WASHINGTON ROAD
CA PFH 123-1(1)

Tahoe National Forest, Nevada County, California

FINAL GEOTECHNICAL AND PAVEMENT REPORT
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1.0 INTRODUCTION

The Washington Road Project is a 5.78-mile two-lane roadway beginning at the intersection with California State Route (SR) 20 at milepost (MP) 0.00 through the Town of Washington, ending just prior to the South Yuba River Bridge at MP 5.78. The roadway is located in the Tahoe National Forest, California (Figure 1, Appendix A). The Town of Washington is approximately 19 miles northeast of Nevada City in Nevada County, California. The Federal Highway Administration (FHWA) in cooperation with the United States Forest Service (USFS), and Nevada County is proposing to perform rehabilitation, restoration and resurfacing (3R) work for this section of Washington Road.

Washington Road was originally paved in approximately 1950, with emergency relief projects at six locations in 1957, which included the concrete box culvert at Washington Creek. Complete records of overlays and improvements since the original construction were not available for review. However, some maintenance records were provided by the Tahoe National Forest Service and Nevada County Road Maintenance office. These records are detailed in recent years regarding flooding events related to El Nino storms in February 1997.

The majority of the existing pavement condition of the roadway is poor, with some observed moderate areas. The width of the road varies from 20 to 26 feet for the two travel lanes with shoulder widths between 0.0 and 1.6 feet. Slope failures and roadway settlement at some locations were previously identified in a scoping trip made in September of 2003 by the project management team. A bridge or extension of the existing concrete box culvert (CBC) is required near MP 4.1 to accommodate the widened portion of the roadway. Naturally occurring asbestos has been found in the vicinity of the existing road.

The purpose of this report is to investigate the subsurface conditions and to provide preliminary geotechnical evaluation and pavement recommendations for the 3R work on this project. The geotechnical and pavement investigation was also completed with the intent of evaluating slope mitigation methods, bridge/culvert foundation recommendations, pavement alternatives, and the presence of the asbestos.

2.0 INVESTIGATION

2.1 Fieldwork

2.1.1 Subsurface Investigation

In October 2004, a geotechnical and pavement subgrade investigation was completed between MP 0.00 and MP 5.78 on Washington Road. Several test holes were attempted in the landslide area, however, only one exploratory geotechnical borehole was drilled near MP 4.6 due to the presence of boulders and cobbles. Two test holes were drilled in the existing CBC structure location at Washington Creek to investigate the subsurface condition at these areas. Twelve pavement boreholes were also drilled to determine the subgrade conditions and pavement thickness. Approximate locations of the borings are illustrated in Figure 2 (Appendix A), although the exact borehole elevations and locations have not been surveyed. Cores were taken of the existing pavement at the top of each boring. The depths of the geotechnical boreholes ranged from 7 to 11 feet while the pavement holes varied from 3 to 6.5 feet. The pavement holes were located approximately one-half mile apart. Graphic diagrams of materials encountered with depth are illustrated in Appendix A, Figures 3 through 7. Boring logs are provided in Appendix

B.

The boreholes were drilled with a truck-mounted rotary drill and 6-inch diameter hollow stem augers by PC Exploration, Inc. based out of Sacramento, California. Samples were collected from both modified California tests (MC), and bulk cuttings. The modified California test was taken with a spoon sampler lined with 2-inch diameter by 4-inch long brass liners used to collect relatively undisturbed soil samples. The sampler was driven into the various strata with blows from a 140-pound hammer falling 30-inches to obtain samples and penetration resistance values. This test is similar to the Standard Penetration Test described by ASTM Method D-1586. Penetration resistance values, when properly evaluated, indicate the relative density or consistency of the soils. Depths at which the samples were taken and the penetration resistance values are shown on the boring logs. Each borehole was backfilled with cuttings and sealed with cold patch asphalt.

Three test pits were also excavated to examine the pavement subgrade and to collect subgrade material samples. Test pits were excavated near MP 0.7, 3.1and 5.5. A total of 100 lbs of pavement, base and sub-base bulk samples were collected. The excavations were backfilled with imported structural fill and sealed with cold patch asphalt.

2.1.2 Road Condition Survey

Pavement condition was surveyed during visits to the site in October 2004 and February 2005. According to the USFS contact, the pavement was chip sealed sometime in the past 5 years. Based on the SHRP Distress Identification Manual, the general road condition shows some polished aggregate and low severity rutting in wheel paths and low to moderate raveling of the roadway, which gives the road a pitted appearance. There is evidence of delamination in several places along the roadway and some pavement cores showed a delamination in the top 1.5 inch of asphalt. Additionally, outside edges of curves and crowned areas of the road have been gouged by machinery, most likely snowplows. Longitudinal cracking often occurs in the gouged areas. Some low severity cracking appears to correlate to locations of culverts. The table in Appendix H describes the roadway width and pavement conditions from the beginning to the end of the proposed rehabilitation area. Also, based on Pavement Management Fact Sheet and the Nevada County Section Condition Survey, 10 of 12 sections of the road are rated poor to fair.

2.2 Laboratory Testing

All samples were shipped to Denver, Colorado in sealed 5-gallon plastic buckets. Laboratory index and strength tests were performed on modified California and bulk samples of base, fill and native soils. Index testing was performed at the Yeh and Associates, Inc. laboratory and the R-value testing was performed at Professional Service Industries, Inc. (PSI), both AASHTO accredited laboratories. The tests performed and the standards followed are given in Table 1.

Table 1. Laboratory Testing Standards.

Test	Standard
Gradation analysis	AASHTO T27
Atterberg Limits	AASHTO T89 and T90
Moisture Content	AASHTO T265
Classification	AASHTO M145 and ASTM D2487
R-value	AASHTO T190
pH	AASHTO T289
Soluble Sulfate Content	AASHTO T290

Table 2 below summarizes the material properties that were encountered during our exploratory drilling investigation.

Table 2. Summary of Laboratory Test Results.

Sample			Natural Moisture Content	Gradation (USCS)			Atterberg Limits			pH	Water Soluble Sulfate	Resistivity	R-Value	Classification	
Boring No.	Depth (ft)	Blow Count	(%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI		(%)	(Ω-cm)		AASHTO	USCS
YAR-01	5.0-6.5	21	21.0	19	49	32	45	44	1	5.9	0.016	20,000		A-2-5 (0)	SM
YAR-02	5.0-6.5	27	20.7	22	38	40	NV	NP	NP					A-4 (0)	SM
YAR-03	5.0-6.5	16	41.4	0	20	80	49	38	11					A-7-5 (11)	ML
YAR-05	5.0-6.5	21	36.1	1	20	79	71	34	38					A-7-5 (33)	CH
YAR-06	5.0-6.5	50 for 6"	4.7	8	74	18	NV	NP	NP	7.1	0	9,259		A-1-b (0)	SM
YAR-07	5.0-6.5	38	8.5	16	50	34	25	20	5					A-2-4 (0)	SM-SC
YAR-07	0-5.0		1.9											A-2-4 (0)	SM-SC
YAR-08	5.0-6.5	33	7.1	0	16	84	41	30	11					A-7-5 (11)	ML
YAR-09	5.0-6.5	50 for 6"	7.0	30	39	31	NV	NP	NP					A-2-4 (0)	SM
YAR-10	5.0-6.5		8.8	36	37	27	32	24	8					A-2-4 (0)	SM
YAR-11	5.0-6.5	50 for 6"	9.5	36	39	25	NV	NP	NP				33	A-1-b (0)	SM
YAR-12	5.0-6.5		4.8	33	43	24	NV	NP	NP	7	0.062	8,403		A-1-b (0)	SM
YA-01	5.0-6.5	53	5.6	30	45	25	NV	NP	NP					A-2-4 (0)	SM
YA-02	5.0-6.5	18								6.2	0.004			A-2-4 (0)	SM
YA-03	5.0-6.5	50 for 6"	16.8	38	46	16	NV	NP	NP					A-1-b (0)	SM
TP-01	0-2.5		16.9	7	63	30	NV	NP	NP				32	A-2-4 (0)	SM
TP-02	0-2.5			84	14	2	36	26	10					A-2-4 (0)	GP
TP-02	0-2.5			1	76	23	29	17	12				12	A-2-6 (0)	SC
TP-03	0-2.5		9.4	41	42	17	NV	NP	NP				38	A-1-b (0)	SM

The R-value test conducted on TP-02 was performed on material passing the 1-inch sieve. A separate set of gradation and Atterberg limit tests was conducted for the minus 1-inch sample that was tested for R-value, as listed in Table 2 above. The R-value for the sample was determined to be 12, but this sample only represented 16 percent of the entire sample collected from TP-02. Because of this, additional R-values were tested, with results all over 30.

Unconfined compressive strength tests were conducted on four samples from YAR-05, YAR-07, YAR-08, and YAR-11. Results indicated unconfined compressive strengths of 7030, 1454, 4798, and 4209 psf, respectively.

Direct shear tests were conducted on two samples to determine the peak and residual strengths of the silty sand material on site. The results from YAR-07 indicate a peak cohesion of 1,858 psf and friction angle of 37.0 degrees, and residual cohesion of 361 psf and friction angle of 36.6 degrees. The results from YAR-11 indicate a peak cohesion of 1,080 psf and friction angle of 42.6 degrees, and residual cohesion of 199 psf and friction angle of 39.6 degrees.

Laboratory test results are presented in detail in Appendix D and Figures 3-7 in Appendix A.

3.0 GEOLOGY

3.1 Regional Geology

The project area is located in the Tahoe National Forest in Nevada County California, which lies within the Sierra Nevada Mountains. The existing Washington Road passes through several distinct geological formations, as listed in Table 3. The southern portion of the road consists of Pliocene age volcanic rocks that are pyroclastic in nature. The middle section is Mesozoic age ultramafic intrusive rocks that are primarily composed of serpentine with minor peridotite and dunite. The Mesozoic age rocks of the area are the product of dense, ultramafic crust under the Pacific Ocean that has been dragged under the overriding, and more buoyant, continental crust of western North America. High pressure from the collision of these two types of earth crust, crumpling at the contact creates wedges of serpentenized rock and zones of metamorphosed ocean deposits of sedimentary rock. The location of the serpentenized rock is illustrated in Figure 2, from approximately MP 1.40 to MP 2.60. The base of the valley consists of Paleozoic age marine deposits of interbedded chert and sandstone, which in many locations is covered with alluvial deposits of sand, gravel, and cobbles. A layer of colluvial deposits and residuum of the highly weathered bedrock base overlies most of the project.

Geohazards along the project area include, but are not limited to, rockfall, slope failures and exposed asbestiform rock. Tree fall from undermined steep slopes is an additional hazard on the road that travels through dense forests of tall (some more than 50 feet tall) fir, pine and ponderosa trees.

Table 3. Geology along Washington Road.

Mile Post (estimated)		Geologic Unit (Age)	Geology
0.00	1.30	Pliocene Volcanics (Cenozoic)	Subgrade is derived from volcanic rocks including pyroclastic rock which occasionally surfaces as outcrops
1.40	2.60	Ultramafic Rocks (Mesozoic)	Ultramafic intrusive rocks, largely **serpentinized** with minor peridotite and dunite exhibited in outcrops from MP 1.4 to 2.6
2.60	5.78	Shoo Fly Formation (Upper Paleozoic)	Subgrade is derived from marine sedimentary and metasedimentary rocks which occasionally surfaces as outcrops

3.2 Naturally Occurring Asbestos

Analysis of the serpentine rock samples collected from the site for the presence of naturally occurring fibrous material was done by the use of polarized light microscopy and was completed

by Analytica Solutions, Inc. in October 2004. The asbestiform mineral chrysotile was detected in the samples gathered from boring YAR-04 and test pit TP-2 at 5% and from boring YAR-06 at trace percentages. Each of these samples was collected from the area between MP 1.40 and MP 2.60, where serpentinized rock outcrops were identified. Samples from borings drilled in the Shoo Fly Formation marine sedimentary units at YAR-08 and YAR-11 yielded no asbestiform minerals. Other non-hazardous minerals detected include antigorite.

Table 4. Asbestos Testing Results (from Analytica Solutions, Inc.)

