriate level for site characterization. The direction of ground water flow is based on eighteen wells and site data on the interaction of ground water and surface water (Appendix E of the Permit Application).

Ground Water Flow Rate (Page 5, first three comments)

In low permeability rock, such as that found at the Headquarters site, neither pumping tests nor slug tests provide information out a large distance from a well. Slug testing is a widely accepted method of testing hydraulic conductivities, especially in low permeability sediments. The tests were performed in different areas of the site, indicating a two order of magnitude variation across the site. This is typical of this type of hydrogeologic setting.

The borings logs (Appendix B), test pits (Appendix C) and laboratory tests results (Appendix D) provide supporting data that are consistent with the slug test data. The predominant sediment type observed in the test pits and boring logs is silty clay and clayey silt which have hydraulic conductivities in the range determined in the slug testing. The sieve and hydrometer laboratory analyses indicate silt and clay percentages that

ranged from 60% to over 90% in the tested samples which confirm the field observations. Remolded permeabilities ranged from 1 x 10^{-6} to 1x10^{-7} cm/sec in samples from the site. For the level of investigation required for a permit application, pumping tests are not necessary to verify the hydraulic conductivity measurements. We understand that three additional slug tests at the site are required by Ecology. These will be performed in March 1992 and the results will be forwarded to Ecology.

There were not an unusual number of assumptions used in the calculation of flow velocity. This calculation has three terms: horizontal hydraulic conductivity, effective porosity, and hydraulic gradient. Horizontal hydraulic conductivity was determined from direct site tests. Vertical hydraulic conductivity is not used in this calculation. A standard literature value was used for effective porosity. As confirmed with Mr. Cook, this is not unusual. Very few, if any sites, use field derived values for effective porosity because of the difficulty in obtaining a representative sample and the difficulty in the laboratory procedures. The hydraulic gradient was determined directly from site data. As discussed above, there is no significant seasonal change in ground water contours and therefore hydraulic gradient. There is more spacial variation of the hydraulic gradient within the site than seasonally. This spacial variation was accounted for by taking eight measurements across the site as described in Appendix B of the Permit Application.

The hydraulic gradient measured at the site accounts for possible influences due to drainages. There is no other method to incorporate their influence in the calculation of ground water flow velocities.

Appendix E of the Geology and Hydrogeology Report, which describes the calculation of hydraulic conductivity, has the necessary information and data to reproduce the calculations. Appendices do not typically provide a step by step analysis, but provide the necessary backup data to support the calculations. Attachment 5 provides the assumptions and additional calculations to simplify the review of the slug test analyses.

Ground Water Flow Direction - (Page 5, last comments)

A table has been provided in Attachment 6 with the necessary data for Ecology to verify the accuracy of Figure 4-1 as well as the March 1991 contour map (Attachment 3).

An evaluation of potential impacts to the deeper aquifer system was performed as part of the EIS. We apologize for not providing Ecology with a copy of this analysis earlier. The results of this evaluation indicate no significant impact. A copy of this analysis along with the liner leak scenario has been attached for Ecology's review (see Attachment 2).

The statement regarding vertical flow in the permit application is based on the water level information provided on the logs of the Headquarters camp wells. Water level measurements were taken on February 13, 1992 to verify the earlier reported values. Depth to water was greater than 150 feet below ground surface, which substantiate our statement on vertical gradients between the shallow and deeper ground water systems.

WAC 173-304-600(3)(b)(i)(E) - Direction of Regional Ground Water (Page 6, first comment)

On a regional basis, the landfill area is in a recharge area, indicating downward vertical flow. This is supported by the documentation of vertical gradients in the site wells and the wells tapping deeper water bearing zones and the water balance calculations which indicate net recharge to the deeper aquifer systems from the shallow system.

WAC 173-304-600(3)(b)(i)(F) and (G) - Private and Public Wells/Water Rights (Page 6, second comment)

We understand that Ecology already has the information regarding the Headquarters Camp wells. These wells are over 2600 feet from the proposed facility. Providing well details and water rights information for wells at a distance greater than 2000 feet is not a requirement of the permit application. However, for any interested parties, this information is publicly available or Weyerhaeuser would be happy to provide it.

WAC 173-304-600(3)(b)(i)(H) - Identification and Description of Surface Water (Page 6, third comment)

A detailed description of the site surface water features is contained in the surface water technical report which is included in the Part 1 application as Appendix E. Actual and long-term average monthly flows are presented in Table 4-2.2 on page 32 of the appendix.

WAC 173-304-600(3)(b)(i)(I) - Background Ground and Surface Water Quality (Page 6, fourth comment)

Appendix E of the Part 1 Permit Application presents the details on the surface water quality data.

WAC 173-304-600(3)(b)(i)(J) - Calculation of Site Water Balance (Page 6, last comment)

The site water balance is a summary of the more detailed water balance calculation presented in Appendix E of the Part 1 Permit Application.

Ecology appears to be concerned about the affect of a potentially low infiltration rate calculated in the water balance on the calculations performed in the leak scenario and aquifer impact analysis (see Attachment 2). The leak scenario and aquifer impact analysis evaluations did not use the results from the water balance in the calculations. It was based on conservative leakage rates only with no dilution from infiltration.

WAC 173-304-600(3)(b)(i)(K) - Ground and Surface Water Monitoring Systems (Page 7, first comment)

The June 1991 permit application supersedes the August 1990 permit application. Proposed ground water and surface water monitoring systems will be submitted in Part 2 of the application.

WAC 173-304-600(3)(b)(i)(L) - Land Use in the Area (Page 7, second comment)

We apologize for not including land use in the Part 1 permit application. The Part 1 outline did not include a section for land use and we overlooked the requirement. The permit application requirements do not specify a distance from the site to evaluate land use or require a detailed discussion of specific types of land uses. The attached map (Attachment 7) delineates land use to a distance of 2 miles from the site and includes the land use designations of forestry, forestry support, and rural residential. The nearest residence is approximately 1.3 miles from the site.

RECOMMENDATIONS

The Recommendations have been addressed in the comments above. A summary of the comments are presented below:

1. Justification for no further investigation of the basalt andesite layer has been presented in the comments above.

2. Two contour maps have been provided in Attachment 3

3. The additional supporting data confirming slug test results have been presented in the comments above. Three additional slug tests will be performed at the site.

4. Additional calculations on the Hvorslev method have been included in Attachment 5.

5. A table of survey reference elevations and water level depths is included in Attachment 6.

6. A discussion of regional vertical flow is presented above.

7. Information regarding water rights and well construction details will be provided on request.

8. and 9. An assessment of surface water is presented in Appendix E of the application.

10. A land use map has been included in Attachment 7.

If you have any questions regarding our comments, please call.

Sincerely,

EMCON Northwest, Inc.

for: Richard S. Thiel, P.E.
Senior Project Engineer

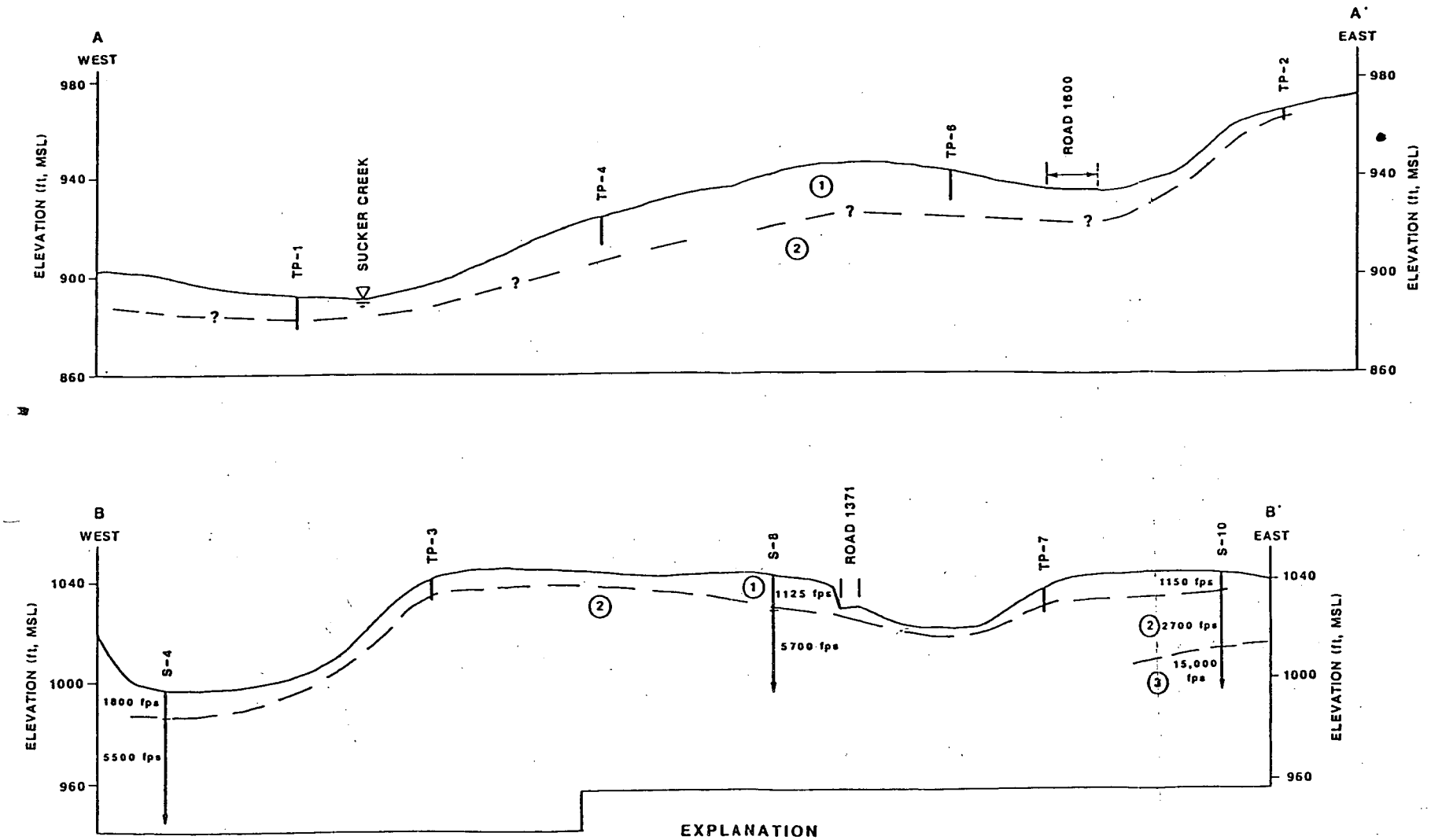
Dorothy Fisher Atwood, R.G.
Supervising Hydrogeologist

Enclosures: Geophysical Testing Results
Liner Leak Scenario and Aquifer Impact Analysis
Ground Water Contour Maps for August 1990 and March 1991
Precipitation and Ground Water Level Data
Additional Hvorslev Calculations
Table of Reference Elevations and Ground Water Depths
Land Use Map

cc/enc: Kirk Cook, Ecology
Chris Haynes, Weyerhaeuser

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GEOPHYSICAL TESTING RESULTS



EXPLANATION

0 200 400
SCALE IN FEET
VERTICAL EXAGGERATION 5x

TP-1 Test Pit

P-1 Observation Well

S-2 Seisatic Station

1000 fps / 1500 fps } Layer velocities (ft/sec)

(1) Layer 1:Clayey Silt (soil)

(2) Layer 2:Clayey Silt, Silty Clay or Fractured Rock (Weathered Rock)

