CITY OF SULLIVAN, MISSOURI

SANITARY LANDFILL

DEVELOPMENT REPORT

Prepared for the
State of Missouri
Department of Natural Resources
Division of Environmental Quality
Solid Waste Management Program

Heagler & Marshall
Consulting Engineers
1413 Forum Drive
Rolla, Missouri

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364-2215

DEVELOPMENT AND OPERATION REPORT

CITY OF SULLIVAN, MISSOURI

SOLID WASTE LANDFILL

SCOPE: It is the intent of this report together with the attached plans to provide the basis for the approval of the State of Missouri, Department of Natural Resources, Division of Environmental Quality, Solid Waste Management Program, of the present and future operation of the City of Sullivan, Missouri's Solid Waste Landfill and the issuance of an operating permit for this facility.

BACKGROUND INFORMATION: The Sullivan Landfill Operation is located in the $SW\frac{1}{4}$ of the $NE\frac{1}{4}$ of Section 3, Township 40 North, Range 2 West, Franklin County, Missouri on a 260 acre tract purchased by the City of Sullivan in the 1960's to provide a location for landfill purposes and a future site for sewage treatment plant construction. The area presently allocated for landfill purposes encompasses 40 acres laying immediately South of the Northwest corner of the total tract. Entry to the site is provided by an all-weather, gravel surfaced county road extending east slightly over $\frac{1}{4}$ mile from old U.S. Highway No. 66. The landfill site is approximately two miles North of the North City Limits of the City of Sullivan and one-half mile North and one-fourth mile east of the Northeast corner of the Village of Oak Grove, City Limits.

The operation of this landfill was started in October, 1970, and has continuously proceeded since that time. Approximately five acres of the site has been filled and covered during this period. A new disposal cell has been opened immediately East of the completed cell, consist-

ing of the deepening and widening of a ravine type section in which waste is off loaded from the top against a face approximately fourteen foot in depth and sixty foot in width.

A hard surfaced, all weather road, extends along the West side of the Landfill Site from the county road to a point about midway of the fill area with a gravel surfaced access road branching to the disposal face. The gradient and surface of these roads provide all weather access to the disposal face. A ten foot wide gravel surfaced road branches off the main access road to the service area.

Service facilities include a 20' X 30' equipment storage shed and a remodeled bus serving as an office.

The site is well fenced along property lines and access from the county road is controlled by locked gates of solid construction.

The site is open for operation five days per week from 9:00 A.M. to 5:00 P.M. and is closed on each Wednesday and Saturday.

Present operating personell consists of one full time equipment operator and one part time labor generally working on general cleanup each Saturday.

The landfill provides for the complete disposal of all material collected within the City of Sullivan by a contracted pickup service under the provisions at City Ordinance No. 1115. City

residents are permitted to personally haul additional waste to the site at no additional charge. Non-residents are permitted to use the site by payment of $.50 per cubic yard averaging $.50 per car and $1.00 to $1.50 per pickup truck load. The site is also used by the Bourbon, Missouri Shoe factory and by the Meramec State Park Administration. Industrial waste collected in the City of Sullivan, Missouri includes plastic shoe lathes, metal cuttings, and cardboard packing. Records are kept of all deliveries to the site by the operator and filed at the City Clerk's office.

Operating equipment consists of the full time use of a 1973 model, International 175 front end loader in good condition. When required, the City street department furnishes 3 additional dump trucks, a motor grader and a John Deere Model 400 front end loader.

Water is available on the site in limited quantities and is provided by a small water line extending from a farm well located at the original farm house on this property. This house is approximately 1000 feet East of the site equipment shed. This supply is adequate for personell use and to extinguish small fires. Earth cover for dampening fires or the services of the cities fire department would be required for any large blaze.

1. WASTE GENERATION

The records of deliveries to the Sullivan Landfill Site during 1975 have been tabulated as follows: The amounts shown represent the City charge of .50/cu. yd.