	YAR-04	YAR-06	YAR-08	YAR-11	TP-02
Percent* Asbestiform Minerals (Chrysotile)	5.0	Trace <1%	bd**	bd	5.0
Percent Other Fibrous Materials (Antigorite)	95	95	bd	bd	85
Percent Non-fibrous Material	bd	4.1	100	100	10

*Table values represent the percentages detected of each listed mineral
** bd indicates below detectable levels

4.0 EXISTING CONDITIONS

4.1 Climate

Nevada County has a wet mountain climate that is unusually mild for an alpine region. Average temperature highs in degrees Fahrenheit in the winter are in the 40's; and in the summer, the middle to upper 80's. Average winter lows are in the 20's; and in the summer, the 40's. Relevant climate statistics are given in Table 5. Bureau of Reclamation weather station at Blue Canyon in Nevada County, located approximately 8.1 miles southeast of the site, at an elevation of 5279 feet elevation records an average yearly snow total of 251.8 inches of snow. Lower elevations at the Washington Road project site (approximately 4500 ft) may experience less accumulation, but construction may be impacted if conducted during the winter months of December through March.

Table 5. Climate Statistics.

	Monthly Range	Annual
Average maximum temperature (°F)	48-89	68.2
Average minimum temperature (°F)	29-49	37.9
Average temperature (°F)	37.8-76.6	53.1
Average rainfall (inches)	.32-11.07	62.64

Source: http://www.weather.com/

The 60+ average annual precipitation along the project area indicates a significant amount of moisture may be penetrating the subsurface. This could be impacting the areas experiencing ground movement, which has additionally been documented in county maintenance records. Slope instability and settlement has been correlated to specific heavy rainfall events along the project. Additionally, overflow of existing culverts has been documented during heavy rainfall events. Construction during months with less precipitation may assist in avoiding soft subgrade issues.

4.2 Existing Roadway Template

The existing roadway width varies from 20 to 24 feet. Unpaved shoulder widths outside of pavement are generally three to ten feet wide. The existing embankment sections are generally able to support the desired width of 26 feet paved roadway and improved foreslopes without modification of the alignment. The existing narrow sections are generally in cut locations where the combined shoulder and ditch width between the edge of pavement and the toe of the cut varies from 0 to 1.6 feet. See Section 5.1 for guidelines and precautions for construction areas containing asbestos. The slope of the shoulders/bench now matches that of the mainline. The existing pavement thickness along the roadway is shown in Table 6 below.

Table 6. Pavement Thickness Summary.

Approximate Mile Marker	Borehole Number	Pavement Depth Inches	Aggregate Base Thickness Inches	Roadway Width Feet
0.05	YAR-01	1	8	24
0.49	YAR-02	1.5	6	24
0.97	YAR-03	2	6	23
1.50	YAR-04	2	7	24
1.98	YAR-05	2	7	24
2.48	YAR-06	2	3	23
2.98	YAR-07	3	4	23
3.23	YA-01	2	6	26
3.46	YAR-08	6	0	23
3.96	YAR-09	6	7	23
4.03	YA-02	None	7	23
4.04	YA-03	1	5	24
4.45	YAR-10	5	7	23
5.14	YAR-11	4	5	24
5.69	YAR-12	3	3	21

No seeps or springs were observed at the time of this investigation along Washington Road. Two possible locations of subexcavation were identified during our investigation. The first area, at approximately MP 0.4, settlement was observed in the roadway following rainfall events in 1997. This area had been resurfaced, but may need further subgrade improvements. The second area is located near the landslide area, near MP 3.2, that is described in the following sections. It is likely that culvert and drainage improvements associated with this project will alleviate subsurface saturation problems in the future.

4.3 Unstable Slopes and Landslide Area

In a previous study, an engineer from Nevada County identified five areas that exhibited slope failures. The inspection report prepared after a field visit conducted by the project manager indicated that only one of the slope failures, at approximately MP 3.2, impacts the current roadway. This landslide was further investigated by Holdrege & Kull in 2002. The geotechnical evaluation along the roadway confirms that there are several unstable slope locations and possible cutslope failure areas in addition to the identified landslides at approximately MP's 2.9 (Photograph 18, Appendix C), 3.8, 4.5 (Photograph 26, Appendix C) and 4.6 (Photographs 27 and 28, Appendix C). These areas are generally associated with over-steepened slopes, which could be mitigated by laying back the slopes at 1.5H:1V to 2H:1V and revegetating the slopes with geosynthetic mats where necessary.

Based on the result of our field investigation and observations, the landslide at MP 3.2 appears to be a rotational slump that has been caused by poor surface drainage of the roadside ditch compounded by a relatively steep embankment fill slope. The landslide area impacts an approximately 205-foot section of Washington Road with slopes with gradients ranging from approximately 2H: 1V to 1-1/2H: 1V. Hummocky terrain was observed below the roadway embankment and tension cracks were observed in the old roadway bench below Washington Road. The head scarp is assumed to be located in Washington Road where distress observations have been made. There is a possibility that the roadway embankment movement is the upper extent of a large extensive slope failure that runs from the roadway platform to the valley floor. Based on previous work and our observations, the landslide appears to be confined to the Washington Road fill and the underlaying, shallow surface soil layers. Photographs of the slide are included in Appendix C, Photographs 19 and 20.

Although groundwater was not present at the time of our investigation at a maximum-drilled depth of 11 feet, occasional loose to soft materials were noted during drilling. As mentioned previously, several auger borings were attempted in the area of the landslide, but the presence of boulders and cobbles resulted in refusal before a bedrock depth could be determined.

4.4 Bridge or Box Culvert Location

The existing box culvert, located at MP 4.1, is a concrete structure approximately 25 feet long (see Photographs 22 to 24, Appendix C). Wing walls are present on both sides of the structure. Part of the upstream wing wall was elevated to serve as a rail. The water flow was low during our field investigations. During high rainfall events, the culvert has overflowed and eroded materials along the roadway. YA-02 and YA-03 encountered silty sand material that classifies as SM according to USCS to the depths excavated of approximately 7 feet and 10 feet, respectively. Blow counts indicate medium dense materials.

4.5 Mine Subsidence

Near the centerline of the roadway, at approximately MP 2.7, a sinkhole was reported to have occurred due to mine subsidence (see Photograph 17, Appendix C). Any patching or pavement cracking that had occurred has been covered. A mine adit is located along the embankment below the roadway and drifts into the hillside in an easterly direction. The adit and its shaft, or raise are remnants of the Red Ledge Mine tunnel #3. The precise depth and orientation had not been determined at the time of the site investigation. The current manager of the mine, Mr. Trenton Davis, is unsure of the areal size of the raise opening that is under the road, but suggested it could be from 36 to 100 square feet. The adit and raise were built in the early 1900's and were closed in the 1940's when Washington Road was constructed. The area above the raise has experienced failure, especially in the east lane (toward Washington). The failure area is most likely due to settling of the fill materials used during road construction and probable collapse of the raise and adit. These shafts were constructed so long ago that the construction type and stabilization cannot be determined. Additionally, the adit and raise were built at the contact between serpentine and metasedimentary rock layers, an area of more easily weathered, softer rock. According to the current manager of the mine, a new adit is being planned approximately 30 feet south of the old site to be used as a secondary exit from the mine. Any construction of new adits and/or shafts should follow the requirements as specified by the Mine Safety and Health Administration (MSHA).

4.6 Subsurface

In general, the soil below the roadway pavement consists of road base from 0 to 8 inches thick. The underlying colluvium or weathered bedrock residuum was encountered to the maximum

depth of exploration, approximately 11.0 feet. Groundwater was not encountered during our drilling operations in any of the test holes or test pits. A detailed description of the subsoil is discussed below and illustrated in Figures 3-7 in Appendix A in the in the boring logs.

4.6.1 Road Base

The road base material generally consists of sand with some silt and gravel that classifies as A-1-b according to the AASHTO classification system (SP-SM by USCS). As shown in Table 4, the thickness of this layer ranges from 0 to 8 inches, averaging 5.25 inches. This unit is difficult to distinguish from the natural on-site materials and may be a compacted and reworked section of in-situ materials.

4.6.2 Colluvial Soils

Colluvial soils were encountered in all of the boreholes. This unit generally consists of loose to medium dense, silty sand with variable amounts of gravel, cobbles and boulders.

4.6.3 Bedrock

Pyroclastic volcanic rocks, ultramafic intrusive rocks containing serpentine and marine deposits described in Section 3.1 above are exposed in the existing road cuts and natural slopes and were encountered in some of the exploratory borings. Photographs 10 through 14, Appendix C, illustrate exposures of serpentine bedrock outcrop.

4.7 Fill Embankments

Current embankment fills generally consist of riprap or boulder and cobble material most likely taken off the cut construction along the route. This fill material is difficult to distinguish from the natural colluvial materials and may be the same. The fill slopes are generally in good condition, with observed settlement areas noted in the previous sections. The base materials are natural, well-draining colluvial materials that should experience minimal long-term settlement. Additional embankment construction is not expected as part of the roadway improvements.

4.8 Colluvium Cut Slopes

The natural slopes are approximately 1-1/2 horizontal to 1 vertical and are probably near the angle of repose of the colluvial material. As recommended in the scoping report, future cuts, if needed, should be less than 34 degrees (the estimated colluvial material internal friction angle) to ensure long-term global stability. Precipitation and frost heave processes may be responsible for surface raveling, which should be taken into account in future cut areas by the use of a wider shoulder or catchment ditch. The catchment ditches should be cleaned and maintained regularly to ensure proper water flow.

4.9 Corrosion Potential

Representative samples of soil and bedrock were tested for pH, resistivity, and water-soluble sulfates to evaluate their corrosion potential for culvert pipes. Table 7 provides the ranges of the measured values for these parameters.

Table 7. Corrosion Parameters

Corrosion Parameter	Range
pH	5.9-7.1
Resistivity (Ω-cm)	8403-20,000
Sulfates (ppm)	<200

Based on the laboratory test results, the general characteristics of the soils at the tested locations indicate a negligible degree of pH and sulfate attacks on concrete exposed to these materials. The soil resistivity results shown in Table 7 were considered virtually non aggressive toward iron and buried metals.

4.10 Seismicity

Washington Road is located in a seismically active area. According to the USGS 1996 Seismic Hazard Map, the project site has a peak horizontal acceleration of 0.15g with a 10% probability of exceedance in 50 years. Although the Melones fault represents the boundary of the ultramafic serpentenized units the metasedimentary Shoo Fly Formation on the site, this fault does not appear to be active. The nearest active faults are the Tahoe-Sierra frontal fault zone and the West Tahoe-Dollar Point Fault Zone, both approximately 20 to 25 miles east of the site, and the Mohawk Valley Fault zone, approximately 25 to 30 miles northeast of the site.

5.0 RECOMMENDATIONS

5.1 Naturally Occurring Asbestos Abatement

Naturally occurring asbestos was identified in the project limits in concentrations greater than 0.25 percent by volume in the areas outlined in Figure 2, from approximately MP1.4 to MP 2.6 and shown in Photographs 10 to 14, Appendix C. This material is not suitable as an aggregate source for pavement or concrete. Any disturbance to the surface materials (both native and embankment fill) should be avoided. Construction activities along the project should conform to the requirements of the California Air Resources Board (ARB). The ARB has established standards for construction in areas containing naturally occurring asbestos. These requirements are provided in Appendix F: Section 93105 Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying and Surface Mining Operations.

5.2 Bridge and Culvert Foundation

Based on the result of our geotechnical investigation, we believe spread footings placed on the existing, undisturbed silty sand material can support either the replacement bridge or CBC extension. Spread footings may be designed for a maximum allowable bearing pressure of 1.5 tsf based on blow counts from YA-02 and YA-03.

Backfill for the CBC extension or bridge abutment should consist of structural backfill in accordance with Section 704.04 of the CFLHD Standard Specifications FP-03. Using this material, both abutments for the bridge or wing walls for the CBC can be designed for a lateral earth pressure computed on the basis of an equivalent fluid density of 35 pcf.

5.3 Landslide Repair

Based on the result of our study of the possible cause of the landslide, we believe the slide area can be mitigated by constructing a 2H: 1V slope above a buttress near the toe of the slope. The buttress can be constructed using large boulders or a mechanically stabilized earth (MSE) wall using onsite granular materials. A professional engineer should design the buttress. As an

alternative mitigation, the slope can be lowered to 3 horizontal to 1 vertical (approximately 18 degrees) by importing fill material and compacting in 8- to 12-inch lifts with moisture and density control. Slope stability analyses (see Appendix F) indicate either mitigation measure would provide factors of safety above 1.5. The preliminary slope stability analysis of the existing slope presented in Appendix F assumed a marginal factor of safety of the existing roadway embankment with a shallow groundwater surface. Any additional water introduced into the embankment mass will reduce the slope stability factor of safety.

