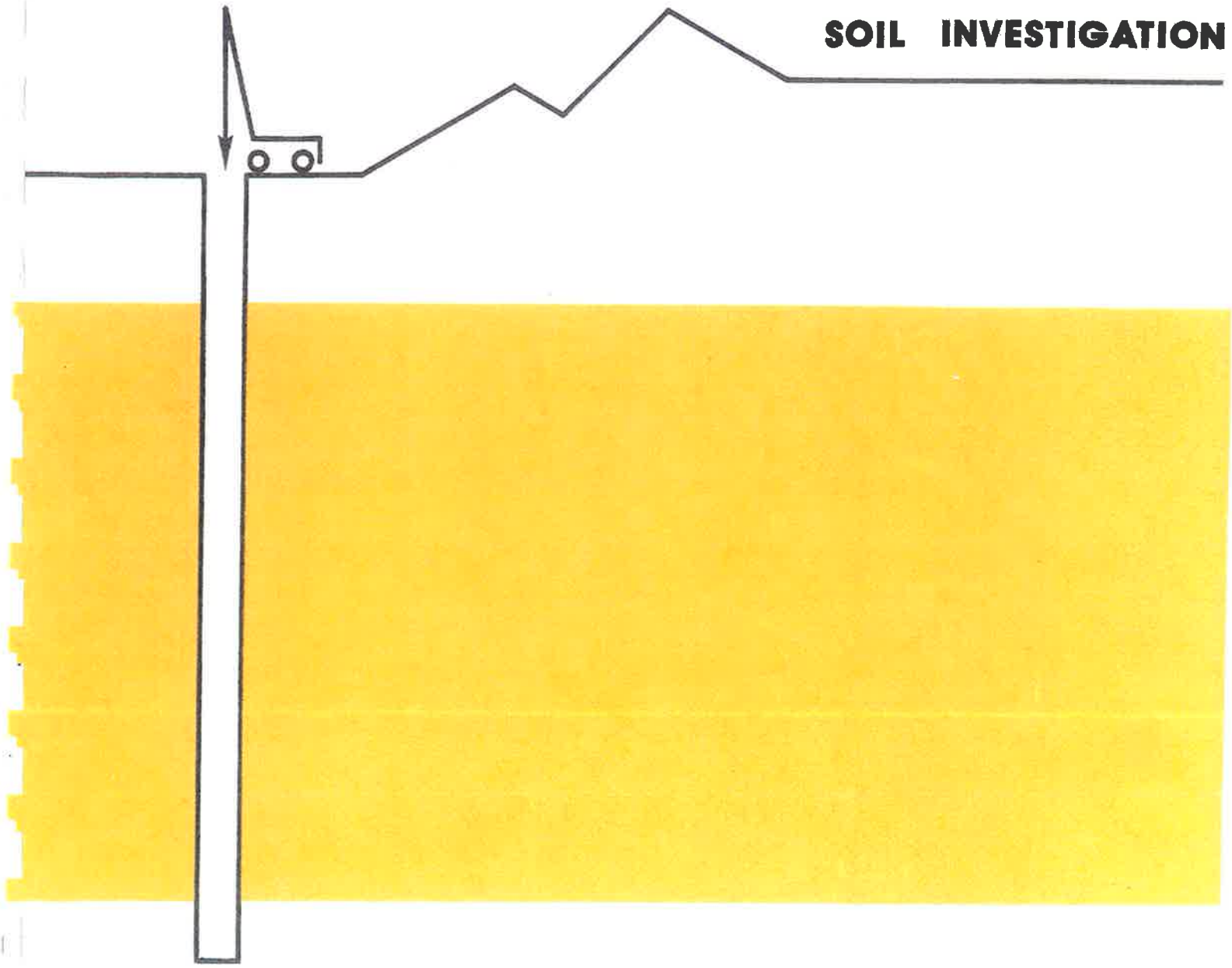
SOIL INVESTIGATION



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Chelan County PUD #1 Commisioners
c/o The DOH Associates
500 Doneen Building
Wenatchee, Wa. 98801

Dec. 2, 1981.

Job Number: S81127

Attn: David O. Harris

PROJECT: Wenatchee Riverfront Park
Wenatchee, Wa.

SUBJECT: Soil and Gas Generation Investigation

Gentlemen:

As requested, we have performed the subject investigation in conjunction with Dr. Kenneth E. Hartz PE, who specializes in Landfills and Methane Generation. The results of our investigation are herewith transmitted.

If any questions should arise regarding the interpretation of the contents of this report, please feel free to contact us for clarification. Specifically, we would welcome the opportunity of reviewing plans and specifications to assure proper incorporation of these recommendations.

It has been a pleasure serving you on this project, and we look forward to the opportunity of assisting you with future endeavors.

Respectfully Submitted
BUDINGER AND ASSOCIATES

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C O N T E X T

1.0 This report presents the results of a soil and gas generation investigation for the proposed Wenatchee Riverfront Park to be constructed along the west side of the Columbia River, between 5th and Orondo Streets in Wenatchee, Washington.

1.1 SCOPE

The field and laboratory investigations contained in the following pages of this report were performed in accordance with generally accepted geotechnical and environmental engineering practices, as outlined in our proposal of 10/26/81. Specifically included are the following engineering evaluations and recommendations:

- Depth & Extent of Surface Cap
- Composition of Soils
- Bearing Strata
- Allowable Bearing Pressures
- Estimated Settlements
- Earthwork Procedures
- Slope Stability
- Lateral Earth Pressures
- Composition of Fill
- Nature of Gas Generation
- Control of Gas Emissions
- Monitoring of Gas Emissions
- Rate of Gas Generation

1.2 STRUCTURAL CONSIDERATIONS

Proposed is the construction of a public park, incorporating numerous plantings, pathways, interpretive displays, and restroom facilities. It is anticipated that foundation loading for the planned facilities will be relatively light, and will not exceed the following:

	MAXIMUM LOAD
Walls	1 klf
Columns	10 k

Some modification of the existing boat ramp is anticipated, as well as construction of paved access roads for maintenance and pedestrian traffic.

The above information was obtained through conversation with the design architects (DOH Associates, Dave Harris), and the Chelan County PUD Interpretative Specialist (Tom Vetter).

1.3 SITE LOCATION

The subject site is situated east of downtown Wenatchee, Washington along the bank of the Columbia River. Specifically, the site trends north to south from 5th Street, extending 1 block beyond Orondo Street to the south. The site is bounded along its western margin by a series of buildings comprising a sewage treatment plant, food processing plant, City Public Works buildings and a steel fabrication plant.

ENCOUNTERED CONDITIONS

2.1 GEOLOGIC SETTING

During the Miocene Epoch (12 million years ago), a series of volcanic events extruded lava from fissures in the earth's crust over an existing topography of Precambrian (over 600 million years old) granitic and sedimentary rocks. These lava flows comprise what is referred to as the "Columbia River Group", and vary in thickness from several feet to several hundred feet. In some areas, the total thickness of the Columbia River Group exceeds 10,000'. The Columbia River Group basalts were later uplifted and tilted to the southwest during an episode of orogeny in the Pliocene Epoch (10 million years ago).

The Columbia River has maintained its channel in these basalt layers during the orogeny; its channel widening considerably, due to the wasting of slopes along its banks. The site occupies what formerly was a low velocity environment within the Columbia River channel, which allowed deposition of silt, clay and fine sand within its margins. Glacial flooding covered many portions of the Wenatchee Valley with gravel, cobbles, and boulders. Underlying the alluvial gravel and fine sands is a friable sandstone of moderate induration.

2.1.1 Surface Winds Surface winds at Pangborn Field near East Wenatchee, on a terrace above the river valley, generally trend from the northwest at 5-10 mph. It is reasonable to assume that some turbulent disruption will occur as the wind travels from the escarpment into the Columbia River Valley at Wenatchee, as well as some redirection alligning the winds north-south within the valley walls. During the summer months, some days of stagnant air conditions, combined with high temperatures occur.

2.2 SURFACE CONDITIONS

The surface of the site comprises a relatively level parcel surfaced with gravel. The eastern margin comprises a steep bank dropping approximately 25' to the waters of the Columbia River. Along its western margin, the site is occupied by several buildings owned by the City of Wenatchee Public Works Department, an asphalt parking lot for City machinery and vehicles, and a small gravel pit and storage area operated by the City of Wenatchee. At its southern end, there is a community boat ramp.

2.3 SITE HISTORY

The subject site was used as a refuse dump periodically from approximately 1930 to 1972. During this time, refuse was discarded along the river bank (in what at the time was a bog). For sometime this refuse was incinerated prior to placement in the landfill, however, this practice was later discontinued. After seasonal high fluctuation of the river level and subsequent erosion of the refuse, a dike was constructed of boulders and concrete construction debris, thereby establishing the eastern margin of the site. According to available records, in 1972 the placement of refuse was discontinued, and the surface of the site graded with 3'-5' of silty sand.

A steel building erected for the City Sanitation Department on the refuse dump prior to 1970, has experienced approximately 1'-2' of differential settlement due to consolidation/degradation of the refuse material upon which it bears. It is evident that the rise in pool elevation caused by modification of Rock Island Dam, inundated portions of the landfill comprising organic solids, thus providing an ideal medium for decomposition/degradation, and subsequent generation of methane and carbon dioxide. The above information was derived through conversation with the Assistant Director of Public Works of the City of Wenatchee, and several Public Works employees (Norm Delabarre, et.al.).

2.4 SUBSURFACE CONDITIONS

The subsurface soils are very similar to those described under "Geologic Setting" and "Site History". Those are a sandstone bed, and flood and slackwater river deposits, overlain by refuse and a blanket of cover soil. For design purposes, the materials encountered can be considered to comprise 7 Strata, described as follows and referred to henceforth by number.

Stratum 1. Silty Sand Cover Soil This Stratum varies in thickness across the site from 2'-5'. Placed as a blanket of cover soil, this material comprises silty sand with a trace of gravel. It is moderately high in shear strength, relatively low in compressibility, has relatively low permeability and is moderately frost susceptible.

Stratum 2. Organic Refuse The refuse Stratum comprises domestic and some industrial refuse consisting of styrofoam sheeting, wire, concrete blocks, paper, stoves, old car bodies, cardboard packing material, asphalt concrete, etc. Although compacted when placed, this refuse is susceptible to subsidence as its constituents decay. During such decay, methane gas generation will occur. For construction purposes, this material should be considered as having very low shear strength, high compressibility, high permeability, and a potential for volumetric change as decay/decomposition occurs.

Stratum 3. Cinder Fill The cinder fill comprises the non-combustible fraction of organic refuse deposited in the landfill after incineration. It possesses moderate shear strength, low compressibility, and is relatively impermeable. As such, this material is reasonably well suited for the support of light structures.

Stratum 4. Inorganic/Non-Combustible Refuse This Stratum was placed presumably during sidewalk renovation and demolition of old buildings during new construction phases. The material has been placed in the form of a dike extending north to south along the eastern perimeter, and as rip-rap along the river bank. Occasional lenses of this material were noted intermingled with the refuse, and underlying the cinders. They are differentiated because of their distinct lack of organic material. This material possesses high shear strength, low compressibility, and high permeability. It should be noted however, that concrete construction debris frequently traps many voids during placement, that can allow subterranean erosion/migration of soils, thus causing subsidence or undermining of structures within close proximity.

Stratum 5. Sewage Sludge This material comprises a sandy silt-type material, possessing moderate shear strength, slight cohesion, high compressibility, and is relatively impermeable. Within the sandy silt matrix, wood fibers and other organics were frequently noted. As such, this material has the potential for subsidence as a result of the decomposition of its organic constituents, as well as overall consolidation due to its overlying surcharge.

Stratum 6. Native Soils Underlying the site at depth are native flood and slackwater deposits comprising clayey silt with some sand to the north, and sandy gravel to the south. This Stratum should not be greatly affected by the structural or surcharge loads of the park development. The gravels possess high shear strength, low compressibility, moderate permeability, and are relatively non-frost susceptible.

Stratum 7. Sandstone Bedrock The sandstone encountered in test boring #9 is slightly indurated and friable. As such, excavation of this material can probably be effected through ripping. It possesses high shear strength, low compressibility, and is essentially impermeable.

2.5 GROUNDWATER

Free groundwater was encountered in test borings extending below river level. As the pool elevation of the Columbia River adjacent to the site varies, it should be anticipated that the high permeability of the solid waste materials will allow the groundwater elevation beneath the site to vary similarly.

Because the pool elevation is well controlled by Rock Island Dam, it is anticipated that the fluctuations incurred will have little or no direct effect on footings of restroom facility structures within the proposed park. Fluctuation in the surface of free groundwater will however, have significant import on the rate of decomposition of domestic refuse materials within the fill. An increase of

decomposition induced by fluctuating water level could, therefore, conceivably produce increased methane gas volumes, as well as some subsidence of the surface due to the volumetric changes of decomposing material. Thus, water level fluctuation could possibly have an indirect effect on structures. Rapid drawdown could have an adverse effect on saturated, fine-grained soil slopes. If drawdown is severe, significant imbalance and possible slope failure could occur.

C O N C L U S I O N S

3.0 Based upon the results of the field and laboratory investigations contained in the following pages, we conclude that the site can be made acceptable for the proposed City Park, if proper precautions and preparations are incorporated in the design. The continuous decomposition of landfill materials underlying the site present two significant problems. These are the generation of methane and carbon dixoide as solid waste is subjected to decomposition, and the decrease in volume accompaning this decomposition.

While the increased risk of disruption of structures must be accepted in constructing on a site such as this, these risks can be minimized by locating structures over areas of most dense fill, or fill comprising inert materials. As methane generation is continuous in nature, a means of constantly releasing accumulated methane is necessary to reduce the possibility of collecting explosive concentrations of gas above ground.

Initial plantings should not be adversely affected by methane generation unless roots penetrate the refuse/cover soil interface. This negative effect should diminish within 5-10 years, such that vegetation with deeper penetrating roots may prove acceptable.

3.1 GAS GENERATION

It is evident from laboratory testing, that the solid waste has undergone a major degree of decomposition and has become relatively stable. Following the procedures theorized by Pacy[2] and quantified by Hartz[3], Table 2 tabulates the projected rates of methane generation and total methane potential. Methane potential deals with the total production capability for gas generation, while methane generation indicates the velocity of gas production.

The landfill has been subdivided into 5 segments, each segment representing a different rate of methane generation. The segments total productions were then accumulated after their respective rates were averaged from a yearly and daily rate standpoint. Air dillution of the methane was then calculated for the first foot of space above the soil surface. Above this level, air mixing generally causes gaseous emissions to be dilluted. This approach is generally a conservative one, in that if explosive conditions are not reached in the first foot of air space above the landfill, such conditions will not be reached. As the methane will diffuse upward, causing lower concentrations and thus less hazardous than calculated herein, the approach used has an inheirant safety factor associated with it.