MONTH	TRUCKS	CARS	PICK UPS	MONTHLY TOTAL
December '74	$1,193.50	8.00	88.00	1,289.50
January '75	980.50	6.50	108.00	1,095.00
February '75	867.50	7.00	106.00	980.50
March '75	916.50	9.00	129.00	1,054.50
April '75	1,252.50	8.00	192.00	1,452.50
May '75	1,394.00	11.00	192.00	1,597.00
June '75	1,433.00	10.50	192.50	1,636.00
July '75	1,444.00	5.50	185.00	1,634.50
August '75	1,273.50	12.00	200.00	1,485.50
September '75	1,247.00	6.50	161.00	1,414.50
October '75	1,452.50	7.00	167.00	1,626.50
November '75	1,224.50	4.00	125.00	1,353.50
Yearly Total	14,679.00	95.00	1,845.50	16,619.50

In addition to the quantities tabulated above must be added the personal delivery to the site by city residents who pay no charge for this service. The operator estimates an average of 5 such deliveries per working day and a volume of 3 cu. yds. per day. With the site open for 260 days/year, this volume would amount to 780 cu. yds. per year. Records are not available to breakdown the origin of the total waste volumes as shown in the above tabulation, but the operator has estimated that during the five years of operation at the site, 60% of all deliveries originate in the City of Sullivan and 40% of the volume is from outside sources. Averaging all delivered waste at 500 lb./cu. yd. indicates a yearly total delivery of 17,000,000 lbs. or 10,200,000 lbs. for the City of Sullivan and 6,800,000 lbs. from the outside sources. Using an estimated 1975 population of 5,500 people

this would indicate a per capita/daily volume of 5.2 lbs. for the City of Sullivan, which is comparitive to estimated loads as derived from U.S. Environmental Protection Agency reports and studies.

Assuming compacting the waste to 1000 lbs./cu. yd., the loading to the landfill operation would be 8,500 cu. yds./year occupying 5.27 acre feet. Based on a solid waste to dirt ratio of 3:1 it will require 1.76 acre ft. of soil cover annually and a total volume of 7.03 acre ft. of the land fill capacity per year with no increase in present annual delivery of waste to the site.

2. PLANNED CAPACITY

a. Present Ravine Fill:

The present ravine fill operations are being phased out and will not be continued. Present operations provide for a shallow fill in the present east ravine section as shown on the attached landfill layout map. No excavation in this ravine will be permitted and present landfill material will receive a two foot deep dirt cover, graded for drainage, seeded and fertilized.

b. Proposed Trench Cells:

Future operations are planned as trench cells located on the North side of the East-West trending ridge referred to in the attached geologic report. Proposed cross sections of these trenches are attached to the landfill layout plan. Excess excavated dirt from these trenches will be used on the site to provide finished contours as shown on plans.

c. Industrial Waste Cell:

An Industrial Waste Cell has been excavated in an East-West direction along the ridge section of the site. Barium Chromate sludge from the Ramsey Corporation plant located in Sullivan, Missouri is being sealed in steel barrells and placed in this trench. This procedure will cease as soon as arrangements can be made to haul this material to an approved regional industrial waste site.

d. Soil Studies:

Atterberg limit tests to determine the nature of the soil in the trenches, the liquid limit, plastic limit and plastic index. Hydrometer tests were also performed to determine the amount of clay size material in the trench soil The results of the above mentioned tests as follows:

1. Liquid Limit = 80%
2. Plastic Limit= 23.8%
3. Plastic Index= 56.2%

Hydrometer tests indicate that the soil contains 40.5%-2 micron clay size with the balance being fine sand and silt. The activity coeficient of the clay fraction is quite high ludicating the probable presence of some Montmorillonite clay minerals.

$$\text{Activity coeficient} = \frac{PI}{\% \text{ Clay}} = \frac{56.2}{40.5} = 1.4$$

The permeability of the soil tested will range from 10^{-7} to 10^{-8} cm/sec which is practically impervious to movement of water or leachate from the trench. This information and that contained in the Addendum to Sullivan Landfill Report, by Thomas J. Dean, Geologist, Missouri Geological Survey, indicates that the trench as located should be satisfactory for the disposal of solid waste without padding the trenches. Copies of Soil Lab Tests and Mr. Deans Addendum to his

(Con't.)

Geologic Report follow.

e. Tabulation:

$\frac{33.55}{7.03}$ = 4.77 years capacity at present annual use.

f. Conformance with Engineering Geologic Report:

It is proposed that the development of the above outlined solid waste fill will conform to all recommendations of the following Engineering Geologic Report and that planned elevations will be varied as required to provide proper cover over rock formations.

3.

SOLID WASTE SITE-ENGINEERING GEOLOGIC REPORT

Missouri Geological Survey and Water Resources
Box 250, Rolla, Missouri 65401 (314) 364-1752

1. Project Sullivan Landfill County Franklin Date _____
2. Owner City of Sullivan Address _____
3. Location ¼ SW ¼ NE ¼, sec. 3, T. 40, R. 2 W Quad. Sullivan
4. Site Investigation requested by Heagler & Marshall Engineers
5. Is this original _____ or repeat x investigation; when 4/1/74
6. Type of refuse (if known) chemical _____, individual _____, household _____
   Demolition _____.
7. Sketch and/or brief location description:

   Site of existing landfill 2 miles northeast of Sullivan.

