SITING, PERMITTING, DESIGNING, AND CONSTRUCTION OF A MAJOR FOREST PRODUCTS LANDFILL FACILITY

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ABSTRACT

What do you do when your only available wood waste disposal facility is closing? You either find another disposal site or build your own. The Weyerhaeuser Company built their own. The landfill is one part of an integrated waste management system. That system manages solid waste across all Weyerhaeuser businesses in the region. Integrated waste management includes waste reduction, recycling, incineration with energy recovery and finally a secure landfill. All of these parts are critical to ensure reliable, cost effective and environmentally sound solid waste management.

It took four years of effort for the Company to site, permit, and construct a new forest products landfill to accept waste from the Weyerhaeuser pulp, paper and timber facilities in Longview, Washington. Significant issues faced during the process included mitigation for filling 48,600 square meters of wetlands and diversion of 610 meters of fish bearing stream, evaluation of over 30 alternative sites, local public support and opposition, major storm water issues involving 65 inches of rainfall annually, difficult volcanic soils, and a four month construction season to accomplish $10 million of initial construction. Getting the new Southwest Washington Solid Waste Facility on line involved a huge effort by Weyerhaeuser, regulators, consultants, engineers, attorneys and contractors as well as a commitment of millions of dollars. Throughout the permitting process Weyerhaeuser made long term commitments to deal with environmental issues, and they emphasized proactive community relations. Landfill cell 1, the first of approximately 20 planned cells, and the related support facilities were designed to meet the permit requirements of the Washington Department of Ecology. Certain portions of the facility were also built to conform to the permit requirements of other state and Federal permits, most notably the Corps of Engineers 404 Wetlands Filling Permit and the Washington Department of Wildlife permit related primarily to fish habitat issues. This paper summarizes the process that Weyerhaeuser Company undertook to meet the demanding challenge of siting, designing and constructing this state-of the-art landfill. It also discusses some of the successful habitat creation that is now supporting local fish and wildlife.

INTRODUCTION

Past practice for Weyerhaeuser's Longview, Washington, mill was to use third party contractors to dispose of its solid waste. Throughout the 1980s the volume of landfilled material from the mill decreased by 70 percent, despite 40 percent higher production during this same period. Increasing concerns regarding the environmental and economic risks associated with this practice, along with uncertainties regarding capacity and long-term costs associated with third parties, prompted Weyerhaeuser to maximize its waste reduction and recycling programs. The company has also carried out pilot composting, soil amendment, and incineration projects. Even with optimum waste reduction and recycling, however, some portion of the company's solid waste still must be landfilled. Weyerhaeuser determined that it should own and operate a modern landfill to manage these wastes.

As a result, Weyerhaeuser's Southwest Washington Solid Waste Facility (Headquarters Landfill) was developed to meet the waste disposal needs of its Longview mill and other facilities in the Pacific Northwest. The landfill is part of an integrated waste management (IWM) system for these facilities, supplementing Weyerhaeuser's current waste minimization and recycling programs. IWM manages waste across all businesses in the region, providing waste reduction, recycling, incineration, and landfilling services.

The types of waste disposed at the landfill (in approximate order of volume) include mill wastewater treatment solids (sometimes called sludge), boiler ash, log sort yard debris, wood fines, pulp mill lime waste, mill construction and demolition debris, polyethylene waste, and miscellaneous mill waste. The landfill will also accept local construction and demolition debris (subject to a strict waste screening process) from third parties and forest products waste from other Weyerhaeuser mills. This may offset the relative percentage of different types of waste. The landfill will not accept municipal or hazardous waste.

SITING PROCESS (INCLUDING CORPS 404 PERMIT)

In 1989, closure of the mill's third party landfill was imminent. Therefore, Weyerhaeuser initiated a study to identify potential landfill sites. The study area included a 48,100 meter radius from the Longview mill and represented nearly 7,320 square kilometers. Weyerhaeuser had the advantage that it owned a substantial portion of the land within this study area as part of its Mount Saint Helens tree farm, but the company did not restrict its search to its own property.