Landslides are generally very sensitive to the presence of groundwater, which makes the landslide mass more active in a typical spring season when groundwater levels are elevated. As part of any mitigation of the embankment failure, it is imperative that surface and subsurface water conditions be managed. Any design should consider diverting and controlling surface water around or away from the repaired area and the remedial design should incorporate an internal drainage system to prevent any build up of groundwater. An internal drainage system should include a system of collection pipes that transports water away from the landslide area. Surface water should be controlled in the roadside ditch and diverted well around the landslide area with an impermeable ditch liner.

5.4 Fills and Excavations

Due to the marginal stability of most of the cut slopes along the roadway and the presence of naturally occurring asbestos, we recommend that excavations made into the hillside be avoided between MP 1.4 and MP 2.6.

Any temporary excavations in the colluvium, fill or soil should be sloped at no steeper than 1-1/2 horizontal to 1 vertical. Any permanent fills should be well compacted and sloped at no steeper than 2 horizontal to 1 vertical.

No seeps or springs were observed at the time of this investigation along Washington Road. Two possible locations of subexcavation were identified during our investigation. The first area, at approximately MP 0.4, settlement was observed in the roadway following rainfall events in 1997. This area had been resurfaced, but may need further subgrade improvements. During construction, this area should be expected to be excavated approximately 3 to 5 feet below the existing grade, then replaced with moisture and density control. A geosynthetic liner and drain may also need to be added to this area. The second area is located near the landslide area, at approximately MP 3.2. It is likely that culvert and drainage improvements associated with this project will alleviate subsurface saturation problems in the future. Surface water should be contained by drainage ditches. Cut slope areas may require wider ditches or other precautions to contain higher surface water flow.

5.5 Pavement Recommendations and Discussion

5.5.1 Traffic

Washington Road has a speed limit of 35 miles per hour and 15 miles per hour through the town of Washington. A current daily traffic volume (AADT) of 426, with 7.5% trucks and a growth factor of 2% was used for the pavement design. Traffic data was provided by Nevada County.

In order to determine the number of logging trucks, the local forest service was contacted to get an estimate of the amount of logging that would occur in this area. Logging truck traffic is only allowed from May 15 to October 15, and although logging in this area is in decline, a busy day

would be 20 trucks. However, if there were a large fire, there would be a large number of trucks. In order to use a conservative traffic loading, a volume of 20 logging trucks per day for the entire allowable number of days would be 20 trucks X 150 days = 3000 logging trucks per year. This would represent 2% of the total traffic.

For the total truck loading, an ESAL factor of 2.2 per vehicle was used for logging trucks, and 1.35 per vehicle for the remainder of the heavy vehicles (5.5% of total traffic). Since there was no data available on the mix of heavy trucks, the various ESAL factors in the FHWA classifications were averaged to establish the ESAL factor for the remaining trucks. Cars had an ESAL factor of 0.0004. The resulting 20-year design ESALs, as calculated using the DARWIN program resulted in a loading of 439,273 ESALs. Applying a 0.6 lane distribution factor yields a design loading of 263,563.8 ESALs.

5.5.2 Existing Pavement

The existing pavement thickness varied from 1 to 6 inches, with a predominant thickness of 2 to 3 inches. The existing pavement was placed over an aggregate base (ABC) with an average thickness of 5.4 inches varying from 0 to 8 inches. Where the ABC layer was thin, the underlying material tested as A-1-b (0) yielding good structural support. Soils below the base course varied from a classification of A-1-b (0) to A-7-5 (33) with A-2-4 (0) being the predominant soil classification. The R-values measured at the three test pits and borehole YAR-11 were 32, 12, 38, and 33 respectively. The summary of laboratory testing of soils appears in Table 2. An R-value of 30 was used for the roadway design. An R-value of 30 was used to represent the subgrade, and the resilient modulus input was calculated using the Colorado DOT design manual, which follows AASHTO, recommended procedures. From the R-value equal to 30, a resilient modulus of 6849 psi was calculated and used in the various pavement designs. The equation for the resilient modulus is shown in Appendix E.

The existing roadway width as previously described varies between 20 to 26 feet and the planned pavement rehabilitation would widen the road to a uniform width of 24 feet.

5.5.3 Rehabilitation Treatments

Numerous treatments were considered and designed and **we recommend that the existing roadway receive full depth reclamation with the foamed asphalt treatment.** The majority of the existing pavement is in poor condition, and full depth reclamation will allow widening and culvert pipe and subgrade repairs, if required, to be made and stabilized with minimal problems to the roadway template and support. In the areas of pipe repairs/extensions and subsidence, the final roadway can be brought up to the proper elevation with ABC, or millings if available. The new pavement will be constructed using a minimum 95% reliability binder, so it should not be as susceptible to thermal cracking or reflective cracking from widening, patching, or reflective cracks from the old pavement.

Table 8 lists the various options designed for this project and their comparative costs. Since the maintenance costs for any of the alternates are similar, except for the overlay existing option, only initial construction costs are presented. All of the alternate design pavement thicknesses were designed using the Darwin program following the AASHTO 1993 Pavement Design Guide.

Table 8. Rehabilitation Options

	HACP Thickness Inches	Total Cost $/yd^2	24 foot Cost/Mile (14080 yd^2)	Preferred Option
Individual Treatment Costs				
Overlay Existing	2.75	$6.05	$85,184.00	
Cold Recycle	2.75	$10.05	$141,504.00	
Pulverization - 6"	4.5	$12.60	$177,408.00	
Pulverization - 8"	4	$11.50	$161,920.00	2
Full Depth Reclamation Options				
3% Foamed Asphalt - 6" +1% Cement	3	$11.75	$165,440.00	1
3% Foamed Asphalt - 8" +1% Cement	3	$12.56	$176,844.80	
Emulsified Asphalt - 6"	3	$12.73	$179,238.40	
Emulsified Asphalt - 8"	2	$11.66	$164,172.80	
Cement	3	$11.26	$158,540.80	
Fly Ash	3	$10.87	$153,049.60	
Through Washington				
Overlay Existing Pavement	2	$4.40	$61,952.00	1

Given:

HMA =	$40.00 /ton
Pulverization=$.30/ft2	$2.70 /yd^2
Reclamation=$.30/ft2	$2.70 /yd^2
Cold Recycle =	$4.00 /yd^2
Asphalt Cement =	$200.00 /ton
Emulsified Asphalt =	$350.00 /ton
Cement =	$150.00 /ton
Fly Ash =	$120.00 /ton

Existing Base and HMA = 145lbs/ft^3

HMA = 110 lbs/yd^2-inch

In Table 8 above, except for overlay only, the costs of each option are within 15% of each other and the cost of the two preferred options (foamed asphalt or full depth reclamation) are within 5% of each other.

Overlay Existing Pavement - Overlay of the existing pavement has the lowest initial cost, but thin widening sections will soon show reflective cracking on the longitudinal joints, and the areas that have experienced subgrade settlement or fatigue failures will require patching and may soon reflect through the new pavement. Additionally, because of reflective cracking from the old mat, this option will have higher maintenance costs than any of the other options.

Cold Recycle + Overlay – This option looks attractive, but to be successful this treatment requires that 1 to 2 inches of the old mat be left in place as a working platform and the pavement thickness on this project is quite variable, and in several locations, very thin. An additional problem with this option is that cold recycling requires a long recycling equipment train, which would have problems with the sharp turns and steep grades on this roadway.

Pulverization + Overlay - This option allows areas where pavement is removed over pipe or box culvert repairs to be addressed and stabilized with ABC or milled pavement prior to overlay, resulting in a uniform base strength for placement of new pavement. Treatment to eight inches will also address the variable asphalt pavement thickness, since this treatment will pulverize the entire existing pavement along with some of the base. If this option is selected, the pulverized materials need to be tested for strength (i.e., R-value) to determine if the structural layer coefficient of 0.12 is correct. If it is higher than the value used in the design, the HACP layer might be thinner than designed resulting in cost savings. This option also allows for an easy transition onto parking areas or pullouts regardless of whether they are to be gravel or paved.

Two depths were presented for this option, with the trade-off being a thicker overlay if the thinner pulverization option is chosen.

Full Depth Reclamation + Overlay – This treatment presents a favorable option for Washington Road and is the recommended option with the 6-inch depth of treatment. The equipment constraints of cold recycling are avoided, since the large cross shaft mixers and additive haul trucks used in this options can negotiate the sharp curves and grades.

Using Foamed Asphalt, two options were studied. When 6 inches of pulverization is used, a structural layer coefficient of 0.25 was used in the pavement design because all of the materials pulverized will be old asphalt pavement or aggregate base course (ABC) providing a relatively clean product to treat with the foamed asphalt. When 8 inches of pulverization is used, a structural layer coefficient of 0.20 was used because some of the A-2 soil will be incorporated into the treated layer. After discussion with the FHWA pavement engineer, the cost of 1% cement and 3% foamed asphalt was added to the cost estimate. The incorporation of 1% cement and 3% asphalt is reflected in the cost data in Table 8. This option allows traffic on the treated base fairly quickly after compaction since only a small amount of water needs to be cured out of the base.

Emulsified asphalt in conjunction with full depth reclamation was also considered and the cost presented in Table 8. This is a viable option, but cure time for the emulsion needs to be considered. It often takes several hours longer to cure emulsion than foamed asphalt. This could impact the length of time traffic control is required.

The costs of cement and fly ash treated base are also presented in Table 8, but base strengths need to be determined in the lab to verify the structure layer coefficients used in the design. If the design structural layer coefficients are verified, the overlay thickness will need to be adjusted to address the lower base strengths, especially if the 8-inch treatment incorporates some of the A-2 soils from the subgrade. Cure times needed for carrying traffic also need to be considered.

5.5.4 Pavement Through the Town of Washington

The pavement through the Town of Washington presents problems with many driveways to match and the desire to limit disruption of local businesses and local traffic (see Photographs 30 to 32, Appendix C). In addition, there may be problems with drainage if the elevation of the pavement is raised. Since the distresses are mainly low severity cracking, a two inch mill and overlay is recommended as the preferred treatment from the Washington sign to the South Yuba River Bridge. This treatment should provide many years of service to the residents, with the only distress being reflective cracking which may appear sooner than cracking on the remainder of the project. The recommended binder is a PG 68-16 and is a high reliability binder for this area. The use of this binder will help delay the early appearance of the cracking distresses.

5.6 Asphalt Mix Recommendations

The PG graded binder for the asphalt mix should be a PG 64-16 to provide a minimum 95% reliability binder. This grade was chosen using the LTPPBind program, which shows this grade as the 98% reliability binder for weather data from Nevada City and Sierra City, the closest weather data listed for the project area.

The HACP 3-inch mat and the 2-inch overlay through Washington should be a nominal ½-inch mix with PG 64-16 binder. An Hveem design meeting Class C (minimum mean stability $\geq$ 30) is recommended and the project plans should include a Type C smoothness specification. A Class E mix is recommended (as per FP-03). The quantity of binder can be estimated at 6% by weight of mix. The unit weight can be estimated at 145 lb/ft^3.

A prime coat should be applied on the foamed asphalt treated base material prior to paving. The material should be an MC-70 cutback (at .33gallon/yd^2) and an item for blotter material should be included at 1.638 lb/ft^2.

Tack coat (at .10 gallons/yd^2) is required in the overlay section and should be either a CSS-1, CSS-1h, SS-1, or SS-1h emulsion.

Asphalt Mix Availability - The closest permanent asphalt plant belongs to Vulcan Materials and is located in Grass Valley, a distance of 23 miles from Washington. Another permanent asphalt plant is in Truckee and belongs to Teichert Materials, a distance of 42 miles. Both of these suppliers as well as Granite Construction via a remote plant and Baldwin from Marysville might be expected to bid on this type of construction.

6.0 LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and

recommendations submitted in this report are based upon the data obtained from exploratory borings, field reconnaissance and the proposed type of construction. The nature and extent of subsurface variations across the site may not become evident until excavation is performed. If during construction, fill, soil, or water conditions appear to be different from those described herein, this office should be advised at once so reevaluation of the recommendations may be made. We recommend on-site observation of excavations and foundation bearing strata by a representative of the geotechnical engineer.