   (to be filled in where applicable by the geologist making the investigation)

8. This site has: no geologic limitations _____; slight geologic limitations _____
   moderate geologic limitations x; severe geologic limitations _____.
9. Topography: flat ___, moderate slope x, steep slope ___.
   On: prairie ___, hilltop x, hillslope x, narrow ravine ___,
   broad valley ___, floodplain ___, terrace ___.
10. Field Evaluation:

    a. Type and condition of bedrock Sandstone of Roubidoux formation on west side - dolomite of Jefferson City formation on east side. Some Pennsylvanian age sandstone.

    b. Type and engineering characteristics of soil Very plastic clay on ridge area and east side. Silt and sandy clay on west side.

    c. Is there suspected danger to groundwater supplies _____? If yes what _____
    Southwest side has sandstone that could contribute leachates to surface and groundwater. See recommendations.

11. General Geologic Setting:

High plateau area on edge of rugged topography to the east. Fringe area of surface drainage to Meramec caverns and other numerous other caves and springs to the east. Sandstone of the Roubidoux formation is the parent bedrock of the area. The high areas have a thin cap of dolomite remaining over the sandstone (above 900 elevation on site plan on east side - above 800 on west side). A plastic clay is present over the dolomite as indicated in test pits. The sandstone in the southwest portion has from 4-6 feet of silty sandy clay over bedrock. This soil is permeable when remolded. Numerous old sinks exist in the general area with I on the site. These sinks are soil slumps into joints of the sandstone where the dolomite has been eroded from the sandstone rather than solution activity (caves) in the dolomite.

12. Exploration Recommendations: None.

Recommend that if the wooded area in the southwest portion below elevation 800 is used that it be designated a fill area only with no cut. The thin soil over sandstone should not be removed, as the sandstone is permeable. The small area on the east side below elevation 900 also has very thin soil over sandstone. Recommend this area not be utilized. Recommend in the majority of area that minimum of 2 feet of clay be left over the dolomite.

The small sink depression near the center of the area is not thought to constitute a hazard to groundwater. This cannot be verified however, so recommend it be used only for demolition debris.

13. Review of plans regarding recommendations above requested _____.

THIS REPORT IS VALID ONLY AT THE ABOVE LOCATION AND BECOMES INVALID ONE YEAR AFTER THE DATE OF ISSUANCE.

Missouri Geological Survey report by Thomas J. Dean, Geologist, 1/20/76 Date

RECEIVED
JAN 21 1976
BUREAU OF SOLID WASTE MANAGEMENT

ADDENDUM TO SULLIVAN LANDFILL

FRANKLIN COUNTY, MISSOURI

LOCATION: SW¼, NE¼, Sec. 3, T. 40 N., R. 2 W., Sullivan Quadrangle.

The east-west trending ridge or high area of the landfill site separates two distinct geologic settings in a short horizontal distance. The southern portion of the existing operating landfill site is in sandstone of the Roubidoux Formation while on the north side of the ridge, Pennsylvanian aged sandstone, clay and shale are present overlying the sandstone of the Roubidoux.

Two 50 foot wide by several hundred feet long trenches have been excavated to the Pennslyvanian material on the north side of the ridge. The multi-colored clays, shales and sandstone that were exposed are very impermeable both vertically and horizontally because of discontinuity of the individual beds or zones. From trench to trench the lithology, be it sandstone or clay, will change. The fireclay type setting on the north side of the ridge probably extends to the east toward the pond area and beyond. Backhoe test pits as indicated in the original report encountered the Pennsylvanian aged type material adjoining sandstone outcrops.

The soils vary from 8 to 10 feet near the ridgetop on the south end of the trench area to a very thin soil on the north end where the trenches daylight on the surface. The dip of the rock will tend to be to the north so leachates, if they develop, will tend to move at the soil-fireclay contact to the north and would most likely daylight on the north end of the property at some future date.

Several large massive sandstone boulders will be encountered as the trenches progress to the east. These boulders will be surrounded by impermeable material and will be a nuisance rather than a geologic or groundwater hazard.