TABLE 1

SOLID WASTE ANALYSIS
RIVERFRONT PARK LANDFILL
WENATCHEE, WASHINGTON

BORING	DEPTH	% MOISTURE [1]	% VOLATILE SOLIDS [2]
1	9 FT.	5.7%	3.1% *
2	13 FT.	12.0%	7.4%
3	7 FT.	23.5%	31.1%
4	9 FT.	15.3%	7.1%
5	5 FT.	13.1%	6.8%
6	9 FT.	14.8%	17.6% *
7	19 FT.	17.4%	6.9%
8	20 FT.	44.1%	17.6%
10	18 FT.	19.6%	7.7%
12	15 FT.	19.4%	3.8%
23	14 FT.	36.2%	23.5%

* INDICATES LARGE QUANTITY OF STYROFOAM PLASTIC.

1. REPORTED ON A TOTAL WET WEIGHT BASIS.
2. REPORTED ON A DRY WEIGHT BASIS.

Table 3 presents a compilation of these calculations, and Figure 1 graphically displays the main concentration as a function of wind velocity. The wind vector has been assumed to be either north or south (a least favorable condition for methane hazard), in order to maintain a conservative viewpoint.

From Table 3, it can be seen that a sustained wind of essentially calm conditions, with no diffusion of methane into the air above, must be encountered within the first year in order for hazardous conditions to be approached. The likelyhood of these conditions existing appears to be remote. Such true calm wind conditions would most likely only be encountered during summer, together with high intensity sunlight. As such, significant dillution of methane and a subsequent reduction of hazard potential would occur as the heated soil would rapidly diffuse gas passing through it into the air mass above.

Methane generation rates should be low, and decrease with the passage of time to extremely low levels. Due to the sporatic nature of generation, and the relatively low rate, it is unlikely that "tiki" style burners will need to be implemented to burn off the landfill emissions. Rather, the generated gasses can probably be adequately vented with venting/monitoring wells.

To assure that gas pressure does not increase within the landfill causing lateral migration of generated methane, and possible build-up to hazardous levels, the installation of additional gas venting/monitoring wells will be necessary. Where such wells might prove awkward to design or space utilization, venting can be routed to a more suitable location. Those areas designated as segments III and IV, have a high methane generation rate relative to other portions of the site. As such, great care should be taken to assure adequate venting within these segments.

TABLE 2

METHANE GENERATION
RIVERFRONT PARK LANDFILL
WENATCHEE, WASHINGTON

BORING	GENERATION RATE [1]	TOTAL POTENTIAL [2]
1	0*	.12
2	.03	.29
3	.59	1.24
4	.02	.28
5	.02	.27
6	.27	.70
7	.03	.27
8	.27	.70
10	.04	.31
12	0*	.15

* GENERATION RATE TOO LOW TO BE DETERMINABLE.

1. CUBIC FEET OF METHANE PER INPLACE POUND CALCULATED FOR YEAR 1982.
2. CUBIC FEET OF METHANE PER IN PLACE POUND.

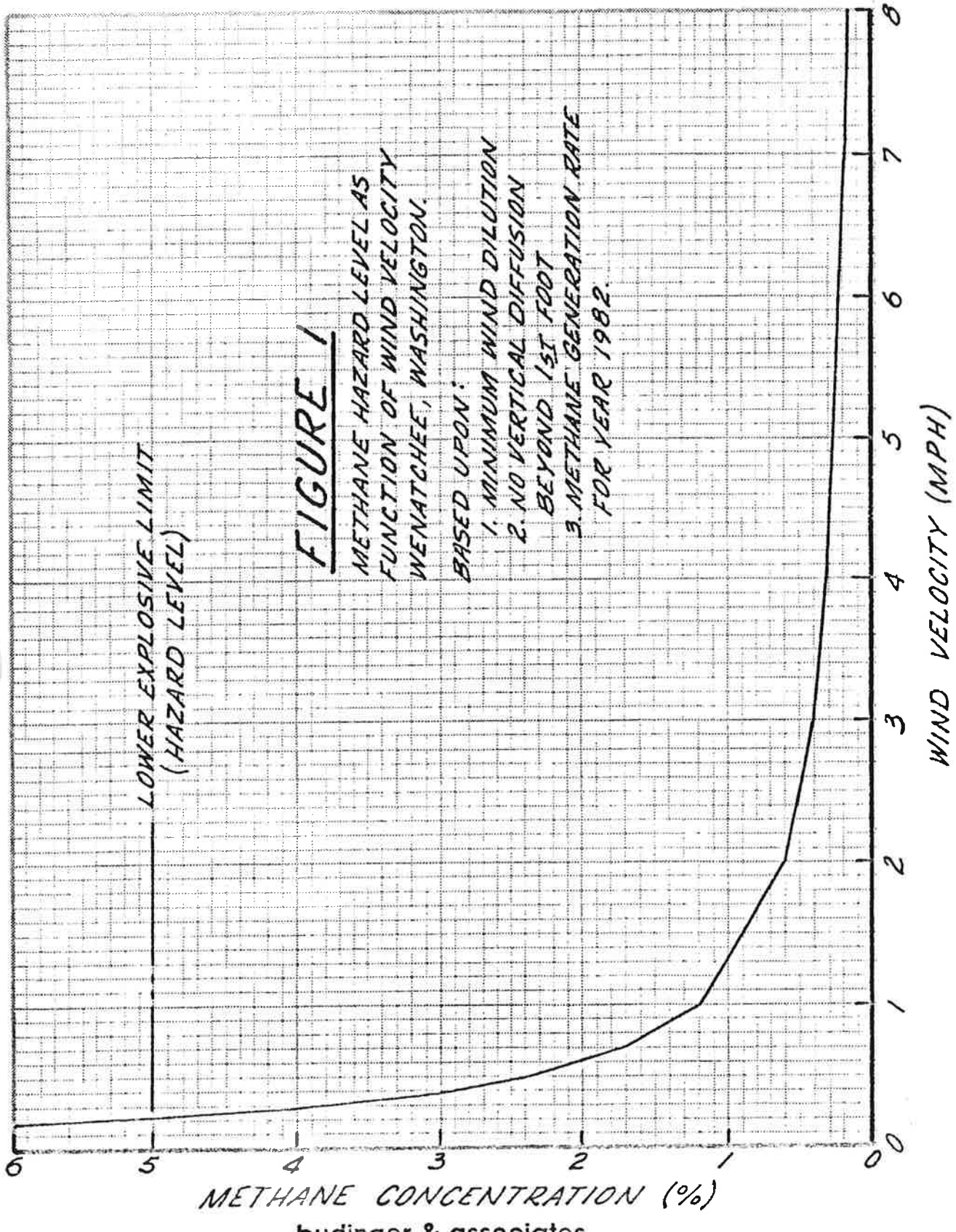
NOTE: BOTH 1. AND 2. ESTIMATED ON BASIS OF IN PLACE DENSITY AT 45 POUNDS PER CUBIC FOOT OF SOLID WASTE.

TABLE 3

METHANE QUANTITIES
RIVERFRONT PARK LANDFILL
WENATCHEE, WASHINGTON

SEGMENT	METHANE [1]	WIDTH [2]	CONCENTRATION [3]
I	0.10×10^5	28	.003
II	1.5×10^5	27	.043
III	0.30×10^5	25	.009
IV	0.83×10^5	24	.027
V	1.10×10^5	23	.037
		TOTAL	.120

1. CUBIC FEET OF METHANE PER DAY.
2. WIDEST REACH IN FEET PERPENDICULAR TO WIND VECTOR.
3. BASED UPON 10 MPH WIND VECTOR IN FIRST FOOT REPORT AS PERCENT METHANE.



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As the rate of methane generation is susceptible to moisture fluctuation, the establishment of a reasonably impermeable cap of cover soil over the solid waste materials is essential. Penetration of runoff water through the cover soil could increase the rate of methane generation and subsequently methane concentrations above ground. The installation of dry wells should therefore, be avoided.

3.2 BUILDING FOUNDATIONS

The only truly suitable material for the support of footings on the site is the native Stratum 6 gravel material. Building locations underlain by Strata 2, 3, 4 and 5 are areas where a high risk of structural disruption must be accepted. While some foundation designs might allow construction on these questionable materials, acceptable solutions are probably not cost effective. Risks can be limited however, if proper methods, combined with locations underlain by Stratum 5,or a thin seam of Stratum 2 replaced with structural fill are selected.

3.3 DIKES

Although the existence of a dike, as mentioned under "Site History", is substantiated in several of our test borings, there remains a possibility that its content, width, or height, may not be continuous along the entire eastern margin of the site. Where encountered, this dike comprised coarse boulders constructed as noted in the cross-sections of the site plan. Although we were assured of its existence by the former landfill operator, and the Assistant Director of Public Works, the possibility of discontinuities as mentioned, still exists. However, as no areas of instability are apparent along the riverbank, it is quite probable that the dike is continuous throughout the length of the site.

3.4 PLANT PRODUCTION

Based upon the results of agronomical soils testing, the existing cover soil appears to be reasonably well suited for the propagation of ornamentals and flowers. Due to the active production of methane beneath the soil cap, it will be necessary to limit the root depth of plantings such that they do not intersect the soil cap/solid waste interface for 5 to 10 years. After this time, it is projected that methane generation rates will be low enough to allow root penetration without adverse effects to vegetation. Although the proposed gas vent caps are relatively unobtrusive, they should probably be camoflaged with small shrub plantings. This is advisable as it is less likely that a smoldering cigarette butt will be discarded into an ornmantel planting, than in the direction of a device of mechanical appearance. Should such a scenario occur during a sporatic episode of methane emission (however unlikely), the results could prove less than desirable.

RECOMMENDATIONS

4.0 It is recommended that methane generation be controlled with a minimum thickness of 5' of cover soil, and that gas pressures be vented to the atmosphere through modification of the existing monitoring wells and the addition of several additional venting/ monitoring wells.

While buildings could be best supported in areas which are not underlain by refuse, we realize that this may not be entirely feasible. Recommendations are presented to establish foundation designs for buildings which must be included in the refuse area.

It is recommended that the conclusions regarding slope stability and the existence of a containment dike be accepted as probable. Consequently, nothing should be done to increase bank stability unless future experience identifies areas of local failure.

Specifically, the project should be designed and constructed in accordance with the following recommendations:

4.1 EARTHWORK

Although relatively little earthwork is anticipated, it will be necessary to place some fill to assure that a 5' thickness of sufficiently fine-grained cover soil exists over the entire site. In addition, these earthwork procedures can be used to place fill for structural support of buildings (in cases where removal and replacement of minor thicknesses of refuse are feasible).

4.1.1 Preparation of Surface to Receive Fill Prior to fill placement, the existing surface should be scarified, brought to the approximate optimum moisture content (± 2%), and compacted in-place to 90% of maximum density.

4.1.2 Fill Material Material similar to that comprising the existing cover soil (Stratum 1), is quite suitable for fill material. To assure low permeabilities and thus confine gas pressures, the material should contain between 20% and 80% fines (silt and clay passing the #200 sieve).

4.1.3 Fill Placement With the exception of the top 1' in areas to support vegetation, fill materials should be brought to the optimum moisture content (± 2%), placed in thin lifts (not exceeding 6" compacted), and compacted to 90% of maximum density. Fill should not be placed in a frozen condition or on frozen ground.

4.1.4 Compaction Compaction of fill materials similar to those existing in Stratum 1, should not present significant difficulties. In our opinion, best results can probably be obtained with sheepsfoot or vibrating sheepsfoot equipment, at or slightly above the optimum moisture content.

4.1.5 Maximum Density Maximum density and optimum moisture content should be determined in accordance with the modified proctor method (ASTM D1557-78).

4.1.6 Verification A qualified technician should be present during all filling operations to test compaction and monitor compliance with these recommendations. While compaction verification is essential to proper fill placement, it is also critical in the backfill of utility trenches or stem walls.

4.2 STRUCTURE FOUNDATIONS

As outlined in "Conclusions" (paragraph 3.2), several options are available for support of buildings and minor structures. It is recommended that every attempt be made to place all structures in areas where they can be supported by inorganic fill or native soil. In areas where this is only partially possible, the existing refuse should be replaced with structural fill as recommended under "Earthwork" (paragraph 4.1). This will likely be the case where thicknesses are not too great (probably at transition zones where refuse pinches out between capping soil and underlying alluvium or dike fill). If it is necessary to construct buildings in areas completely underlain by refuse, it is recommended that a compensated mat foundation be used.

Specifically, footings founded in, and above, inorganic soils should be designed in accordance with the following:

FOOTING TYPE	MINIMUM DEPTH*	MINIMUM WIDTH	BEARING PRESSURE
Continuous Wall	30"	16"	1500 psf
Isolated Column	30"	24"	1800 psf

* No less than depth of average frost penetration as established by local experience.

The recommended bearing pressure is intended to include dead load plus sustained live load, and may exclude temporary live loads (less then 1 month's duration), as well as 80% of the subterranean footing weight. These bearing pressures may be increased by 1/3 when the temporary effects of wind and seismic forces are included.

For structures supported on areas underlain by refuse, mat footings should be founded at depths such that the total weight of excavated Stratum 1 soil is equal to the total weight of the structure (dead plus sustained live load), including the foundation weight. It is anticipated that for small restroom type buildings, this can be achieved by excavations of approximately 2'-3' below grade. As with spread footings, minimum depth should not be less than the average depth of frost penetration as established by local experience.

In either case, if footing excavations have been inadvertantly over-excavated, the concrete should be placed directly on the excavated, undisturbed surface. Attempts to bring over-excavated footing excavations to grade without adequate control, seldom achieve acceptable results.

4.2.2 Settlement Foundations bearing on structural fill or native mineral materials should expect only negligible amounts of settlement. Although the exact amount is not predictable, it is not likely that it would exceed 1" and probably be limited to less than ½".

However, footings founded in refuse areas can be expected to experience substantial subsidence. The effect of the compensated mat is intended to cause the building to be supported without an increased soil load at the compressible levels. Consequently, while severe settlements (2' ±) may be anticipated, they should be relatively uniform between the structure and the adjacent soils. This should minimize shear stresses on utility lines entering and leaving the structures. While theoretically the compensated foundation should not allow any settlement of the building relative to the adjacent soil, in practice, some is bound to occur. It is estimated that this is not likely to exceed 1" unless there is a substantial descrepancy between the total building weight and the weight of excavated soil.

4.3 SUBSIDENCE

As suggested under "Settlement", the entire refuse area can be expected to settle consistantly under the surcharge of the capping soil, and due to the general decomposition of the refuse. If in the past portions of the landfill were covered in cells (typical in sanitary landfill operations), the inorganic material between cells could be expected to act as vertical dikes of relatively incompressible material. The resulting subsidence could then take the form of a concave, scalloped surface as the refuse decomposes, allowing the capping soil to subside between cells.

4.4 LATERAL EARTH PRESSURES

Lateral earth pressures are provided for design of subterranean structures, such as vaults, partial basements, etc. They are calculated assuming vertical walls, level backfill, and drained conditions. As the Active pressure requires some displacement to achieve full shear strength within the soil, the higher At-Rest pressures should be used in cases where retaining structures are rigidly restrained.

