CHAPTER 2

OYSTER BAY REGIONAL SHORELINE: SPECIFIC PROBLEMS OF PARK DEVELOPMENT

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Introduction

This paper deals with specific problems in the proposed development of Oakland Scavenger Company's Davis Street Sanitary Landfill operation into a shoreline park by the East Bay Regional Park District. The feasibility of similar development (from shoreline sanitary landfill to shoreline park) for other District-proposed sites has been eroded due to high projected development and maintenance costs. Some of these high costs stem from the long-term threat to water quality posed by shoreline sanitary landfills. This threat results from the close proximity of such landfill sites to surface waters during the entire process of decomposition taking place within the landfill.

There are many problems unique to the conversion of sanitary landfill sites into recreational areas. These include prevention of pollution of ground and surface waters by leachate, proper management of methane production, proper control of settlement, problems of park design, proper timing of development, and acquisition of topsoil or a suitable substitute, among others. Pattillo has written an excellent review of the problem of recreational development from a landscape architect's perspective.[24] The development of a shoreline sanitary landfill such as the Davis Street site poses special problems of long-term protection of surface water quality. This report considers only the most important physical problems in the development of Oyster Bay: the leachate, methane, and top-soil problems. These are the problems most likely to cause high initial development and continuing maintenance costs for the District.

Each of the above problems is currently facing the District (or Oakland Scavenger Company) as the planning for Oyster Bay Regional Shoreline proceeds. This paper will explore the methods available to the District for minimizing cost while effectively implementing a long-term solution in every case.

Background

Oyster Bay Regional Shoreline is located southeast of Oakland International Airport and north of the San Leandro Marina (Figure 1). The 785 square kilometer site has been a dump or sanitary landfill operation since 1949. Filling will continue until final grading and landscaping requirements for the future park are met.

The Davis Street Sanitary Landfill is currently owned and operated by the Oakland Scavenger Company. Oakland Scavenger's filling permit expires December 31, 1978, but may be extended another year.[10] Ownership of the future Oyster Bay site will then be transferred to the District after final site closure requirements are met. Final site closure must be approved by the State Water Quality Control Board (WQCB).[30]

The adjoining area is primarily industrial and includes the San Leandro Sewage Treatment Plant. The area has some recreational and residential as well as industrial components. Oakland Galbraith Golf Course lies

Figure 1. Location of Oyster Bay Regional Shoreline

Source: Land Use Development Plan[12]

just north of the sewage treatment plant, and to the south, private residences line the Bay Shore from the landfill site to the San Leandro Marina.

Many features of the history of this area serve to illustrate that the name "Oyster Bay" is indeed appropriate for the planned park. The Saklan Indians used local oysters as their staple food. Today there are still oysters near the site but the Department of Health does not recommend their consumption due to the poor water quality in the area (from the San Leandro Sewage Treatment Plant near the site). Perhaps oyster harvesting could resume in the future if water quality improves in the Bay off the San Leandro shore.

Plans for Park

Oyster Bay will significantly expand the District's limited group picnic facilities (Figure 2). Two central meadows at the future park are designed to handle group picnics of up to 1000 persons simultaneously.[10] The expected level of park use is approximately 300 visits per day.[12] The park entry will be from Neptune Drive which is easily reached from the Nimitz Freeway via Davis Street or Marina Boulevard. Presently A.C. Transit Route 55 runs within two blocks of the park entry, and the District intends to encourage A.C.