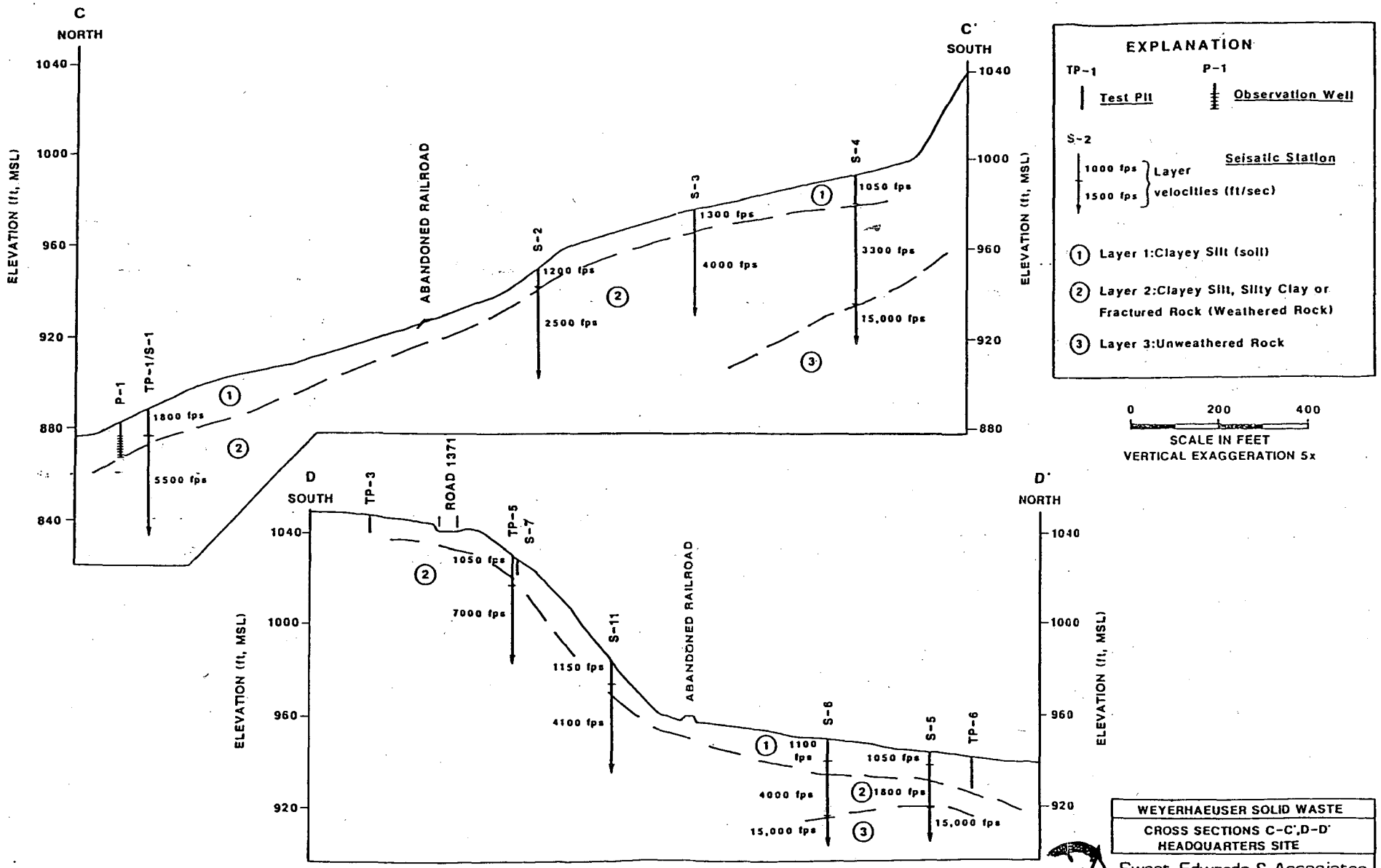
(3) Layer 3:Unweathered Rock

WEYERHAEUSER SOLID WASTE
CROSS SECTIONS A-A', B-B'
HEADQUARTERS SITE

Sweet, Edwards & Associates

	INITIALS	DATE
DRAWN BY	tmm	5-10-86
CHECKED BY		
REVISED		

FIGURE 9



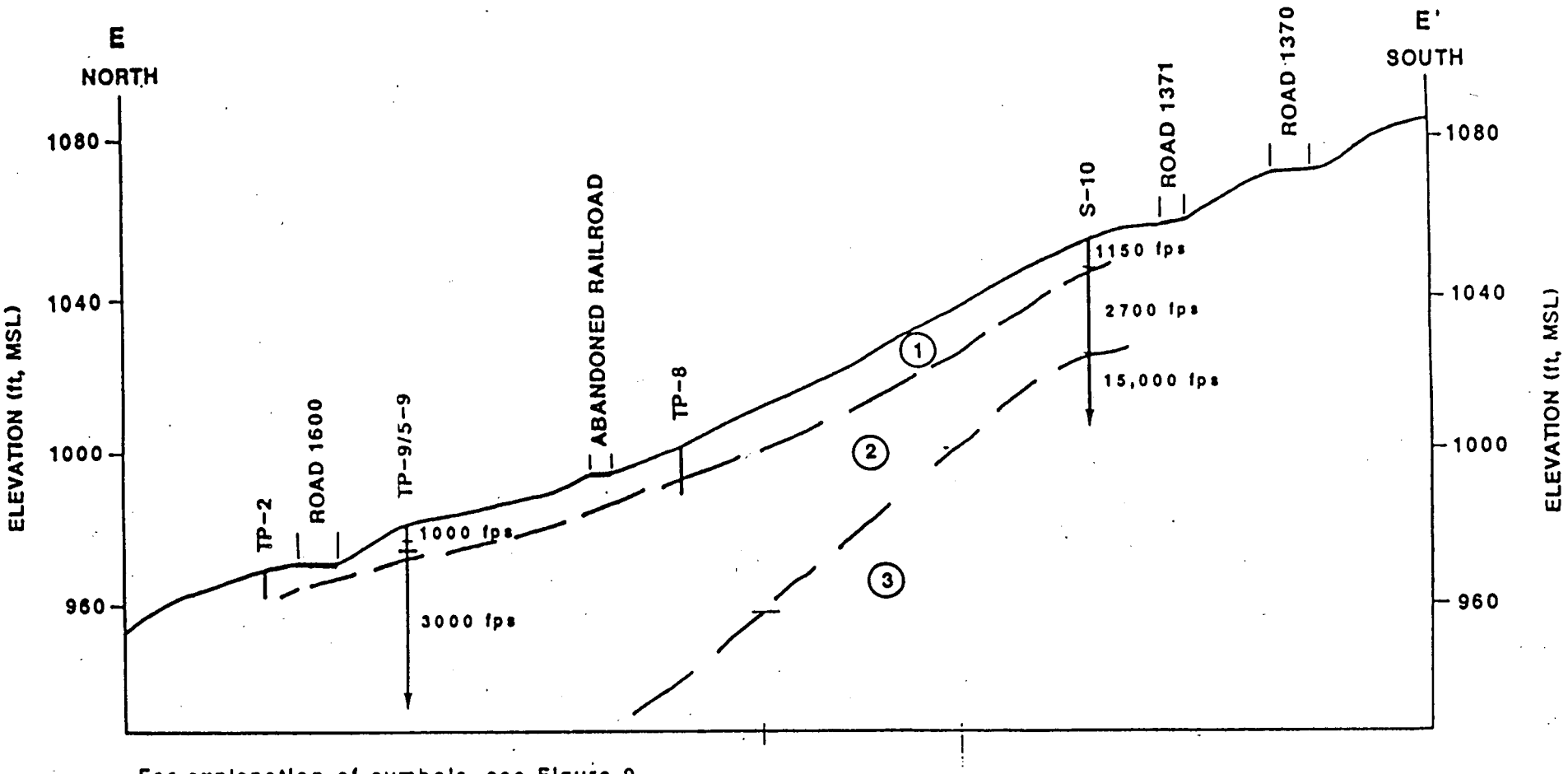
WEYERHAEUSER SOLID WASTE

CROSS SECTIONS C-C',D-D'
HEADQUARTERS SITE

Sweet, Edwards & Associates

	INITIALS	DATE
DRAWN BY	TMM	5-16-86
CHECKED BY		
REVISED		

FIGURE 10



For explanation of symbols, see Figure 9.

0 200 400

SCALE IN FEET

VERTICAL EXAGGERATION 5x

WEYERHAEUSER SOLID WASTE

CROSS SECTION E-E'
HEADQUARTERS SITE

Sweet, Edwards & Associates

	INITIALS	DATE
DRAWN BY	[illegible]	5-10-86
CHECKED BY		
REVISED		

FIGURE 11

LINER LEAK SCENARIO
AND AQUIFER IMPACT ANALYSIS

NOTE: The liner leak scenario and aquifer impact analysis are included in Appendices B and E of this EIS.

GROUND WATER CONTOUR MAPS FOR AUGUST 1990 AND MARCH 1991

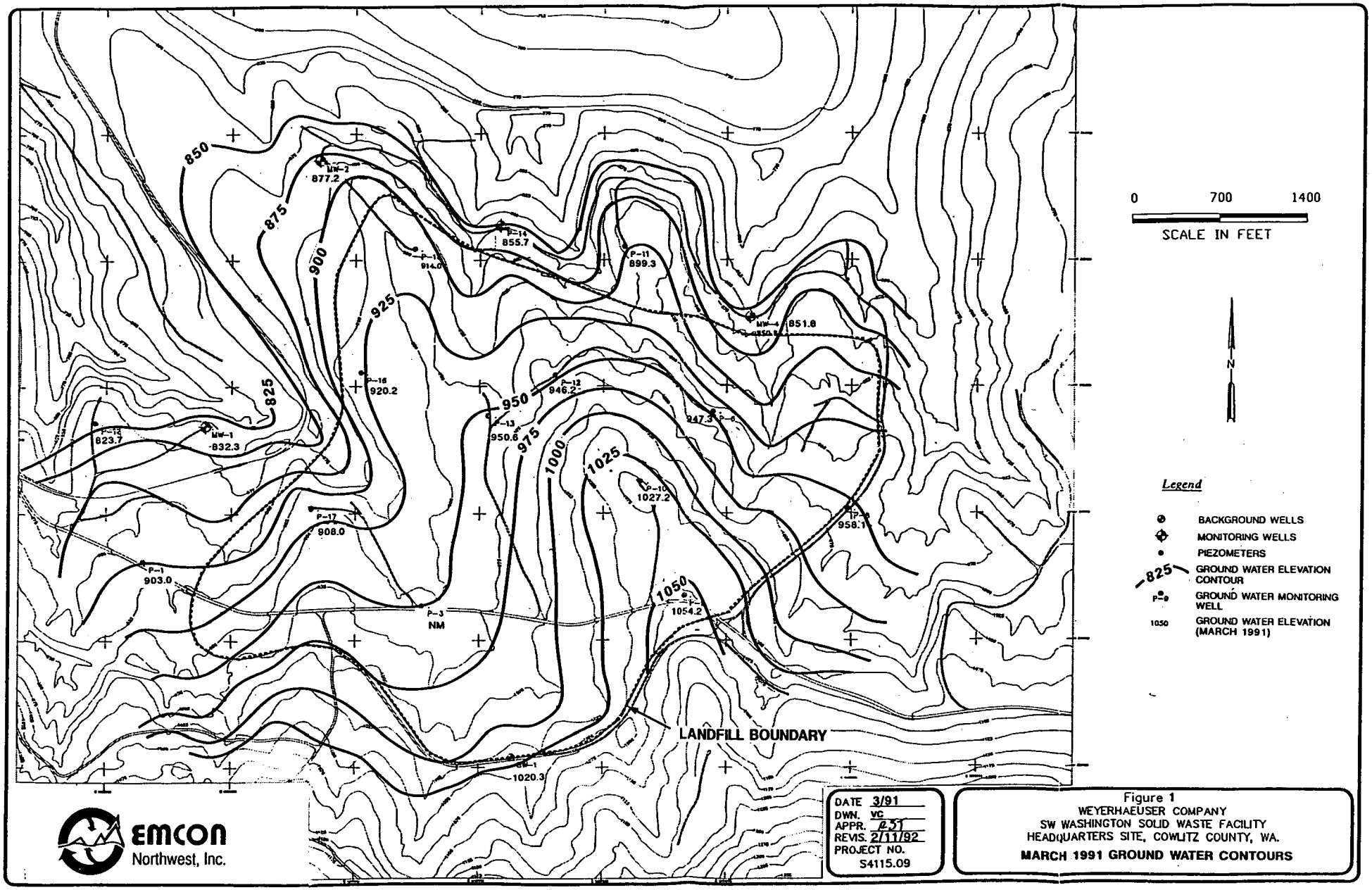


Figure 1
WEYERHAEUSER COMPANY
SW WASHINGTON SOLID WASTE FACILITY
HEADQUARTERS SITE, COWLITZ COUNTY, WA.
MARCH 1991 GROUND WATER CONTOURS

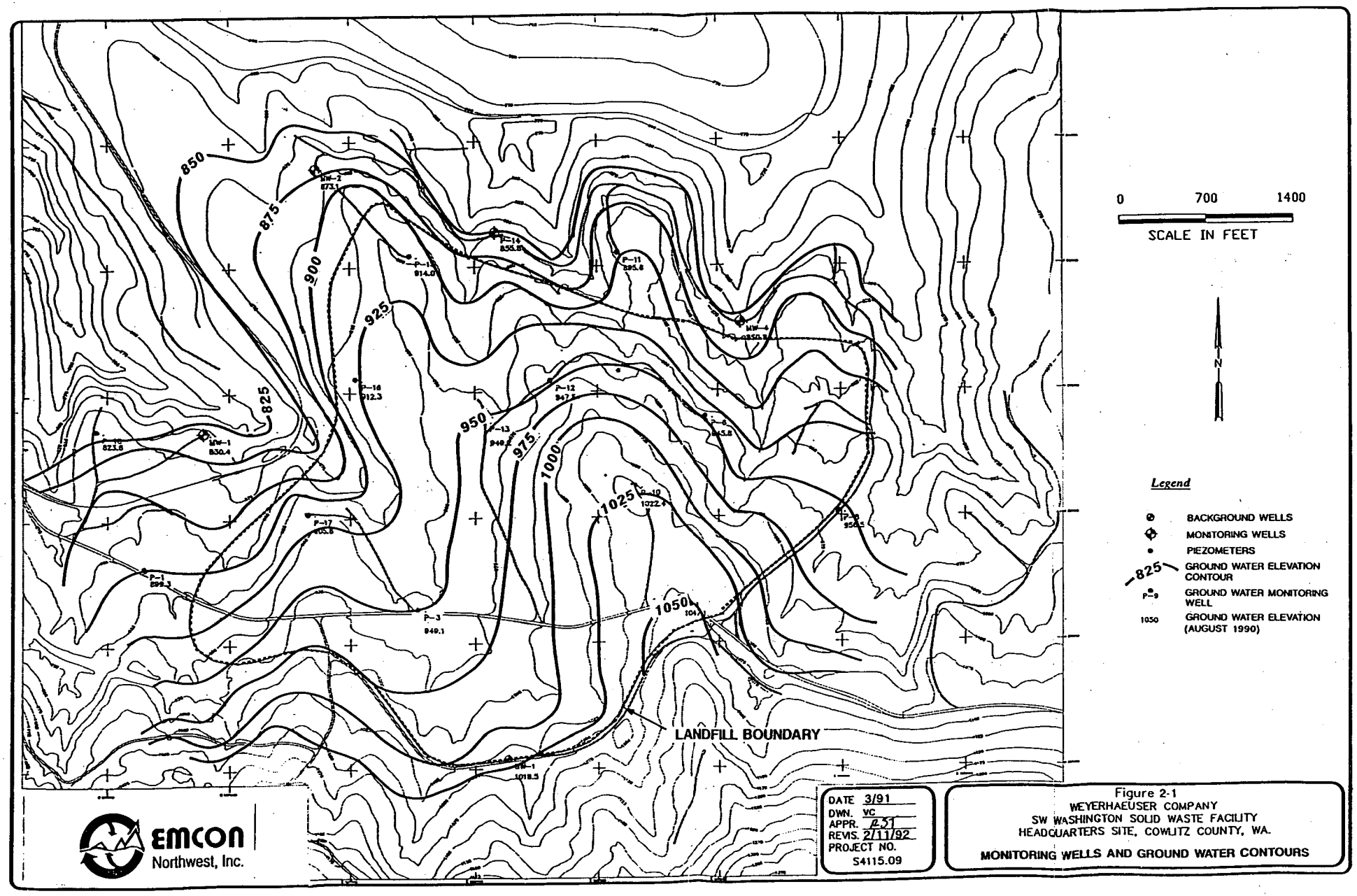
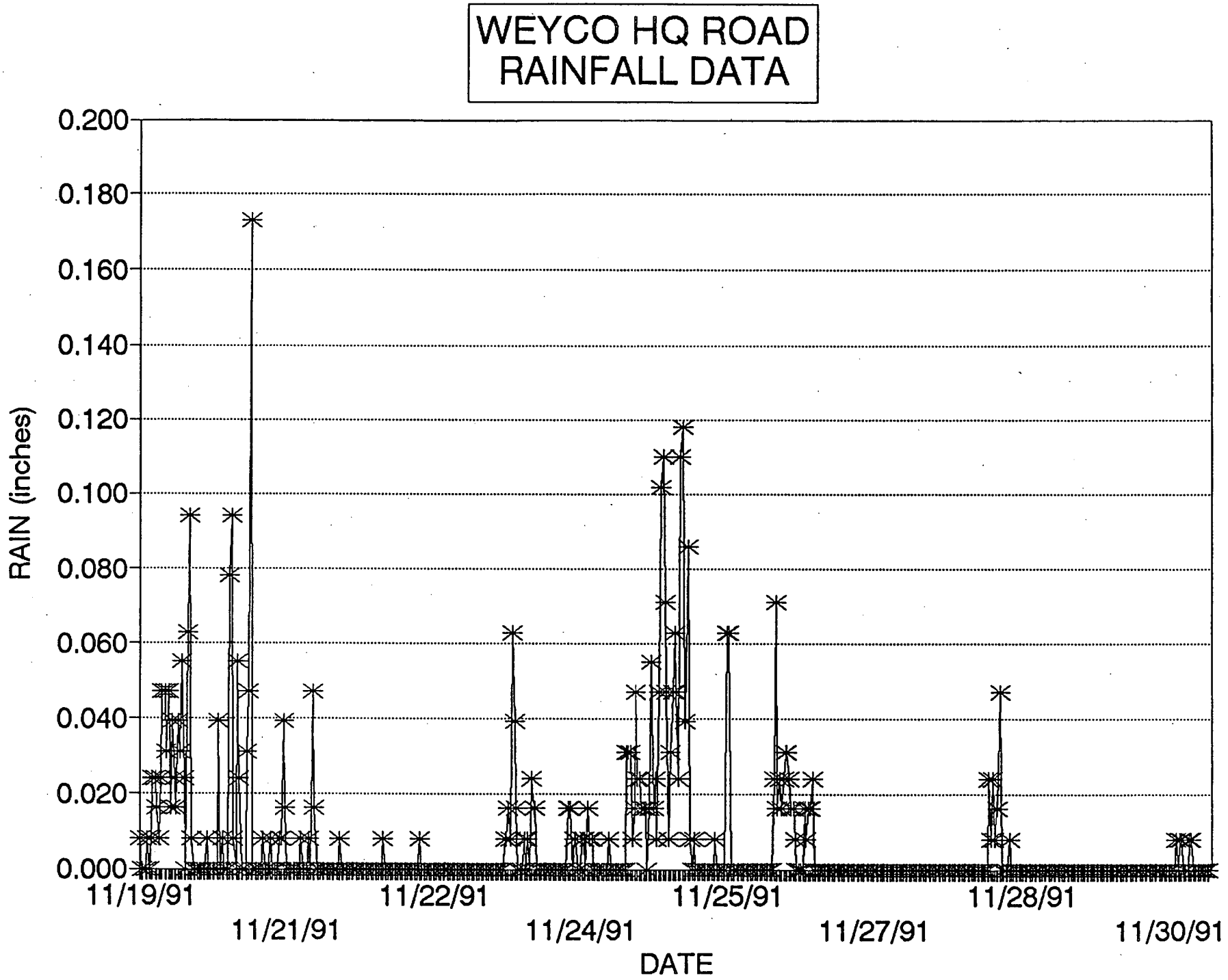
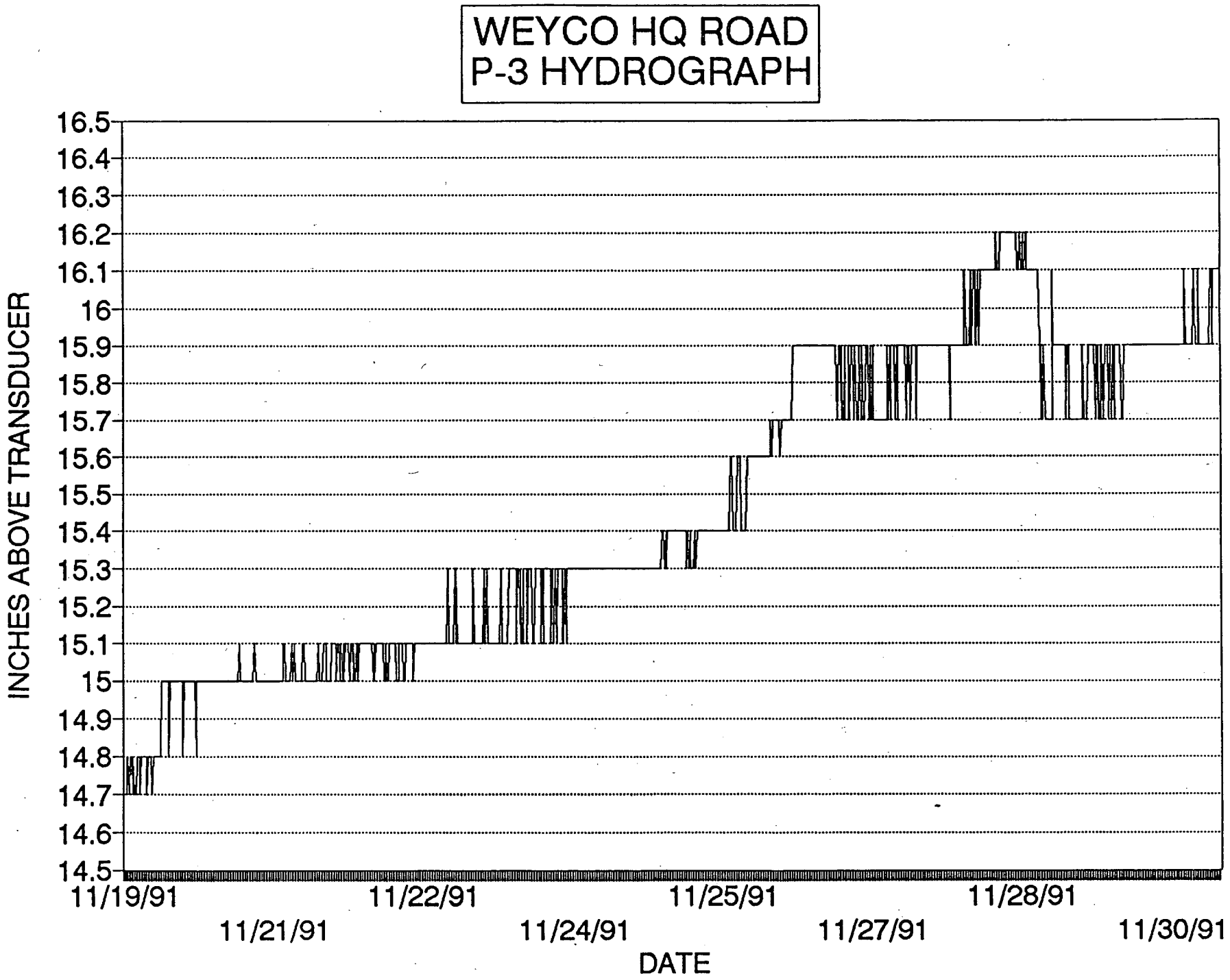