EARTH PRESSURE CONDITION	EQUIVALENT FLUID PRESSURE
Active	35 pcf
At-Rest	50 pcf
Passive	400 pcf

The Passive earth pressure is intended to provide lateral resistance for structures founded in Stratum 1. It can be used together with an earth/concrete friction factor of 0.35.

4.5 GAS VENTING WELLS

The existing gas monitoring wells installed during the field investigation, should be converted to venting wells. Four to five additional wells should be constructed at locations indicated on the site plan. It is recommended that the individual wells be provided with surface vents to defuse gasses and resist vandalism from normal park usage. A suggested design detail is included on the following page. It is further suggested that the wells be screened by a growth of low shrubs to further deffuse venting gasses, and to provide protection from casually tossed cigarettes etc.

NOTE:

GAS WELLS TO BE LOCATED UNDER BUSHES, HEDGE ROWS OR OTHER COVERINGS.

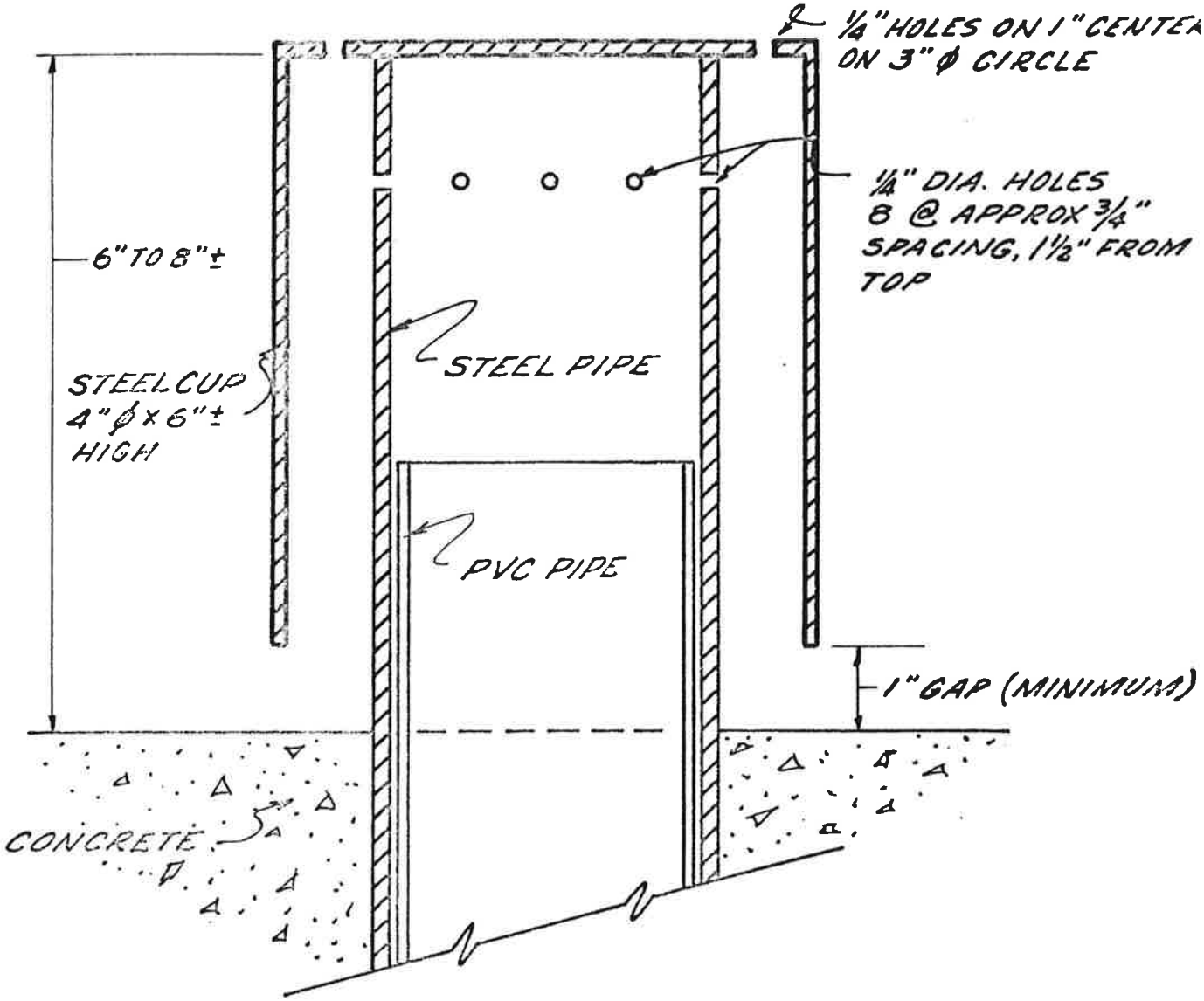


FIGURE 3

SUGGESTED CAP DETAIL

NO SCALE

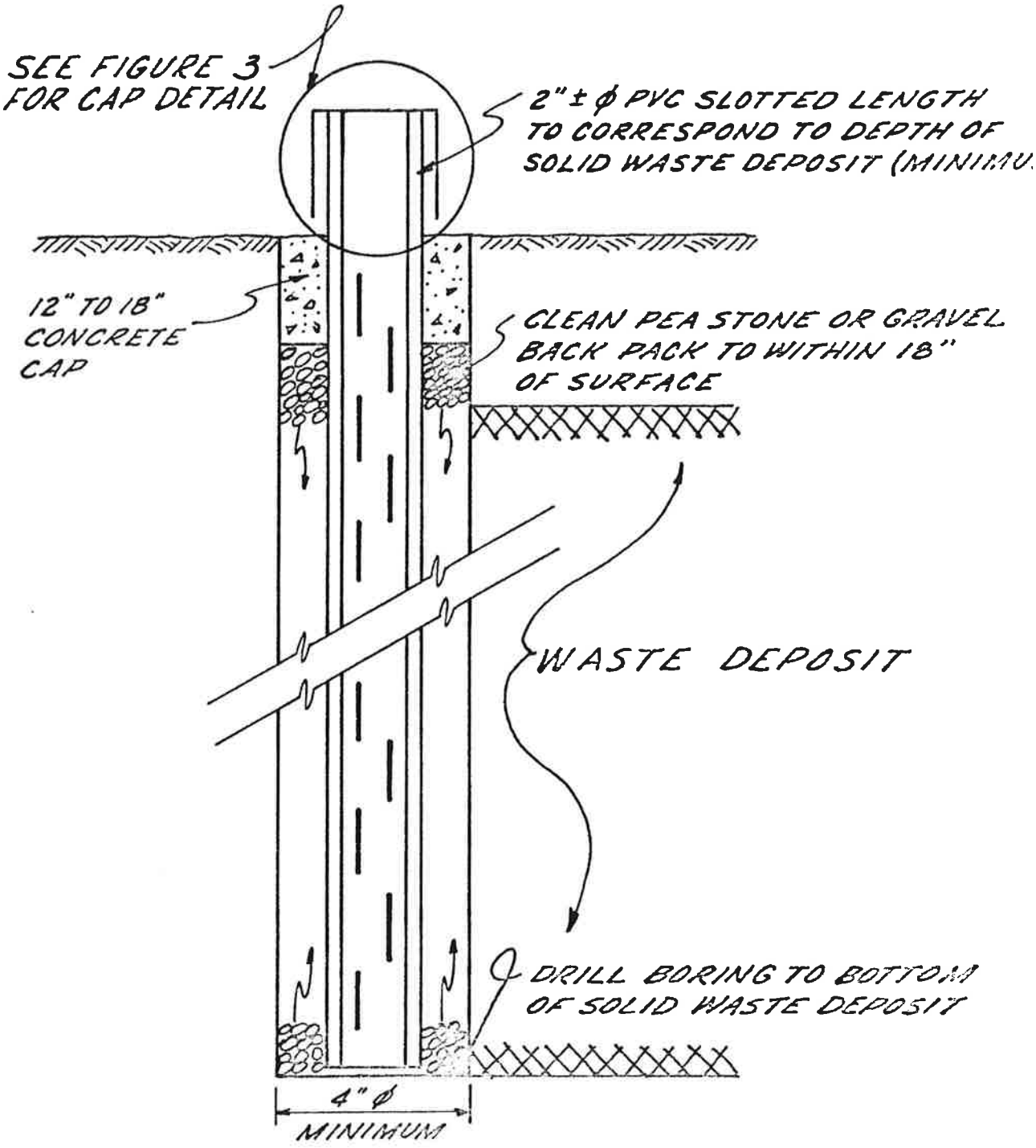


FIGURE 2

TYPICAL GAS WELL

NO SCALE

Although individual venting of each well is preferable, several may be grouped into a single vent through a piping manifold system, if necessary for park planning. However, it is recommended that individual vents be retained in the area of higher gas generation rates (area III and IV). Vents may be laterally offset from the well locations if necessary.

4.5.1 Monitoring Gas wells should be pumped annually to collect samples which should be checked in the laboratory for methane, carbon dioxide, oxygen and nitrogen. In the event that laboratory tests indicate methane concentrations above 30% by volume, the soils engineer should be notified to recommend a more intense monitoring program. Routine operation of the park should include periodic monitoring of the lower explosive limit (LEL) using MSA (Mine Safety Association) hand-held equipment. If periodic readings above 5% by volume are obtained, the soils engineer should be notified to allow re-evaluation of the venting program.

In our opinion, the continued venting of the landfill at the 9 selected locations should provide an adequate means of releasing methane and other gasses generated within the landfill. While installation of additional wells could further reduce gas pressures and risks of developing explosive concentrations, it is our opinion, that the recommendations will provide adequate venting with acceptable safety factors.

However, the possibility remains that, even with additional wells, some generating cells may be isolated from the venting system, such that pressures could allow gas percolation through the soils in localized areas. Although considered extremely remote, this risk must be accepted as inheirent with construction on landfills.

4.6 VEGETATION

The results of agronomical testing performed on Stratum 1 samples indicate moderate to high sulphur and phosphorus levels, medium organic matter content, relatively high concentrations of potassium, tolerable soluable salt concentrations, and that soil pH is well within the desirable range. As such, maintenance applications to balance sulphur, phosphorus, and potassium should be applied. Further, agronomical testing of cover soils should be performed annually to maximize crop production. Fertilizer recommendations for a crop of ornamentals and flowers to be grown in 1982 are as follows:

1. 80 lbs actual Nitrogen/Acre
2. 120 lbs actual P_2O_5/Acre
3. 60 lbs actual K_2O/Acre
4. 20 actual Sulfur/Acre*

*excluding segment IV

Vegetation should be selected such that root penetration is limited to Stratum 1 for at least 8-10 years. Penetration below the Stratum 1/ Stratum 2 interface may expose vegetation to toxins produced by Stratum 2, until lower generation rates are achieved. The recommended minimum compacted Stratum 1 thickness should limit migration of methane through soils to well below toxic levels. Soils should be tested annually however, to assure acceptable levels for established vegetation.

4.7 PAVEMENT SECTION

The following pavement section is designed to bear on either Stratum 1 material, or select compacted fill.

	MATERIAL	THICKNESS	% COMPACTION	
0"	Asphalt Concrete	2"	90% TM*	0"
2"	*prime coat*			2"
	Aggregate BAse	4"	95% MP**	
6"	Stratum 1 or Structural Fill	-----	95% MP**	6"

*Theoretical Maximum
**Modified Proctor

The preceeding pavement section should provide an economical surface under the prevailing soil conditions.

It should be noted that a higher degree of compaction is required for the subgrade than for the remainder of the site grading. As such, it is recommended that additional compaction be obtained after construction is completed during the fine grading operations of the paving contractor. After completion of the base course, a prime coat of RC 250 liquid asphalt should be applied to the compacted surface and allowed to cure.

A comprehensive maintenance program should be established to maintain the section integrity. This program should schedule a seal applied to the asphalt concrete surface periodically, to prevent infiltration of moisture into the subgrade through surface cracks. Further, positive surface drainage should be provided to prevent the ponding of melt water on the section's surface.

L I M I T A T I O N S

These conclusions and recommendations are based upon the field and laboratory investigations contained in the following pages, and our understanding of the planned development, derived from information received from the architect (DOH Associates, David Harris).

These conclusions and recommendations were developed in accordance with generally accepted environmental and geotechnical engineering practices as outlined in our proposal of 10/26/81, and we make no other warranties either expressed or implied.

The conclusions and recommendations contained herein are based upon the assumption that classification and stratification of soil or refuse are continuous between test borings or pits. Although the boring pattern is reasonably dense, there always exists the possibility that conditions may vary between test borings, and that subterranean barriers may exist to prevent uniform gas migration.

Furthermore, the identification of the dike to contain refuse and provide slope stability is predicated partially on the fact that the auger met refusal at locations and depths where the surface of such a dike would be expected. There exists the possibility that this refusal pattern could be coincidental. If during construction variations in subsurface conditions are encountered, they should be brought to our attention immediately so that these conclusions and recommendations may be re-evaluated.

REFERENCES CITED

1. APHA, AWWA, WPCF, Standard Methods, American Public Health Association, Washington, D.C. 14th Ed., 1975

2. EMCON Associates, John Pacey, President, Methane Generation and Recovery from Landfills, Ann Arbor Science, Michigan, 1980

3. Hartz, E.E., "Studies of Methanogenesis in Samples from Landfills", Research conducted for Getty Synthetic Fuels, Inc., University of Wisconsin - Madison 1977-1979.

FIELD INVESTIGATION

6.1.1 TEST BORINGS

Test borings were drilled with a truck-mounted Mobile B-40H drill rig, and were advanced with 4½" diameter, solid-stem, continuous flight auger. Due to the variable nature of the Stratum 2 materials encountered (ranging from silt to concrete construction debris, stoves, discarded wire etc.), our auger met refusal in many test borings in this Stratum. Where rip-rap or large debris was not encountered, test borings were refused on native river cobbles or bedrock.

6.1.2 TEST PITS

Backhoe pits were excavated with a tractor-mounted Dynahoe to depths of refusal or maximum reach. From these pits, samples of newspaper were retrieved to date the deposit. To avoid discontinuity of Stratum 1, all backhoe pits were topped with a depth of cover soil equivalent to that removed by excavation.

Logs of test pits performed by our firm at the north end of the site for a previous soils investigation are presented together with pit locations, following the more recent subsurface information. These are presented with the permission of our previous client's agent (DOH Associates, David Harris).

6.1.3 GAS MONITORING WELLS

Gas monitoring wells comprising slotted 2" PVC pipe, were installed in 5 test borings to provide a means of monitoring gasses developed during decomposition/degradation of Stratum 2 materials. It is intended that these wells be converted to venting wells to dissipate build-up of subterranean gas pressure. All gas monitoring wells were secured with a locking cap to prevent accidental venting or detonation, and marked with steel fence stakes. The locations of test borings that received gas monitoring wells are indicated on the site plan, together with suggested additional well locations.

6.1.4 SAMPLING

The coarse granular nature of Stratum 1, together with the severe caving encountered at depth, precluded the retrieval of undisturbed samples. As such, auger cutting samples representing the various Strata encountered, were obtained as the drilling was performed, and sealed in waterproof bags for laboratory analysis.