No padding of the Pennsylvanian aged material is necessary to prevent downward movement of water as the material itself is relatively impermeable. For construction purposes, the material would probably be considered bedrock but in the geologic sense it is not bedrock but a residue of a formation that was once present that is now preserved in low spots and in the underlying bedrock.

In summary, no groundwater contamination problems would be expected on the north side of the east-west trending ridge.

Thomas J. Dean, Geologist
Applied Engineering & Urban Geology
Geology & Land Survey
June 24, 1977

orig: Bob Marshall
Heagler & Marshall
cc: John Doyle, Jeff City

HYDROMETER ANALYSIS

SAMPLE Sullivan Landfill DATE 7/25/77

TARE NO ____ WT AIR DRY SOIL + TARE ____ WT. DRY SOIL + TARE 50.76g WT. WATER ____

WT. TARE 7.61g WT. DRY SOIL 43.15g AIR DRY WATER CONTENT, w_a ____

WT. AIR DRY SAMPLE ____ WT. SOLIDS, w_o ____ MENISCUS CORRECTION, c_m .5

DISPERSING AGENT USED Calgon QUANTITY 4g DISPERSING AGENT CORR, c_d 4

CLOCK TIME	ELAPSED TIME MIN	TEMP °C	HYDROMETER READING (R')	MENISCUS CORRECTED HYDROMETER READING (R)	EFFECTIVE DEPTH (H_R) CM.	PARTICLE DIAMETER (D) MM.	TEMP CORRECTION (M)	R+C_D+M	PERCENT FINER	
									PARTIAL	TOTAL
	1	29	26	26.5	9	.0257	+2.1	34.6	53.2	
	2	29	24	24.5	11.7	.0185	+2.1	32.6	47.9	
	4	29	24	24.5	11.7	.0134	+2.1	32.6	47.9	
	8	29	23	23.5	12.2	.0094	+2.1	31.6	45.3	
	15	29	22.5	23	12.4	.0071	+2.1	31.1	44.3	
	30	29	22	22.5	12.6	.0075	+2.1	30.6	43.1	
24hrs →	1440	29	21	21.5	10.7	.0011	+2.1	19.1	40.5	

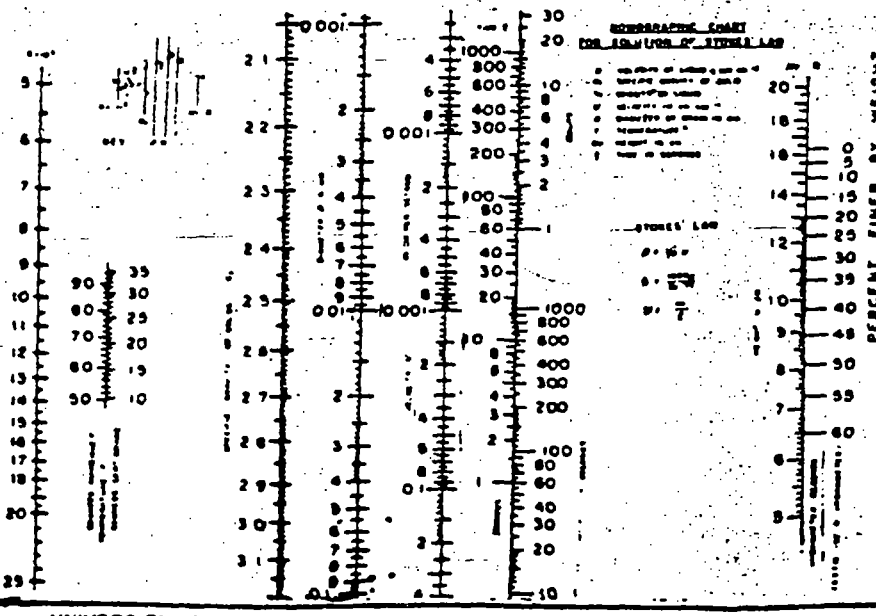
TEMPERATURE (°c)	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5	26.0	26.5	27.0	27.5	28.0	28.5	29.0
TEMP. CORR. (M)	+0.2	+0.3	+0.4	+0.5	+0.6	+0.7	+0.8	+0.9	+1.0	+1.1	+1.3	+1.4	+1.5	+1.6	+1.8	+1.9	+2.1