Figure 2-1
WEYERHAEUSER COMPANY
SW WASHINGTON SOLID WASTE FACILITY
HEADQUARTERS SITE, COWLITZ COUNTY, WA.

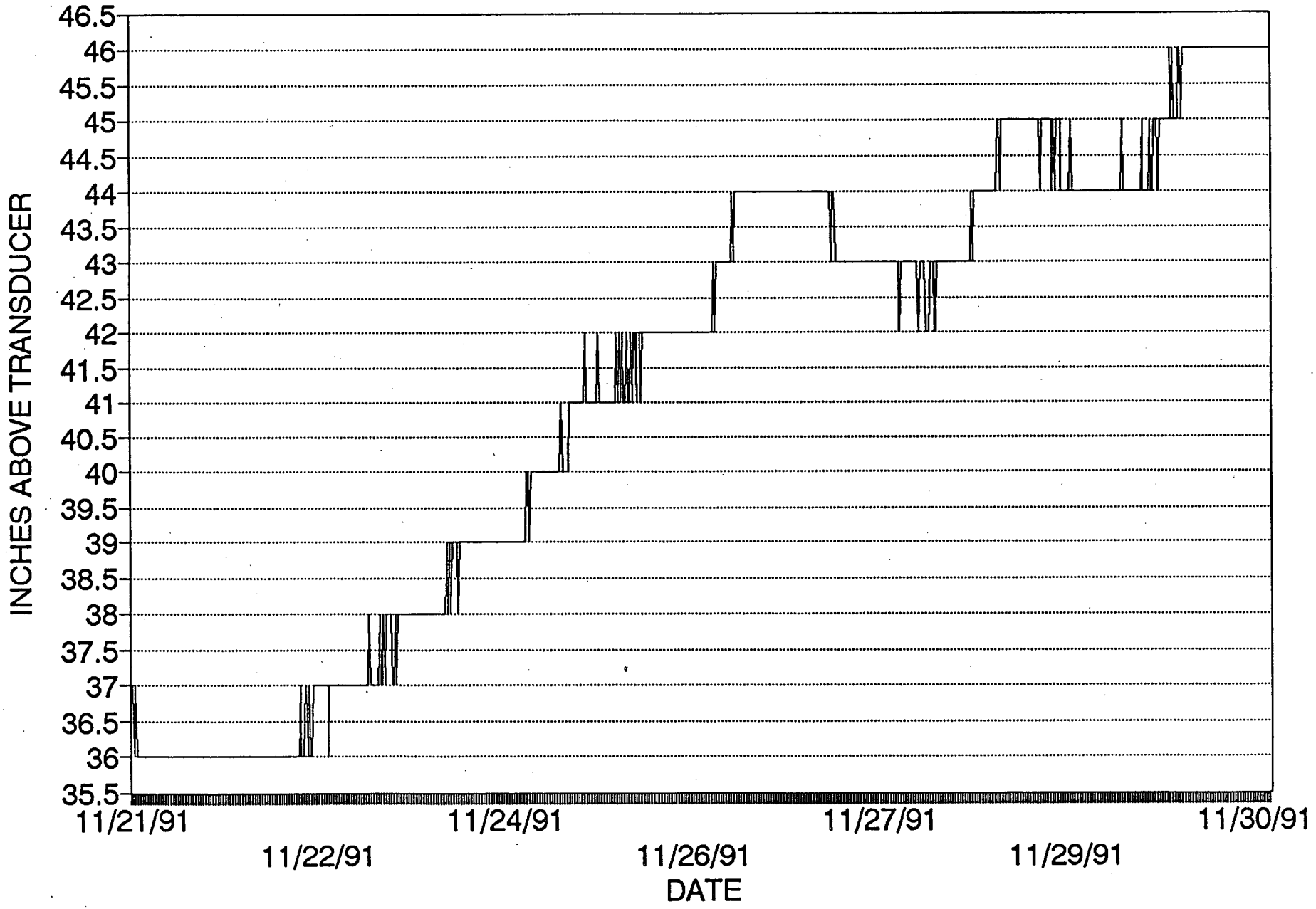
MONITORING WELLS AND GROUND WATER CONTOURS

PRECIPITATION AND GROUND WATER LEVEL DATA

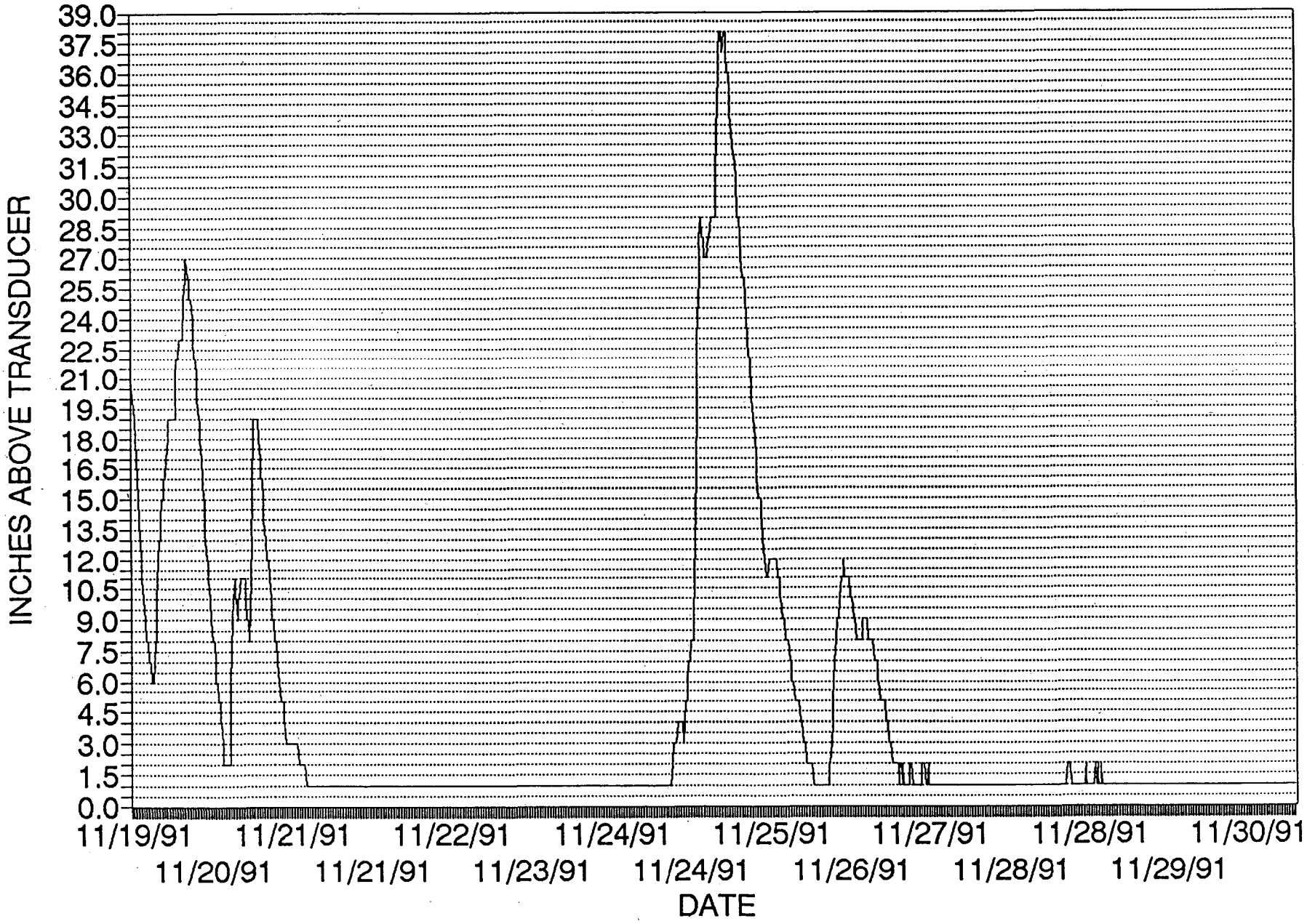

WEYCO HQ ROAD
RAINFALL DATA
RAIN (inches)
0.200
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
11/19/91
11/21/91
11/22/91
11/24/91
11/25/91
11/27/91
11/28/91
11/30/91
DATE


WEYCO HQ ROAD
P-3 HYDROGRAPH
INCHES ABOVE TRANSDUCER
16.5
16.4
16.3
16.2
16.1
16
15.9
15.8
15.7
15.6
15.5
15.4
15.3
15.2
15.1
15
14.9
14.8
14.7
14.6
14.5
11/19/91
11/21/91
11/22/91
11/24/91
11/25/91
11/27/91
11/28/91
11/30/91
DATE