6.4.0 CLASSIFICATION ASTM D2488

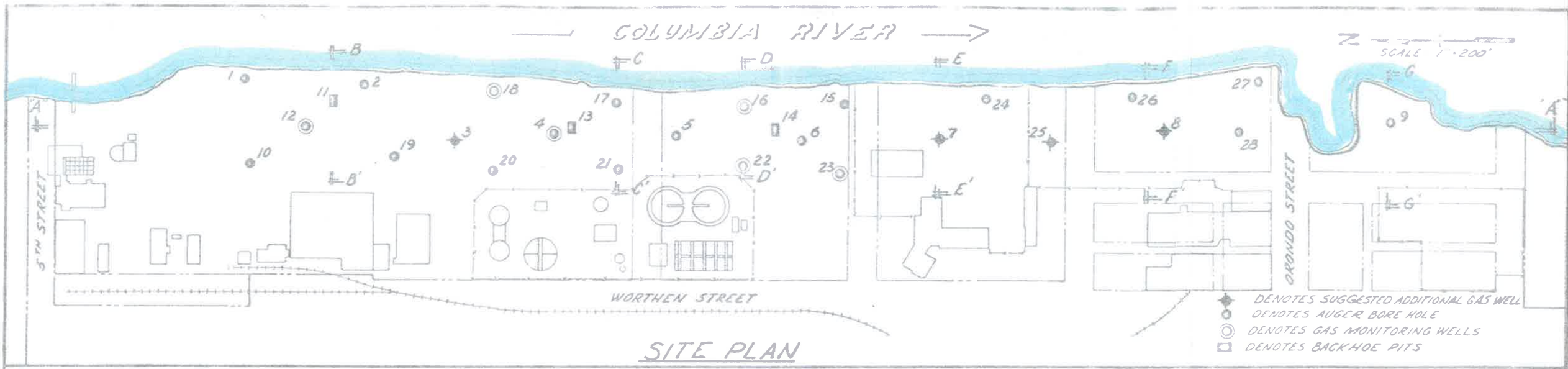
All soils were classified visually from disturbed samples and drill rig response. The resulting descriptions presented on the boring logs are intended to comply with the UNIFIED SOIL CLASSIFICATION SYSTEM.

6.5.1 BORING LOCATIONS

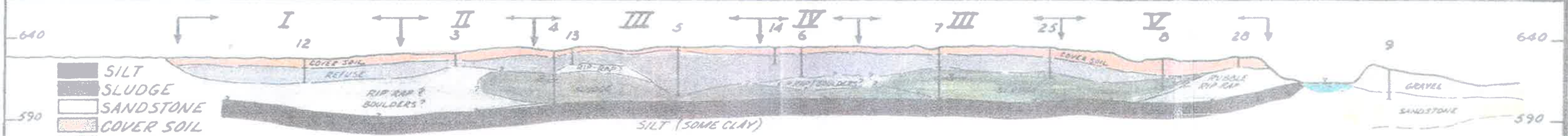
As precise surveying techniques were not employed in the location of test borings, and several borings in a single location were frequently performed, in an attempt to break through cobbles or boulders, locations presented on the site plan should be considered accurate to the nearest 10'. Test borings were located as close to those described by the architect as was logistically feasible.

6.5.2 ELEVATIONS

Elevations of the test borings were interpolated from a topographic plan provided by the architect (DOH Associates). As such, boring elevations should be considered accurate to the nearest 1'.

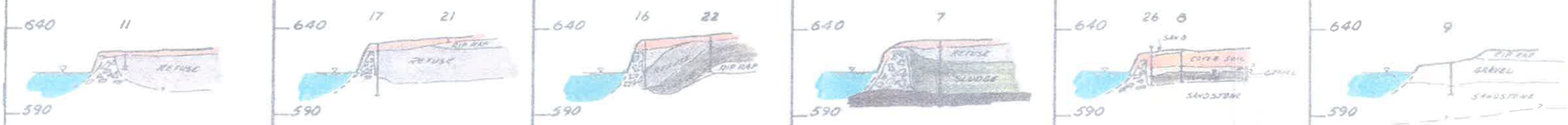


SITE PLAN



SECTION A-A'

SCALE HORIZ. 1"=200'
VERT 1"=50'



B-B' C-C' D-D' E-E' F-F' G-G'

SITE PLAN — CROSS-SECTION
WENATCHEE RIVERFRONT PARK
WENATCHEE, WASHINGTON
DOH ASSOCIATES/CHELAN CO. PUD.

NOVEMBER 5, 1981

JOB Nº SB1127

BUDINGER AND ASSOCIATES

budinger & associates
geotechnical & material engineers

TEST BORING #1a

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/4/81

ELEVATION 626 ± SURFACE Graded Gravel

	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
0–4	Moist	Mod. Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
5–10	Moist	Mod. Dense	Tan	4	Refuse	CONCRETE FRAGMENTS matrix of SAND small amount of GRAVEL poorly graded (med-fine) subrounded
						Auger refused in adjacent boring at 9½'

Auger Refused @ 9½'

SDS

budinger & associates
geotechnical & material engineers

TEST BORING #1C

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/4/81

ELEVATION 626' ± SURFACE Graded Gravel

	MOISTURE	CONDITION	COLOR		DEPOSIT	VISUAL DESCRIPTION
0–3	Moist	Mod. Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
4	Moist	Mod. Dense	Tan	4		
5–10	Wet	Compacted	Varied	2	Refuse	CONCRETE FRAGMENTS matrix of SAND small amount of GRAVEL poorly graded (med-fine) subrounded
11–20					Refuse	SAND poorly graded (med-fine) some TRASH aluminum, styrofoam, wood fiber plastic pipe, tin, steel sheets ORDORIFEROUS
21–33	Saturated	Firm	Gray	6	Alluvial	CLAY some SILT trace of SAND poorly graded (med-fine) moderately plastic
34–38	Saturated	Firm to Stiff	Gray	6	Alluvial	SILT SAND CLAY fine GRAVEL of river bottom channel

Boring Terminated @ 38'

METHODS | MOISTURE | CONDITION | COLOR | DATUM | DEPOSIT | VISUAL DESCRIPTION

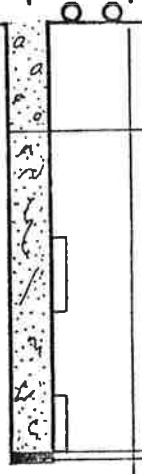
TEST BORING #2

budinger & associates
geotechnical & material engineers

JOB NUMBER S81127
11/5/81

Wenatchee Riverfront Park
Wenatchee, Wa.

ELEVATION 628'± SURFACE Graded Gravel



MOISTURE	CONDITION	COLOR		DEPOSIT	VISUAL DESCRIPTION
Sl.Moist	Mod.Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
Wet	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH styrofoam sheet, wire, plastic, string, glass
					CONCRETE FRAGMENTS

Auger Refused @ 13'

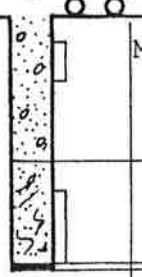
budinger & associates
geotechnical & material engineers

TEST BORING #3

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 632'± SURFACE Graded Gravel



METHODS	MOISTURE	CONDITION	COLOR	STRATUM	DEPOSIT	VISUAL DESCRIPTION
	Moist	Mod. Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
	Wet	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH fibrous material, cloth & wood ODORIFEROUS
						SMOOTH OBJECT, CONCRETE OR STEEL

Auger Refused @ 7½'

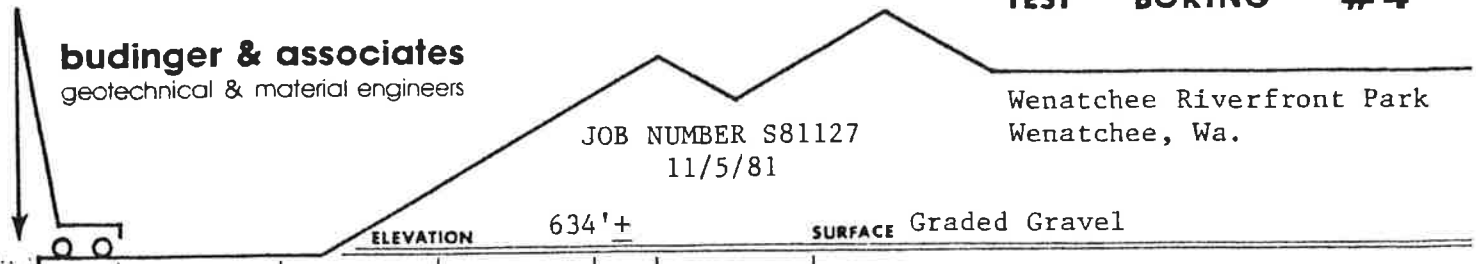
TEST BORING #4

budinger & associates
geotechnical & material engineers

JOB NUMBER S81127
11/5/81

Wenatchee Riverfront Park
Wenatchee, Wa.

ELEVATION 634'± SURFACE Graded Gravel



FEET	MOISTURE	CONDITION	COLOR	NUM	DEPOSIT	VISUAL DESCRIPTION
0–4	Moist	Mod.Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
5–14	Moist	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH styrofoam sheet, chain link fence, wire, springs
15–26	Moist	Mod.Loose	Black	5	Refuse	SEWAGE SLUDGE? SILTY SAND poorly graded fine with ORGANICS (roots?) glass, slightly plastic
27–32	Saturated					
33–34	Saturated	Firm	Gray	6	Alluvial	CLAY some SILT trace SAND poorly graded fine moderately plastic

Boring Terminated @ 34'

TEST BORING #5

budinger & associates
geotechnical & material engineers

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 635'+ SURFACE Graded Gravel

Depth	MOISTURE	CONDITION	COLOR	SAMPLE NUM	DEPOSIT	VISUAL DESCRIPTION
0–4	Moist	Mod. Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded, (med-fine) subrounded
5–16	Moist	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH trace brush, wire, plastic bags, rubber.
17						CLOTH, RAGS poor recovery

Boring Terminated @ 30'

budinger & associates
geotechnical & material engineers

TEST BORING #6

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 636'± SURFACE Graded Gravel

DBS	MOISTURE	CONDITION	COLOR	NUM	DEPOSIT	VISUAL DESCRIPTION
0-4	Sl.Moist	Mod.Loose	Brown	1	Cover Soil	SANDY GRAVEL poorly graded (med-fine)
5-18	Moist	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH styrofoam, plastic, wood, cardboard, newspaper (legible), leather
						BOULDERS & COBBLES

Auger Refused @ 18'

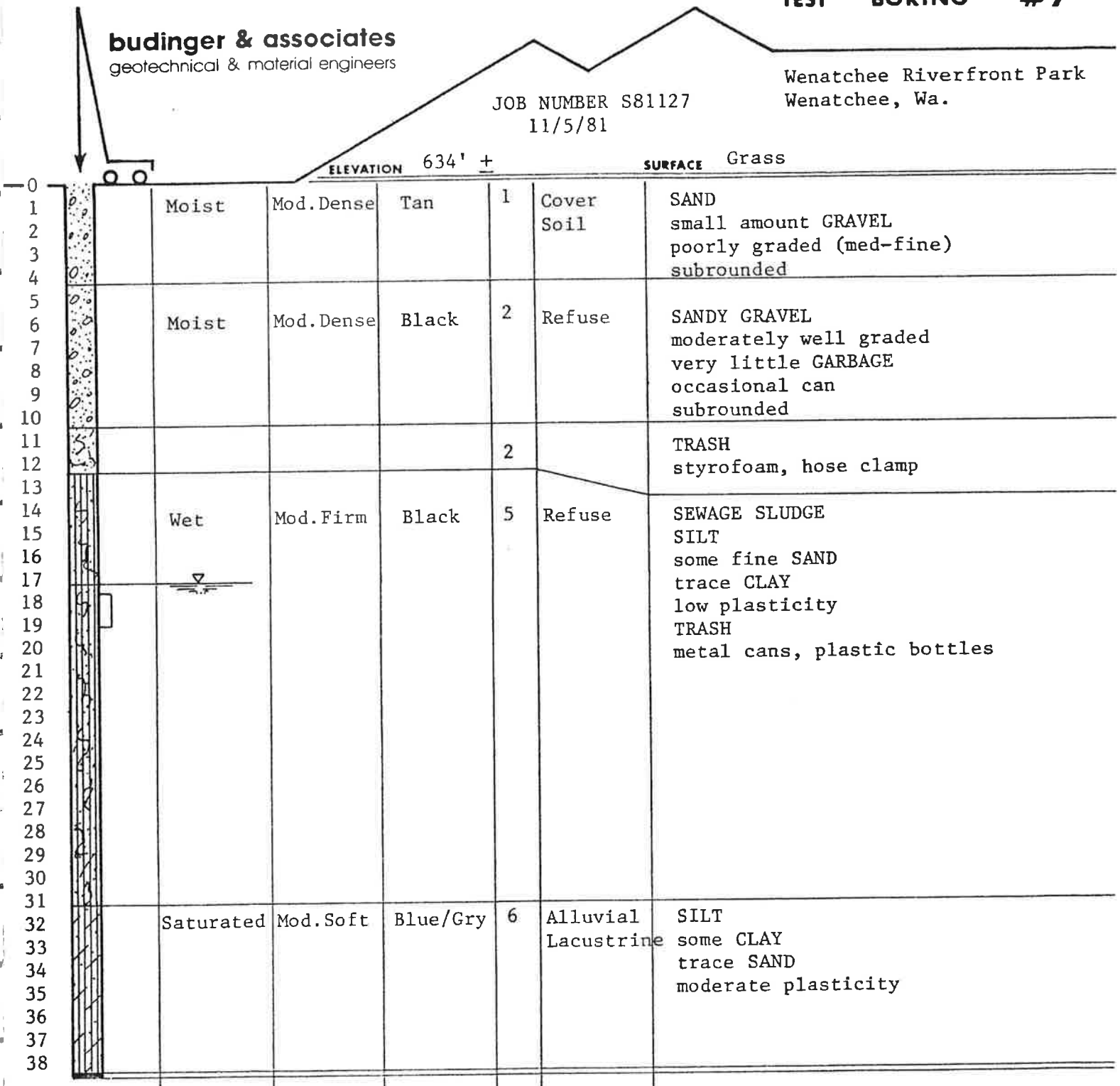
TEST BORING #7

budinger & associates
geotechnical & material engineers

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 634' ± SURFACE Grass



MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
Moist	Mod.Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
Moist	Mod.Dense	Black	2	Refuse	SANDY GRAVEL moderately well graded very little GARBAGE occasional can subrounded
			2		TRASH styrofoam, hose clamp
Wet	Mod.Firm	Black	5	Refuse	SEWAGE SLUDGE SILT some fine SAND trace CLAY low plasticity TRASH metal cans, plastic bottles
Saturated	Mod.Soft	Blue/Gry	6	Alluvial Lacustrine	SILT some CLAY trace SAND moderate plasticity

Boring Terminated @ 38½'

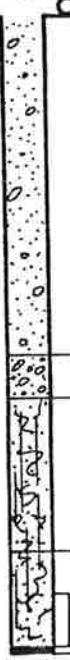
TEST BORING #8

budinger & associates
geotechnical & material engineers

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 624'± SURFACE Graded Gravel



	Moist	Mod.Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
	Moist	Dense	?	4	Refuse	GRAVEL OR RUBBLE
	Wet		Brown	5		SEWAGE SLUDGE? with wood fiber, timbers, and small amount of metal
	Saturated					
						HOOKED DEBRIS, STEEL?