7.0 REFERENCES

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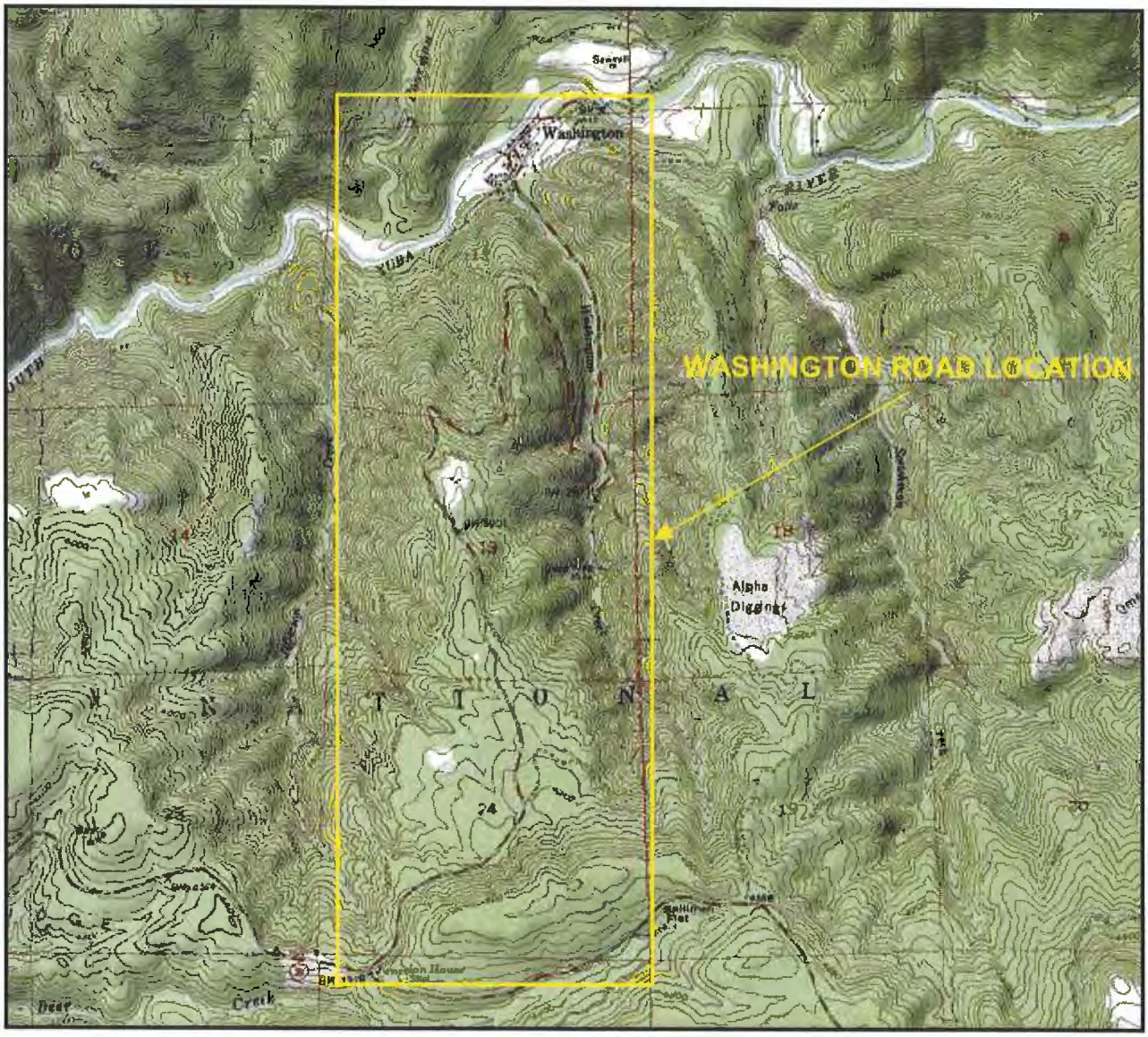
APPENDIX A
Figures



Topographic contour Interval is 40 feet.

WASHINGTON ROAD

CA PFH 123-1(1)

Tahoe National Forest, Nevada County, California

GEOTECHNICAL & PAVEMENT REPORT

24-108

Figure 1
Site Map

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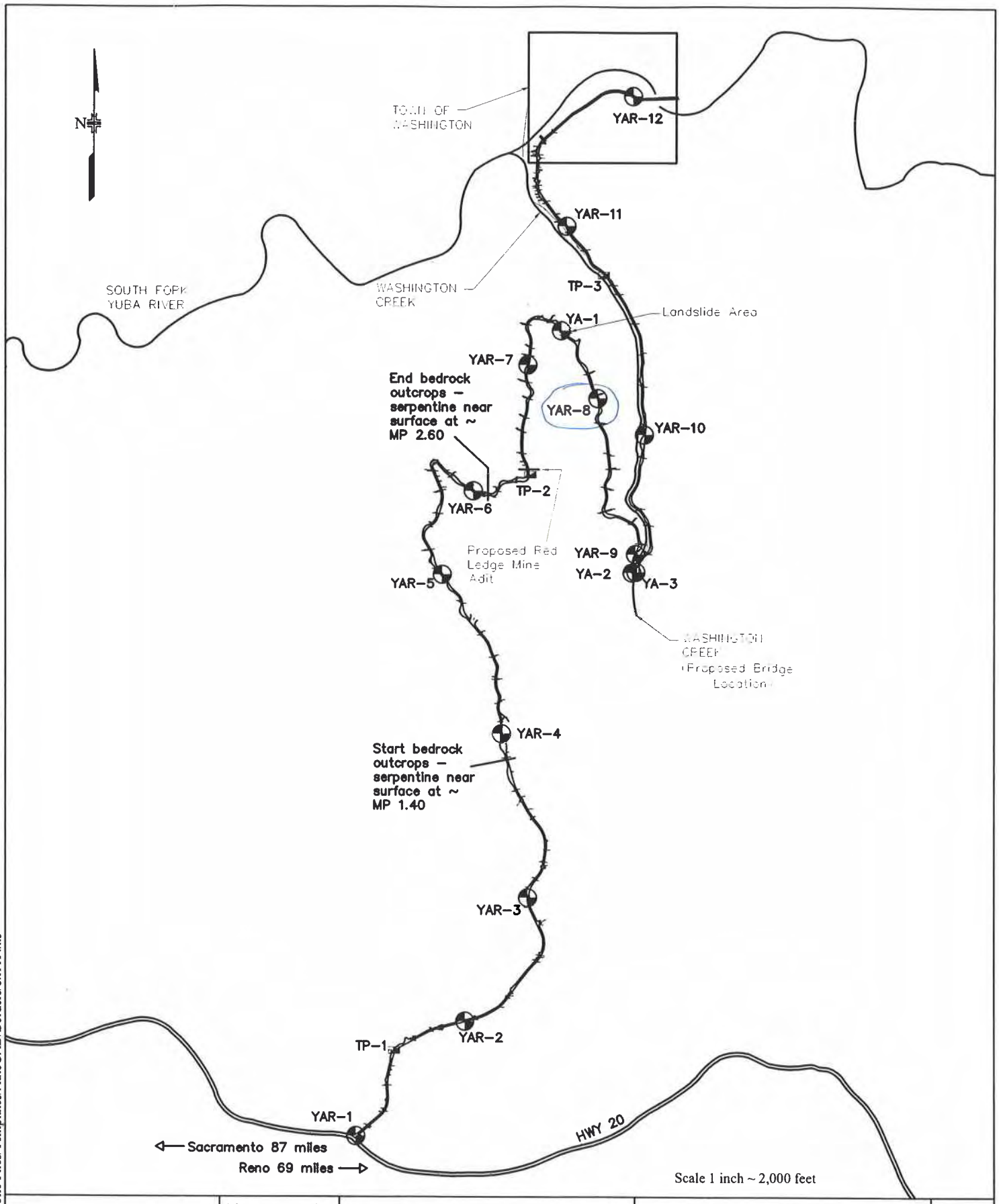

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Boring Locations

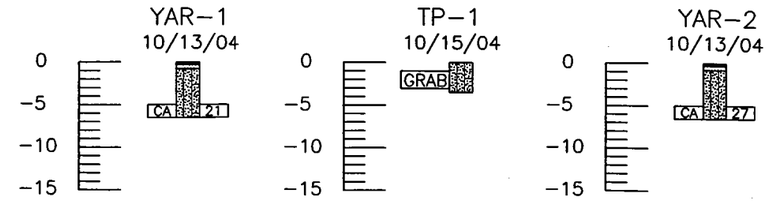
Project: **Washington Road, CA**

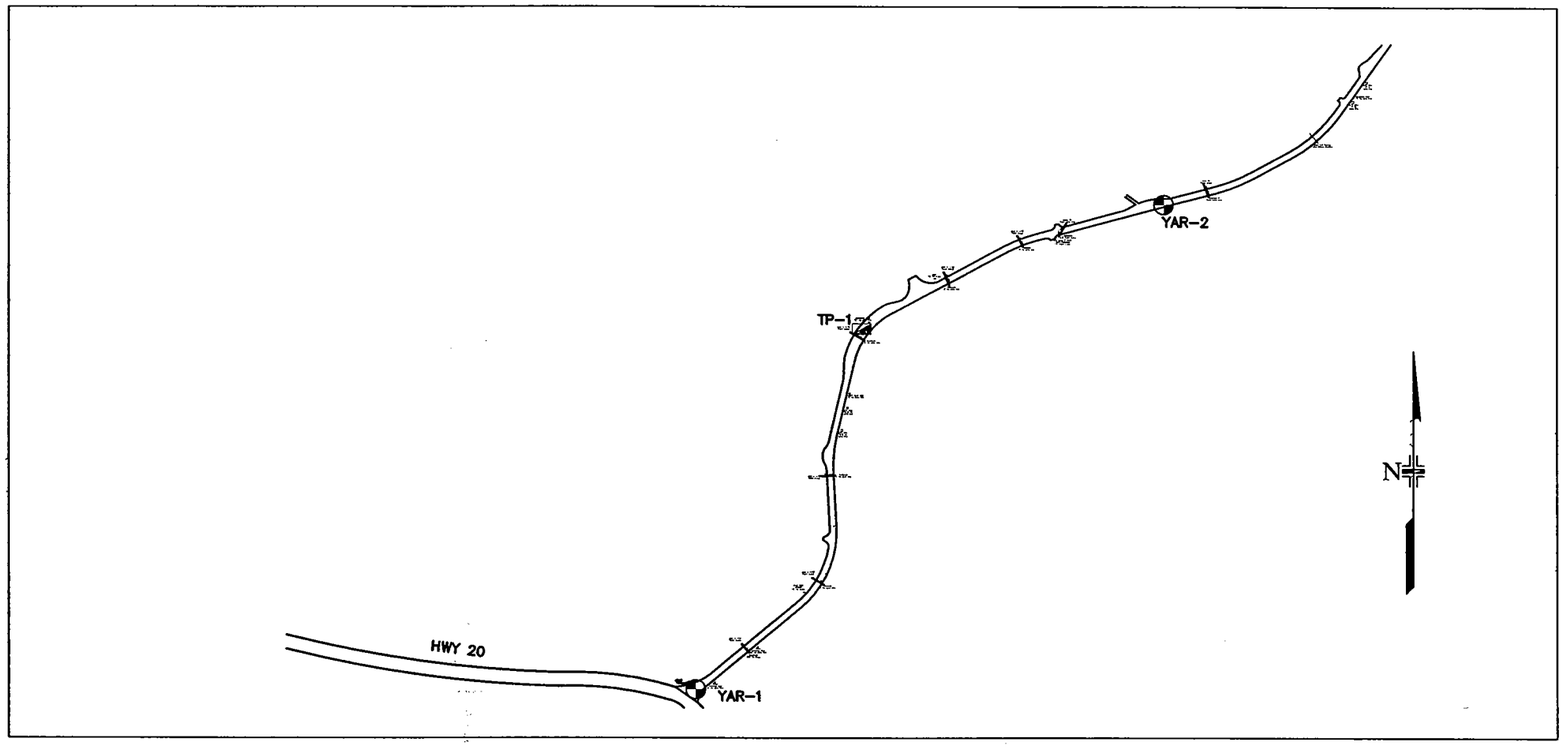
Date: **December 8, 2004**

Drawn by: **LDO** Checked by: **RDA**

Project Number: **24-108**

Figure Number: **2**





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LEGEND

Boring ID

Sample Type CA 30 Blows per Foot *
CA–California Spoon
R = Refusal (Bounce)

Approximate Location of Test Boring

Approximate Location of Test Pit

* Standard Penetration Test {AASHTO T 206–87(2000)} and Penetration Test

TYPE OF MATERIAL

- Asphalt
- Road base
- sandy CLAY with silt and gravel, brown, stiff to very stiff, (colluvium).
- sandy SILT with some clay, yellow, stiff to very stiff (alluvium/colluvium).
- silty SAND with clay, gravel, cobbles and boulders, reddish brown to brown, stiff to very stiff (colluvium).
- silty GRAVEL with clay, sand, cobbles and boulders, reddish brown to brown, stiff to very stiff (colluvium).