To narrow down the selection of potential sites, an exclusion study was performed using screening criteria. Screening criteria included jurisdiction (out-of-state and out-of-county areas that had little hope of receiving land use approval), slope (stability being the primary concern), access (via road or rail), floodplains, and proximity to populated areas (minimum 800 meters from recognized towns). A series of map overlays were created. The overlays contained each of the exclusionary criteria. Areas not included in site exclusion areas represented potential landfill locations used for additional study.

At this point, the siting evaluation shifted from being a "negative" process whose goal was to exclude areas, to a "positive" process whose goal was to identify potentially acceptable sites. Weyerhaeuser assembled a team of foresters, land managers, geologists, and engineers familiar with the area to conduct the search. Topographic and geologic maps, aerial photographs, helicopter flyovers, and site visits were used extensively. Thirty-five potential landfill sites were identified.

The company's goal for this project was to permit a site with 30 years of waste capacity (to be commensurate with its long-term investment goals in the Longview mill). This goal required a minimum waste capacity of 23 million cubic meters. The estimated minimum size landfill footprint for this size landfill, not including ancillary facilities, was 1,000,000 square meters. Many of the original 35 sites were eliminated from further study because they could not meet this goal.

The next step was to rank the remaining sites. Ranking criteria included capacity, access, proximity to neighbors, and potential environmental impacts. (It took about one year to reach this site ranking stage in the project.) Chief among the potential environmental impacts requiring evaluation were wetlands and fisheries. All the remaining potential sites contained wetlands that would have to be filled (typical for this part of the country, especially for this size project). The Clean Water Act section 404(b)(1) guidelines (administered by the U.S. Army Corps of Engineers) prohibits filling 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. It was clear that the Corp's 404 permit approval was intrinsic to the siting process.

The last step was to rank the sites in terms of their aquatic impacts, then to evaluate the best ranked sites in terms of other significant environmental impacts. The Headquarters site required filling approximately 48,600 square meters of wetlands and diversion of a fish bearing stream. It was identified as the preferred alternative, even though one other potential site contained fewer wetlands and no fisheries. The other site was within 30 meters of an interstate highway rest stop, and within 1,570 meters of 47 residences that had water supplied by ground and spring water.

Major benefits of the Headquarters site are its remoteness (nearest neighbor 1,600 meters away), lack of downgradient beneficial groundwater use, significant land buffer (Weyerhaeuser owns the land all around the site), access (it can be accessed by Weyerhaeuser's private railroad system or by county road), favorable low permeability soils, rock quarry resources, and capacity (nearly 38 million cubic meters of waste).

When Weyerhaeuser and its consultants believed they had identified the most advantageous site to meet the regulatory agencies', the public's and the company's goals, they proceeded with the permitting process. The process took an additional 2½ years to receive final approval from the Corps. Final approval came on July 12, 1993. This 2½ years was also used to perform a highly structured alternatives analysis, conduct interagency mitigation planning, and perform detailed site evaluation with the Corps. Meanwhile, several other permits and planning processes also had to be completed.

OTHER PERMITTING PROCESSES (CLOSELY TIED TO PUBLIC RELATIONS)

Simultaneous with the Corps 404 process three other major permitting processes were occurring. These included an environmental impact statement (EIS, administered by the county), a hydraulic permit approval (HPA, administered by the Washington Department of Wildlife) to divert the fish-bearing stream, and a state solid waste disposal permit (administered by the Washington Department of Ecology). Land use approval was not a major issue because of the existing classification of the site in the forest lands.

Key to obtaining approval for all these processes and permits was successful public relations. While the public was

invited to comment on all the agency permits, the largest forum for public involvement was in the EIS process. This is also a forum landfill opponents typically use to bring up difficult questions and issues to raise doubts about a project's validity.

Weyerhaeuser adopted two strategies at the outset of this project. In hindsight, these were key to its success. The first was establishment of a team spirit that fostered open communication, professional respect, and commitment to the project from beginning to end. The second was an up-front, proactive, open relationship with the community and agencies. This second strategy proved most valuable in the EIS process because it allowed all the issues to be aired and resolved throughout the permitting process.