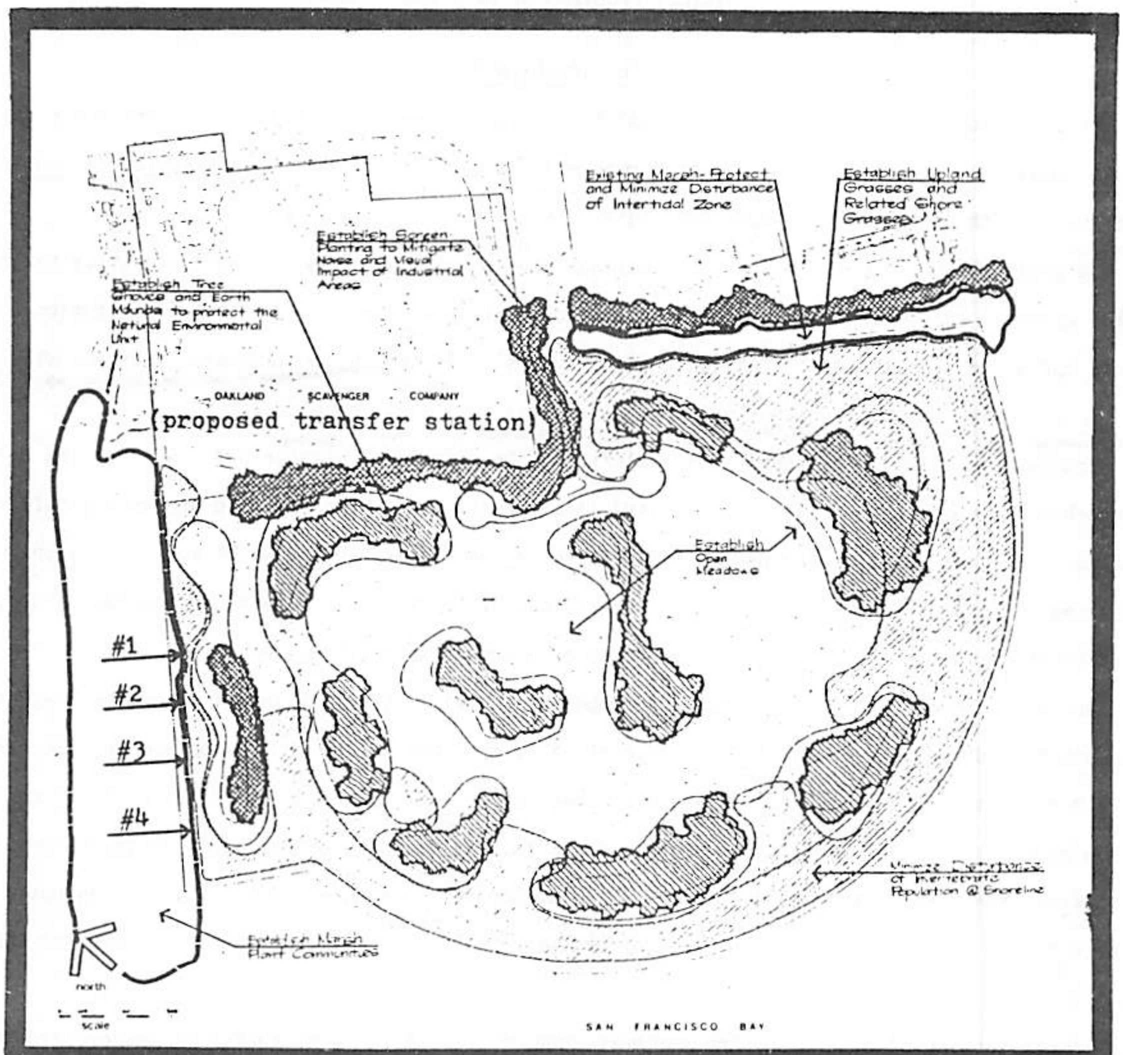

Figure 2. Site Plan (locations #1 - #4 indicate leaks)

Source: Land Use Development Plan [12]

Transit service to the park. This would greatly encourage use by low income and elderly people in the District. The location of the San Leandro Marina relative to the park (two and one-half blocks south) should make bus service to Oyster Bay more attractive to A.C. Transit.