Boring Terminated @ 19'

DS | CONDITION | COLOR | MC | DEPOSIT | VISUAL DESCRIPTION

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geotechnical & material engineers

TEST BORING #9

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 622'± SURFACE Dirt Road

	MOISTURE	CONDITION	COLOR		DEPOSIT	VISUAL DESCRIPTION
0–14	Moist	Dense	Brown	6	Alluvial	GRAVELLY SAND moderately well graded subrounded occasional COBBLES
14–19	Sl.Moist to dry	Dense to hard	Gray	7	Sedimentary	SANDSTONE friable moderately well indurated

Auger Refused @ 19'

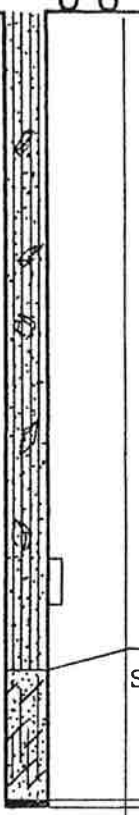
budinger & associates
geotechnical & material engineers

TEST BORING #10

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 628'± SURFACE Graded Gravel



METHODS	MOISTURE	CONDITION	COLOR	NUMBER	DEPOSIT	VISUAL DESCRIPTION
	Moist	Mod.Loose	Brown	3	Fill	SILTY SAND - CINDERS poorly graded fine small amount BRICK RUBBLE & GLASS
	Saturated	Mod.Firm	Tan	6	Alluvial	SANDY SILT small amount CLAY moderate plasticity

Boring Terminated @ 24'

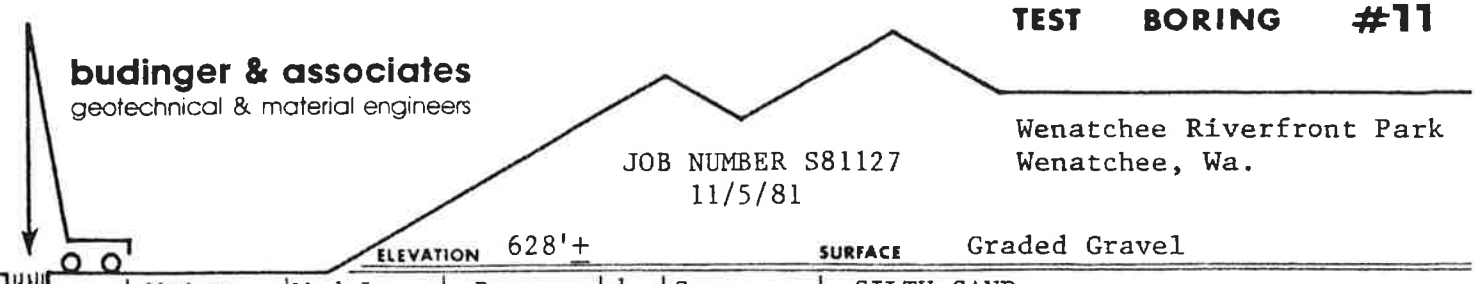
budinger & associates
geotechnical & material engineers

TEST BORING #11

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 628'+ SURFACE Graded Gravel



ODS	MOISTURE	CONDITION	COLOR	NUM	DEPOSIT	VISUAL DESCRIPTION
0-2	Moist	Mod.Loose	Brown	1	Cover Soil	SILTY SAND some COBBLES moderately well graded
3-9	Wet	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH power cable, landscape clippings, wood waste, concrete fragments, metal, and paper *(dated 1969)* ODORIFEROUS

Backhoe Pit Terminated @ 9'

budinger & associates
geotechnical & material engineers

TEST BORING #12

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 628'+ SURFACE Graded Gravel

METHODS	MOISTURE	CONDITION	COLOR	DATUM	DEPOSIT	VISUAL DESCRIPTION
	Sl.Moist	Mod.Dense	Brown	1	Fill	GRAVELLY SAND moderately well graded subrounded
	Moist	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH newspaper, wood fiber ORDORIFEROUS
						CONCRETE FRAGMENTS?

Auger Refused @ 14½'

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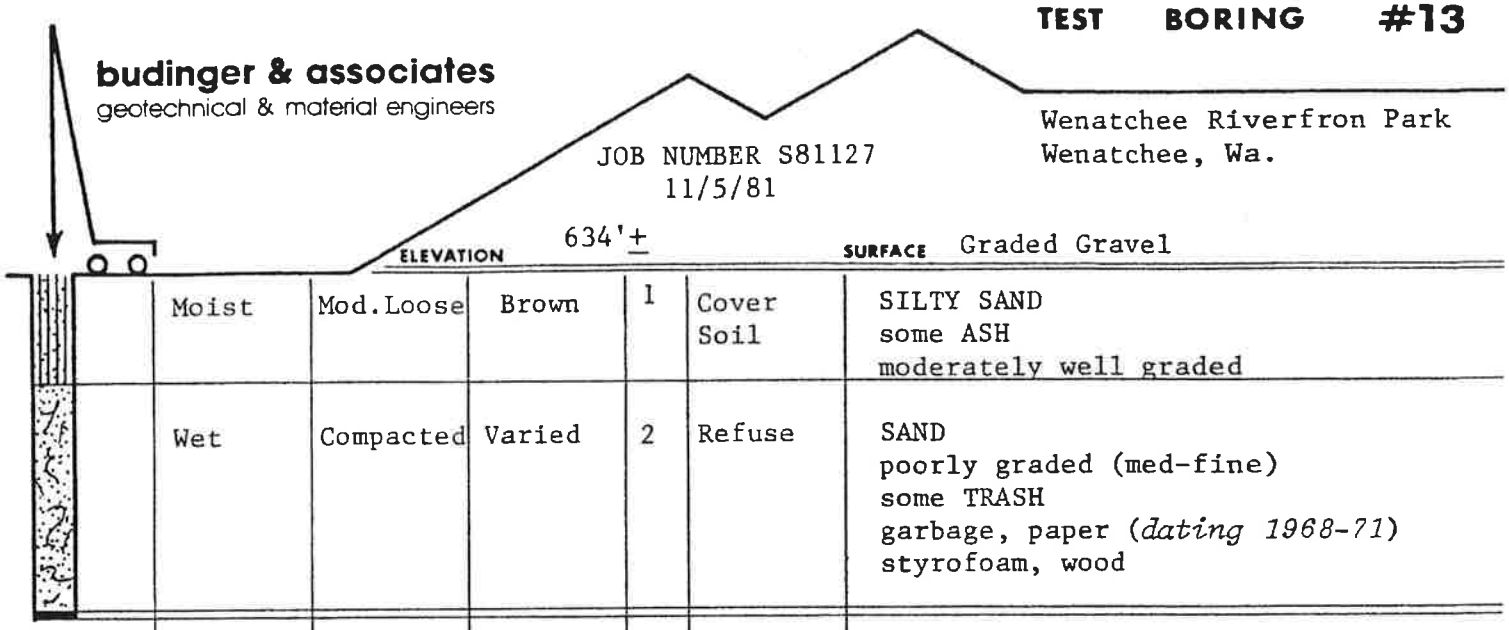
geotechnical & material engineers

TEST BORING #13

Wenatchee Riverfron Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 634'± SURFACE Graded Gravel



MOISTURE	CONDITION	COLOR	USM	DEPOSIT	VISUAL DESCRIPTION
Moist	Mod.Loose	Brown	1	Cover Soil	SILTY SAND some ASH moderately well graded
Wet	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH garbage, paper (*dating 1968-71*) styrofoam, wood

Backhoe Pit Terminated @ 10'

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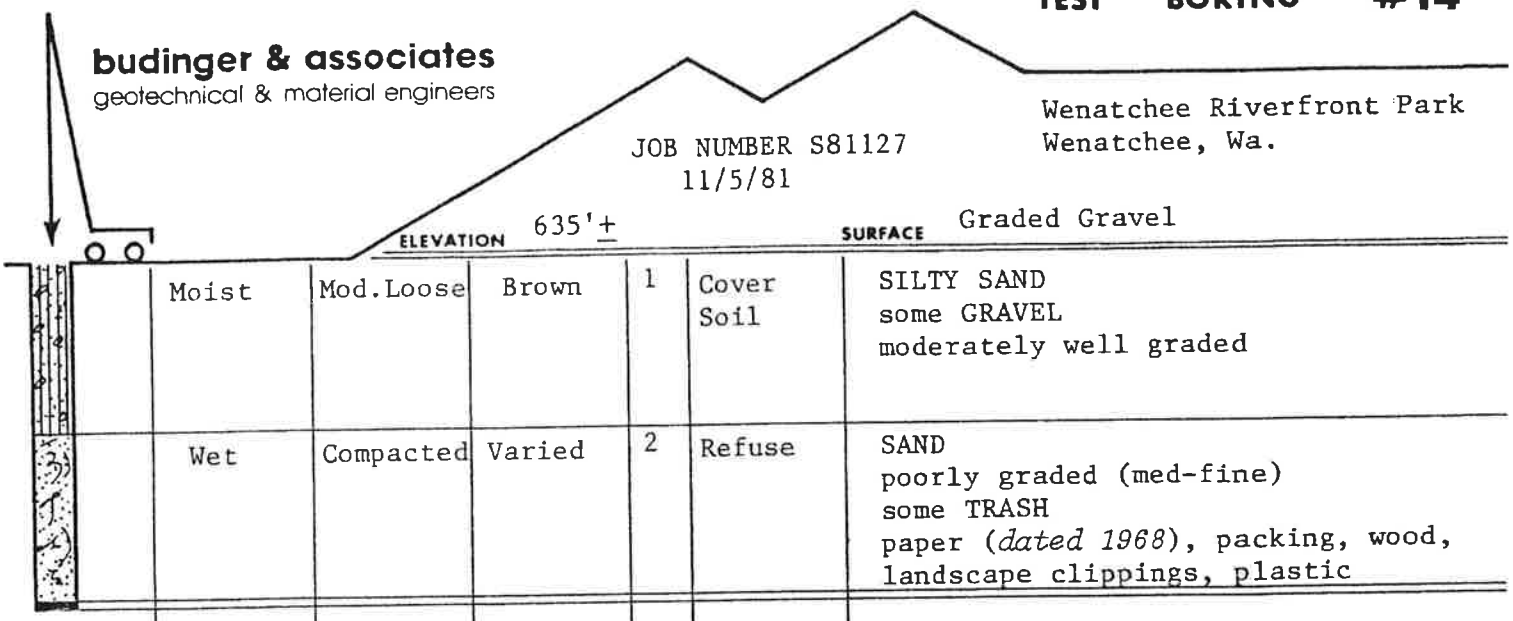
geotechnical & material engineers

TEST BORING #14

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/5/81

ELEVATION 635'± SURFACE Graded Gravel



DS	MOISTURE	CONDITION	COLOR	USM	DEPOSIT	VISUAL DESCRIPTION
0–5	Moist	Mod.Loose	Brown	1	Cover Soil	SILTY SAND some GRAVEL moderately well graded
5–10	Wet	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH paper (*dated 1968*), packing, wood, landscape clippings, plastic

Backhoe Pit Terminated @ 10'

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TEST BORING #15

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 632'+ SURFACE Graded Gravel

	MOISTURE	CONDITION	COLOR	SAMPLE NUM	DEPOSIT	VISUAL DESCRIPTION
0-6	Moist	Mod.Dense	Brown	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
7-14	Moist	Mod.Dense	Gray/Blk	2	Refuse	SAND poorly graded (med-fine) some TRASH wood fiber, styrofoam sheet, ORDORIFEROUS
15-19						
20-25	Saturated	Mod.Loose	Black	5	Refuse	SEWAGE SLUDGE? SILTY SAND poorly graded fine with ORGANICS (roots?) glass slightly plastic
26-29						CONCRETE FRAGMENTS?

Auger Refused @ 29'

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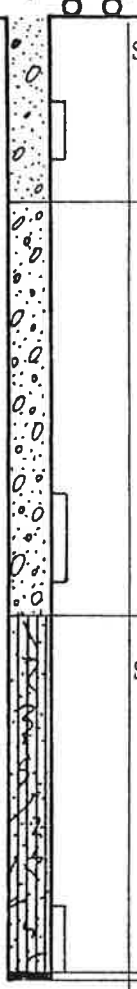
geotechnical & material engineers

TEST BORING #16

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 634'± SURFACE Graded Gravel



	MOISTURE	CONDITION	COLOR		DEPOSIT	VISUAL DESCRIPTION
0–5	Sl.Moist	Mod.Loose	Brown	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
6–18	Moist	Mod.Loose	Gry/Blk	1	Cover Soil? Dike Material?	GRAVEL small amount of SAND moderately well graded
19–29	Saturated	Mod.Loose	Black		Refuse	SEWAGE SLUDGE? SILTY SAND poorly graded fine with ORGANICS (roots?) wood fibers, metal, plastic slightly plastic

Boring Terminated @ 29'

ODS | MOISTURE | CONDITION | COLOR | TUM | DEPOSIT | VISUAL DESCRIPTION

budinger & associates
geotechnical & material engineers

TEST BORING #17

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 632'+ SURFACE Graded Gravel

DEPTH	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
0–4	Sl.Moist	Mod.Loose	Brown	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
5–30	Moist	Mod.Dense	Gry/Blk	2	Refuse	SAND poorly graded (med-fine) some TRASH styrofoam, wood fiber, metal, rags, leather, steel
31						RUBBLE & STEEL?

Boring Terminated @ 30½'

ODS

budinger & associates
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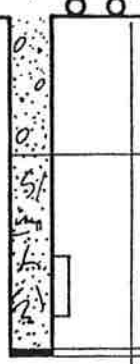
TEST BORING #18

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 633'+ SURFACE Graded Gravel



DDS	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
0–4	Moist	Mod.Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
5–10	Moist	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH styrofoam sheeting, newspaper *(1961?)*
						BOULDER (of Dike?)