Weyerhaeuser conducted a series of community outreach programs, including those for its own employees. Open public meetings were held, beyond any required by the permitting processes, in communities that would be most affected by the project. A consistent group of dedicated opponents raised difficult questions during the outreach programs, but Weyerhaeuser showed it was committed to working with the community to create a responsible project and did not back down from any challenge to project integrity.

Significant controversies flushed out in the EIS process were the effect of a rail car leachate spill or landfill liner leaks, long-term sediment and nutrient loading to surface water from erosion, wetlands and fisheries, odor, visual aesthetics, and railroad operations noise and traffic intersection delays. Also important was the no-action alternative, which would result in premature filling of the county's municipal landfill. It took approximately 2½ years to complete the EIS process; final approval was received in January 1993.

The HPA permit for the fisheries was strongly linked to the Corps permit because of the aquatic issues. The HPA permit was finally issued in June 1993.

The solid waste permit required extensive site hydrogeologic characterization and engineering analyses. The challenges, however, remained largely in the technical arena. Politically, the state solid waste department valued the project as an advancement in the area of solid waste management for the forest products industry and gave the project its general endorsement throughout the other permitting processes. The solid waste permit was issued in May 1993.

Approximately 20 other minor permits (e.g., grading, burning, quarry, storm water, etc.) were required to construct the project.

FINAL PROJECT DESCRIPTION

From one point of view, the final project can be described as two separate systems brought together by the modern permitting process. The first system is the engineered features that allow the landfill to operate, such as the geomembrane and soil liners, leachate and storm water controls, access roads, and waste and leachate loading systems. The second system is the natural habitat that was modified or created to offset the impacts imposed by the new landfill facilities.

Landfill Design and Operational Features

The final landfill footprint will occupy 1,246,000 square meters, contain about 38 million cubic meters of waste, and have a maximum fill thickness of about 76 meters. The final landfill slopes will be 4.5(H):1(V). The landfill will be developed incrementally in a series of 20 cells (the first being 73,000 square meters in size). A site layout of the landfill facility is shown on Figure 1. Major design elements are as follows:

- **Landfill bottom liner and leachate collection system.** A single composite liner, comprising 0.6 meters of low-permeability soil overlain by a 1.5 mm polyethylene geomembrane. The liner system is completely underlain by a gravel underdrain layer to protect it against high groundwater. The liner system is overlain by a 0.3-meter-thick gravel leachate collection layer containing an embedded pipe network. The leachate collection system drains to a 1.5-meter-diameter sump containing two 10-horsepower submersible pumps.

- **Leachate holding pond.** Leachate is pumped from the landfill sump via a force main to a double-lined 19-million liter capacity holding pond. The pond is divided into two cells by a berm to reduce the amount of rainwater falling into the active leachate holding cell in the winter. (The site annually receives an average of 65 inches of rain.)

- **Rail transfer facility.** All the waste comes to the landfill in 30-cubic-meter containers on the Weyerhaeuser-owned Woods Railroad. Waste is loaded at the Longview mill, 25.65 km from the landfill. A waste-car siding and a tank car siding were constructed next to the main railroad line for the waste transfer. Leachate collected in the holding ponds is transferred from the holding pond into 76,000-liter-capacity rail tank cars and hauled back to the Longview mill for treatment. The tank car rail loading area is underlain by a cast-in-place concrete and geomembrane-lined structure to

catch spills and leaks which are pumped back to the leachate pond.

- **Storm water controls.** Since the site has opened, there have been several 50-year storms. (Many 24-hour storms have had over 2 inches of rain.) An upgradient diversion channel intercepts the headwaters of a stream that formerly ran through the site and diverts the stream around the landfill. Runoff from inactive areas of the landfill is captured in a concrete perimeter channel, located along the west edge of the landfill, and sent to a sedimentation/ detention basin via a 1,200 mm-diameter pipe. Runoff from other areas of the site is also directed by gravity to the sedimentation/ detention basin, which was designed to settle a 10-micron particle size from a 25-year storm. The only area that requires storm water pumping is the rail transfer area. A biofiltration basin designed for a 2-year storm receives outflow from the sedimentation basin before the water is discharged to the natural drainage courses.

- **Temporary plastic cover.** Inactive landfill areas are covered with temporary plastic, ballasted with sandbags, to shed runoff and reduce leachate generation.