Preservation of wildlife resources, especially birds, should - and probably will - take a high priority in future management of the park. There are approximately 60 species of birds common to Oyster Bay on a regular or seasonal basis. The Audubon Society has advocated preservation of the small marsh area at the site and plantings or seedings of native plants to encourage the bird population. Buffer zones between human activities and bird retreats have also been suggested.[13]

Other types of wildlife at the site include invertebrates, fish, reptiles, and mammals. Notable mammals are the abundant Black-tailed Jackrabbit and the California Ground Squirrel. The most important gamefish in the area is undoubtedly striped bass. These fish are probably accessible from the park shore in season but further research will be required to verify this. The shallow water near the park may discourage these migratory fish from frequenting the area.

Physical Problems of Park Development

The Leachate Problem

There is potential at some sanitary landfills for pollution of subsurface aquifers and surface waters through seepage of leachate. Leachate is formed when water penetrates through a sanitary landfill, becoming contaminated with dissolvable or suspended materials.

The Davis Street site is located in a wetland area and is therefore in close proximity to ground and surface waters. This means that protection of water quality will require continual monitoring and maintenance for an indefinite period (at least twenty years). In the future sanitary landfills will probably not be constructed in California's wetland areas unless absolutely necessary.[30]

Groundwater pollution by seepage of leachate is not expected at Oyster Bay. A thick and relatively impermeable layer of bay mud (silty blue clay) lies directly below the site and probably constitutes an adequate natural liner for the confinement of leachate.[28] At Oyster Bay the aquifer is at a level somewhere within the 15-21 m. thick layer of bay mud underlying the landfill. Low-level monitoring of groundwater for pollution from leachate is planned at Oyster Bay as a precautionary measure.[25]

The Davis Street site is only one of a number of shoreline sanitary landfills on the Bay. Each of these sites is diked to separate the refuse completely from Bay waters and to contain any leachate formed within the perimeter of the dike. In practice these dikes are known to leak if not properly constructed or kept in good repair. The efficacy of a dike for containing leachate is dependent on the materials used in its construction. Most of the Davis Street dike is constructed of dredged bay mud with an outer layer of concrete rubble and an additional "riprap" of greywacke sandstone exterior to the concrete on the seaward side.[13, 25]

A newer section of dike along the northern edge of the site is constructed of large-sized concrete rubble. Such rubble has been known to cause subsequent dike failure. Extensive leaking is a result of this type of construction at the Alameda sanitary landfill adjacent to San Leandro Bay. There has also been significant dike failure due to poor dike construction at South San Francisco and North Berkeley.[30] The rising and falling of the tides can force Bay water through a leak and into the landfill at high tide. The leachate will return to the bay at low tides because the water pressure gradient is then reversed.

There is reason to question the integrity of the newer section of dike at Davis Street. Suspected leachate seepage was observed on two different days between March 1 and April 1, 1978, on the northern embayment mudflats exposed at low tide. Rivulets were running from the outside base of the dike into the channel of Bay water in the center of the embayment (Figure 2). Three of the four leaks had significant discoloration and all had a noxious odor of varying potency. Four 8 to 16 oz. samples were collected in jars at low tide on April 1, 1978, as suggested by a staff member of the Regional WQCB. These were presented to the Oakland WQCB office on April 7, 1978. However, a quantitative analysis of the samples was not performed because standard sampling techniques involving certain chemical preservatives were not followed. Many leachates will undergo significant chemical change (even if preservatives are added to slow this process) before the samples can be brought to a lab for analysis. For this reason an on-site analyzer is often used by Regional WQCB sampling teams.[30]

The extent of the leachate problem at Davis Street will not be known until more complete monitoring is carried out. The entire dike should be surveyed for the presence of leaks. Visual inspection for dike failure is difficult because most low tides do not expose the mudflats next to the western and southern portions of the dike. Stahler reports that aerial inspection was an effective way to spot major leaks at the Richmond Sanitary Landfill Site.[28] Infrared photography can be used to spot leaks which are sometimes visible as a light or dark cloud in the water next to the outer perimeter of the dike.[5] The District has helicopters which could easily perform an aerial reconnaissance for the presence of major leaks at Davis Street. Perhaps data obtained by infrared photography would be accurate enough to assist the District, Oakland Scavenger Company, and the RWQCB in insuring that site closure requirements are met.