SUMMARY OF TEST RESULTS

Boring No.	Depth	Sample Type	Natural Moisture %	Sieve Analysis AASHTO			Atterberg Limits			pH	Water Soluble Sulfate (%)	Swell %	USCS* Classification	AASHTO Classification
				Gravel >#4	Sand	Fine< #200	Liquid Limit	Plastic Limit	Plastic Index					
YAR–01	5–6.5	CA	21.0	19	49	32	45	44	1	5.9	0.016		SM	A–2–5 (0)
TP–1	0–2.5	GRAB	16.9	7	63	30	NV	NP	NP	–	–		SM	A–2–4 (0)
YAR–02	5–6.5	CA	20.7	22	38	40	NV	NP	NP	–	–	–	SM	A–4 (0)

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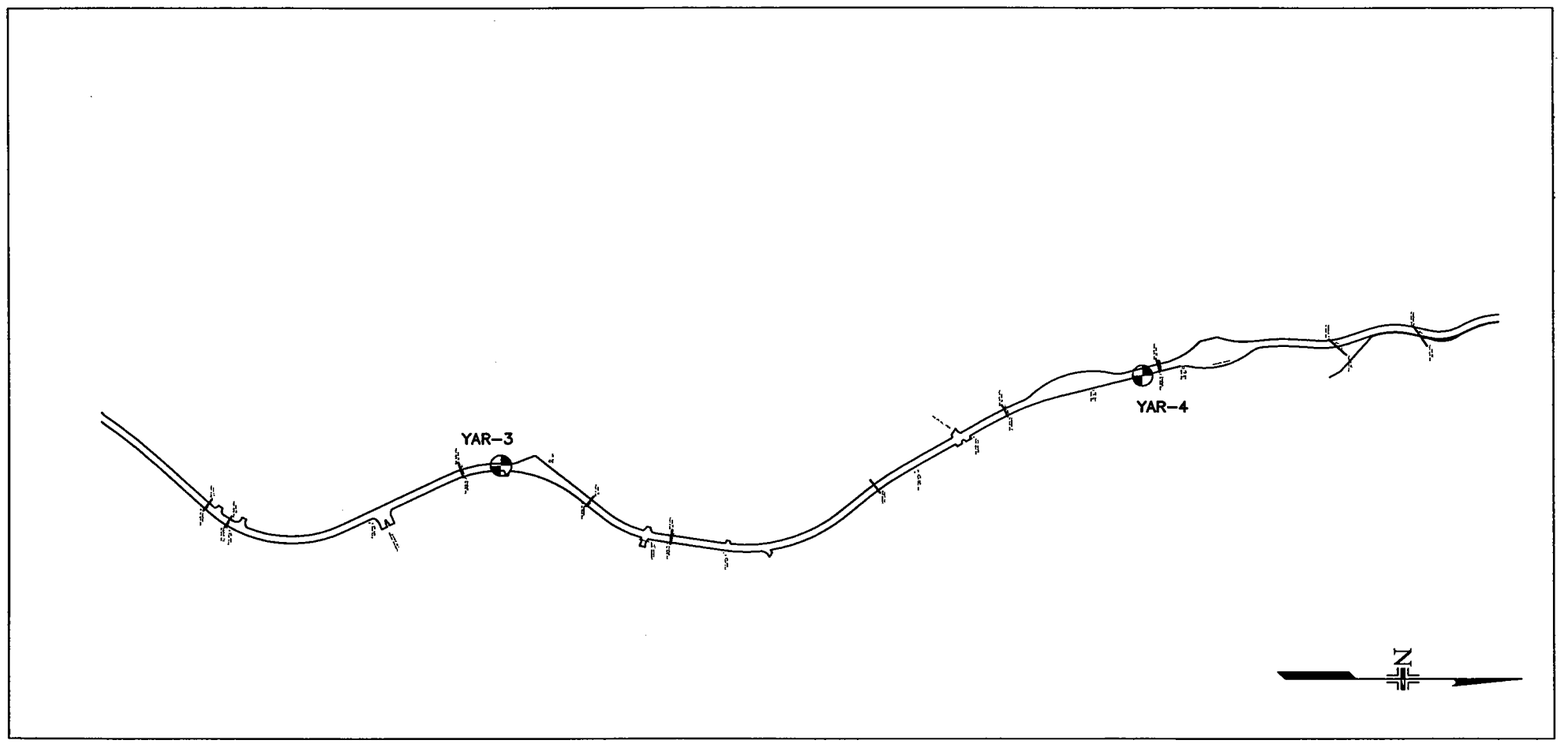

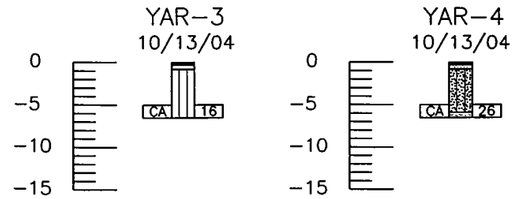

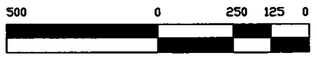

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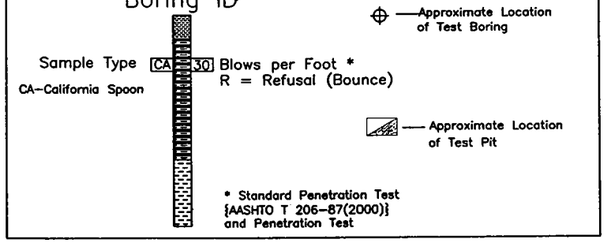

TYPE OF MATERIAL

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- sandy SILT with some clay, yellow, stiff to very stiff (alluvium/colluvium).
- silty SAND with clay, gravel, cobbles and boulders, reddish brown to brown, stiff to very stiff (colluvium).
- silty GRAVEL with clay, sand, cobbles and boulders, reddish brown to brown, stiff to very stiff (colluvium).
- Weathered SERPENTINE, gray–brown to blue–gray, (Mesozoic Ultramafic Rocks).

SUMMARY OF TEST RESULTS

Boring No.	Depth	Sample Type	Natural Moisture %	Sieve Analysis AASHTO Gravel >#4	Sand	Fine<#200	Atterberg Limits Liquid Limit	Plastic Limit	Plastic Index	pH	Water Soluble Sulfate (%)	Swell %	USCS* Classification	AASHTO Classification
YAR–03	5–6.5	CA	37.0	0	20	80	49	38	11	–	–		ML	A–7–5 (11)
YAR–04	5–6.5	CA	–	–	–	–	–	–	–	–	–		–	

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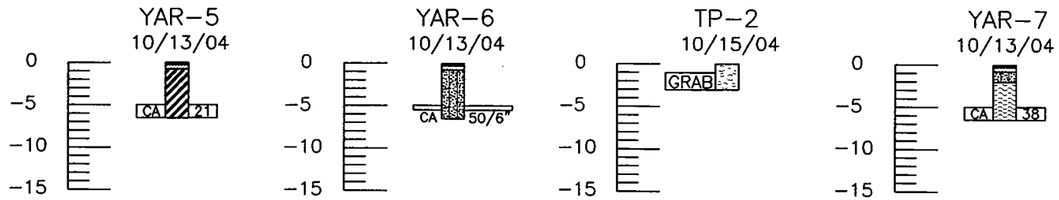

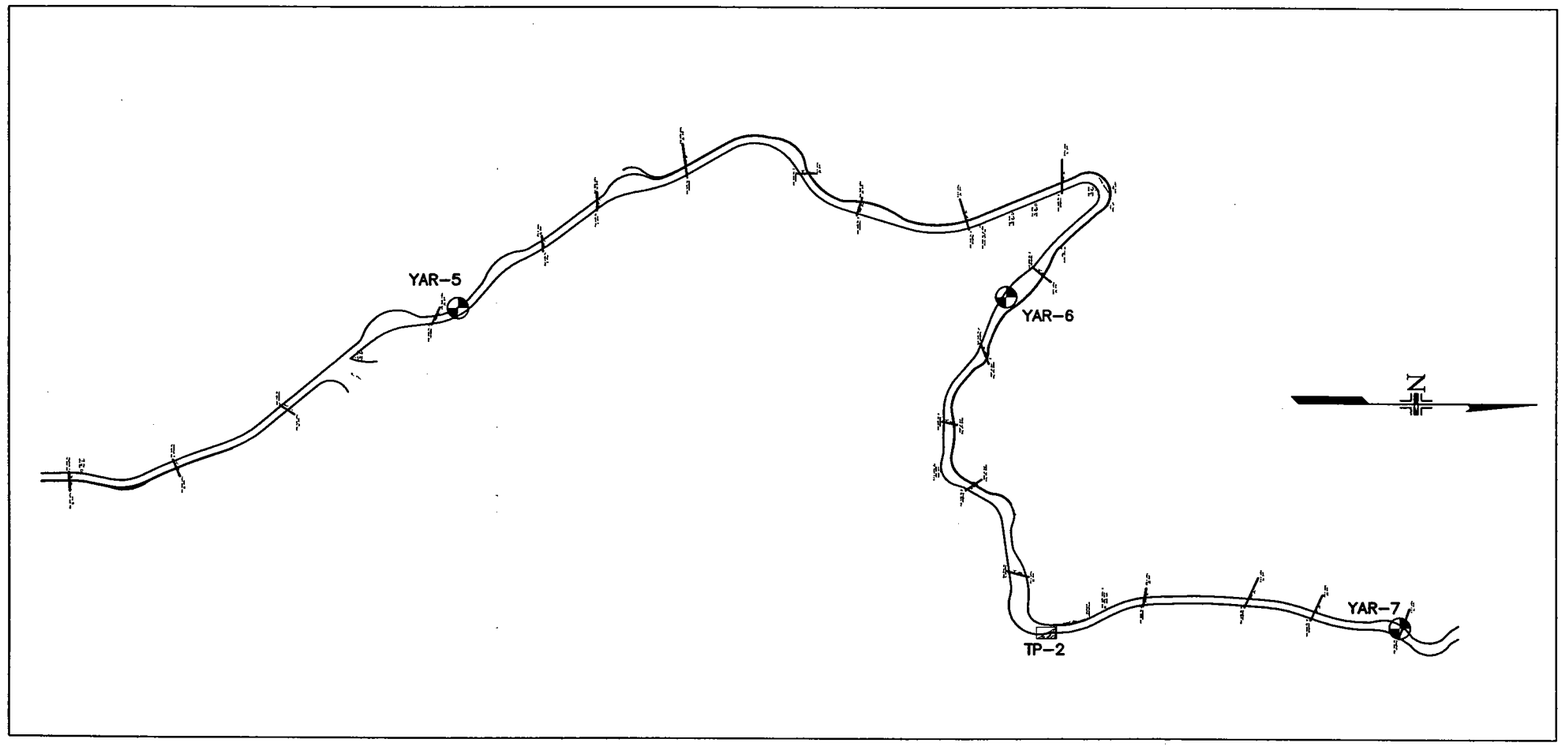

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Boring ID

Approximate Location of Test Boring

Sample Type CA 30 Blows per Foot *
R = Refusal (Bounce)

CA–California Spoon

Approximate Location of Test Pit

* Standard Penetration Test {AASHTO T 206–87(2000)} and Penetration Test

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- silty GRAVEL with clay, sand, cobbles and boulders, reddish brown to brown, stiff to very stiff (colluvium).
- Weathered SANDSTONE/SILTSTONE, brown to light brown, laminated, (Shoo Fly Complex).