Auger Refused @ 10'

TEST BORING #20

budinger & associates
geotechnical & material engineers

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 634'+ SURFACE Graded Gravel

DEPTH (FEET)	MOISTURE	CONDITION	COLOR	SAMPLE NUMBER	DEPOSIT	VISUAL DESCRIPTION
0–2	Sl.Moist	Mod.Loose	Tan	1	Cover Soil	SAND moderately well graded trace of SILT
3–7	Moist	Mod.Dense	Brown	1	Cover Soil	GRAVEL some SAND moderately well graded trace COBBLES subrounded
8–13	Moist	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH plastic bags, metal, paper, wire
						METALLIC DEBRIS

Auger Refused @ 13'

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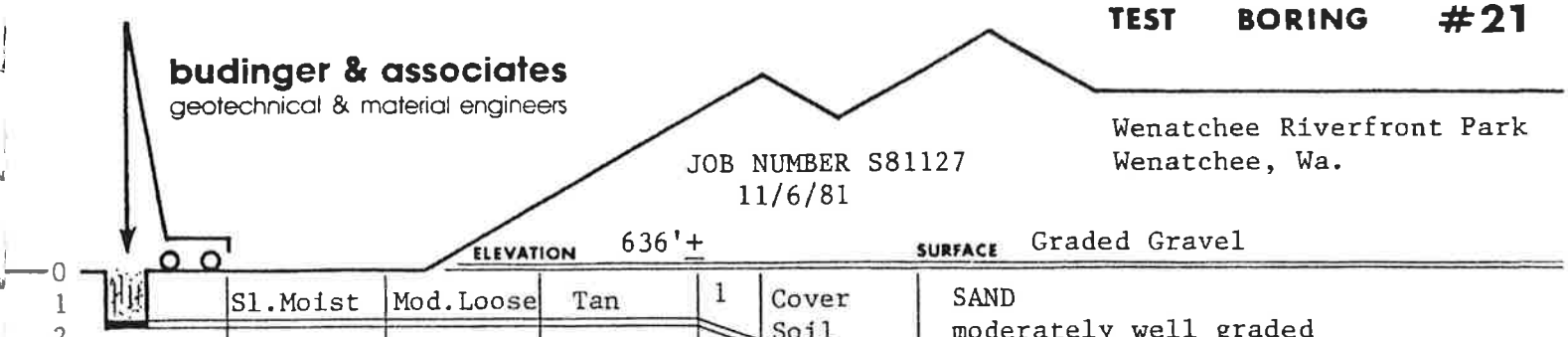
TEST BORING #21

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 636'+ SURFACE Graded Gravel



MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
Sl.Moist	Mod.Loose	Tan	1	Cover Soil	SAND moderately well graded trace of SILT
			4		RIP RAP?

Auger Refused @ 1½'

Auger Refused in 5 adjacent holes on Rip Rap @ 6"

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TEST BORING #22

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 636'+ SURFACE Graded Gravel

	METHODS	MOISTURE	CONDITION	COLOR	NUM	DEPOSIT	VISUAL DESCRIPTION
0–3		Moist	Mod.Dense	Tan	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
4–7		Moist	Compacted	Varied	2	Refuse	SAND poorly graded (med-fine) some TRASH paper, plastic bags, glass & wood
8–18		Moist	Mod.Firm	Black	5	Refuse	SLUDGE, wood fibers SILT some fine SAND trace of CLAY low plasticity ORDORIFEROUS
19–22		Moist	Mod.Dense		4	Refuse	RUBBLE & STEEL

Boring Terminated @ 22'

Due to Hooking of Auger

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TEST BORING #23

JOB NUMBER S81127
11/6/81

Wenatchee Riverfront Park
Wenatchee, Wa.

ELEVATION 635'± SURFACE Graded Gravel

ODS	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
0–5	Moist	Mod. Dense	Brown	1	Cover Soil	SAND small amount GRAVEL poorly graded (med-fine) subrounded
5–17	Moist	Compacted	Varied	2	Refuse	SAND poorly graded fine some TRASH paper, styrofoam, phone wire, plastic bags, wood fibers, purple cardboard (fruit packaging) ORDORIFEROUS
17–29	Wet	Black	Black	5		SLUDGE, wood fibers SILT some fine SAND trace CLAY low plasticity ORDORIFEROUS wood fibers, trace of plastic

Auger Refused @ 29'

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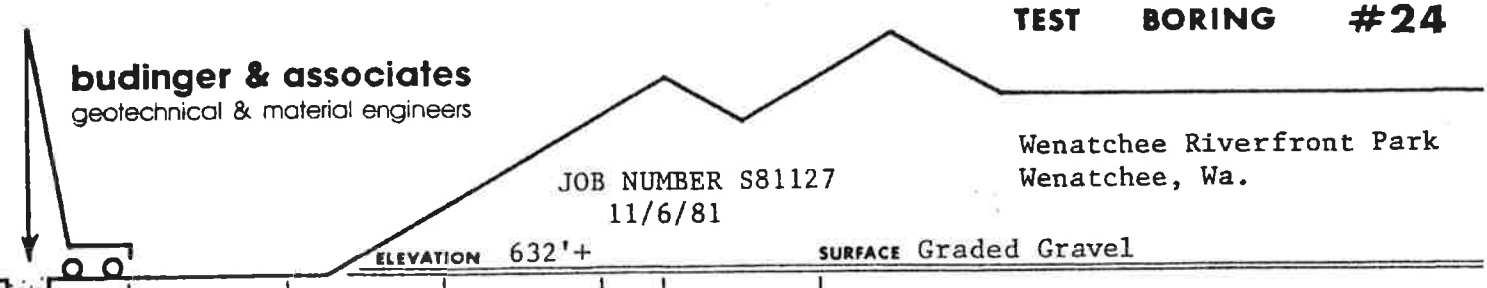
geotechnical & material engineers

TEST BORING #24

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 632'+ SURFACE Graded Gravel



DDS	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
	Sl.Moist	Mod.Dense	Brown	1	Cover Soil	GRAVELLY SAND moderately well graded subrounded
	Wet	Mod.Firm	Gray	5	Refuse	SLUDGE, wood fibers SILT some fine SAND trace of CLAY low plasticity ORDORIFEROUS wood fibers, trace of plastic
	Saturated					

Boring Terminated @ 27½'

budinger & associates
geotechnical & material engineers

TEST BORING #25

Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 634'± SURFACE Graded Gravel

Depth	MOISTURE	CONDITION	COLOR	USM	DEPOSIT	VISUAL DESCRIPTION
0–7	Sl.Moist	Mod.Dense	Brown	1	Cover Soil	GRAVELLY SAND moderately well graded subrounded
8–9				2	Refuse	Wood Fibers, Paper, Metal, etc.
10–19	Moist	Mod.Firm	Black	5	Refuse	SLUDGE, wood fibers SILT some fine SAND trace CLAY low plasticity ORDORIFEROUS purple cardboard
20						Auger Refused @ 19½'

SOILS

TEST BORING #26

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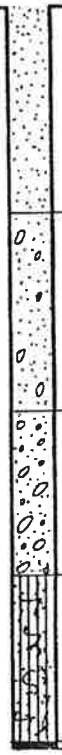
Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/6/81

ELEVATION 634'± SURFACE Graded Gravel



DS	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
	Moist	Mod.Loose	Beige	1	Fill	SAND poorly graded fine clean
	Moist	Mod.Dense	Brown	1	Fill	SAND small amount fine GRAVEL moderately well graded subrounded
	Moist	Mod.Dense	Brown	1	Fill	GRAVEL some SAND moderately well graded subrounded
	Moist	Compacted	Varied	2	Refuse	SILT some SAND poorly graded (med-fine) TRASH purple cartons, paper, sludge low plasticity

Auger Refused @ 22½'

TEST BORING #27

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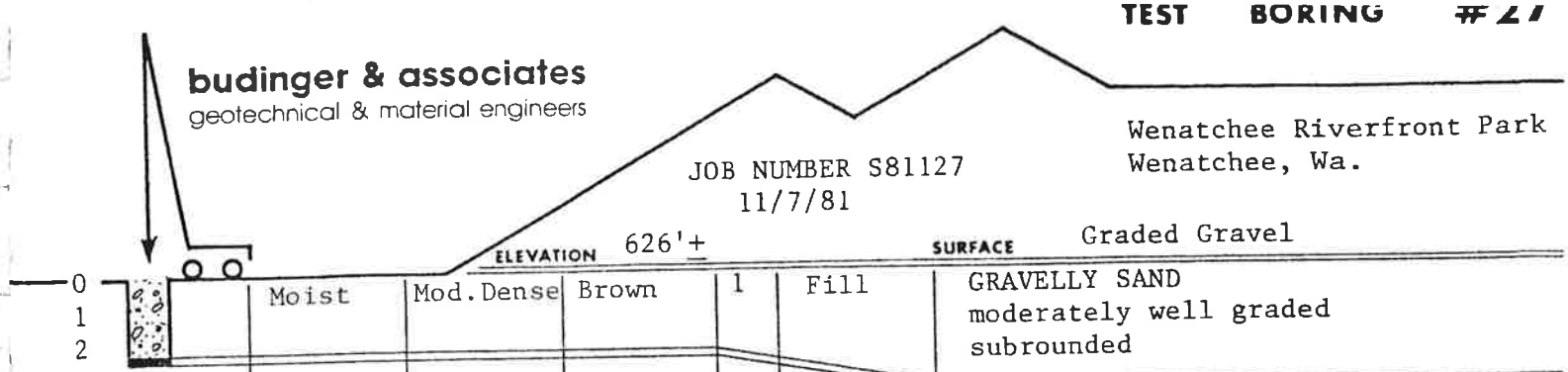
Wenatchee Riverfront Park
Wenatchee, Wa.

JOB NUMBER S81127
11/7/81

ELEVATION 626'+ SURFACE Graded Gravel



	MOISTURE	CONDITION	COLOR		DEPOSIT	VISUAL DESCRIPTION
0 1 2	Moist	Mod. Dense	Brown	1	Fill	GRAVELLY SAND moderately well graded subrounded
				4		RIP RAP

Auger refused in 3 adjacent borings @ ½' and 1'

BRICK, RUBBLE AND SANDSTONE BLOCKS are evident on the site of the cut to the boat ramp, also concrete destruction debris.

Auger Refused @ 2'

TEST BORING #28

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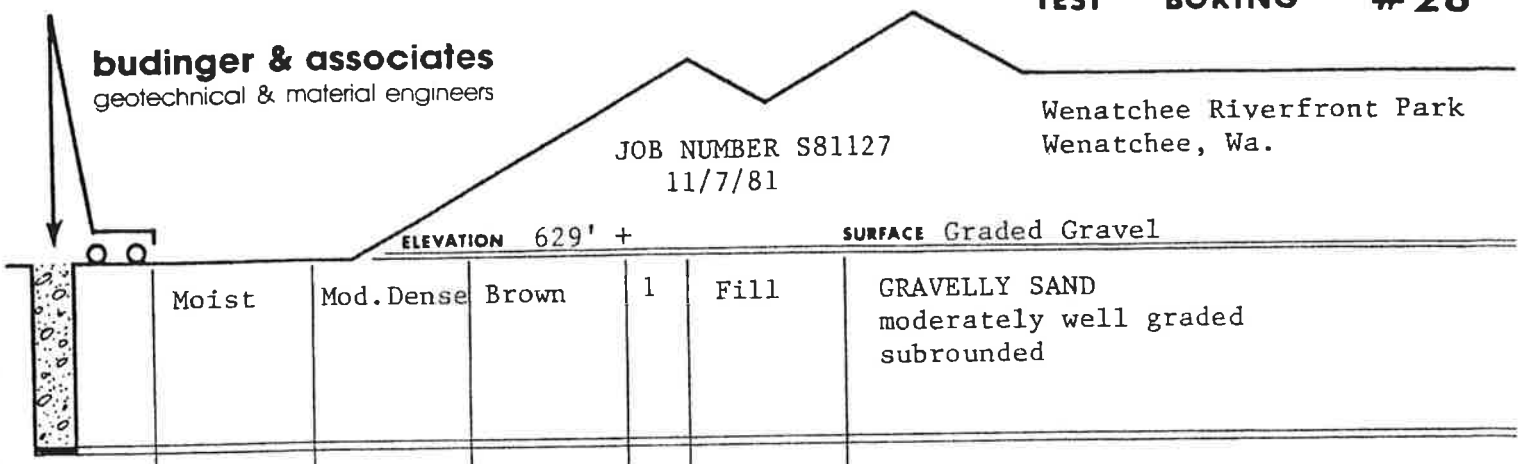
geotechnical & material engineers

Wenatchee Riverfront Park
Wenatchee, Wa.

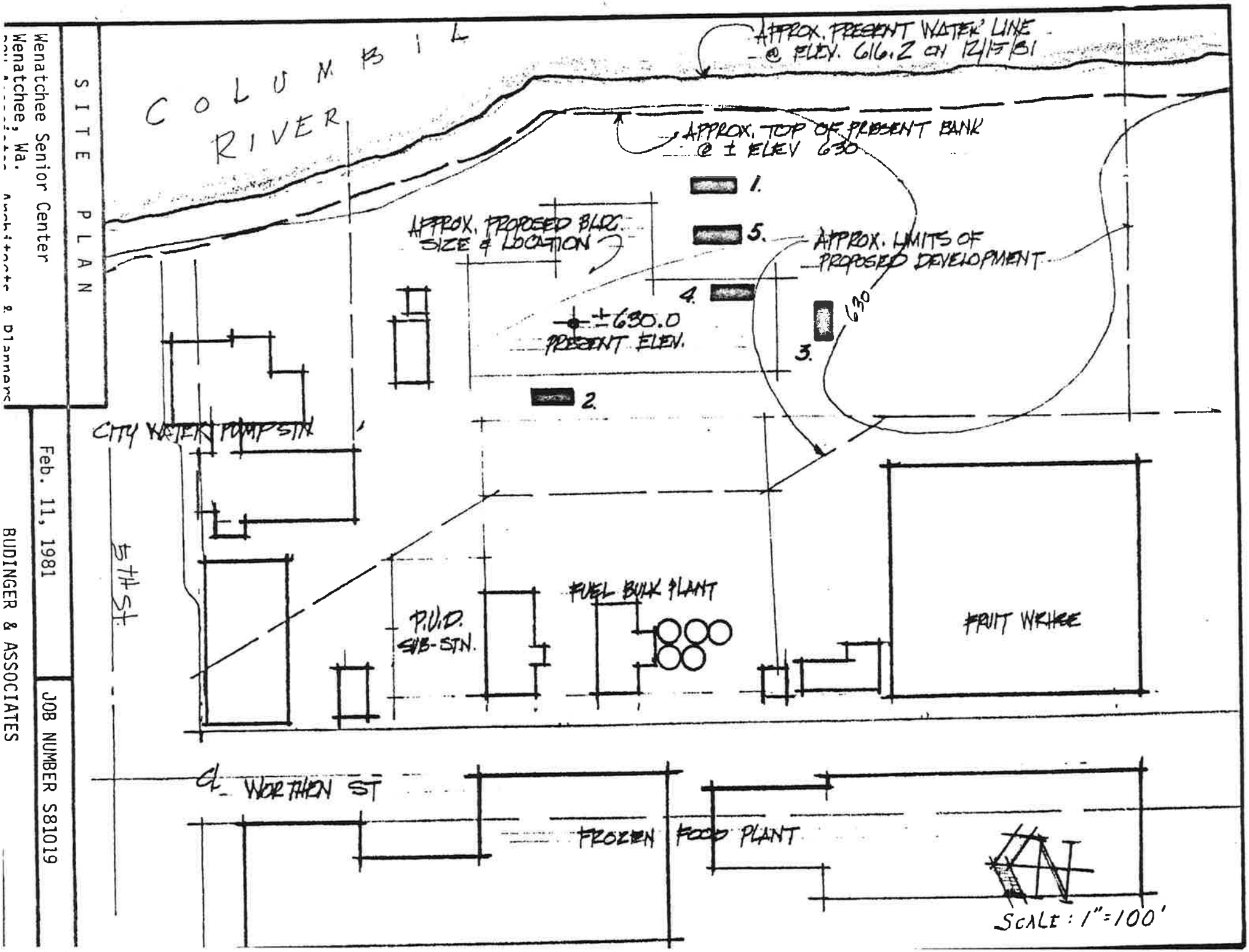
JOB NUMBER S81127
11/7/81

ELEVATION 629' + SURFACE Graded Gravel



DS	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
	Moist	Mod. Dense	Brown	1	Fill	GRAVELLY SAND moderately well graded subrounded
				4		RIP RAP or BOULDER?