There are three general types of dike repair for situations such as that at Davis Street. One involves applying an impervious layer to the seaward exterior; a second, filling an interior section of the dike. The impervious layer is usually "keyed into" the bay mud to a depth sufficient to prevent formation of new leaks underneath the repair.[30] The City of Berkeley is currently repairing its North Berkeley Marina dike by these methods at a cost of approximately $800,000. Most of this repair has been funded by the Federal Government under the Local Public Works Act.[4] A third type of repair involves uncovering the exterior of the dike facing the landfill with a deep trench and application of a similar impervious layer. Materials such as asphalt, compacted clay, cement mixtures, layers of filter rock and various other mixtures have been successfully used. South San Francisco tried plastic with disastrous results. Failure was due to leaks caused by a layer of sharp rubble over which the plastic was applied. In most cases an engineering consultant will determine the method of repair in conjunction with Regional WQCB personnel. A combination of the three major types of repair is sometimes used.[30]

The extent of the leachate problem at Oyster Bay is not known. A quantitative analysis of the leaks at the northern edge of the site should be initiated. Expensive repairs may be required if monitoring reveals that other sections of the dike are leaking or have otherwise deteriorated.

The Methane Problem

Anaerobic decomposition of organic wastes in a sanitary landfill produces methane. The length of time methane is produced varies inversely with the rate of decomposition and directly with the availability of water within the landfill. At Oyster Bay it is expected that essentially all methane production will occur within twenty years of site closure.[10] Problems caused by methane production may include deterioration or death of plants, explosions, and noxious odors.

The presence of methane causes a condition of oxygen depletion in the soil which may impair plant growth or even kill valuable plants. A blue or dark grey soil and the smell of hydrogen sulfide (rotten eggs) are signs of methane gas accumulation. Methane may build up to flammable densities of five to fifteen percent in culverts or under buildings. Contact with oxygen or simply a spark may then cause the accumulated gas to ignite or explode. Problems related to methane are intensified when a clay seal (part of the cover material) is used to reduce the production of leachate. Such a seal is planned at Oyster Bay. Methane has been known to migrate up to twelve hundred feet laterally from its source in a sanitary landfill.[24] A clay seal greatly increases the tendency for lateral migration.

Appropriate venting of gas collection systems will prevent methane buildup to levels that endanger plants or cause explosions. Areas beneath buildings at sanitary landfill sites must be kept well ventilated. One large sanitary landfill in Los Angeles County uses the methane produced as a supplement to local natural gas utility lines after it has been well washed to eliminate caustic contaminants.[11] The Davis Street site does not have the capacity to produce an adequate volume of methane for economical local utility line supplementation. Monitoring and venting for methane are planned. Vents will either burn off the methane or be built tall enough to eliminate unreasonable odors from the park site.[10]

The Topsoil Problem

The high cost of topsoil has been a major obstacle to the development of shoreline sanitary landfill sites by the District. The cost of providing a 30 cm layer of good quality topsoil over the portion of the Oyster Bay site to be landscaped is approximately three million dollars.[4, 23, 25] Because of this high cost the District has chosen to substitute composted sewage sludge for the natural topsoil. The composted sludge will be amended with fertilizers if this becomes necessary.[10]

The original topsoil from a sanitary landfill site is often saved to reduce subsequent land reclamation costs.[24] This practice is not possible at shoreline landfill sites such as Oyster Bay where there was no topsoil present. Topsoil or an acceptable substitute must therefore be provided on those portions of the Oyster Bay site that will be landscaped.