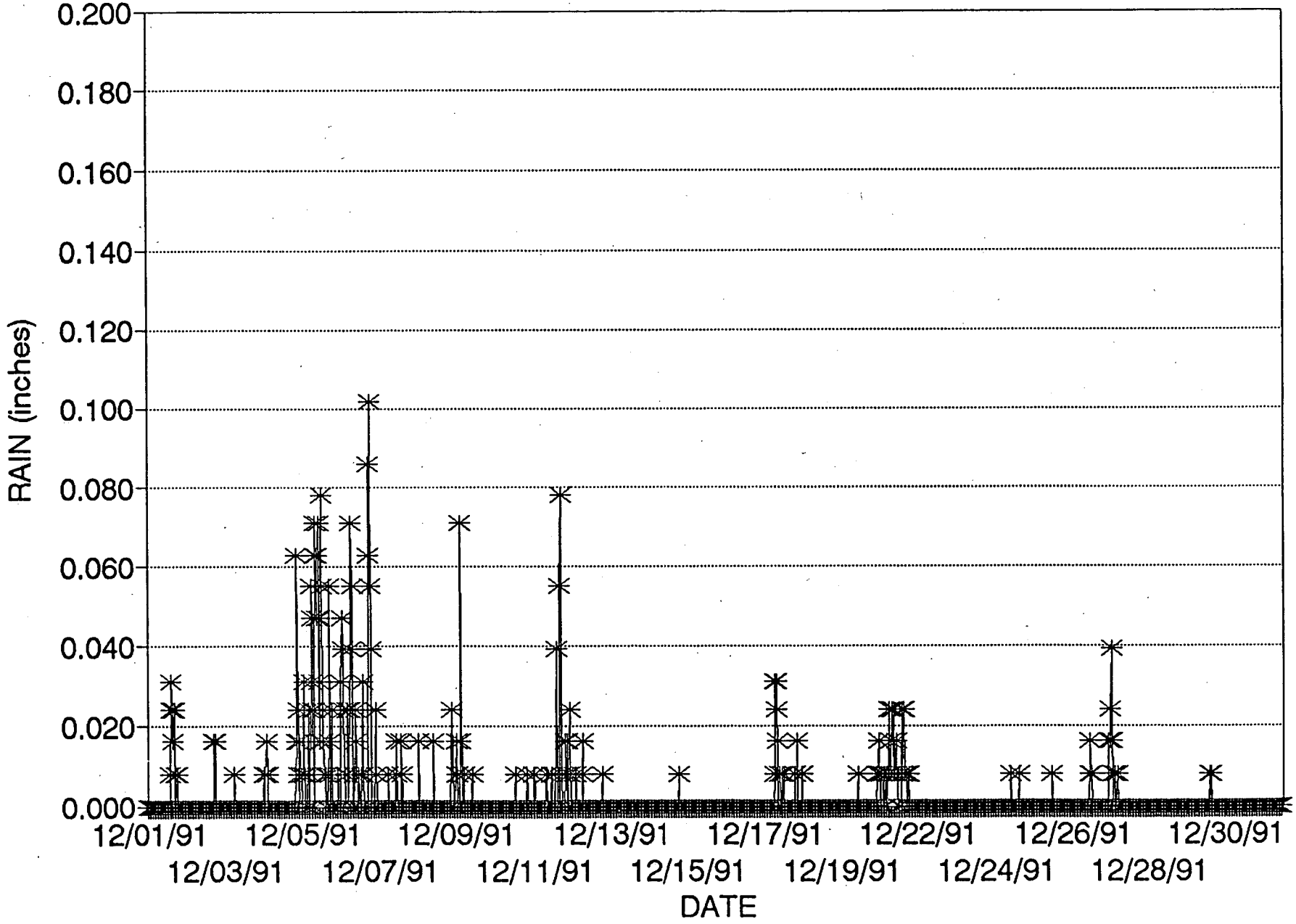
WEYCO HQ ROAD
P-10 HYROGRAPH

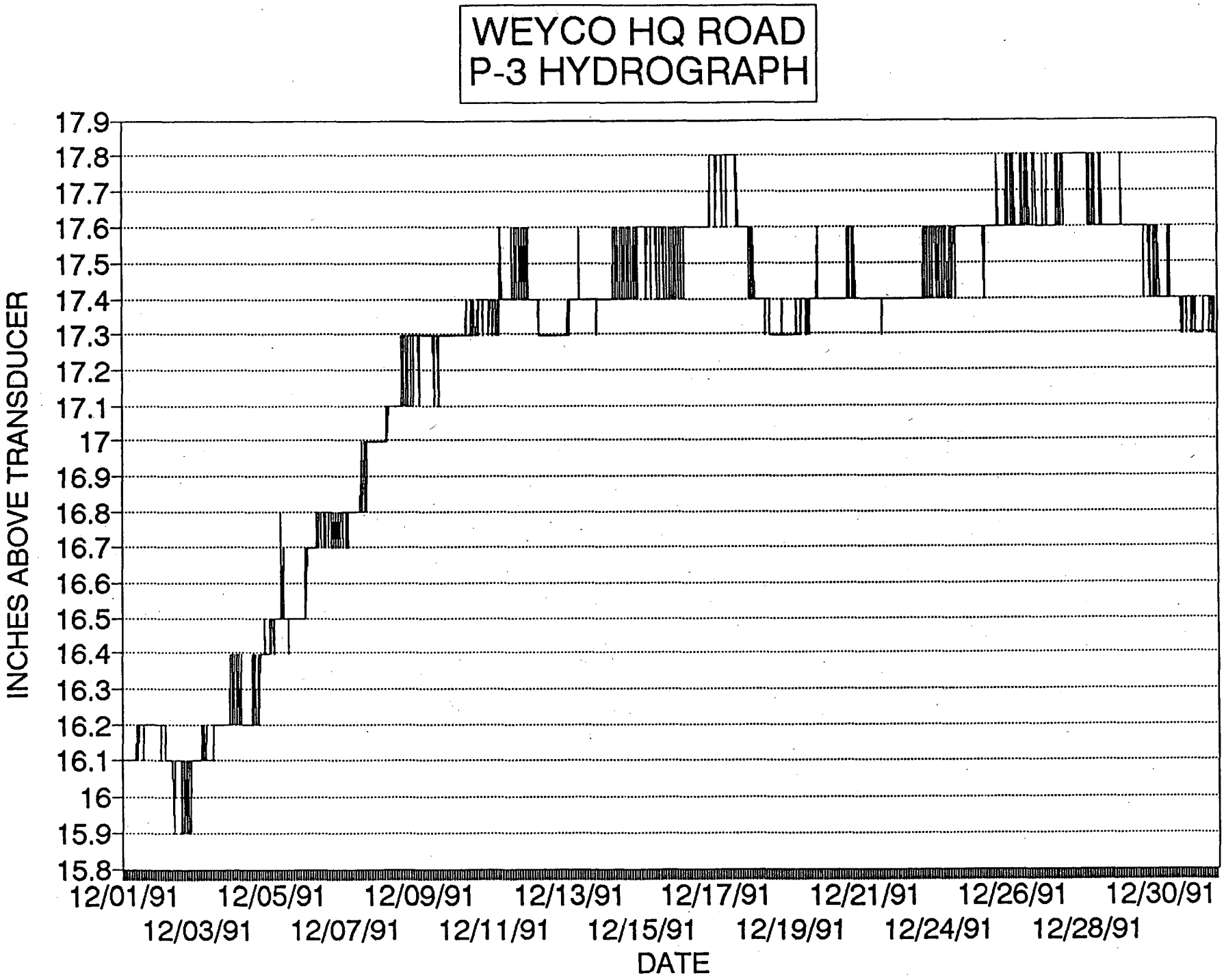


WEYCO HQ ROAD
P-13 HYDROGRAPH

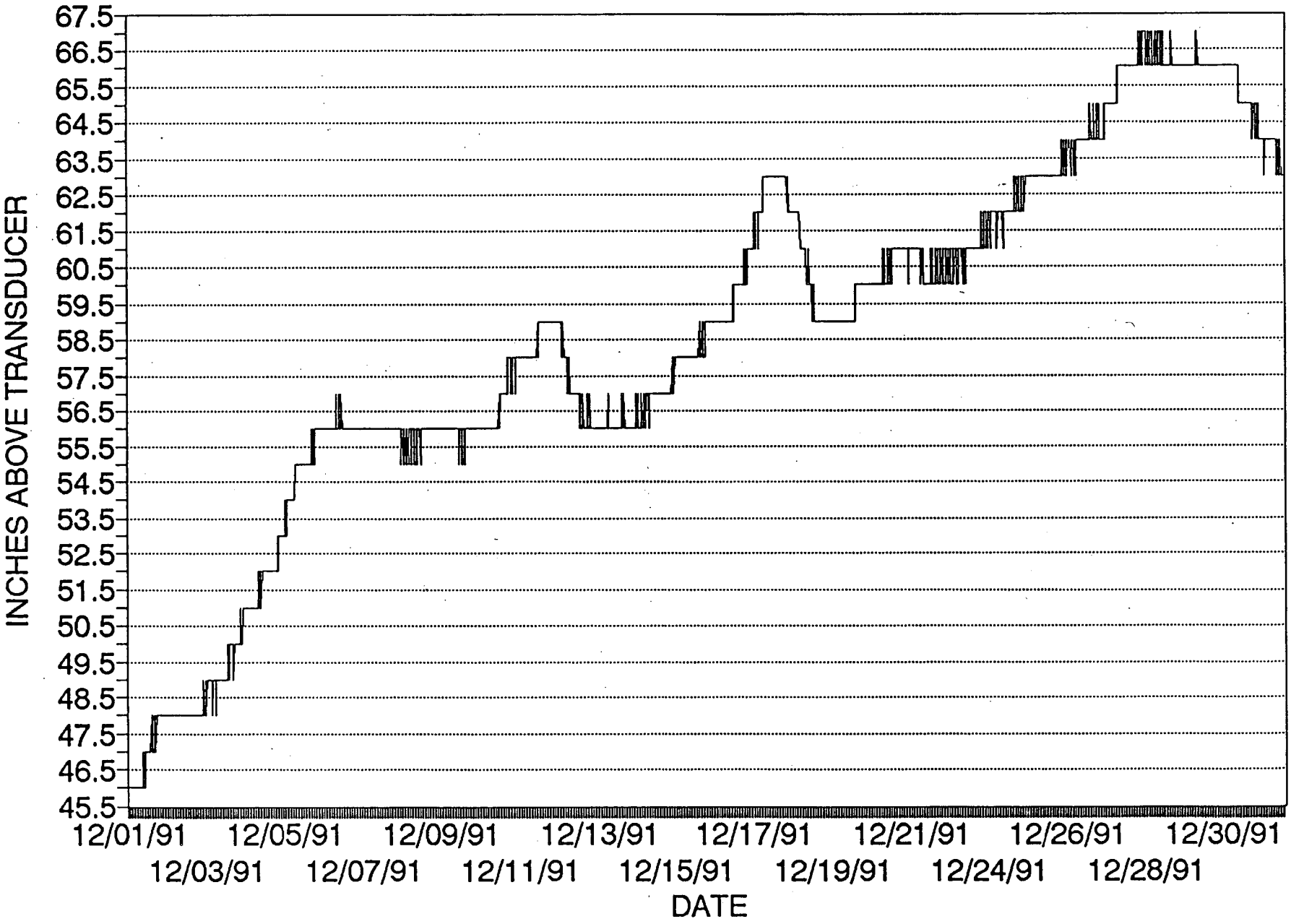


WEYCO HQ ROAD RAINFALL DATA

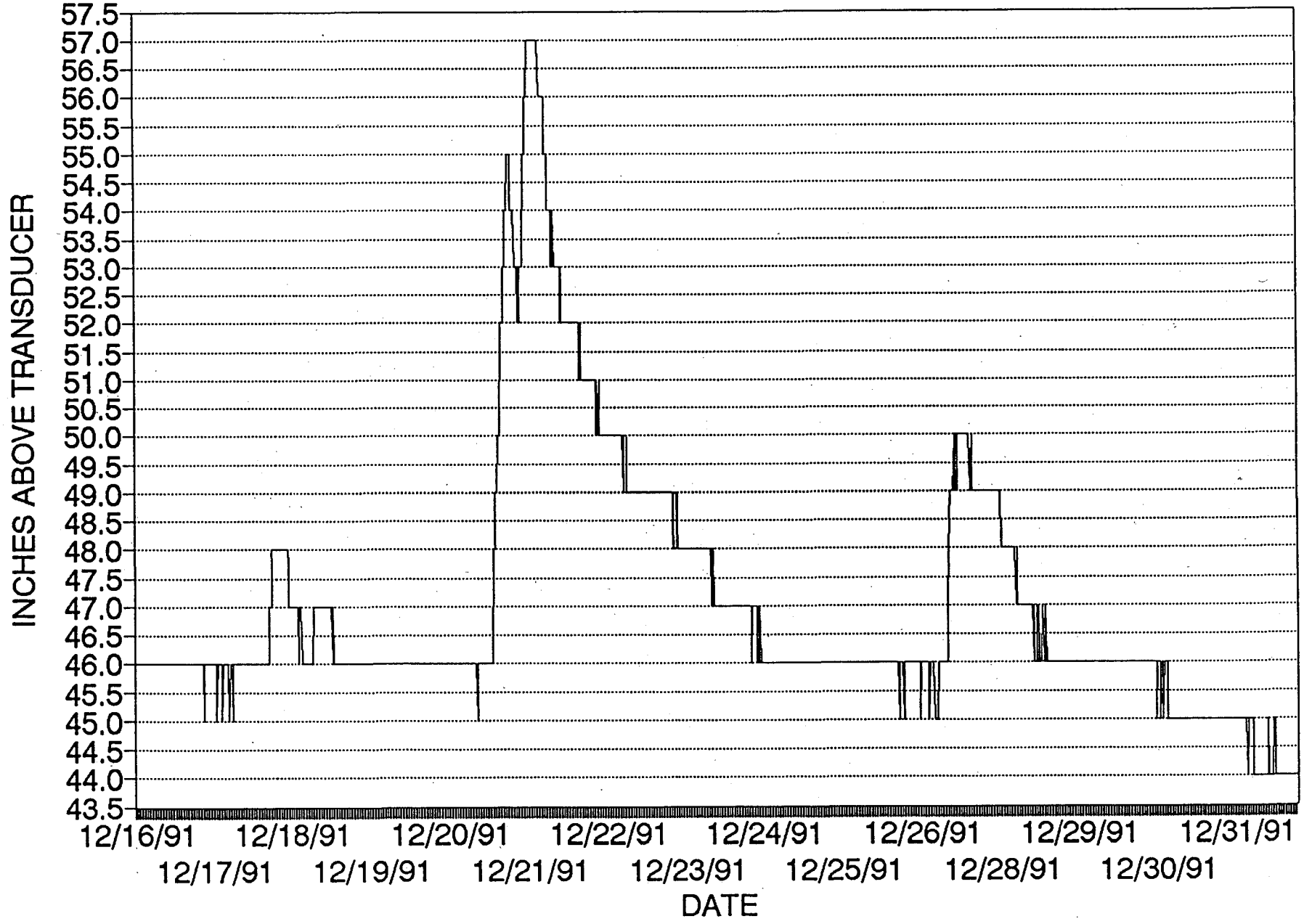



WEYCO HQ ROAD
P-3 HYDROGRAPH
INCHES ABOVE TRANSDUCER
17.9
17.8
17.7
17.6
17.5
17.4
17.3
17.2
17.1
17
16.9
16.8
16.7
16.6
16.5
16.4
16.3
16.2
16.1
16
15.9
15.8
12/01/91
12/03/91
12/05/91
12/07/91
12/09/91
12/11/91
12/13/91
12/15/91
12/17/91
12/19/91
12/21/91
12/24/91
12/26/91
12/28/91
12/30/91
DATE