SUMMARY OF TEST RESULTS

Boring No.	Depth	Sample Type	Natural Moisture %	Sieve Analysis AASHTO Gravel >#4	Sand	Fine< #200	Atterberg Limits Liquid Limit	Plastic Limit	Plastic Index	pH	Water Soluble Sulfate (%)	Swell %	USCS* Classification	AASHTO Classification
YAR–05	5–6.5	CA	36.1	1	20	79	71	34	38	–	–		CH	A–7–5 (33)
YAR–06	5–6.5	CA	4.7	8	74	18	NV	NP	NP	7.1	0		SM	A–1–b (0)
TP–2	0–2.5	GRAB	13.2	90	8	2	36	26	10	–	–		GP	A–2–4 (0)
YAR–07	5–6.5	CA	8.5	16	50	34	25	20	5	–	–		SM–SC	A–2–4 (0)

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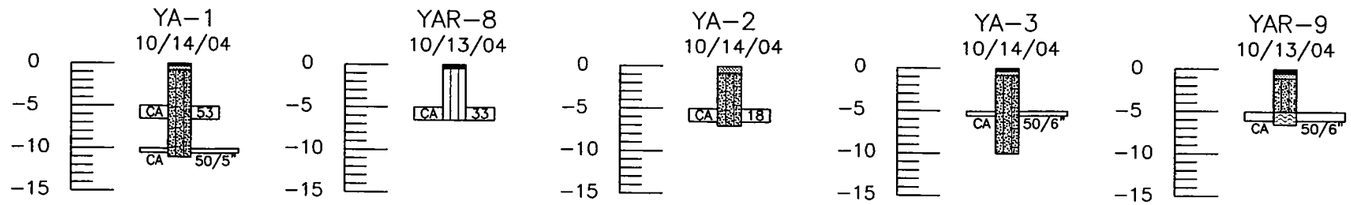

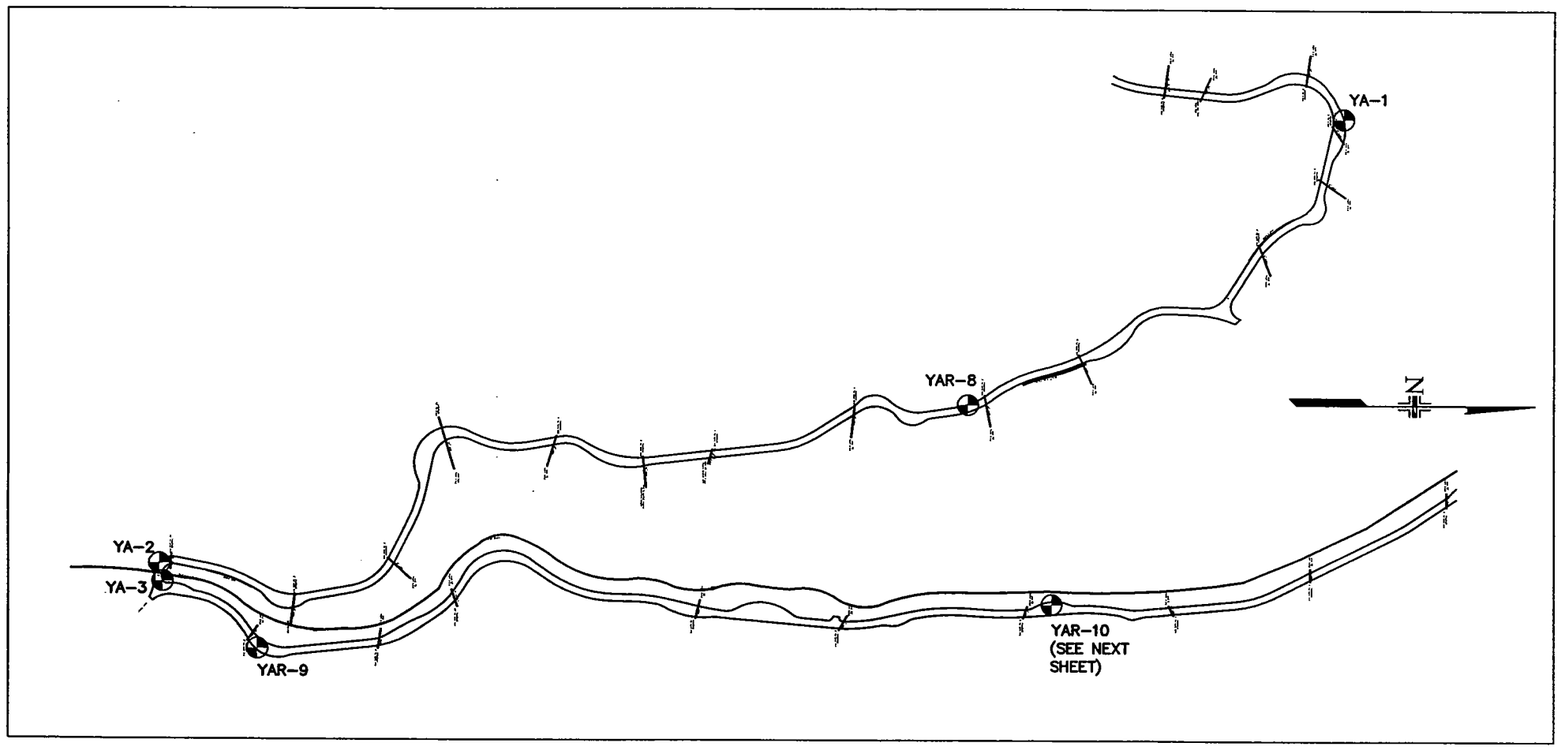

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Boring ID

Sample Type CA 30 Blows per Foot *

CA–California Spoon

R = Refusal (Bounce)

⊕ — Approximate Location of Test Boring

— Approximate Location of Test Pit

* Standard Penetration Test {AASHTO T 206–87(2000)} and Penetration Test

TYPE OF MATERIAL

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- Road base
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YA–01	5–6.5	CA	5.6	30	45	25	NV	NP	NP	–	–		SM	A–2–4 (0)
YAR–08	5–6.5	CA	7.1	0	16	64	41	30	11	–	–		ML	A–7–5 (11)
YA–02	0–2.5	CA	–	–	–	–	–	–	–	6.2	0.004		–	–
YA–03	5–6.5	CA	16.8	38	46	16	NV	NP	NP	–	–		SM	A–1–b (0)
YAR–09	5–6.5	CA	7.0	30	39	31	NV	NP	NP	–	–		SM	A–2–4 (0)

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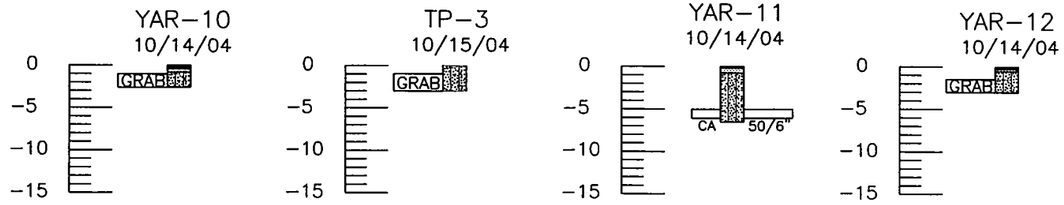
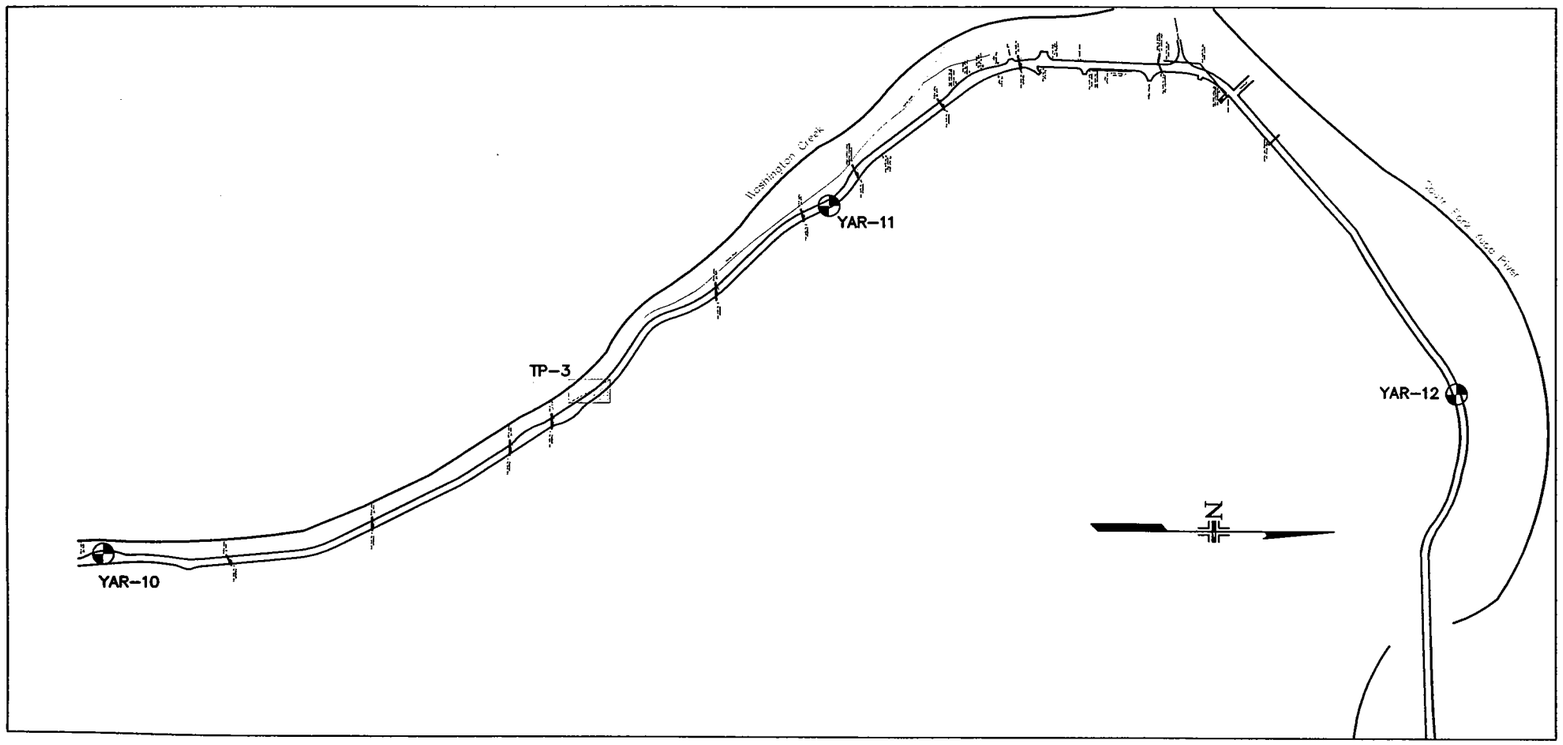
24–108
Sheet Number 6





500 0 250 125 0

SCALE" 1" = 500'

LEGEND

Boring ID

—Approximate Location of Test Boring

Sample Type CA 30 Blows per Foot *
R = Refusal (Bounce)

CA–California Spoon

—Approximate Location of Test Pit

* Standard Penetration Test {AASHTO T 206–87(2000)} and Penetration Test

TYPE OF MATERIAL

- Asphalt
- Road base
- sandy CLAY with silt and gravel, brown, stiff to very stiff, (colluvium).
- sandy SILT with some clay, yellow, stiff to very stiff (alluvium/colluvium).
- silty SAND with clay, gravel, cobbles and boulders, reddish brown to brown, stiff to very stiff (colluvium).
- silty GRAVEL with clay, sand, cobbles and boulders, reddish brown to brown, stiff to very stiff (colluvium).
- Weathered Sandstone/Siltstone, gray–brown to light brown, (Shoo Fly Complex).

SUMMARY OF TEST RESULTS

Boring No.	Depth	Sample Type	Natural Moisture %	Sieve Analysis AASHTO Gravel >#4	Sand	Fine< #200	Atterberg Limits Liquid Limit	Plastic Limit	Plastic Index	pH	Water Soluble Sulfate (%)	Swell %	USCS* Classification	AASHTO Classification
YAR–10	5–6.5	GRAB	8.8	36	37	27	32	24	8	–	–		SM	A–2–4 (0)
TP–3	0–2.5	GRAB	9.4	41	42	17	NV	NP	NP	–	–		SM	A–1–b (0)
YAR–11	5–6.5	CA	9.5	36	39	25	NV	NP	NP	–	–		SM	A–1–b (0)
YAR–12	5–6.5	GRAB	4.8	33	43	24	NV	NP	NP	7	0.062		SM	A–1–b (0)

Computer File Information	
Creation Date: 12/08/04	Initials: LDO
Last Modification Date: 03/28/05	Initials: JDD
Full Path: Z:\\2004 Projects\24–108\DWGs\...	
Drawing File Name: 1.Eng–Geo.dwg	
Acad Ver.:ACAD 2000 Scale: NTS	Units: English

Sheet Revisions

Yeh and Associates, Inc.
Consulting Geotechnical Engineers
5700 E. Evans Avenue Denver, CO 80222
Phone: (303) 781-9590 Fax: (303) 781-9583

As Constructed
No Revisions:
Revised:
Void:

ENGINEERING GEOLOGY SHEET

Designer: RDA
Detailer: LDO
Sheet Subset:
Structure Numbers
Subset Sheets: of

Project No./Code
YAR–10, 11 & 12, TP–3
24–108
Sheet Number 7

APPENDIX B
Boring Logs

YEH AND ASSOCIATES, INC. GEOTECHNICAL ENGINEERING CONSULTANTS	Project: Washington Rd. Project Number: 24-108 Date:

Legend for Symbols Used on Borehole Logs

Sample Types


Grab Sample


Modified California Sampler

Soil Lithology


USCS Silty Sand

USCS Silt


USCS Poorly-graded Gravel

Weathered Bedrock


Asphalt

USCS High Plasticity Clay


Fill (made ground)