The District will obtain approximately 380,000 cubic yards of composted sludge for use at Oyster Bay. It will be provided essentially free of charge by the East Bay Municipal Utility District over a ten year period. Transportation costs between the composting site and the park will be negotiated if necessary. The probable composting site is the EBMUD Sewage Treatment Plant just south of the Bay Bridge. At one time Oyster Bay was the intended composting site. The future park is now low on the list of alternative composting sites for two reasons: its limited lifespan (ten years) and the fact that composted sludge, having a relatively low water content, is cheaper to transport than raw sludge.[31]

A 15 cm layer of composted sludge will be applied at Oyster Bay. The District would like to obtain additional compost in order to further enrich the soil.[10] Chances for obtaining additional compost are dependent on the extent to which a retail market for compost is developed in the Bay Area. A large retail market for a bagged composted sludge product now exists in Los Angeles. However, it is expected that it will probably take five to ten years to overcome retail market resistance for such a product in the Bay Area. The S.F. Bay Region Wastewater Solids Study has recommended that EBMUD begin phasing out the disposal of sludge in sanitary landfill sites by 1980.[18] The District is accepting a major portion of EBMUD's composted sludge until the anticipated retail market is developed.[18]

The composted sludge to be used at Oyster Bay will be produced by the "static pile" method with blower aeration. This method was successfully demonstrated by the Regional Compost Demonstration Project at the Berkeley Marina Landfill Site. The project was a cooperative effort sponsored by EBMUD, the S.F. Bay Region Wastewater Solids Study (WSS), and the City of Berkeley. Two hundred cubic yards of composted product were produced for use on Berkeley parks.[18, 21]

The materials used in the sludge composting process are dewatered sludge (approximately 84% moisture by weight) and some form of bulking agent. The bulking agent may be leaves, wood chips, previously composted material, cut rubber tires, or even pieces of metal. It functions to reduce the moisture content to 45% to 55% by weight. Rubber or metal bulking agents must be removed after composting.[31] Raw sludge and the bulking agent are mixed with a front-end loader and roto-tilled. A static pile is mounded over a section of perforated pipe connected to a fan. Air is then drawn through the pile and odors are captured in a small mound of previously composted material.[27]

The District can supply EBMUD with a large volume of plant material for use as a bulking agent from normal logging and thinning operations. EBMUD and the District are negotiating the joint purchase of a wood chipper so that efficient reduction of various plant materials to a usable bulking agent will become feasible. Garden trimmings from District residents will not be used as a source of plant material for the chipper. The possibility of metal present in garden trimmings causes the threat of expensive damage to the chipping device. Furthermore, there is no shortage of plant material from District-owned sources.[10]

Use of raw sludge (which contains pathogens and heavy metals) to fertilize croplands has raised questions about the safety of composted sludge. However, the static pile composting process creates temperatures of $140^{o}F$ to $160^{o}F$ for two to three weeks as a direct result of aerobic decomposition. This amount of heat is theoretically sufficient to kill all pathogens - bacteria, viruses, and parasites - present in the sludge. Although every pathogen may not be killed, the few that remain should pose no danger to park users unless the compost is directly injested. Golden Gate Park in San Francisco has been using minimally composted sludge successfully as a mulch and fertilizer since the 1930's.[10, 18]

The danger of pathogens in reclaimed water to be used for irrigation at Oyster Bay is more significant than the danger of pathogens in composted sludge. Nevertheless, such water is considered safe by planners if properly treated.[10]

Questions have also been raised about the possibility of heavy metal toxicity to plants, animals, and man, especially from zinc, copper, nickel and cadmium.[3, 22] Long-term studies are now being carried out to determine the cumulative effects of heavy metals in raw sludge used on croplands. The same heavy metals are found in composted sludge since the composting process does not remove them. Meanwhile the EPA is attempting to reduce the amount of heavy metals that enter sewage treatment facilities.[22] An analysis of municipal sludge from 16 American cities showed EBMUD sludge to be extremely low in cadmium.[2] Some park planners advocate the planting of edible fruits and nuts to enhance the enjoyment of park users.[16] This practice should be avoided at Oyster Bay due to the possibility of heavy metal toxicity.