- **Final cover system.** The proposed final cover will include a geomembrane, an overlying drainage layer, and at least 0.45 meters of topsoil. Additional soils may be added if trees or shrubs are grown. A landfill gas system, designed for the volume of gas being generated at the time of closure, will be constructed in conjunction with the final cover system.

- **Groundwater and surface water monitoring.** Groundwater monitoring wells and surface water sampling points are regularly monitored for environmental impacts. However, the most effective sampling point for monitoring performance of the liner system is probably the outlet of the underdrain system. The path of least resistance is the underdrain system because native soils are mostly of low permeability.

- **Power.** A primary 460-volt, 3-phase electrical power supply was brought to the site's central transforming and switching station. From that point, the power is distributed throughout the landfill where needed. A backup emergency generator, designed to provide power to all the pumps and controls, has already proved invaluable during the winter and stormy weather.

Wetlands and Fisheries Mitigation

In establishing the project scope, Weyerhaeuser avoided and minimized natural habitat impacts to the fullest extent possible. This was accomplished by the site selection process, by on-site footprint alteration, and by good design and construction of environmental containment features. Studies were then performed to delineate wetlands and fisheries impacts. These studies showed that the major affected habitats included approximately 48,600 square meters of scrub shrub and emergent wetlands, and 790 meters of perennial fish-bearing stream (containing primarily cutthroat trout and some coho salmon).

Compensatory mitigation was designed to offset the unavoidable loss of wetland and stream habitat. The mitigation package consisted of several elements designed to address the concerns of multiple agencies, including the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the Washington Department of Ecology, and the Washington Department of Fisheries. Major components of the mitigation package included the following:

- **Up-front mitigation.** Although the wetlands impacts would be spread out over 30 years, all of the mitigation was performed up-front.

- **Wetland creation.** Approximately 48,600 square meters of emergent, scrub shrub, and forested wetland were created in the landfill vicinity, all associated with the stream diversion. These wetlands include a small portion of year-round open water obtained from excavating into the upper groundwater region. While some of the creation is in small, 4,000 square meter pockets, the largest amount of creation is in a 32,300 square meter contiguous area.

- **Wetland enhancement or restoration.** Approximately 8,100 square meters of existing emergent wetland, located near the landfill and further downstream, were enhanced.

- **Wetland preservation.** Approximately 202,000 square meters of forested wetland, in the headwaters of a nearby stream, were placed in a conservation easement to prevent future timber harvest within the area.

- **Off-channel fish rearing pond creation.** Three inter-connected off-channel ponds, each connected with the main stream, were created downstream of the project to provide rearing habitat and winter refuge for cutthroat trout and coho salmon. About 4,000 square meters of open water and associated fringe emergent wetlands were created.

- **Fish passage and habitat creation in diversion channel.** To the extent possible, a series of riffles and pools were created on the lower portion of the stream diversion channel around the landfill to promote fish passage and habitat.

Habitat creation potential is limited due to the steep gradient. However, about 610 meters of the stream habitat created has proven to bear fish. As an aside, fish population studies in the summer of 1994 showed four times as many fish in this part of the channel than were found during preconstruction studies.

FAST-TRACK DESIGN AND CONSTRUCTION (TEAM WORK)

The status of the Corps 404 permit was not known until the day it was issued on July 12, 1993. Up until that time, there was a strong probability that the project could be denied, and Weyerhaeuser would have to start over. With this scenario, the Weyerhaeuser management team had to decide whether to go ahead with final design early enough to get the project built in 1993, or delay until project approval was received. The latter decision would result in a year of lost time and expensive long-haul rail costs for transporting the mill wastes.

Weyerhaeuser decided to authorize final master plan permitting design in September of 1992. This permitting effort was completed by December. Weyerhaeuser then authorized final construction design. The same design team members were used for the final design of the first landfill cell, the required site improvements, the rail transfer facility, the leachate system, and the mitigation improvements. The final design effort required coordinating seven consulting firms over a 5-month period. The final design contained over 100 full-size drawings and 450 pages of technical specifications.