Bedrock Lithology

Lab Test Abbreviations

MC-Moisture Content
DD-Dry Density
#200-Percent Passing #200 Sieve
LL-Liquid Limit
PL-Plastic Limit
PI-Plastic Index
S-Sulphate Content
S/C-Swell/Consolidation
UCCS-Unconfined Compressive Strength
Re-Resistivity
PtL-Point Load Test
AASHTO-AASHTO Classification
USCS-USCS Classification

* Indicates that gradation analysis was performed, Atterberg limits were not performed, but the USCS classification was applied assuming non plastic characteristics

YEH AND ASSOCIATES, INC. GEOTECHNICAL ENGINEERING CONSULTANTS	Project: Washington Rd. Project Number: 24-108 Date:	Boring: **TP-1** Sheet 1 of 1

Boring Began: 10/15/2004 Completed: 10/15/2004 Total Depth: 3.0 ft
Drilling Method: Rubber Tire Backhoe Drill Bit: Ground Elevation:
Drill: 1-TON Casing: Location:
Driller: PC Exploration Weather: Clear, Warm Coordinates: N: E:
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 3.5 ft. silty SAND with clay, gravel, cobbles and boulders, SM, reddish brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (colluvium).	MC= 17 % #200= 30 % AASHTO: A-2-4 (0) USCS: SM
								Bottom of Hole at 3.0 ft.	
	5								
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **TP-2**
Sheet 1 of 1

Boring Began: 10/15/2004
Drilling Method: Rubber Tire Backhoe
Drill: 1-TON
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/15/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 3.0 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 3.5 ft. silty GRAVEL with clay, sand, cobbles and boulders, GP, reddish brown to blue - gray, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (colluvium).	MC= 13 % #200= 1 % LL= 36 PL= 26 PI= 10 AASHTO: A-2-4 (0) USCS: GP 5% Chrysotile Asbestos
								Bottom of Hole at 3.0 ft.	
	5								
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **TP-3**
Sheet 1 of 1

Boring Began: 10/15/2004
Completed: 10/15/2004
Total Depth: 3.0 ft
Drilling Method: Rubber Tire Backhoe
Drill Bit:
Ground Elevation:
Drill: 1-TON
Casing:
Location:
Driller: PC Exploration
Weather: Clear, Warm
Coordinates: N: E:
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 3.5 ft. silty SAND with clay, gravel, cobbles and boulders, SM, reddish brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (alluvium/colluvium).	MC= 9 % #200= 17 % AASHTO: A-1-b (0) USCS: SM
								Bottom of Hole at 3.0 ft.	
	5								
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YA-01**
Sheet 1 of 1

Boring Began: 10/14/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/14/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 11.0 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.2 ft. Asphalt.	
								0.2 - 0.8 ft. Road Base.	
								0.8 - 11.0 ft. silty SAND with clay, gravel, cobbles and boulders, SM, reddish brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (landslide debris).	
	5				16/21/32	53			MC= 6 % #200= 25 % AASHTO: A-2-4 (0) USCS: SM
	10				50/5"	50/5"			Boulder encountered.
								Bottom of Hole at 11.0 ft.	Auger refusal at 11.0'

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YA-02**
Sheet 1 of 1

Boring Began: 10/14/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/14/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 7.0 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.6 ft. Road Base.	
								0.6 - 7.0 ft. silty SAND with clay, gravel, cobbles and boulders, SM, reddish brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (alluvium).	
	5				11/10/8	18			pH= 6.2 S= 0.004 % AASHTO: A-2-4 (0) USCS: SM
								Bottom of Hole at 7.0 ft.	Auger refusal at 7.0'
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YA-03**
Sheet 1 of 1

Boring Began: 10/14/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/14/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 10.0 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.1 ft. Asphalt.	
								0.1 - 0.5 ft. Road Base.	
								0.5 - 10.0 ft. silty SAND with clay, gravel, cobbles and boulders, SM, reddish brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (alluvium).	
	5				50/6"	50/6"			MC= 17 % #200= 16 % AASHTO: A-1-b (0) USCS: SM
									Boulder Encountered
	10							Bottom of Hole at 10.0 ft.	Auger refusal at 10.0'

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-01**
Sheet 1 of 1

Boring Began: 10/13/2004
Completed: 10/13/2004
Total Depth: 6.5 ft
Drilling Method: Hollow-Stem Auger
Drill Bit:
Ground Elevation:
Drill: CME 75
Casing:
Location:
Driller: PC Exploration
Weather: Clear, Warm
Coordinates: N: E:
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.1 ft. Asphalt.	
								0.1 - 0.8 ft. Road Base.	
								0.8 - 6.5 ft. silty SAND with some clay, SM, reddish brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (colluvium).	
	5				4/9/12	21			MC= 21 % #200= 32 % LL= 45 PL= 44 PI= 1 pH= 5.9 S= 0.016 % AASHTO: A-2-5 (0) USCS: SM
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-02**
Sheet 1 of 1

Boring Began: 10/13/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/13/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.1 ft. Asphalt.	
								0.1 - 0.6 ft. Road Base.	
								0.6 - 6.5 ft. silty SAND with clay and cobbles, SM, brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (colluvium).	
	5				5/12/15	27			MC= 21 % #200= 40 % AASHTO: A-4 (0) USCS: SM
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-03**
Sheet 1 of 1

Boring Began: 10/13/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/13/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.2 ft. Asphalt.	
								0.2 - 0.7 ft. Road Base.	
								0.7 - 6.5 ft. sandy SILT with clay, ML, reddish brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (colluvium).	
	5				7/7/9	16			MC= 37 % #200= 80 % LL= 49 PL= 38 PI= 11 AASHTO: A-7-5 (11) USCS: ML
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-04**
Sheet 1 of 1

Boring Began: 10/13/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 55
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/13/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.2 ft. Asphalt.	
								0.2 - 0.8 ft. Road Base.	
								0.8 - 5.8 ft. silty SAND with clay, gravel and some cobbles, SM, brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (colluvium).	
	5				7/11/15	26			
								5.8 - 6.5 ft. Weathered SERPENTINE, gray - brown mottled with blue - gray, dry to damp, laminated, moderately decomposed, contains chrysotile asbestos, (Mesozoic ultramafic rocks).	5% Chrysotile Asbestos
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-05**
Sheet 1 of 1

Boring Began: 10/13/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/13/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.2 ft. Asphalt.	
								0.2 - 0.8 ft. Road Base.	
								0.8 - 6.5 ft. sandy CLAY with silt and gravel, CH, brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, high plasticity, (colluvium).	
	5				5/8/13	21			MC= 36 % #200= 79 % LL= 71 PL= 34 PI= 38 UCCS= 7100 psi AASHTO: A-7-5 (33) USCS: CH
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-06**
Sheet 1 of 1

Boring Began: 10/13/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/13/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.2 ft. Asphalt.	
								0.2 - 0.4 ft. Road Base.	
								0.4 - 6.5 ft. silty SAND with clay and cobbles, SM, gray to green, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (colluvium).	
	5				50/6"	50/6"			MC= 5 % #200= 18 % pH= 7.1 S= 0 % AASHTO: A-1-b (0) USCS: SM Trace Chrsotile Asbestos
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-07**
Sheet 1 of 1

Boring Began: 10/13/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/13/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.3 ft. Asphalt.	
								0.3 - 0.6 ft. Road Base.	
								0.6 - 2.0 ft. silty SAND with clay and cobbles, SC-SM, reddish brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (colluvium).	MC= 9 % #200= 34 % LL= 25 PL= 20 PI= 5 AASHTO: A-2-4 (0) USCS: SM-SC
	5				27/22/16	38		**2.0 - 6.5 ft.** Weathered SILTSONE/SANDSTONE, gray - brown to light brown, dry to damp, laminated, moderately decomposed, (Shoo Fly Complex).	
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-08**
Sheet 1 of 1

Boring Began: 10/14/2004
Drilling Method: Hand Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/14/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.5 ft. Asphalt.	
								0.5 - 6.5 ft. sandy SILT with some clay, ML, yellow, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (alluvium/colluvium).	
	5				12/17/16	33			MC= 7 % DD= 97.1 pcf #200= 84 % LL= 41 PL= 30 PI= 11 UCCS= 4897 psi AASHTO: A-7-5 (11) USCS: ML 0% Chrsotile Asbestos
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/29/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-09**
Sheet 1 of 1

Boring Began: 10/14/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/14/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.5 ft. Asphalt.	
								0.5 - 1.1 ft. Road Base.	
								1.1 - 5.0 ft. silty SAND with clay and gravel, SM, yellow to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (alluvium/colluvium).	MC= 7 % DD= 136.0 pcf #200= 31 % AASHTO: A-2-4 (0) USCS: SM
	5				25/50/6"	50/6"		**5.0 - 6.5 ft.** Weathered SANDSTONE/SILTSTONE, brown to light brown, dry to damp, laminated, moderately decomposed, (Shoo Fly Complex).	
								Bottom of Hole at 6.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-10**
Sheet 1 of 1

Boring Began: 10/14/2004
Completed: 10/14/2004
Total Depth: 2.5 ft
Drilling Method: Hollow-Stem Auger
Drill Bit:
Ground Elevation:
Drill: CME 75
Casing:
Location:
Driller: PC Exploration
Weather: Clear, Warm
Coordinates: N: E:
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.4 ft. Asphalt.	
								0.4 - 1.0 ft. Road Base.	
								1.0 - 2.5 ft. silty SAND with clay and gravel, SM, light brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (alluvium).	MC= 9 % #200= 27 % LL= 32 PL= 24 PI= 8 AASHTO: A-2-4 (0) USCS: SM
	5							Bottom of Hole at 2.5 ft.	
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Washington Rd.
Project Number: 24-108 Date:

Boring: **YAR-11**
Sheet 1 of 1

Boring Began: 10/14/2004
Drilling Method: Hollow-Stem Auger
Drill: CME 75
Driller: PC Exploration
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Completed: 10/14/2004
Drill Bit:
Casing:
Weather: Clear, Warm

Total Depth: 6.5 ft
Ground Elevation:
Location:
Coordinates: N: E:

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.3 ft. Asphalt.	
								0.3 - 0.7 ft. Road Base.	
								0.7 - 6.5 ft. silty SAND with clay and gravel, SM, light brown to brown, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (alluvium/colluvium).	
	5				25/50/6"	50/6"			MC= 10 % DD= 126.6 pcf #200= 25 % AASHTO: A-1-b USCS: SM 0% Chrsotile Asbestos
	10							Bottom of Hole at 6.5 ft.	

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

YEH AND ASSOCIATES, INC. GEOTECHNICAL ENGINEERING CONSULTANTS	Project: Washington Rd.	Boring: **YAR-12**
	Project Number: 24-108 Date:	Sheet 1 of 1

Boring Began: 10/14/2004 Completed: 10/14/2004 Total Depth: 3.0 ft
Drilling Method: Hollow-Stem Auger Drill Bit: Ground Elevation:
Drill: CME 55 Casing: Location:
Driller: PC Exploration Weather: Clear, Warm Coordinates: N: E:
Logged By: J. Deuto
Final By: B. Francis
Inclination: Vertical

Ground Water Notes: Dry

Depth	-	-	-	-
Date	-	-	-	-
Time	-	-	-	-

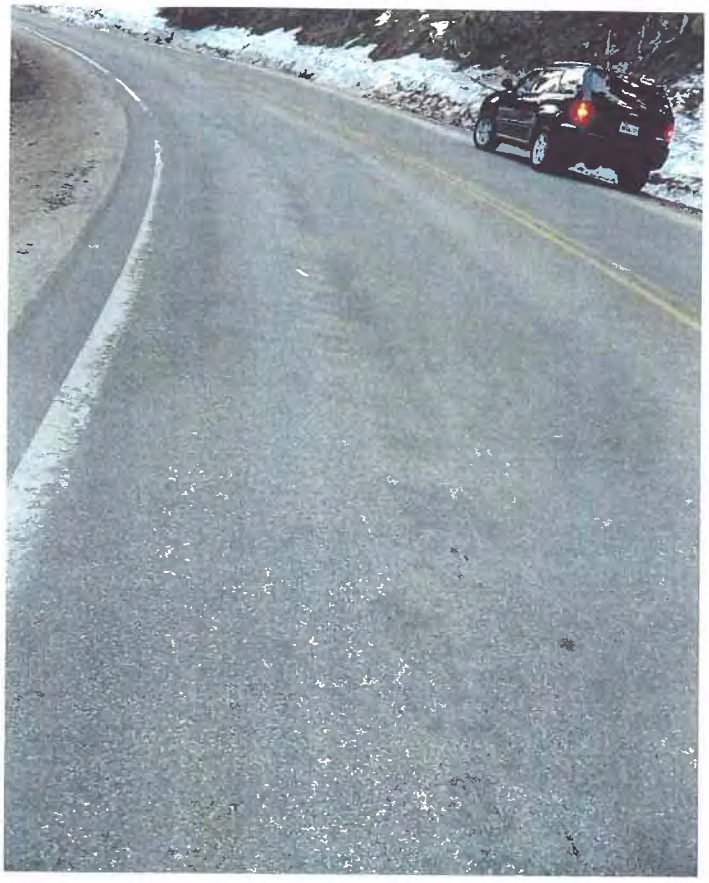
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples SPT Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.2 ft. Asphalt.	
								0.2 - 0.4 ft. Road Base.	
								0.4 - 3.0 ft. sandy SAND with clay and gravel, CL, brown to gray, damp, stiff to very stiff, rounded to subrounded, weak cementation, homogeneous, (alluvium/colluvium).	MC= 5 % #200= 24 % pH= 7 S= 0.062 % AASHTO: A-1-b USCS: SM
								Bottom of Hole at 3.0 ft.	
	5								
	10								

BORING LOG WASHINGTON RD.GPJ YEH ASSOCIATES.GDT 3/28/05

APPENDIX C
Photographs

Photograph 1: MP 0.00 - Intersection of California State Route 20 and Washington Road.