The heavy metal content of sludge from a single sanitary district is likely to vary over time as a result of periodic changes in industrial, commercial, and domestic effluent composition. For this reason the significance of the analysis of sludges from sixteen American cities is lowered with respect to anticipating heavy metal toxicity from the use of composted sludge at Oyster Bay. Periodic monitoring of the composted sludge for <u>all</u> heavy metals of interest (Cu, Zn, Cd, Ni, and Pb) could assist a soils expert or plant ecologist in determining whether potentially toxic levels were indeed present. In particular, lead concentration should be measured as a part of such monitoring. The above-mentioned analysis showed EBMUD sludge to have a lead concentration (2521 ppm dry weight) surpassed only by Los Angeles sludge. The fourteen other sludges tested from major American cities had a lower lead concentration.[2] Although high lead concentration does not normally affect plant growth, the contamination of soil from sludges high in lead should not be overlooked.[3]

Current plans for Oyster Bay call for a 15 cm. layer of composted sludge to be mixed with a 31 cm. layer of inert cover material to create a 46 cm. layer of topsoil. This layer will be supplemented with chemical fertilizers if necessary. However, a policy of the District is to discourage the use of chemical fertilizers on its parklands.[10] There is evidence to indicate that this policy is somewhat unrealistic. It is unlikely that any composted sludge can provide enough potassium for vigorous plant growth because most potassium in sewage remains in the effluent and the content in sludge is quite low. Two other essential plant nutrients, nitrogen and phosphorus, are often deficient unless high rates of sludge application are used.[3]

The use of composted sludge for land reclamation is still a developing technology and very little reliable information is now available.[22] A land reclamation project carried out under conditions very similar to those found at Oyster Bay may therefore be of great interest. The U.S. Park Service used composted sludge to create Constitution Gardens in Washington, D.C.[22] This project also required 46 cm. of topsoil for application to 42 acres of land. Two hundred thousand dollars were saved by substituting 9000 tons of composted sludge for natural topsoil.

The sludge used at Constitution Gardens was first composted with wood chips for three months. It was then mixed with a one-year-old decaying leafmold mixture (high in phosphorus and potassium) and existing soil. This mixture was compacted into a 36 cm. layer. A full 10 cm. of natural topsoil were then added to create the 46 cm. layer required. Nevertheless, nitrogen fertilizer had to be added "to make the garden flourish."[22] It is obvious that District planners cannot expect the plants used in landscaping Oyster Bay to flourish on inert soil and composted sludge alone.

Conclusion

This paper has explored specific problems in the proposed conversion of the Davis Street sanitary landfill site to Oyster Bay Regional Shoreline. The topsoil, methane, and leachate problems at Oyster Bay have the potential to cause high initial development and continuing maintenance costs for the District. However, a thorough planning effort, timely development, continued monitoring, and careful maintenance procedures will greatly reduce these costs. If the District succeeds in reducing these costs, park development will become feasible at a number of additional shoreline sanitary landfill sites in the East Bay.

References Cited

1. Alameda County, 1977, Solid Waste Management Facilities Plan for Alameda County: Alameda County Solid Waste Management Authority, Hayward, California.

2. Bache, C.A., and others, 1976, Multi-element and Chlorinated Hydrocarbon Analysis of Municipal Sewage Sludges of American Cities: Journal of Environmental Science and Technology, Vol. 10, no. 7, pp. 683-87.

3. Bates, T.E., 1972, Land Application of Sewage Sludge: Ontario Ministry of the Environment, Pollution Control Branch, Toronto, Canada.

4. Baumann, Mike, 1978, oral communication: Assistant Engineer, City of Berkeley.

5. Butler, Leonard, 1978, oral communication: Waste Management Engineer, Regional Water Quality Control Board, Sacramento Office.

6. California Regional Water Quality Control Board, 1977, Minimum Criteria for Proper Closure of Class II Solid Waste Disposal Sites: San Francisco Bay Region, Oakland Office.