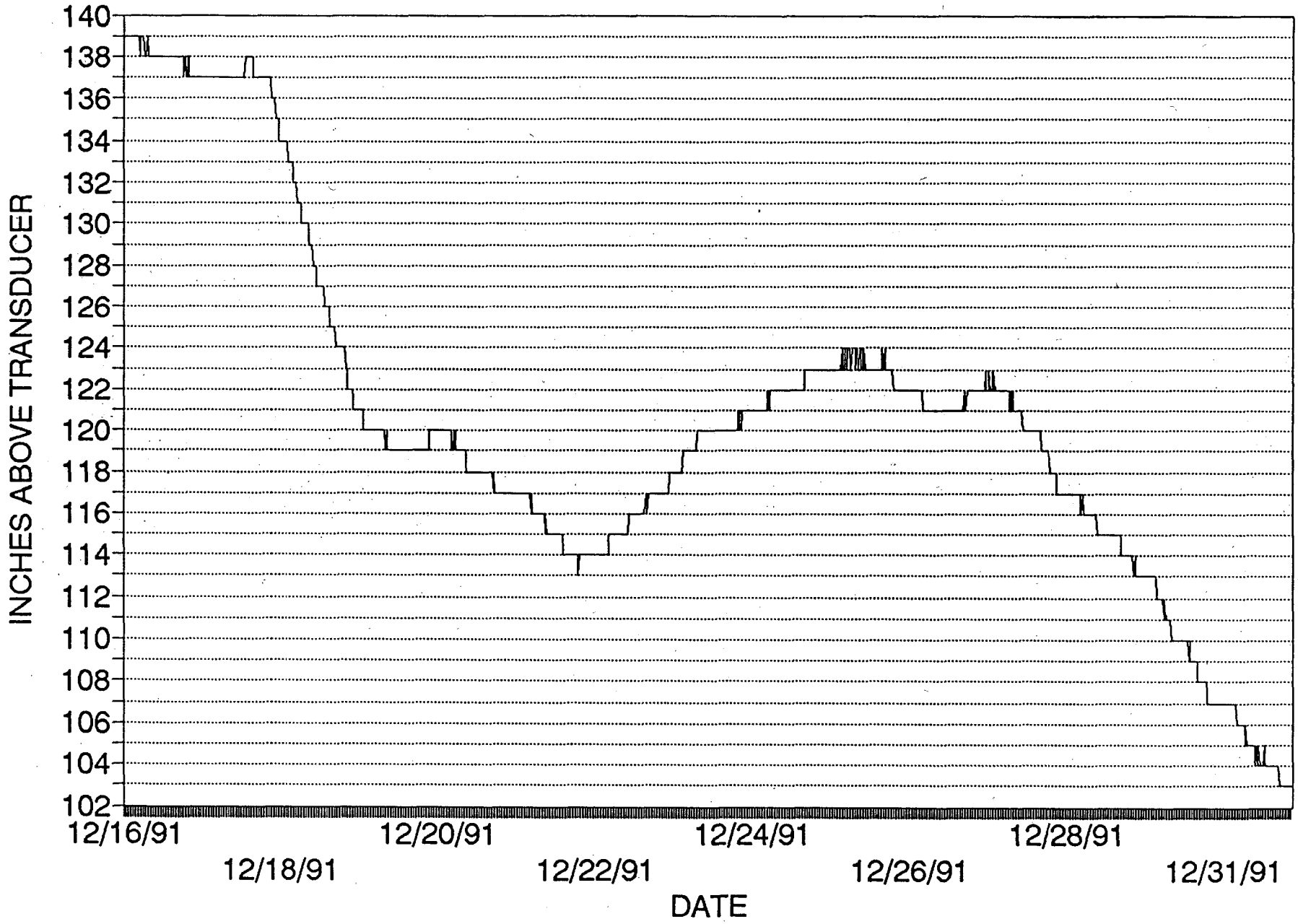
WEYCO HQ ROAD
P-10 HYROGRAPH

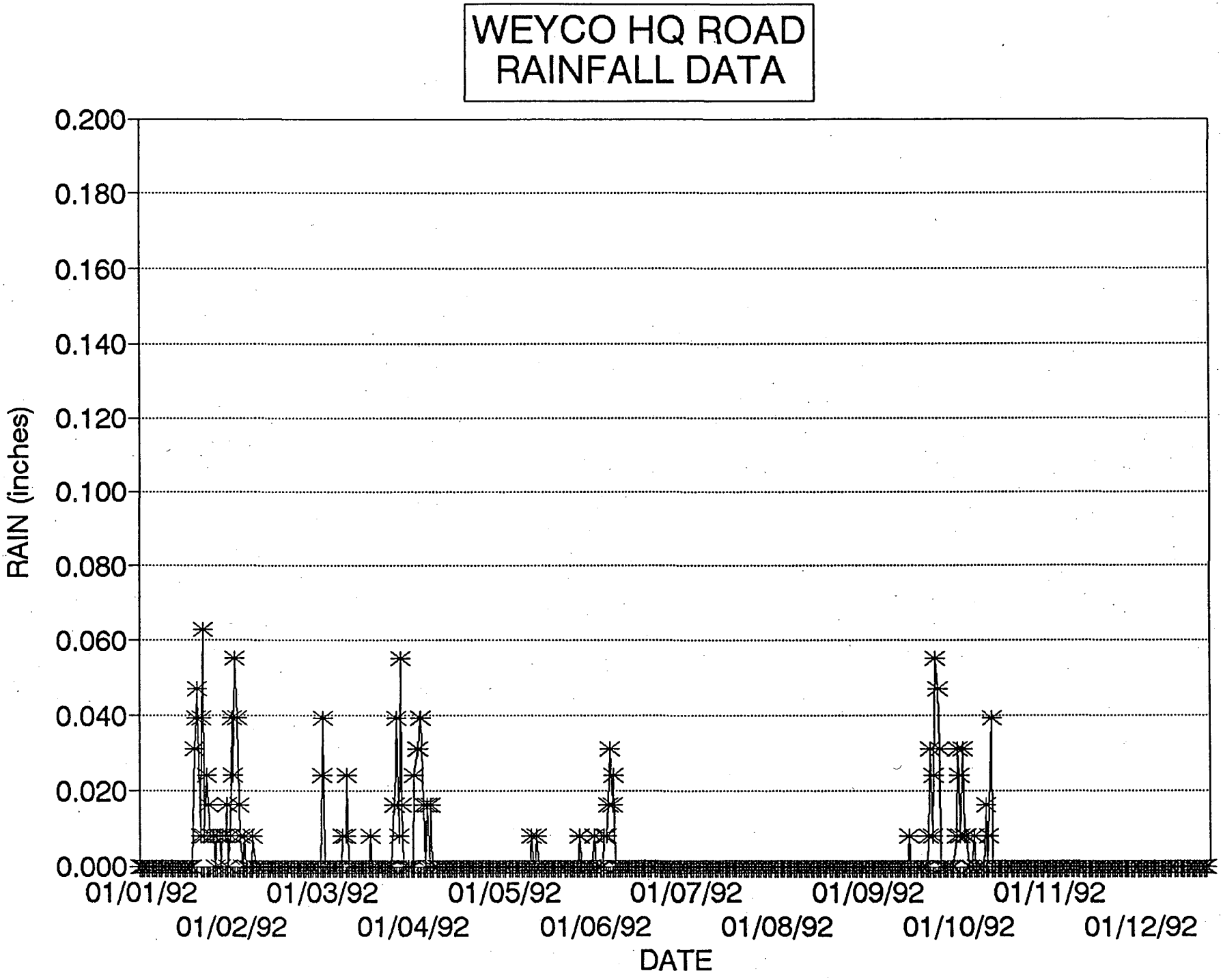


WEYCO HQ ROAD
P-13 HYDROGRAPH

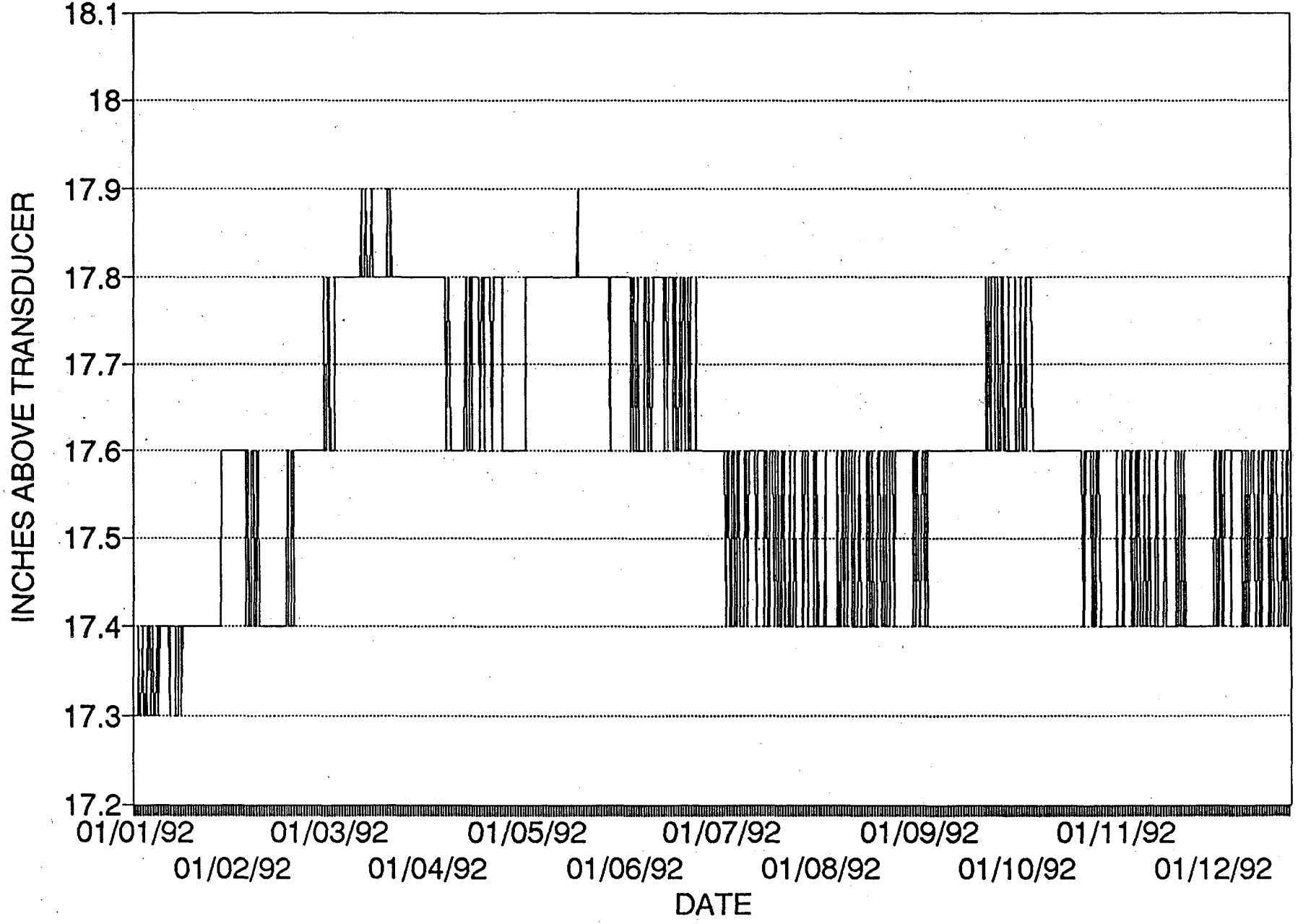


WEYCO HQ ROAD
P-16 HYDROGRAPH

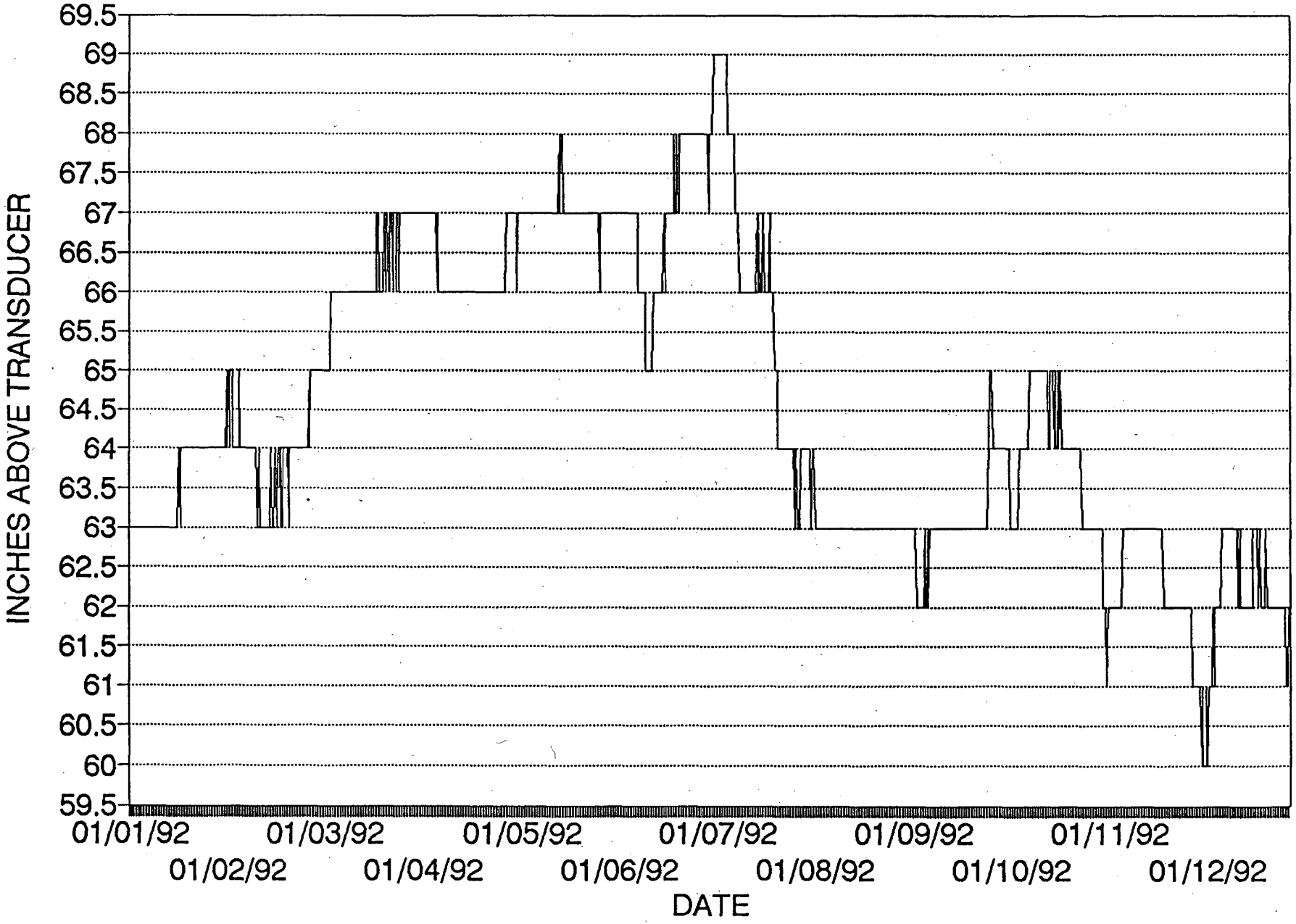



WEYCO HQ ROAD
RAINFALL DATA
0.200
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
RAIN (inches)
01/01/92
01/02/92
01/03/92
01/04/92
01/05/92
01/06/92
01/07/92
01/08/92
01/09/92
01/10/92
01/11/92
01/12/92
DATE