The project was put out for initial construction bids to five prequalified general contractors, using a set of preliminary plans. Detailed interviews were conducted with each of the final three bidders (two dropped out). One of the keys to the success of the construction project was not going with the low bidder. The final selection was based primarily on ability to accomplish the job in a sound manner within a tight time frame. Safety and environmental performance were also key considerations. Weyerhaeuser then entered into final negotiations with the selected bidder. By that time, final plans and specifications were ready.

The construction contract was awarded on June 9th, but for over 1 month, the contractor sat with engines running at the site, fully mobilized, waiting for Corps approval. Approval was finally obtained on July 12. Given the short construction season in the Pacific Northwest, an extremely aggressive construction schedule was pursued.

The construction was fast-tracked working six, 12-hour, days per week. Two major factors influencing the construction progress were weather and the soil conditions encountered. Weather through July was unseasonably wet, causing above normal soil saturation. August through October, however, were drier than normal, which allowed the project to be built.

During and after contract negotiations, Weyerhaeuser pursued a team relationship with the selected contractor, in the same way as with the consultants during permitting and design. Open communication between all parties, and mutual support were emphasized. The result was an atmosphere of trust between the parties that allowed the work to go forward with a minimum of slowdowns.

The excavated soils were highly variable volcanic and basaltic soils. The high degree of moisture and short construction season did not allow time for many of the soils to be suitably dried for embankment construction. Rock had to be brought in from nearby Weyerhaeuser quarries to supplement the soils.

To meet the project schedule, the project design engineering team was used to perform construction monitoring. As issues came up in the field, design decisions and changes could be made quickly and efficiently. A CAD system was brought on site to issue drawing revisions on the spot, as necessary. In one instance, a large topographic discrepancy was discovered in an area where tall trees existed when the original mapping was performed. This resulted in a significant design change and additional earthwork. The project designers were able to turn around the design changes in a matter of days by working with the CAD system and survey information on site.

Construction was substantially complete to support landfill operations by the end of October. Approximately $10 million worth of construction was performed in less than 4 months. The resident engineer was able to turn in the construction report for agency approval within days following substantial completion. The first waste train arrived November 18, 1993, and the landfill opened for business.

RESULTS (AND SOME LESSONS LEARNED)

The landfill operates successfully within its permit conditions. While some construction and operational startup costs were higher than originally estimated, the overall project provides service at a reasonable cost.

The first year of operations (particularly the winter) brought some design and operational bugs. Many of the bugs were associated with oversights due to the fast-track design and construction process. Some of the difficulties were

associated with the normal process of gaining experience with a new site.

Some areas where operational experience led to a better landfill site after startup are as follows:

- Erosion control techniques with the site soils. The landfill site is a huge area to control. It is especially difficult due to the colloidal nature of the soil materials.

- Improved management of the temporary plastic and construction of additional temporary berms over inactive landfill areas to reduce leachate generation.

- Wet weather filling techniques with the waste (particularly the sludge). During the wintertime, it is difficult to manage the waste materials in the rain. They absorb a great deal of moisture and then lose stability.

- Mechanical and electrical design and operation of the leachate loadout system (Experience provides 20/20 hindsight into better ways of doing things.)

- Various design details associated with such things as valve locations, add-ons for electrical systems, warning systems, controls, etc.