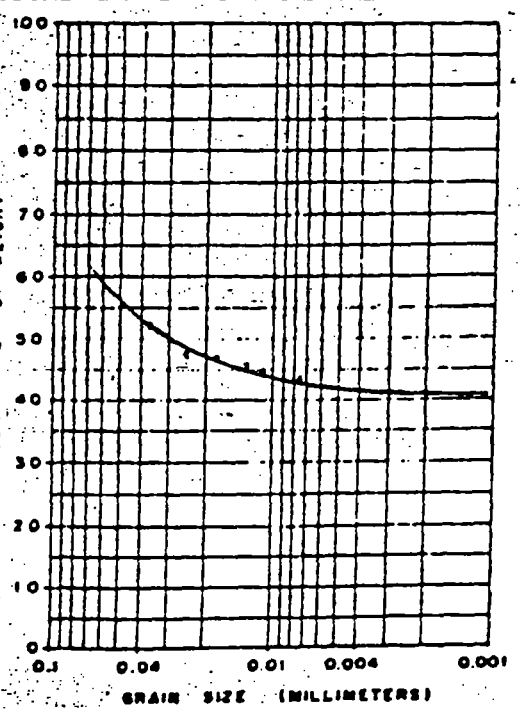
WT. COMBINED ANALYSIS SAMPLE, w_s ____

SPECIFIC GRAVITY OF SOLIDS 2.65

PARTIAL PERCENT FINER = $\frac{100}{w_o}(R - C_D + M)$

TOTAL PERCENT FINER = $\frac{w_o}{w_s}$ x PARTIAL PERCENT FINER

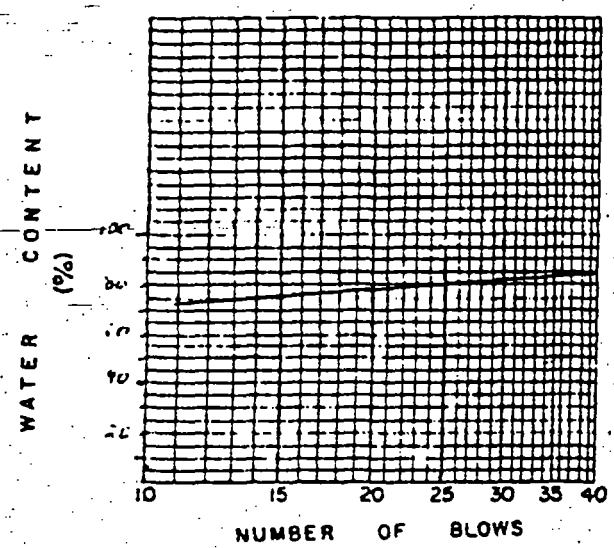




ATTERBERG LIMITS

SAMPLE Sullivan Landfill DATE 7/28/77

LIQUID LIMIT							NATURAL WATER CONTENT	
TRIAL NO.	1	2	3	4	5	6	1	2
TARE NO.	"8"	"HM"	"AB"				"A"	
WT. WET SOIL + TARE	9.86g	6.58g	9.04g				139.28g	
WT. DRY SOIL + TARE	6.07g	4.27g	5.49g				126.66g	
WT. WATER	3.79g	2.31g	3.53g				12.66g	
WT. TARE	1.40g	1.41g	1.33g				3.71g	
WT. DRY SOIL	4.67g	2.86g	4.16g				122.85g	
WATER CONTENT (w)	81.2%	80.8%	84.9%				10.3%	
NUMBER OF BLOWS	26	34	32					



SHRINKAGE LIMIT

SHRINKAGE DISH NO.	
WT WET SOIL + DISH	
WT. DRY SOIL + DISH	
WT. WATER	
WT. SHRINKAGE DISH	
WT. DRY SOIL (W_S)	
WT. SHRINKAGE DISH + H_G	
WT. H_G IN SHRINKAGE DISH	
WT. PETRI DISH + H_G	
WT. PETRI DISH	
WT. H_G IN PETRI DISH	
VOL SHRINKAGE DISH (V_O)	
VOL. DRY SOIL (V_S)	
$V_O - V_S$ (V_D)	
(V_D / W_S) X 100 (Q)	
WATER CONTENT (w)	
SHRINKAGE LIMIT - SL (w-Q)	
SHRINKAGE RATIO - R(W_S / V_S)	

PLASTIC LIMIT

TRIAL NO.	1	2	3
TARE NO	"R-2"	"M-5"	
WT. WET SOIL + TARE	1.84g	2.17g	
WT. DRY SOIL + TARE	1.79g	2.05g	
WT WATER	.12g	.17g	
WT. TARE	1.40g	1.41g	
WT. DRY SOIL	.39g	.64g	
WATER CONTENT (w)	25.6%	21.9%	