Auger Refused @ 5½'


SITE PLAN
Wenatchee Senior Center
Wenatchee, Wa.
Architects & Planners
Feb. 11, 1981
JOB NUMBER S81019
BUDINGER & ASSOCIATES
COLUMBIA RIVER
APPROX. PRESENT WATER LINE @ ELEV. 616.2 ON 12/15/81
APPROX. TOP OF PRESENT BANK @ ± ELEV 630
APPROX. PROPOSED BLDG. SIZE & LOCATION
APPROX. LIMITS OF PROPOSED DEVELOPMENT
1.
2.
3.
4.
5.
630
±630.0 PRESENT ELEV.
CITY WATER PUMP STN.
5TH ST.
P.U.D. SUB-STN.
FUEL BULK PLANT
FRUIT WHSE.
WORTHEN ST
FROZEN FOOD PLANT
SCALE: 1"=100'

budinger & associates
geotechnical & material engineers

TEST BORING #2

NW corner of building

Wenatchee Senior Center
Wenatchee, Wa.

JOB NUMBER S81019
2/11/81

ELEVATION 633' ± SURFACE Graded w/snow

	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
0–5	Moist	Relatively Firm	Brown	1	Fill	SANDY SILTS SILTS GRAVELLY SILTS w/SAND *soil types indiscriminately intermix*
5–12	Wet	Mod.Dense	Red,Brn, and Blk.	3	Fill	CINDERS from incinerated garbage *sand & fine gravel sizes* moderately well graded
12–21	Wet	Condensed	Black	4	Dump	TRASH non-combustible materials *primarily metal (car bodies etc)*

Pit termin. @ 21'

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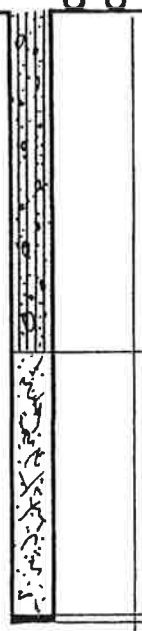
TEST BORING #3

S. end of Building

JOB NUMBER S81019
2/11/81

Wenatchee Senior Center
Wenatchee, Wa.

ELEVATION 631 ± SURFACE Graded w/snow



	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
0–5	Moist	Relatively Firm	Brown	1	Fill	SANDY SILTS SILTS GRAVELLY SILTS w/SAND *soil types indiscriminately intermi*
5–9	Wet	Loose	Varied	2	Recent dump	domestic GARBAGE & TRASH *primarily paper, wood, metal*

Backhoe pit terminated @ 9'

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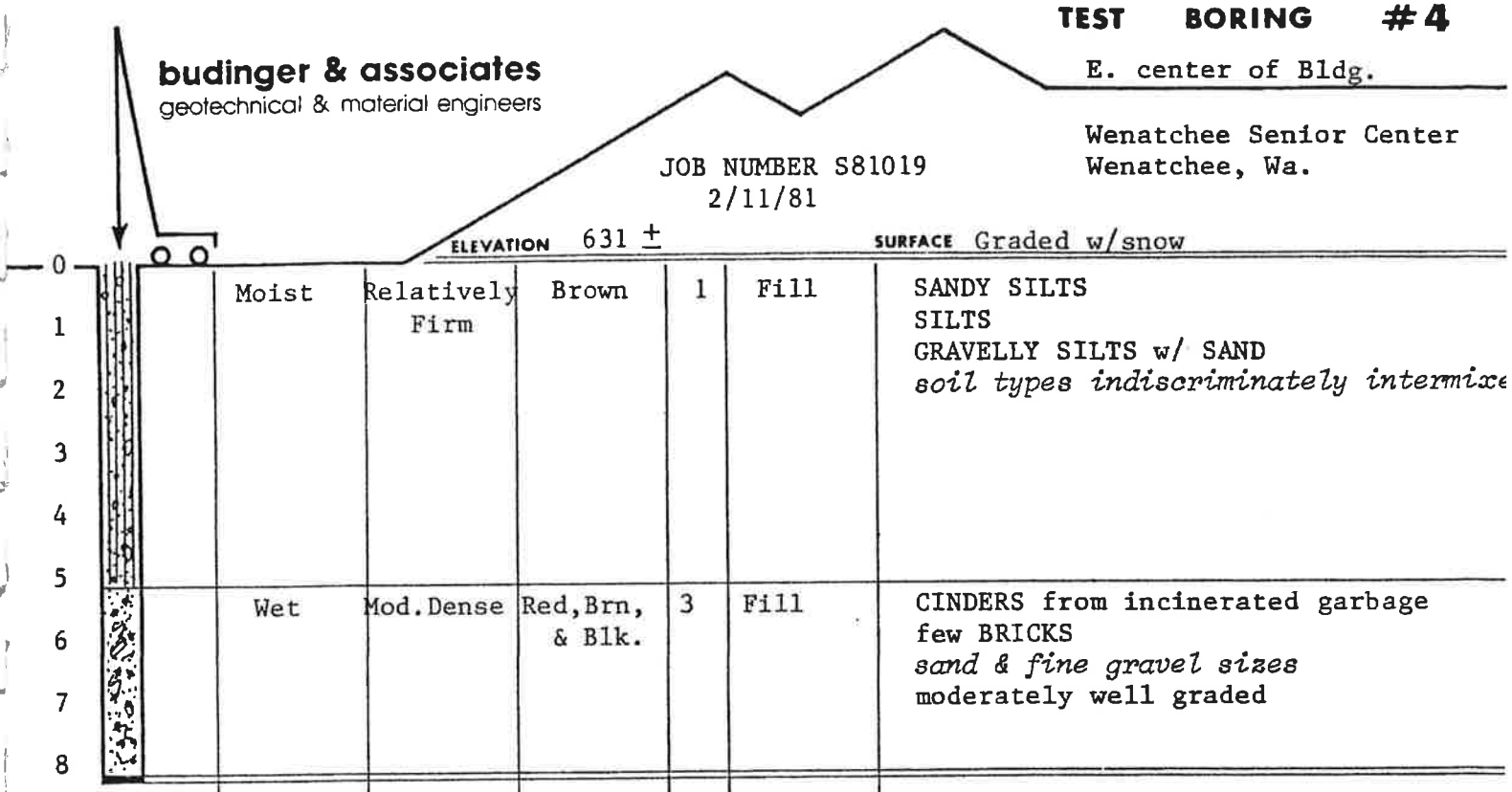
TEST BORING #4

E. center of Bldg.

Wenatchee Senior Center
Wenatchee, Wa.

JOB NUMBER S81019
2/11/81

ELEVATION 631 ± SURFACE Graded w/snow



DS	MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
	Moist	Relatively Firm	Brown	1	Fill	SANDY SILTS SILTS GRAVELLY SILTS w/ SAND *soil types indiscriminately intermixe*
	Wet	Mod.Dense	Red,Brn, & Blk.	3	Fill	CINDERS from incinerated garbage few BRICKS *sand & fine gravel sizes* moderately well graded

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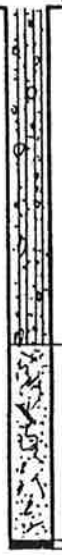
TEST BORING #5
E. center of Bldg.

Wenatchee Senior Center
Wenatchee, Wa.

JOB NUMBER S81019
2/11/81

ELEVATION 631' ± SURFACE Graded w/snow



MOISTURE	CONDITION	COLOR	UM	DEPOSIT	VISUAL DESCRIPTION
Moist	Relatively Firm	Brown	1	Fill	SANDY SILTS SILTS GRAVELLY SILTS w/SAND *soil types indiscriminately intermix*
Wet	Loose	Varied	2	Recent Dump	domestic GARBAGE & TRASH *primarily paper, wood, metal*

Backhoe pit terminated @ 8'

LABORATORY INVESTIGATION

7.1.1 MOISTURE CONTENT — ASTM D2216

Moisture content was determined for disturbed samples representing the silty sand cover soil and are presented as a percentage of dry weight, as is the convention in geotechnical analyses.

7.1.2 DIRECT SHEAR — ASTM D3080

Direct shear strength was determined for a sample representing Stratum 1. Due to the disturbance of surface samples, a remolded test was performed. The test was conducted by the consolidated-underained method, with strain controlled under submerged conditions. The failure envelope was developed from the average of 3 points, sheared at normal stresses of 1, 2, and 3 ksf. The stress/strain curve is plotted for each point and presented graphically together with the Mohr-Coulomb shear envelope. It should be noted, that re-molded shear tests will yield slightly higher results for non-cohesive soils.

7.1.3 GRADATION — ASTM D421 & 422

Samples representing Stratum 1 were subjected to mechanical sieve and hydrometer analyses to determine their coarse and fine-grained particle size distributions respectively. The results present the percentage of each sample passing (smaller than), individual U.S. Sieve Sizes, or particle diameters, by dry weight. U.S. Sieve Sizes represent either nominal particle diameter, or meshes per inch. Particle sizes are also presented in metric units.

7.1.4 pH ASTM E70

Strata 1 & 2 materials were tested to determine their pH for evaluation for corrosive and vegatative impact potential. the pH is presented on the laboratory summary, based on a 14 point scale (1 acid - 14 base), with 7.0 representing neutral.

7.2.1 SOLID WASTE MOISTURE CONTENT Standard Method

Moisture content for solid waste materials was determined in accordance with standard methods. Samples were subjected to moderate heat (76°C) until their weight remained consistent. Moisture contents for solid waste are presented as a percentage of total initial (moist) weight.

7.2.2 VOLATILE SOLIDS Standard Method

Volatile solids content was determined for selected samples representing Stratum 2. These samples were fluxed at a temperature of 600°C for a period of 1 hour, after which, they were placed in a dessicator and allowed to cool for 24 hours. Volatile solids are represented on the laboratory summary as a percentage of initial dry weight lost through firing.

Wenatchee Riverfront Park

JOB NUMBER S81127

SUMMARY OF LABORATORY RESULTS

SOILS

BORING #	3	16	19	28
DEPTH	1' 2'	3' 4'	2' 3'	3' 4'
ELEVATION	631'	631'	628'	626'
STRATUM	1	1	1	1
MOISTURE (%)	9.1	23.0	4.8	7.9
pH	7.5	7.1	7.8	7.6
INTERNAL FRICTION (Ø)				42°
COHESION (C)				0 psf
VOLATILE SOLIDS BY DRY WEIGHT				
SULPHUR (ppm)	15	21	11	15
NITROGEN #/acre	14	7	18	51
PHOSPHORUS(ppm)	24	10	10	16
POTASSIUM (ppm)	398	106	125	217
CALCIUM meq/100g	15.3	10.7	26.4	15.6
SOLUABLE SALTS mmhos/cm	.66	.77	.70	1.12
Sieve Size % Passing 3/4"	100%		100%	100%
1/2	98		95	97
3/8	97		88	95
#4	87		80	89
10	78		70	82
16	73		65	78
30	64		56	71
40	60		52	66
100	44		39	51
200	33		29	42
.05mm	30		26	25
.01	14		16	12
.005	10		12	8
.001	3		5	3
UNIFIED SOIL CLASSIFICATION	SP		SP	SP

Wenatchee Riverfront Park

JOB NUMBER S81127

SUMMARY OF LABORATORY RESULTS

BORING #	5	5	6	3	18	19	2	1c	4	23	2
DEPTH	compo-site	4' 5'	6' 10'	5½' 7'	8' 10'	8' 9'	7' 9'	9' 10	9' 10'	13' 14'	12' 13'
ELEVATION	631'	626'	626'	626'	625'	622'	621'	621'	621'	621'	620'
STRATUM	2	2	2	2	2	2	2	2	2	2	2
MOISTURE(%)	23.0	13.1	14.8	23.5	11.5	16.4	9.3	5.7	15.3	36.2	12.(
pH	7.4					7.7	7.8				
VOLATILE SOLIDS BY DRY WEIGHT		6.8	17.6	31.1				3.1	7.1	23.5	7.4

Wenatchee Riverfront Park

JOB NUMBER S81127

SUMMARY OF LABORATORY RESULTS

BORING #	16	25	15	1c	12	4	10	16	7	8	4
DEPTH	15' 17'	16' 18'	15' 20'	15' 20'	12' 14'	22' 24'	17' 18'	27' 29'	18' 19'	18' 19'	30' 32'
STRATUM	2	5	2	2	2	5	3	2	2	2	5
MOISTURE (%)	8.0	32.6	47.3	10.6	19.4	21.9	19.6	15.9	17.4	44.1	41.2
pH	7.5		6.0			7.5		7.3			7.6
VOLATILE SOLIDS BY DRY WEIGHT					3.8		7.7		6.9	17.6	