7. California Water Resources Control Board, 1976, Waste Discharge Requirements for Nonsewerable Waste Disposal to Land - Disposal Site Design and Operation Information: Sacramento, California.

8. Chian, S.K., 1975, Compilation of Methodology for Measuring Pollution Parameters of Landfill Leachate: Municipal Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

9. City of San Leandro, 1978, Final Environmental Impact Report, Proposed Solid Waste Transfer Station - West End of Davis Street: Community Development Office, San Leandro, California.

10. Crutcher, Lewis, 1978, oral communication: Chief of Planning, East Bay Regional Park District.

11. Dair, F.R., 1977, Methane Gas Generated from Landfills: APWA Reporter, Vol. 44, no. 3, pp. 20-23.

12. East Bay Regional Park District, 1977, Land Use Development Plan and Environmental Impact Report for Oyster Bay Regional Shoreline: Resolution No. 1977-6-181, Oakland, California.

13. _________, 1976, Resource Inventory and Analysis for Oyster Bay Regional Shoreline: Resolution No. 1976-12-357, Oakland, California.

14. Freiberger, A., and Landreth, R., 1976, Gas and Leachate from Landfills - Formation Collection, and Treatment: Proceedings of a Research Symposium at Rutgers University March 25 and 26, 1975, New Brunswick, New Jersey; co-sponsored by the U.S. Environmental Protection Agency and the Department of Environmental Science, Cook College, Rutgers University.

15. Geswein, A.J., 1975, Liners for Land Disposal Sites - An Assessment: U.S. Environmental Protection Agency, Publication No. 530/SW-137, Washington, D.C.

16. Gold, S.M., 1976, Human Response to Vegetation in Parks: Department of Environmental Horticulture, Agricultural Experiment Station, University of California, Davis, California.

17. Goss, J., 1972, Solid Waste Disposal in the S.F. Bay Region: S.F. Bay Region Environment and Resources Planning Study, Basic Data Contribution 49, U.S. Geological Survey.

18. Hilliard, Cathy, 1978, oral communication: Public Participation Coordinator, San Francisco Bay Region Wastewater Solids Study.

19. Hoeks, J., 1976, Pollution of Soil and Groundwater from Land Disposal of Solid Wastes: Institute for Land and Water Management Research, Wageningen, The Netherlands.

20. International City Management Association, 1977, Landfill Siting in Refuse Report, Vol. 3, no. 3, July/Aug./Sept.

21. Javitts, Tom, 1978, oral communication: Consultant, Berkeley Composting Project.

22. League of Women Voters, 1976, Municipal Sludge: What Shall We Do with It? in Current Focus: Washington, D.C.

23. Nichols, John, 1978, oral communication: Planner, East Bay Regional Park District.

24. Pattillo, Christine, 1975, Recreation Facilities on Sanitary Landfills: Some Problems and Solutions: unpublished Masters Thesis, Department of Landscape Architecture, University of California, Berkeley, California.

References Cited

(continued)

25. Powell, Don, 1978, oral communication: Field Engineer, Oakland Scavenger Company, Oakland, California.

26. S.F. Bay Region Wastewater Solids Study, 1978, Draft Wastewater Solids Management Plan for the S.F. Bay Region: Oakland, California.

27. _________, 1977, Composting Demonstration Project - Berkeley Landfill Site: Oakland, California.

28. Stahler, Jim, 1978, oral communication: Environmental Scientist in Resource Recovery, Environmental Protection Agency, Region IX, San Francisco Office.

29. Stevens, D.M., 1966, Refuse Disposal on S.F. Bay - summary of the report, Solid Waste Disposal and S.F. Bay: S.F. Bay Conservation and Development Commission, San Francisco, California.

30. Whitcel, Richard, 1978, oral communication: Environmental Specialist 3, Regional Water Quality Control Board, Oakland Office.

31. Winnicki, Paul, 1978, oral communication: Associate Engineer, San Francisco Bay Region Wastewater Solids Study.