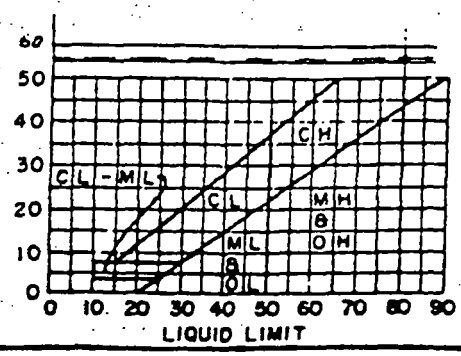
LIQUID LIMIT 50

PLASTIC LIMIT 23.8%

PLASTICITY INDEX 56.2

SHRINKAGE LIMIT

CLASSIFICATION CH



4. PROPOSED OPERATIONAL PROCEDURES

It is proposed that the City adopt and enforce the following rules and regulations for the operation of this landfill.

a. Solid Waste Accepted

Solid Waste Material accepted for disposal shall not include the waste materials excluded in Section 2.20 "The Missouri Solid Waste Management Law," including hazardous wastes, bulk liquids, semisolids, sludges containing free moisture, highly flammable or volatile substances, unexpended pesticide containers, pesticides, raw animal namure, septic tank pumpings, raw sewage sludge, and industrial process sludge.

b. Satisfactory Compliance:

—If wastes requiring special handling are proposed to be received in the future, a proceedural plan for disposing of these wastes will be submitted to the MDNR for approval before such wastes are accepted.

c. Satisfactory Compliance: Operations

The landfill shall be operated using approved routine techniques for spreading and compacting solid wastes including compaction of the waste as received evenly in shallow layers on the slope face by repeated travel of equipment over the layers until a uniform depth of two feet has been attained or the entire days deliveries have occurred after which the waste will be covered with at least six inches of compacted, suitable earth cover. At completion of cell filling, the entire surface of the cell area shall be given a final cover of 2 feet of compacted earth so graded as to prevent ponding of surface water, provide proper

drainage, minimize the escape of odors, prevent rodents from burrowing, provide for control of gas and provide an aesthetically acceptable finished site. The operator shall erect temporary fencing placed near the working area to control blowing litter and shall police the site daily to minimize the scattering of solid waste. The operator shall not permit salvaging operations at the site or the accumulation of salvage material. The operator shall maintain the site access road to provide for all-weather delivery to the face of the disposal cell and shall arrange with the street department of the city for the use of alternate equipment in case of breakdown of Land Fill equipment. Operator shall establish a routine schedule of inspection and maintenance to insure full operational use of equipment under normal conditions.

The operator shall maintain signs at the site entrance that clearly indicate the purpose of the operation, the owner of the site, hours of operation, materials accepted or excluded, instructions for after hour delivery, fee charges and emergency telephone numbers.

The operator shall make periodic volumetric surveys determining the increments of deposited solid waste in comparison with the recorded delivery tickets to permit the use-rate and remaining capacity of the site to be evaluated. These surveys shall be made each 30 days of operation.

The office at the land fill site will be provided with telephone service to promote better performance and to request assistance in case of emergencies. A suitable sanitary toilet facility will be provided for use of employees and existing water service will provide handwashing facilities in the existing equipment storage building and to provide drinking water and site watering facilities.

The operator shall control and restrict the unloading of solid waste to an area where the material can easily be incorporated into the working space with available equipment and to balance the average daily unloading with the size of the working fact to avoid delays and unnecessarily exposure of solid waste.

The operator shall have or had an adequite supply of hose connected to the domestic water supply to provide for extinguishing small fire, shall maintain a stockpile of earth reasonably close to the working face to smother fires and suitable chemical fire extinguishers at all buildings and on all equipment. Arrangements shall be made for emergency service from the City of Sullivan, Fire Department.

The operator by proper earth covering and daily litter clean-up shall control conditions to discourage the production of insects and rodents. If these measures do not provide adequate vector control, he shall institute a supplemental program including spraying, etc. to quickly eliminate this problem.

The operator shall grade the site during cell construction and after final cover has been placed so as to minimize run off into the land fill, prevent erosion, avoid surface puddling and blend the completed surface into the surrounding area and the drainage from such area.

The operator shall operate the landfill in conformance with the overall plan and design and shall maintain daily logs to record such operational information as to type and quantity of solid waste

received, type and volume of cover material used, portion of the site used and deviations from plans and specifications. A copy of the original plans and specifications, a copy of the daily log and a plan of all completed landfill shall be kept on file by the City Clerk.