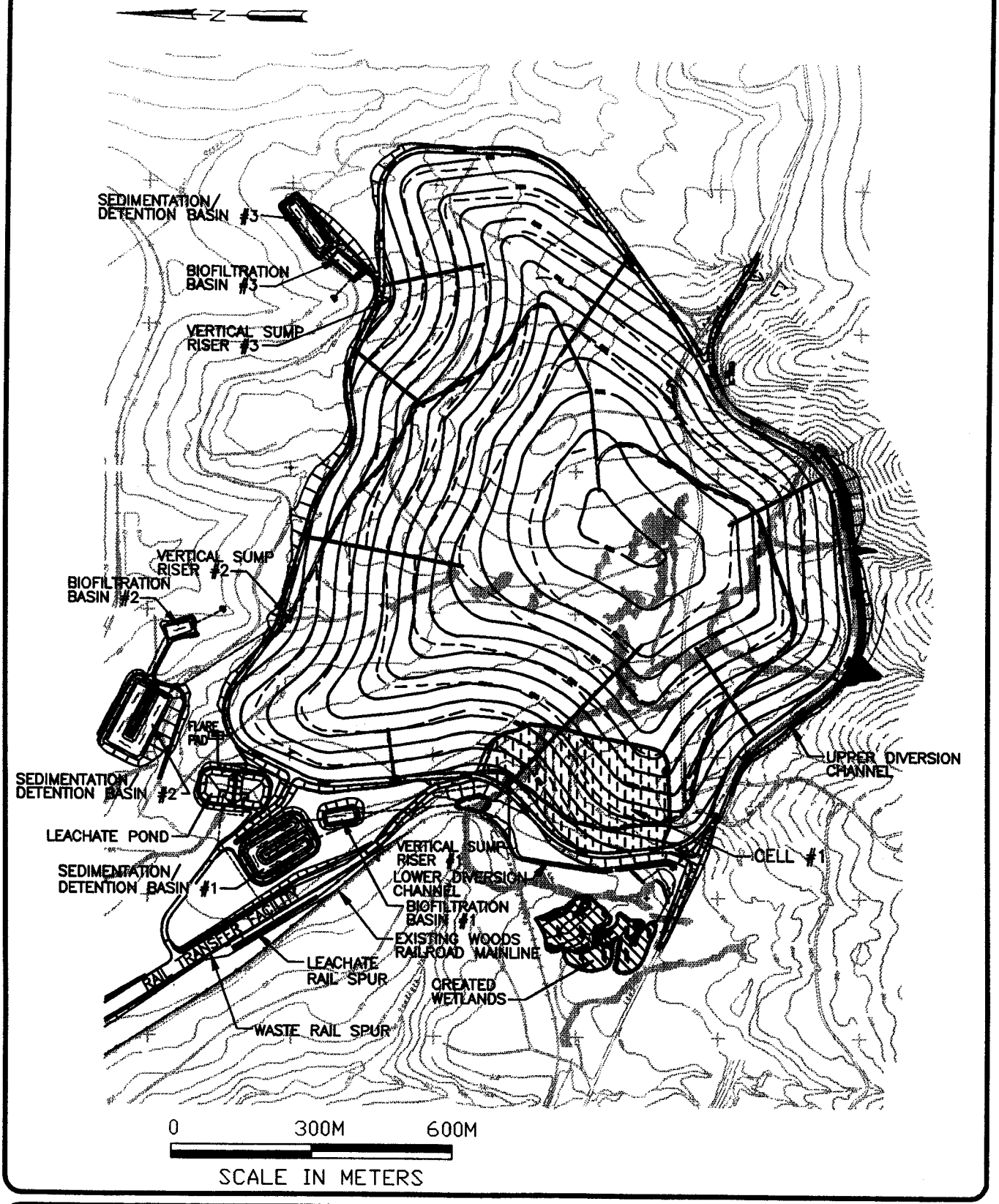
- The intensive planting plan required by the agencies for the mitigation areas would have benefited from, and a lot of money would have been saved, if volunteer plant reproduction had been evaluated before purchasing and installing potted plants.

Large landfill projects such as this should anticipate startup costs to work out system problems similar to pulp and paper mill startups.

CLOSING

Today the landfill facility is a major attraction for area visitors and a standard part of the Longview mill tour. Many people touring the entire mill complex (one of the largest in the world, and currently undergoing a one-half billion dollar upgrade) have exclaimed that the landfill is the best part of the tour! Weyerhaeuser is also working with local schools to make the landfill and associated wetlands a part of their environmental curriculum.

It took Weyerhaeuser 4 years from conception to realizing its first load of waste. Along the way, $23 million were spent, and there were many moments when the fate of the project was in doubt. As a reward, the company has assured waste disposal capacity, stable, predictable disposal costs, and more control over its environmental destiny.



EMCON Northwest, Inc.

DATE 12/94
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Figure 1
SOUTHWEST WASHINGTON SOLID WASTE FACILITY
HEADQUARTERS SITE, COWLITZ COUNTY, WASHINGTON

LANDFILL FACILITY LAYOUT

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