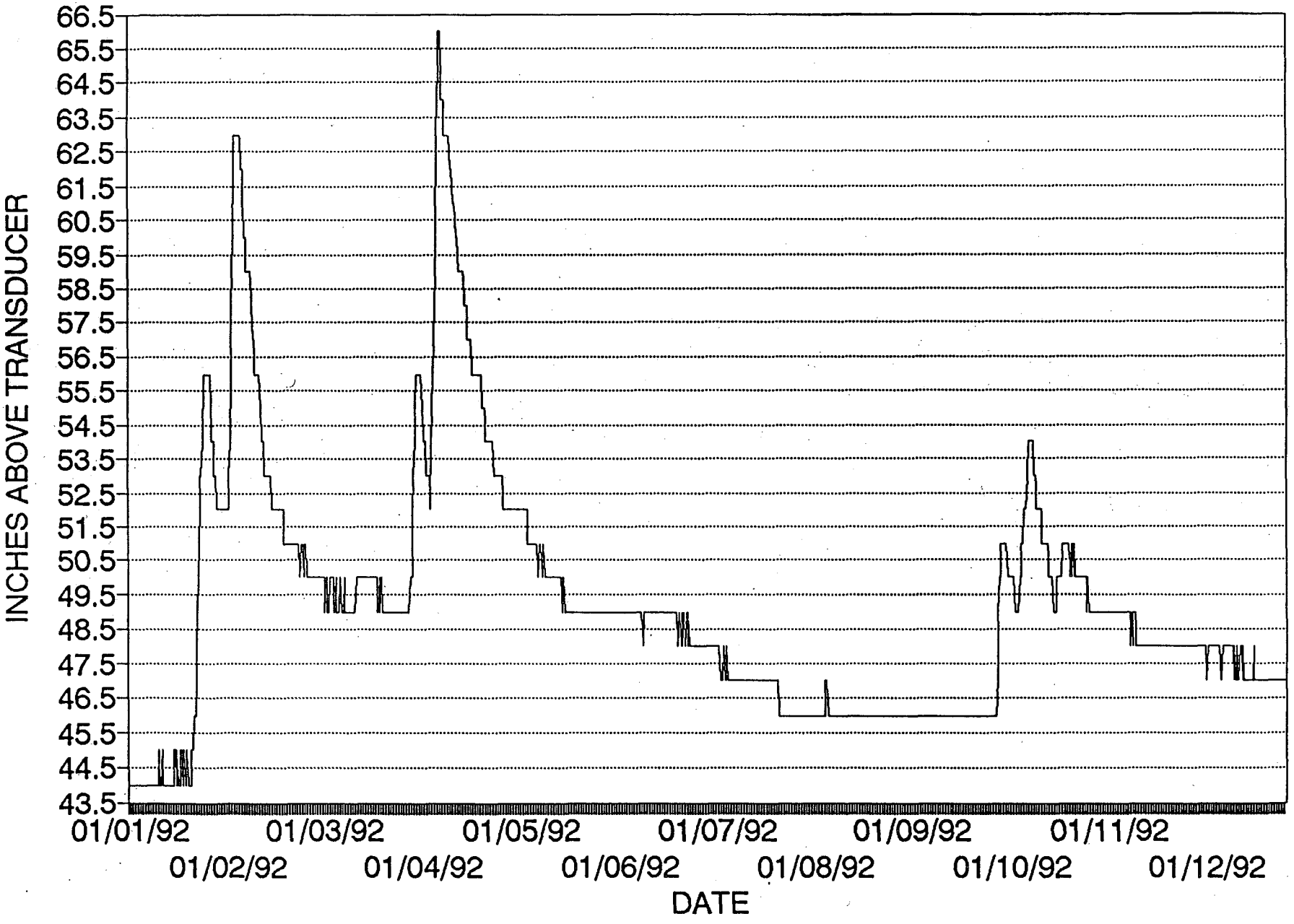
WEYCO HQ ROAD
P-3 HYDROGRAPH



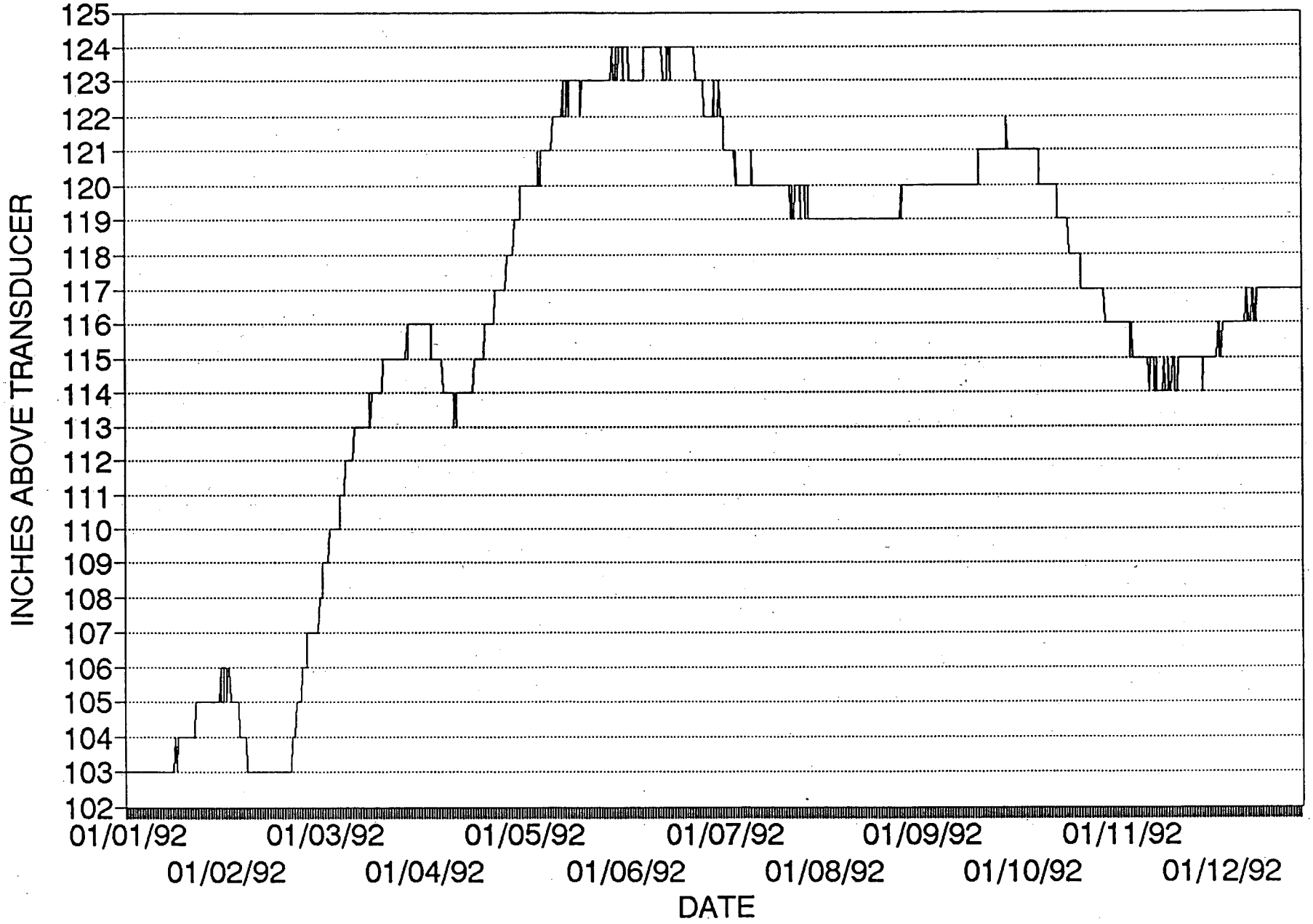
WEYCO HQ ROAD
P-10 HYROGRAPH



WEYCO HQ ROAD
P-13 HYDROGRAPH



WEYCO HQ ROAD
P-16 HYDROGRAPH



ADDITIONAL HVORSLEV CALCULATIONS

ADDITIONAL HVORSLEV CALCULATIONS

Hvorslev Method

Description of Slug Test Calculation

Estimates of saturated horizontal hydraulic conductivities for the volcanic rocks at the Headquarters site were made using the Hvorslev (1951) method, which defines the following relationship:

$$K_h = \frac{d^2 \ln \left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D} \right)^2} \right]}{8LT}$$

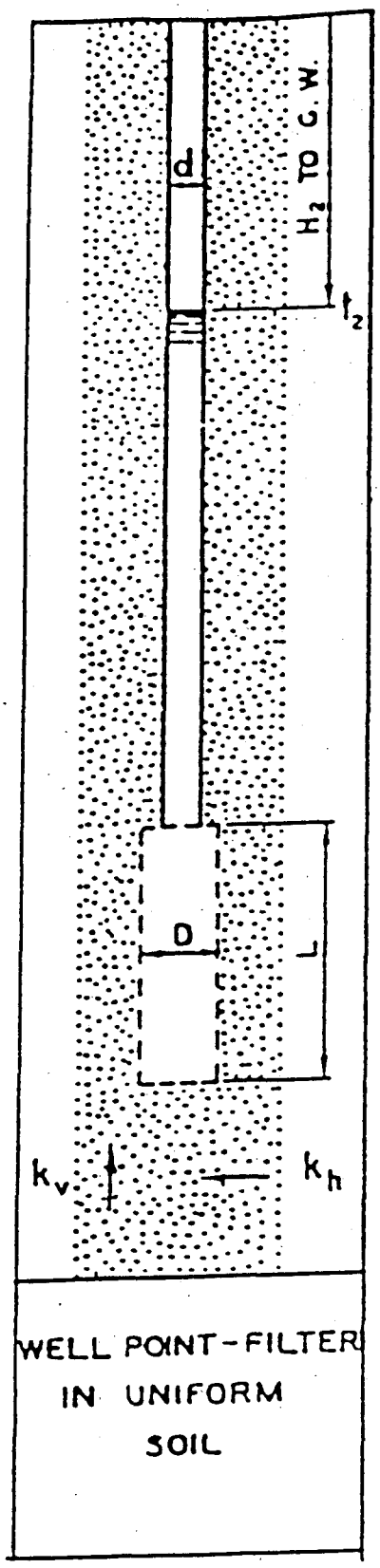
where:

K_h = horizontal hydraulic conductivity
d = inside diameter of riser pipe
L = length of saturated sand pack
D = effective diameter of intake area
m = $(K_h/K_v)^{½}$ where: $K_h/K_v = 10$

T = Time lag from plot where: $T = t_2 - t_1 \; / \; \ln (h_1 \; / \; h_2)$

t_2 = later time on straight-line through data
t_1 = earlier time on straight-line through data
h_1 = unrecovered head at t_1
h_2 = unrecovered head at t_2

The method assumes that Darcy's law is valid and that soil and water are incompressible. The equation for hydraulic conductivity also depends on the geometry of the well installation. The geometry that is most similar to that of the Headquarters wells is shown in the schematic illustration on the following page.


d
G.W.
H_2
t_2
D
L
k_v
k_h
WELL POINT-FILTER
IN UNIFORM
SOIL

When

$$\frac{mL}{D} > 4$$

the general equation simplifies to:

$$K_h = \frac{d^2 \ln\left(2\,\frac{mL}{D}\right)}{8LT}$$

The effective diameter of the intake area (D) was calculated to include the porosity of the sand pack in the cross-sectional area of the well. The calculation was based on the following equation from Bouwer and Rice (1976):

$$D = 2\left[r_c^2 + n\left(r_{bh}^2 - r_c^2\right)\right]^{1/2}$$

r_c = radius casing (1 inch)
r_{bh} = radius bore hole (4 inches)
n_{sp} = sand pack porosity (assumed to be 30%)

Time Lag Values From Plots

Early Time Data	MW-1	MW-2	BW-1	P-6
t_1 (min)	6.5	10	130	0.67
t_2 (min)	80	20	170	2.0
h_1 (ft)	0.55	.40	.73	0.96
h_2 (ft)	0.49	.35	.65	0.66
Late Time Data	**MW-1**	**MW-2**	**BW-1**	**P-6**
t_1 (min)	NA	26	110	6.0
t_2 (min)	NA	78	280	9.0
h_1 (ft)	NA	.34	.78	0.50
h_1 (ft)	NA	.23	.52	0.46

The variabiles used in the hydraulic conductivity calculations are shown in the table below. Also included on the table is the starting water level depth (wl) as measured from the top of casing.

Variables Used For Calculations

	WELL			
	MW-1	MW-2	BW-1	P-6
wl (feet)	29.53	24.15	20.98	10.70
d (feet)	0.17	0.17	0.17	0.17
L (feet)	9.47	15.85	12.90	9.20
D (feet)	0.39	0.39	0.39	0.39
m	3.2	3.2	3.2	3.2
T_L (min)	636.29	133.04	419.27	36.0
T_E (min)	---	74.89	344.61	3.55

Notes: T_L = later time slope from plot
T_E = early time slope from plot

Estimated Hydraulic Conductivities — (feet/min)

	MW-1	MW-2	BW-1	P-6
K_L	3.02×10^{-6}	9.56×10^{-6}	3.58×10^{-6}	5.47×10^{-5}
K_E	--	1.69×10^{-5}	4.36×10^{-6}	5.55×10^{-4}

Notes: K_L = horizontal hydraulic conductivity from late time data.
K_E = horizontal hydraulic conductivity from early time data.

TABLE OF REFERENCE ELEVATIONS AND GROUND WATER DEPTHS

Table 1

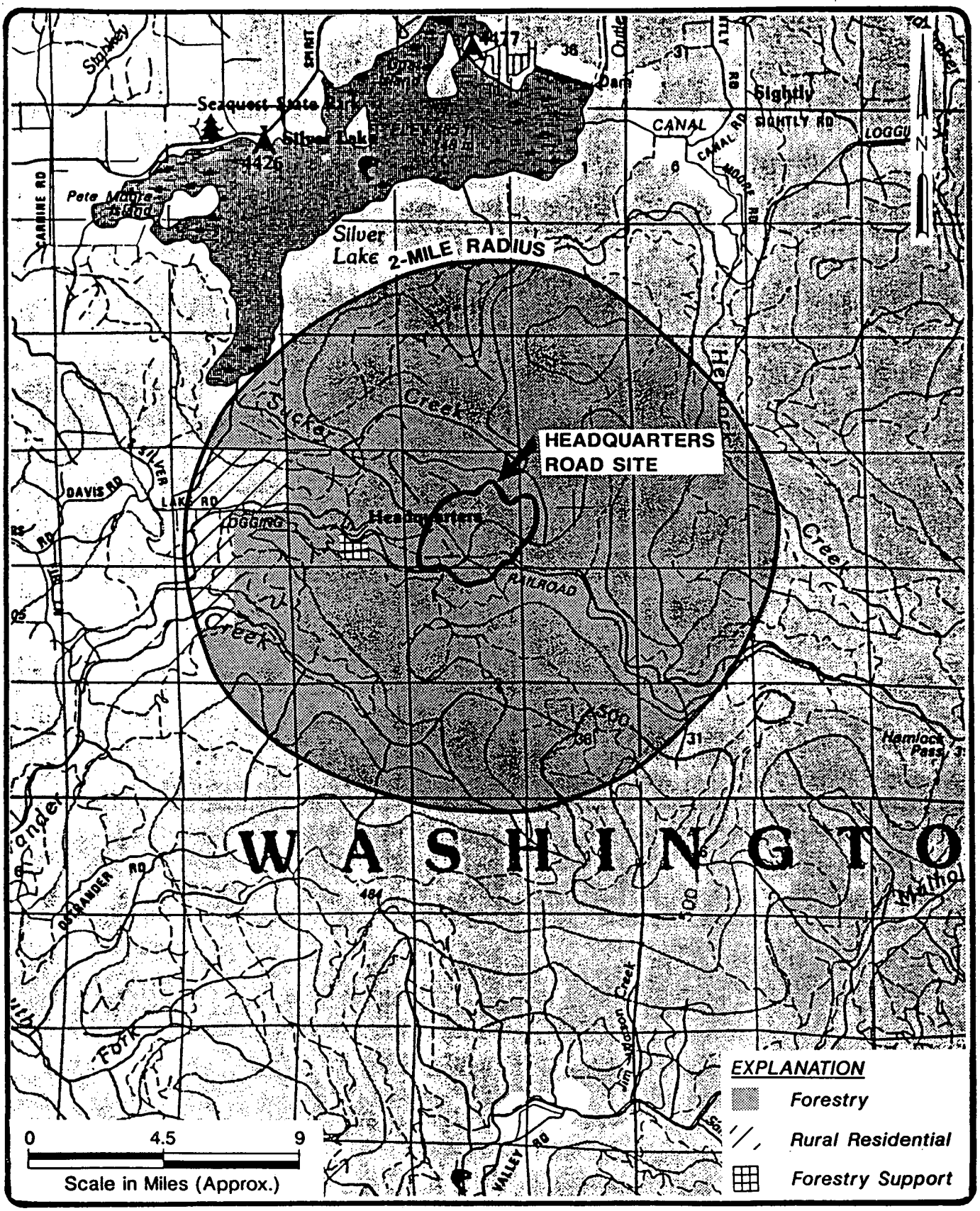
Weyerhaeuser Headquarters Road Landfill
Water Level Measurements, August 1990 vs March 1991