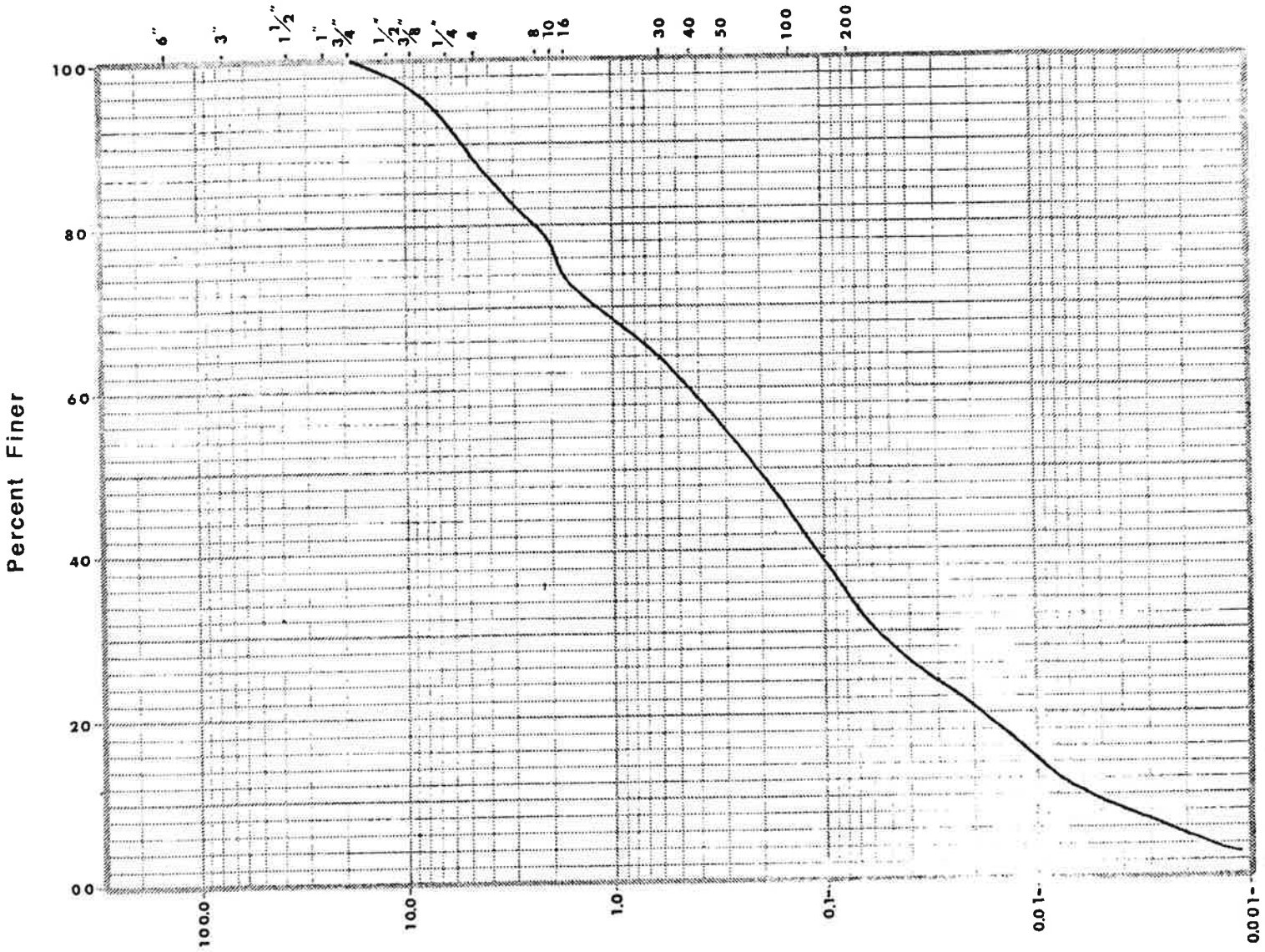
Wenatchee Riverfront Park

BORING #3
DEPTH 2'-3'
JOB NUMBER S81127

GRAIN SIZE DISTRIBUTION

COBBLE	GRAVEL (COARSE / FINE)	SAND (COARSE / MEDIUM / FINE)	SILT	CLAY

U.S. STANDARD SIEVE SIZES



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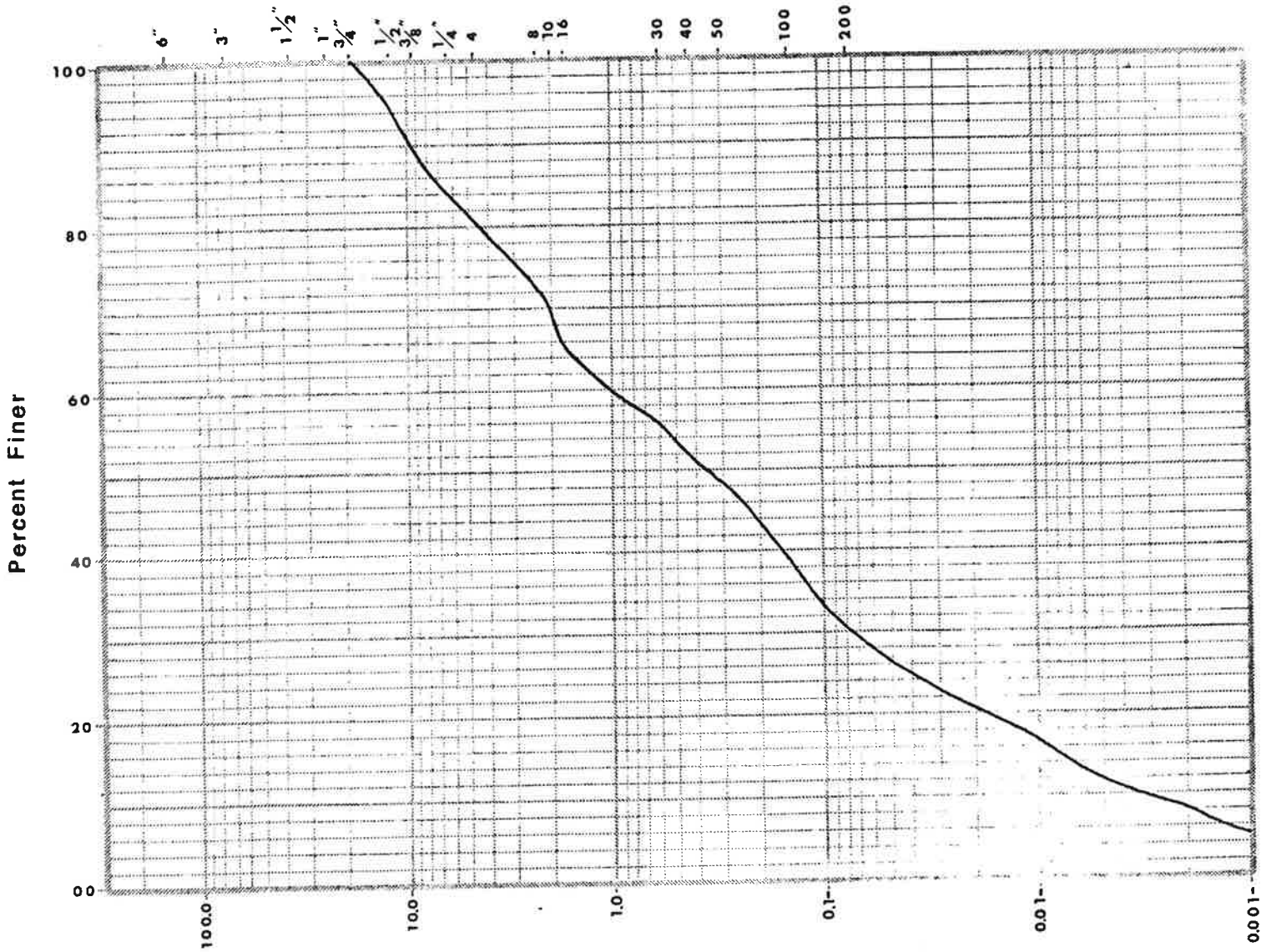
BORING #19
DEPTH 2'-3'
JOB NUMBER S81127

GRAIN SIZE DISTRIBUTION

COBBLE	GRAVEL (COARSE / FINE)	SAND (COARSE / MEDIUM / FINE)	SILT	CLAY

U.S. STANDARD SIEVE SIZES



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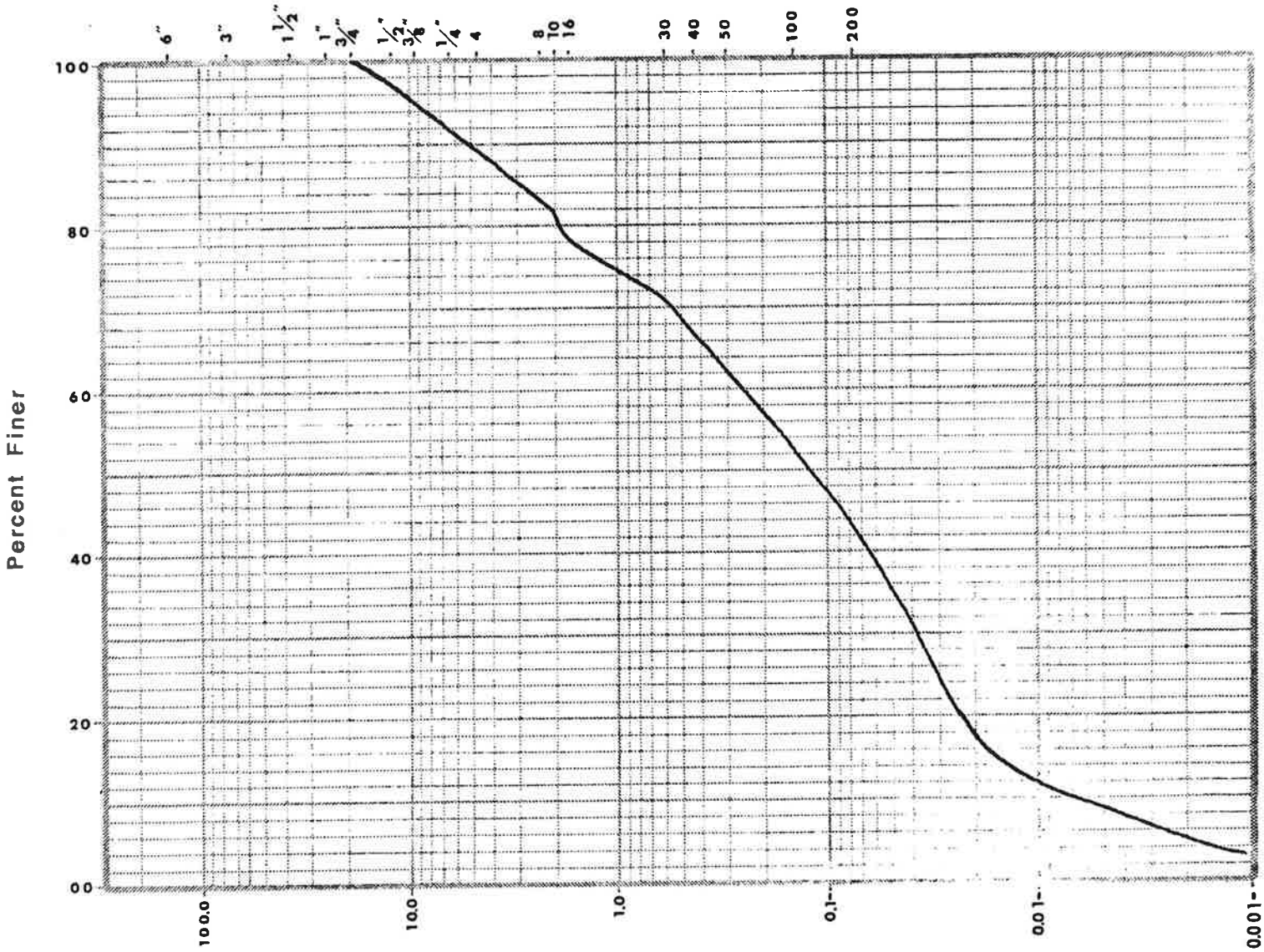
Wenatchee Riverfront Park

BORING # 28
DEPTH 3'4"
JOB NUMBER S81127

GRAIN SIZE DISTRIBUTION

COBBLE	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

U.S. STANDARD SIEVE SIZES



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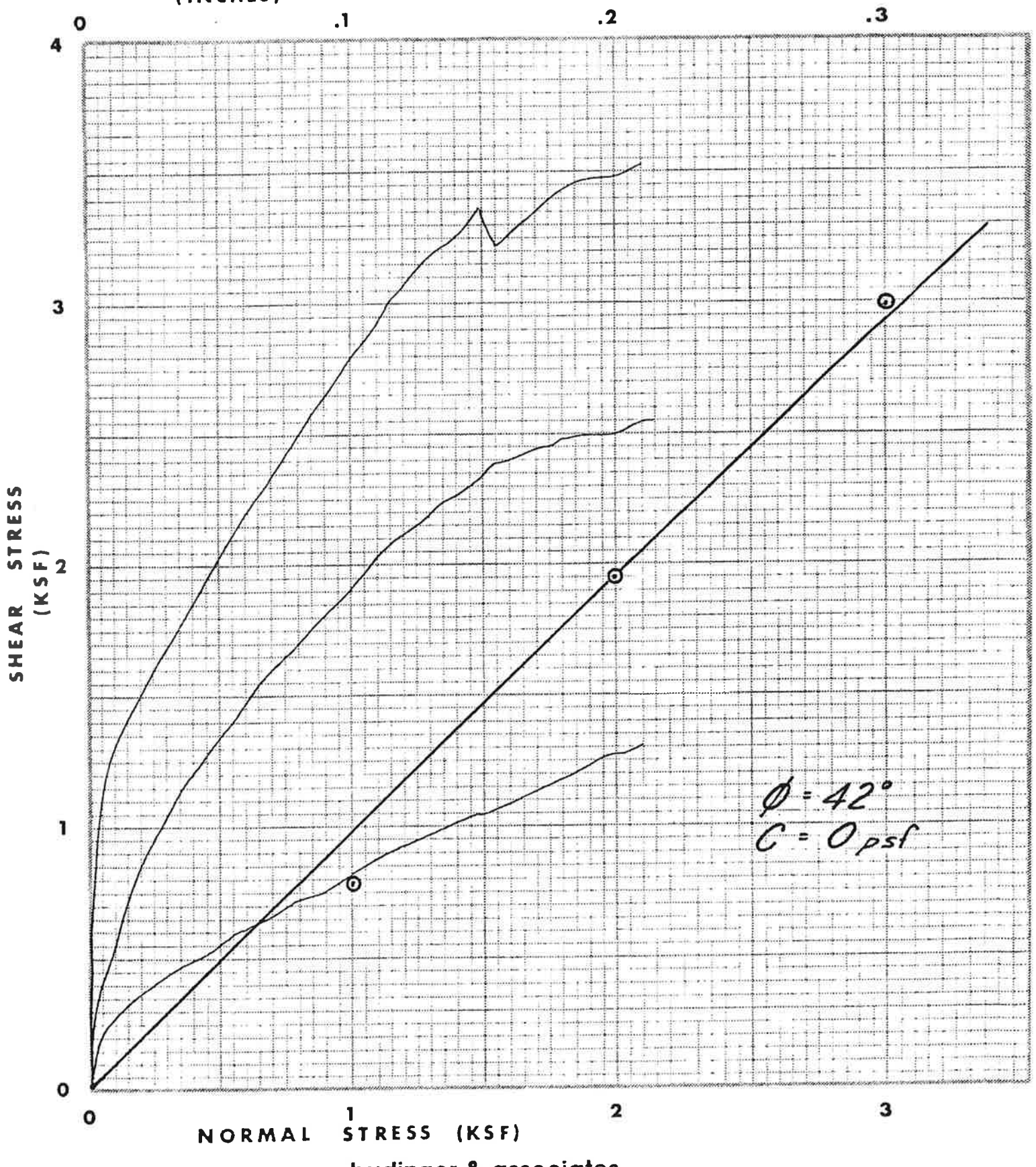
Wenatchee Riverfront Park

BORING #28
DEPTH 3'-4'

JOB NUMBER S8112

RE-MOLDED SHEAR

(-10% passing #200 sieve)



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