Well Information					Water Level Information			
					August 1990		March 1991	
Well Number	Casing Elevation (feet MSL)	Ground Elevation (feet MSL)	Northing[1]	Easting	Depth to Ground Water (feet)	Ground Water Elevation (feet MSL)	Depth to Ground Water (feet)	Ground Water Elevation (feet MSL)
BW-1	1,038.23	1,036.73	339,084.3	1,066,260.8	19.77	1,018.46	17.98	1,020.25
MW-1	860.80	859.23	341,691.7	1,063,790.6	30.39	830.41	28.46	832.34
MW-2	893.26	891.80	343,788.1	1,064,704.7	20.17	873.09	16.02	877.24
MW-4	859.08	857.59	342,551.5	1,068,187.3	8.24	850.84	7.30	851.78
P-1	915.37	914.05	340,626.3	1,063,293.5	16.05	899.32	12.38	902.99
P-3	961.33	959.96	340,273.5	1,065,541.4	12.28	949.05	Not measured	
P-6	957.76	956.34	341,802.3	1,067,890.9	11.98	945.78	10.51	947.25
P-8	961.85	960.39	341,037.6	1,068,968.8	5.31	956.54	3.76	958.09
P-9	1,079.65	1,078.35	340,346.6	1,067,653.2	32.53	1,047.12	25.42	1,054.23
P-10	1,079.73	1,078.43	341,247.9	1,067,292.2	57.34	1,022.39	52.55	1,027.18
P-11	930.07	928.97	343,106.4	1,067,157.4	34.44	895.63	30.80	899.27
P-12	988.12	986.72	342,090.8	1,066,606.4	40.58	947.54	41.88	946.24
P-13	962.07	960.97	341,771.4	1,066,066.1	12.94	949.13	11.43	950.64
P-14	877.70	876.40	343,275.1	1,066,159.7	21.93	855.77	21.98	855.72
P-15	946.13	944.93	343,091.2	1,065,479.2	32.11	914.02	31.51	914.62
P-16	940.37	938.67	342,111.2	1,065,044.8	28.06	912.31	20.22	920.15
P-17	943.48	942.08	341,040.5	1,064,636.3	37.64	905.84	35.54	907.94
P-18	888.85	887.85	341,719.3	1,062,909.0	65.23	823.62	65.12	823.73

[1] Northings and Eastings based on the Landberg Grid, Washington South Zone. Casing elevations, ground elevations, and ground water elevations are in feet with respect to mean sea level (MSL).

P/WEYE/SWPATB-1.313-92/LB:2
S4115.03

LAND USE MAP



EMCON Northwest, Inc.

DATE 2/92
DWN. VC
APPR.
REVIS.
PROJECT NO. S4115.09

Figure 1-1
WEYERHAEUSER COMPANY
COWLITZ COUNTY
LAND USE MAP

Chuck Clarke
[illegible]
Director

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504-6811 • (206) 753-2353

April 8, 1992

Mr. David Riggs
Director
Environmental Health Division
1516 Hudson
P.O. Box 458
Longview, WA 98632-0046

Re: Weyerhaeuser Headquarters Camp Solid Waste Disposal Facility, Part I Solid Waste Permit Application: Site Characterization

Dear Mr. Riggs:

The purpose of this letter is to convey to you the Department of Ecology's current position regarding the above-referenced proposed landfill's site characterization report.

Ecology's initial comments on the referenced site characterization report were addressed to you in a letter dated February 7, 1992. The site characterization report is only one of the Part I solid waste permit application documents. However, Ecology's initial comments did reflect the details that would be expected in a complete final permit application document. The comments were intended to help the applicant to prepare an acceptable final document.

On February 27, 1992, Ecology and EMCON Northwest, Inc./Weyerhaeuser technical group met to discuss the comments and the format for future submittals. The consensus was that some of the details requested in the initial comments will be provided in Part II of the permit application documents. In addition, EMCON Northwest, Inc., in a letter dated March 13, 1992, provided some of the additional information requested by Ecology. Based on the results of the technical group's meeting and the additional information provided in EMCON Northwest's response to the initial comments, Ecology's concerns over background information regarding the site characterization have been addressed.

If you have any questions regarding this letter, please contact me at (206) 753-0144.

Sincerely,

Roland O. Ugochuku
Regional Engineer
Solid and Hazardous Waste

RU:dc(14/shw1)

cc: Kirk Cook, Ecology

Appendix P

Miscellaneous Correspondence

Headquarters Camp
Solid Waste Disposal Facility

BAS Laboratories Limited
Consulting Environmental Chemists

14 Abacus Road
Brampton, Ontario
Canada L6T 5B7

Phone (416) 794-2522
Fax (416) 794-2338

16 December 1992

Jean Garber
8436 129th Place SE
Renton, Washington
U.S.A. 98056

Dear Ms. Garber:

Subject: Dioxins and Furans in Weyerhaeuser Solid Wastes

Paul Whitney of our Portland office asked me to comment to you on the question of whether dioxin and furan compounds present in Weyerhaeuser's solid wastes would pose a significant risk to human health or the environment if disposed of in a lined landfill. I offer the following summary thoughts for your consideration.

It is well known that dioxins and furans occur in bleached pulp mill wastes as well as in residues and products from other manufacturing processes, and Weyerhaeuser's mills are no exception. Parker (1990) documents that the Longview Mill waste contained 2,3,7,8-tetrachloro-dibenzo-p-dioxin ("TCDD", one of many types of dioxin) as well as the corresponding furan compound, TCDF. My understanding is that this mill has made a number of pulping and bleaching process improvements that have lead to a steady decline in dioxin in the wastewater-treatment-plant solids ("WTS"). WTS produced at the Longview Mill in March, May, and September, 1992, had no detectable TCDD or TCDF (Table 1). I am also aware that, with a mill modernization project, Weyerhaeuser proposes oxygen delignification and other improvements which, if implemented, would further reduce the likelihood that these compounds will be produced during pulp manufacture. Ash produced in the boilers at the Longview Mill have also been tested for TCDD, and have been shown to periodically contain low concentrations. Ash samples were non-detect for TCDD in May, but contained 153 ppt in September 1992.

Generally, dioxins and furans have a very low solubility in water (0.2 ppb), are not easily leached, and are strongly bound to soils and small particles (Hazardous Substance Database, 1992, attached). Therefore, I believe it is unlikely that dioxins will be present in the leachate in the proposed landfill and subsequently leave it (whether intact or via a tear in the liner). To verify the literature conclusion that dioxins and furans are not likely to leach, an EPA specified assessment, known as the Toxicity Characteristic Leaching Procedure ("TCLP"), was conducted on a composite sample of the waste mix listed in the Headquarters EIS (Table I-1). The TCLP results were non-detect for all dioxins and furans (Catalano, D., 1992, Service Request Number 10309). This is what I would expect based upon the literature and my working knowledge of dioxins and furans.

To summarize, dioxins and furans occur periodically at very low concentrations in the ash component of the waste that would be landfilled at the proposed Headquarters facility, and are declining or even eliminated from the other pulp mill wastes. These compounds bind tightly to small particles, and are not easily leached from the wastes as the TCLP result illustrates. Thus, I do not expect the presence of dioxins and furans in the waste to pose a significant threat to human health or the environment.

Please feel free to contact me at (416) 794-2325, extension 320 if you would like to discuss my views further.

Sincerely,

BAS LABORATORIES LIMITED

Donna McCurvin, B.Sc.
Manager, Organic Laboratory

DM/cl
Attached

cc: Paul Whitney

BAS
Laboratories
Limited

Table 1: **Summary Of Results From Tests Of Waste Samples From The Weyerhaeuser Longview Mill**

Date	2,3,7,8 TCDD (ppt)	2,3,7,8 TCDF (ppt)
Waste Treatment Sludge		
12/01/89	45	260
11/30/90	51*	103.7*
12/12/91	50	92
03/05/92	ND(22)	86
05/19/92	ND(5.3)	140
09/08/92	ND(2.7)	24
#11 Boiler Ash**		
05/18/92		
08/12/92	ND(0.43)	27
	153	223

* Mean Of Six Samples

** Ash Was Only Analyzed In May and August 1992

HAZARDOUS SUBSTANCES DATABANK 12/07/92
SEARCH COMPLETION MENU

(/CO = Command list, /EX = Exit, /HE = Help)
**** Your search has now retrieved 1 record and 9 occurrences ****

Would you like to:

[1] Print/view results online in 15 line segments?
[2] Print/view results online continuously?
[3] Print results offline?
[4] Print/view complete record(s) online in 15 line segments?
[5] Print/view complete record(s) online continuously?
[6] Print complete record(s) offline?
[7] Add chemical(s) to your search strategy?
[8] Review offline print requests?

/ST to Start a new search; /RE to Review; /MO to Modify
Enter your choice or a command: q

*** INVALID RESPONSE ***
Enter your choice or a command: /st

HAZARDOUS SUBSTANCES DATABANK 12/07/92
CONCEPT SELECTION MENU

(/CO = Command list, /EX = Exit, /HE = Help)

Do you wish to search for information concerning:

[1] Human Health Effects?
[2] Emergency Medical Treatment?
[3] Chemical Safety and Handling?
[4] Environmental Fate/Exposure Information?
[5] Animal Toxicity Studies?

1 - HSDB
NAME OF SUBSTANCE 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN
CAS REGISTRY NUMBER 1746-01-6
ENVIRONMENTAL FATE/EXPOSURE SUMMARY

2,3,7,8-Tetrachlorodibenzodioxin (TCDD) is currently released to the environment primarily through emissions from the incineration of municipal and chemical wastes, in exhaust from automobiles using leaded gasoline, and from the improper disposal of certain chlorinated chemical wastes. If released to the atmosphere, gas-phase TCDD may be degraded by reaction with hydroxyl radicals and direct photolysis. Particulate-phase TCDD may be physically removed from air by wet and dry deposition. If released to water, TCDD will predominantly be associated with sediments and suspended material. TCDD near the water's surface may experience significant photodegradation. Volatilization from the water column may be important, but adsorption to sediment will limit the overall rate by which TCDD is removed from water. The persistence half-life of TCDD in lakes has been estimated to be in excess of 1.5 yr. Bioconcentration in aquatic organisms has been demonstrated. If released to soil, TCDD is not expected to leach. Photodegradation on terrestrial surfaces may be an important transformation process. Volatilization from soil surfaces during warm conditions may be a major removal mechanism. The persistence half-life of TCDD on soil surfaces may vary from less than 1 yr to 3 yrs, but half-lives in soil interiors may be as long as 12 years. Screening studies have shown that TCDD is generally resistant to biodegradation. The major route of exposure to the general population results from incineration processes and exhausts from leaded gasoline engines. (SRC)
[CITATION] **PEER REVIEWED**

ENVIRONMENTAL FATE

TERRESTRIAL FATE: Vertical distribution of TCDD has been monitored in soil at Seveso down to depth of approx 30 cm at several sites & times in 1976 & 1977. As a rule, the amt of TCDD detected more than 8 cm below the surface were approx 1/10 or less than those detected down to 8 cm. Being only slightly sol in water, its migration in soil may have occurred along with soil colloids & particles to which it may have been bound. No definite conclusions may as yet be drawn as to mechanisms responsible for TCDD vertical movement. Moreover, available data indicate that some soil stabilization of TCDD distribution occurred in 1977 as compared to 1976. [Di Domenico A et al; Ecotoxicol Environ Safety 4 (3): 327-38 (1980)] **PEER REVIEWED**

ENVIRONMENTAL FATE

... water transport of TCDD is limited since its solubility in water is only 0.2 ppb. [CASARETT & DOULL'S TOXICOLOGY. 2ND ED 1980 , p. 648] **PEER REVIEWED**

ENVIRONMENTAL FATE

TERRESTRIAL FATE: Soil adsorption studies and monitoring of various soils contaminated by 2,3,7,8-TCDD have demonstrated that TCDD does not leach significantly. Movement by surface erosion or flooding may be possible however(1). TCDD exposed to sunlight on terrestrial surfaces

may be susceptible to significant photodegradation. Volatilization from soil surfaces during warm, summer months may be a major mechanism by which TCDD is removed from soil. Volatilization during cold, winter months or from soil depths several centimeters below the boundary layer is extremely slow. Various biological screening studies have demonstrated that TCDD is generally resistant to biodegradation. The persistence half-life of TCDD on soil surfaces may vary from less than 1 yr to 3 yrs, but half-lives in soil interiors may be as long as 12 years(1,SRC). [(1) DHHS/ATSDR; Toxicological Profile for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (Draft) (11/87)] **PEER REVIEWED**

ENVIRONMENTAL FATE

AQUATIC FATE: Due to its very low water solubility, most of the 2,3,7,8-TCDD occurring in water is expected to be associated with sediments or suspended material. Aquatic sediments may be an important, and ultimate, environmental sink for all global releases of TCDD(1). Two processes which may be able to remove TCDD from water are photolysis and volatilization. The photolysis half-life at the water's surface has been estimated to range from 21 hr in summer to 118 hr in winter; however, these rates will increase significantly as water depth increases. Many bottom sediments may therefore not be susceptible to significant photodegradation. The volatilization half-life from the water column of an environmental pond has been estimated to be 46 days; however, when the effects of adsorption to sediment are considered, the volatilization model predicts an overall volatilization removal half-life of over 50 years. Various biological screening studies have demonstrated that TCDD is generally resistant to biodegradation. The persistence half-life of TCDD in lakes has been estimated to be in excess of 1.5 yr(1). TCDD has been shown to bioconcentrate in aquatic organisms(SRC). [(1) DHHS/ATSDR; Toxicological Profile for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (Draft) (11/87)] **PEER REVIEWED**

ENVIRONMENTAL FATE

ATMOSPHERIC FATE: Although 2,3,7,8-TCDD has an extremely low vapor pressure (7.4X10-10 mm Hg at 25 deg C)(1), it has been shown to be volatile(2) and to occur in air in both the gas-phase and particulate-phase(3). Gas-phase TCDD reacts with photochemically produced hydroxyl radicals in air at an estimated half-life rate of 8.3 days; direct photolysis of gas-phase TCDD may occur at a faster rate than hydroxyl radical reaction. Sufficient data are not currently available to estimate the potential photolysis rate of particulate-phase TCDD. TCDD particulates may be physically removed from the atmosphere by wet and dry deposition. Monitoring data have indicated that TCDD may be transported long distances through the atmosphere. An ultimate environmental sink of airborne particulates may be sediments of the earth's surface waters(4,SRC). [(1) Podoll RT et al; Environ Sci Technol 20: 490-2 (1986) (2) Freeman RA, Schroy JM; Environmental Mobility of Dioxins. ASTM Spec Publ 891 (Aquat Toxicol Haz Assess) 8th Symp: 422-39 (1986) (3) Fairless BJ et al; Environ Sci Technol 21: 550-5 (1987) (4) DHHS/ATSDR; Toxicological Profile for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (Draft) (11/87)] **PEER REVIEWED**

ENVIRONMENTAL FATE

Polychlorinated dibenzo-p-dioxins and dibenzofurans ranging from tetra- to octachlorocongeners in ash and fly ash from incinerators, river water, effluent water from incinerators, groundwater, soil, and sediment were determined isomer specifically by high-resolution gas chromatography/mass spectrometry in order to manifest an environmental situation polluted with those cmpd in Japan. The most toxic 2,3,7,8,-tetrachlorodibenzo-p-doxin was detected only in fly ash. [Yasuhara A et al; Environ Sci Technol 21 (10): 971-9 (1987)] **PEER REVIEWED**

MICHAEL R. YANTIS ASSOCIATES, INC., P.S.
consulting in acoustics and vibration

MEMORANDUM

Date: December 18, 1992

To: **Paul Whitney**
BEAK Consultants

From: Dennis Noson

Re: **Weyerhaeuser Headquarters Camp Solid Waste Disposal Facility**
Addendum to Noise Technical Report

1. **Summary.** The application of federal noise guidelines developed by the Federal Interagency Committee on Urban Noise (FICUN) and the Environmental Protection Agency (EPA), Region X, are primarily intended to address the reaction of the *community* surrounding a project which impacts the noise environment, rather the reaction of *individual receivers*. The following supplemental description of the federal guidelines and supporting analysis is an expansion of Section 7.0, Federal Noise Annoyance Guidelines, of Appendix L to the *Environmental Technical Report for the Proposed Weyerhaeuser S. W. Washington Solid Waste Facility*, June, 1991. In addition, the probable complement of equipment operating at a waste cell has been revised. This addendum provides a description of the revised operational noise levels and predicted noise levels received in the surrounding community.

2. **Federal Guidelines for Evaluating Noise Impacts.** The FICUN guidelines are applied to measurements and predictions of community noise levels averaged over a 24 hour period, the day-night average noise level, abbreviated as L_{dn}. The day-night average noise level is applied to all noise sources, stationary and transient. The FICUN guidelines suggest degrees of compatibility between land uses and levels of environmental noise, establishing the following categories:

L_{dn} (dBA)	Noise Zone	Exposure
0 - 55	A	Minimal
55 - 65	B	Moderate
Above 65	C	Significant

Residential land uses are considered compatible with noise zone A and B. At levels from L_{dn} 55 to 65 (dBA), noise levels are above the EPA L_{dn} 55 goal set for *outdoor* recreation activities in residential areas. However, the guideline is not intended to cause regulatory action in land use evaluation at the L_{dn} 55 level. Only above L_{dn} 65 does the guideline recommend that action be taken, by reduction of *indoor* noise exposures. The recommended noise reduction is to be made by improving the design of new dwellings proposed for construction in the affected noise zone.

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The EPA Region X guidelines are applied to measurements and predictions of *increases* in community noise levels. These guidelines complement the FICUN guidelines by taking into account the reaction of the community to noise based upon existing noise levels to which the community is accustomed. For example, in residential communities where noise exposure is low (below L_{dn} 55), a project which increases residential exposure to the L_{dn} 60 noise level, considered a moderate level by FICUN guidelines, would be a significant 5 dB *increase* according to Region X guidelines, indicating mitigating action should be considered.

3. **Railroad Noise Analysis.** As stated in the Final EIS, the residential properties near the rail line will change from ambient noise levels for all noise sources of L_{dn} 67 to L_{dn} 70 with the addition of two train round trips per day. The existing and predicted noise levels are calculated as shown in Tables A and B on the following two pages. Varying the estimated noise levels for Headquarters Road traffic levels (column 3) and ambient levels (column 2) changes the calculated L_{dn} levels by less than 1 dB.

4. **Revised Waste Cell Operational Noise Levels.** The combination of equipment in daily operation on the site at any one time has been revised to include 1 bulldozer (Caterpillar D6), 5 haul trucks, and 1 miscellaneous vehicle (water truck or similar noise source). The predicted noise levels for the revised equipment mix is shown in the following table. The noise level received at locations surrounding the project site will be an increase over the previous predicted levels, but will remain less than ambient levels at all receiver sites. During periods of low ambient noise levels, the equipment noise may be audible, but will not exceed state regulated limits and will not exceed federal guidelines for increased noise.

EQUIPMENT NOISE ESTIMATES
(dBA)

Receiver Location	*Noise Level (L_{eq})*
#2 Headquarters Road	44.6
#4 So. Silver Lake Road	41.0
#5 Carnine Road	32.1
#7 Streeter Resort	36.4

Table A

WEYERHAEUSER SWF RAILROAD NOISE ESTIMATES @ HQ ROAD

HOURLY AVERAGES (L_{eq})
dBA

	Typical T L_{eq} (ambient)	Traffic L_{eq} @ 50'	Train L_{eq}	Train +Ambient @ PL	Train+amb. +Traffic @ PL	RR+Traffic @ house (400')
1	30 e	35 e		30.0	34.8	35.0
2	30 e	35 e		30.0	34.8	35.0
3	30 e	35 e		30.0	34.8	35.0
4	30 e	35 e		30.0	34.8	35.0
5	35 e	45 e		35.0	43.6	45.0
6	35 e	55 e		35.0	53.1	55.0
7	40 e	55 e		40.0	53.2	55.0
8	40 e	65 e		40.0	63.0	65.0
9	40 e	65 e	80 up	80.0	79.1	77.3
10	40 e	65 e	grade	40.0	63.0	65.0
11	40 e	63.0		40.0	61.0	63.0
12	40 e	60.0		40.0	58.1	60.0
13	40 e	64.0		40.0	62.0	64.0
14	40 e	62.0	78 down	78.0	77.1	75.2
15	40 e	65.0	grade	40.0	63.0	65.0
16	40 e	50.0		40.0	48.6	50.0
17	35 e	42.0		35.0	41.2	42.0
18	35 e	48.0		35.0	46.3	48.0
19	35 e	41.0		35.0	40.5	41.0
20	35 e	38.0		35.0	38.5	38.0
21	35 e	40 e		35.0	39.8	40.0
22	35 e	41 e		35.0	40.5	41.0
23	35 e	40 e		35.0	39.8	40.0
24	35 e	40 e		35.0	39.8	40.0
L_{dn}:	**42**	**61**		**68**	**68**	**67**

Abbreviations:
e: Estimated noise level
PL: Property Line

Table B

WEYERHAEUSER SWF RAILROAD NOISE ESTIMATES @ HQ ROAD

***** TWO ADDED TRAINS *****

HOURLY AVERAGES (L_{eq})
dBA

	Typical L_{eq} (ambient)	Traffic L_{eq} @ 50'	Train L_{eq}	Train +Ambient @ PL	Train+amb. +Traffic @ PL	RR+Traffic @ house (400')
1	30 e	35 e		30.0	33.0	35.0
2	30 e	35 e		30.0	33.0	35.0
3	30 e	35 e		30.0	33.0	35.0
4	30 e	35 e		30.0	33.0	35.0
5	35 e	45 e		35.0	43.0	45.0
6	35 e	55 e		35.0	53.0	55.0
7	40 e	55 e		40.0	53.0	55.0
8	40 e	60 e	80 #1 up	79.7	78.7	76.8
9	40 e	65 e	80 log up	80.0	79.1	77.3
10	40 e	65 e		40.0	63.0	65.0
11	40 e	63	78 #1 dn	78.0	77.1	75.3
12	40 e	60		40.0	58.0	60.0
13	40 e	64		40.0	62.0	64.0
14	40 e	62	78 log dn	78.0	77.1	75.2
15	40 e	65		40.0	63.0	65.0
16	40 e	50		40.0	48.0	50.0
17	35 e	42	80 #2 up	79.7	78.7	76.7
18	35 e	48		35.0	46.0	48.0
19	35 e	41		35.0	39.0	41.0
20	35 e	38		35.0	36.0	38.0
21	35 e	40 e	78 #2 dn	78.0	77.0	75.0
22	35 e	41 e		35.0	39.0	41.0
23	35 e	40 e		35.0	38.0	40.0
24	35 e	40 e		35.0	38.0	40.0
L_{dn}:	**42**	**60**		**72**	**72**	**70**

CC BRIDGEWATER

COWLITZ COUNTY PROSECUTING ATTORNEY

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PUBLIC WORKS DEPT.

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Douglas S. Boole

Chief Civil Deputy
David R. Koss

Administrative Assistant
Danelle M. Craig

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Susan I. Baur

Deputies
Walter A. DePuy
Jill Johanson
Thomas A. Ladouceur
Lourene Miovski
Melanie Paige Romo
Lisa E. Tabbut
Lindsay Taylor Thompson

MEMORANDUM

TO: Don Olson
Solid Waste Superintendent

FROM: David R. Koss DRK

DATE: July 8, 1992

RE: Supreme Court Decision on Out-of-State Wastes

As you know, state and local governments throughout the nation have tried a variety of measures to restrict or prohibit the importation of out-of-state solid wastes. Our March 20, 1992 memorandum discussed some legal aspects of this issue. We noted that some jurisdictions had adopted restrictions that applied to both out-of-*county* and out-of-*state* wastes. At least two courts had upheld these restrictions, on the ground that since they treat out-of-state wastes no more harshly than out-of-county wastes, they did not discriminate against interstate commerce. We noted that the United States Supreme Court would be reviewing one of those cases.

The Supreme Court issued its decision last month, in *Fort Gratiot Sanitary Landfill, Inc. v. Michigan Department of Natural Resources,* 112 S.Ct. 2019 (1992). That case involved a Michigan law that said solid wastes from outside a county could not be disposed of at a landfill within that county, unless such disposal was authorized by the county's solid waste management plan. A private landfill operator was denied permission to accept out-of-state wastes because the county's plan did not permit it. The operator sued.

The Supreme Court ruled in favor of the landfill operator. It said that the state law violated the "commerce clause" of the U.S. constitution. It didn't matter that the same restriction also applied to out-of-county wastes from the same state.

Another case decided the same day involved an Alabama statute that imposed a special tax on the disposal of out-of-state hazardous wastes at private facilities in Alabama. The Supreme Court

likewise ruled that this law was unconstitutional. *Chemical Waste Management, Inc. v. Hunt,* 112 S.Ct. 2009 (1992).

These cases are further evidence that, in drafting our solid waste management plan, we must be careful to not subject *private* waste facilities to restrictions based solely on the point of origin of the wastes. However, these new cases will still allow the county to restrict use of its own landfill to county residents.

Let me know if you have any questions.

HELLER, EHRMAN, WHITE & McAULIFFE
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JOHN C. McCULLOUGH
PARTNER

June 15, 1992

Mr. Cal Palmer
Weyerhaeuser Company
P. O. Box 188
Longview, Washington 98632

Re: Exemption From State Noise Regulations

Dear Mr. Palmer:

We understand an issue has arisen in the preparation of the draft environmental impact statement for the Longview Limited Waste Landfill. The issue relates to the discussion of noise impacts from operation of the railroad which is intended to be utilized in that project. We have reviewed these railroad operations and the laws and regulations that are applicable to them, and we are writing you now to summarize the results of our review.

The Headquarters Camp Disposal Facility ("Project") is a limited-purpose waste landfill proposed to be built on Weyerhaeuser property located approximately seven miles east of Interstate 5 and two miles south of Silver Lake in Cowlitz County. The Project would handle waste generated by Weyerhaeuser's Longview mill and other Weyerhaeuser facilities in the region, waste which would be transported to the Project site by rail on an existing rail line. The Longview mill complex is one of Weyerhaeuser's major forest products facilities in the Northwest. It produces rough grade lumber, finished grade lumber, pulp and pulp products for shipment throughout the United States and to various other nations in the world. The project, as proposed, would constitute a component of this overall commercial activity.

We also understand that the Woods Railroad, the private rail line that is proposed to haul this waste by-product to the Project

site, has been in continuous operation since at least the 1930's, averaging up to six trips per day on the existing tracks. The Woods Railroad is subject to periodic monitoring and review by Federal Railway Administration ("FRA") and we are informed it meets all noise standards enforced by the FRA.

The specific question that has arisen relates to whether the operations of the Woods Railroad are subject to the provisions and limitations of the Washington State Noise Regulations, set forth at Chapter 173-60 WAC. Based upon the facts discussed above, and upon our review of the applicable law, it is clear that they are not. WAC 173-60-050(4)(c) provides exemptions for carriers involved in interstate commerce by rail. There is no doubt that the operations of Weyerhaeuser at the Longview Mill complex constitute activities in interstate commerce. The scope of these mill operations includes the proposed hauling of waste to the Project site. As such, waste hauling by rail qualifies for the exemption from the state noise regulations.

We recognize that someone may argue that the operations of the rail line (insofar as it is used to haul waste by-products) cannot be "interstate" in nature, since all those operations occur within Washington State. The federal courts have historically and consistently, however, rejected such an artificially truncated view of commercial activity, when reaching a determination of whether those activities implicate interstate commerce. Activities conducted within state lines do not, by this fact alone, escape from the operation of the commerce clause, since interstate commerce may be dependent upon those activities. In this case, the hauling and disposal of wood waste products is an activity integral to the operation of the Longview mill complex, and thus, is an activity that implicates interstate commerce.

This result does not indicate, however, that the operations of the Woods Railroad are exempt from <u>any</u> noise regulation, merely that they are exempt from Washington State noise regulations. Under 42 USC § 4916, the administrator of the FRA is authorized to adopt noise emission regulations for "surface carriers engaged in interstate commerce by railroad". This phrase, of course, is the same phrase that appears in the exemption of WAC 173-60-050(4)(c). By the same federal law, these federal railroad noise emissions standards are given preemptive effect over inconsistent noise standards adopted by any state or local jurisdiction. Federal noise standards are set forth at 49 CFR 201.1 et. seq., and as we have noted, it is these standards to which the operations of the Woods Railroad is required to comply.

I hope this clarifies the status of the Woods Railroad operations with respect to applicable noise regulations. Please be sure to call if you have any further questions about these issues.

Very truly yours,

HELLER, EHRMAN, WHITE & McAULIFFE

John C. McCullough

JCM:caf

C\CAF:Palmer.LT1 4:49pm