Photograph 2: MP 0.10-0.20 - Typical raveling of roadway
6-inch (15.2 centimeter) ruler for scale.



Photograph 3: MP 0.10-0.20 - Typical cuts and rutting of pavement, possible snowplow damage.

Photograph 4: MP 0.20-0.21-Moderate severity longitudinal cracking.

Photograph 5: MP 0.20-0.26 - Typical moderate to high severity transverse cracking.

Photograph 6: MP 0.20-0.26 - High severity transverse cracking.

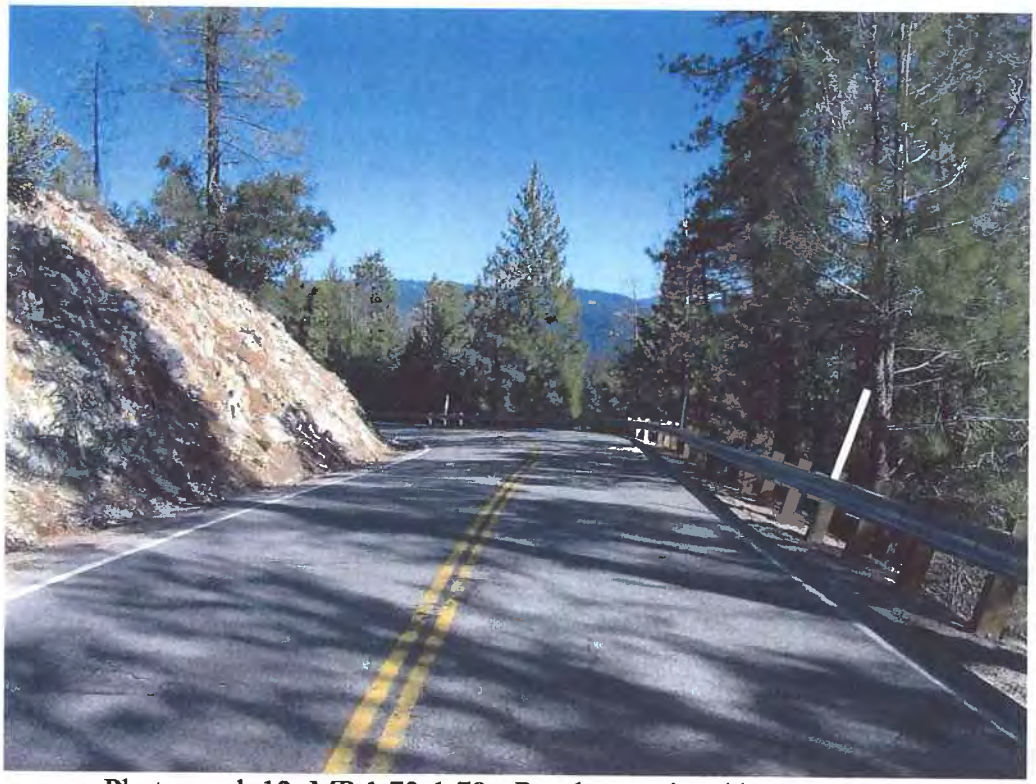
Photograph 7: MP 0.48 - Patched 5-foot (1.5 meter) diameter pothole and moderate to high severity longitudinal cracking.

Photograph 8: MP 0.61 - High severity edge cracking.

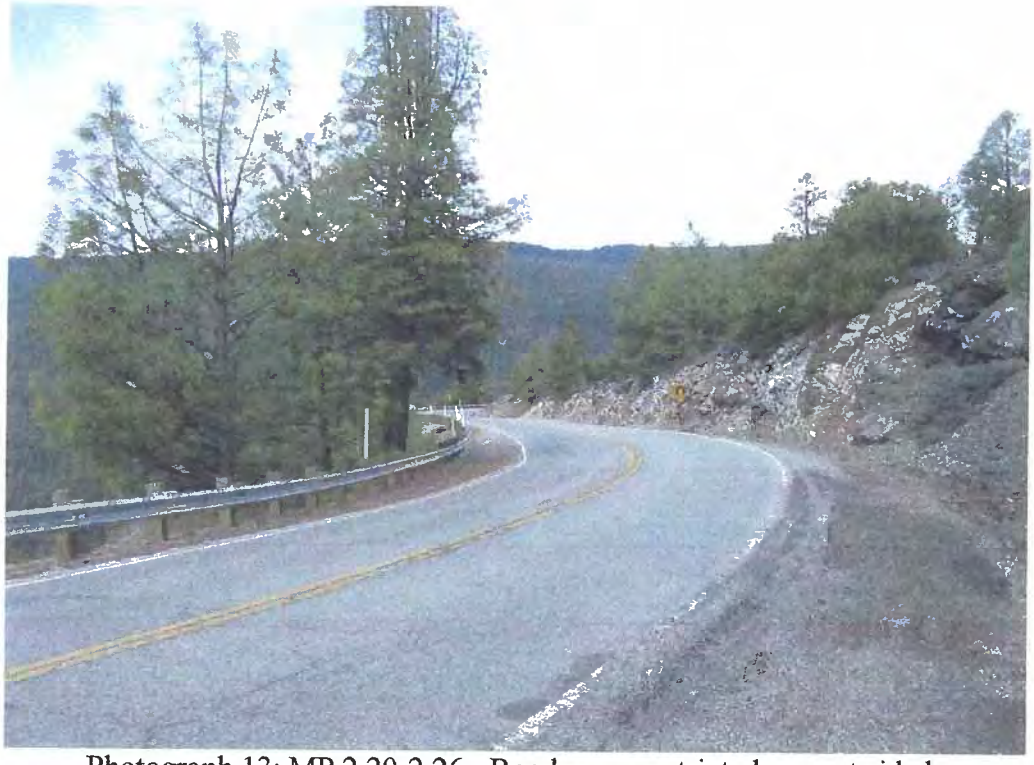
Photograph 9: MP 0.97 - Typical drilling set up at borehole YAR-03.

Photograph 10: MP 1.53 - Serpentine bedrock outcrop exposed on west side of road.

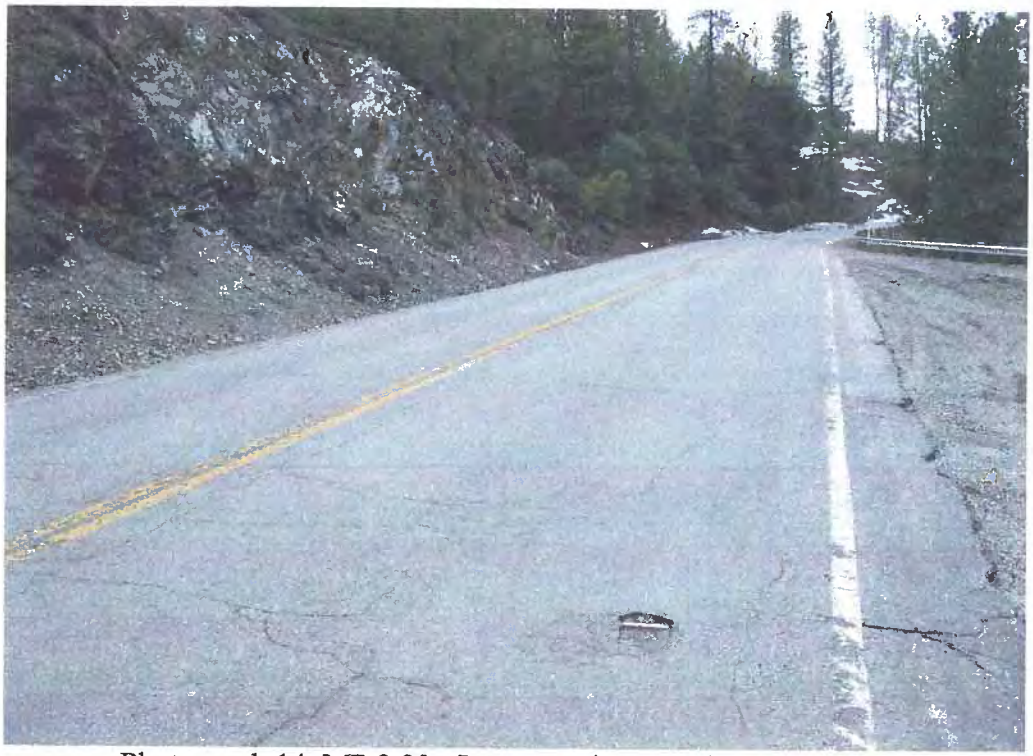
Photograph 11: MP 1.55-1.58 - Roadway constricted by bedrock outcrops on west and steep drop off on east (looking north).



Photograph 12: MP 1.72-1.78 - Road constricted by serpentine/ asbestiform bedrock to west and steep drop off to east (looking north).



Photograph 13: MP 2.20-2.26 - Roadway constricted on east side by bedrock outcrops and on west side by steep drop off (looking north).



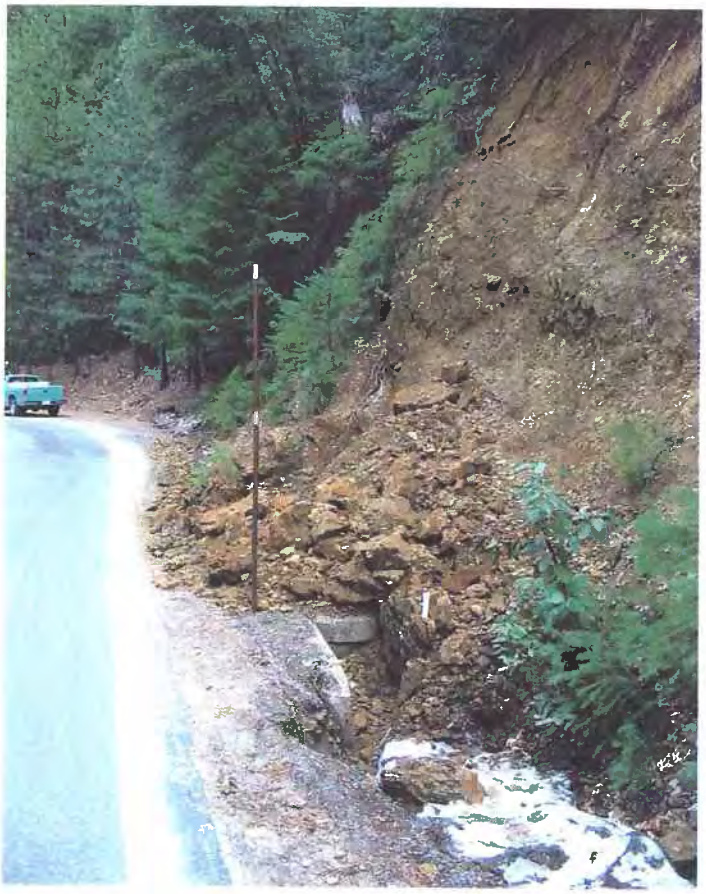
Photograph 14: MP 2.23 - Low severity pothole with moderate severity transverse cracking connected by some moderate severity longitudinal cracking. Serpentine bedrock outcrop at the road cut.

Photograph 15: MP 2.34 - Delamination shows previous highway markings.

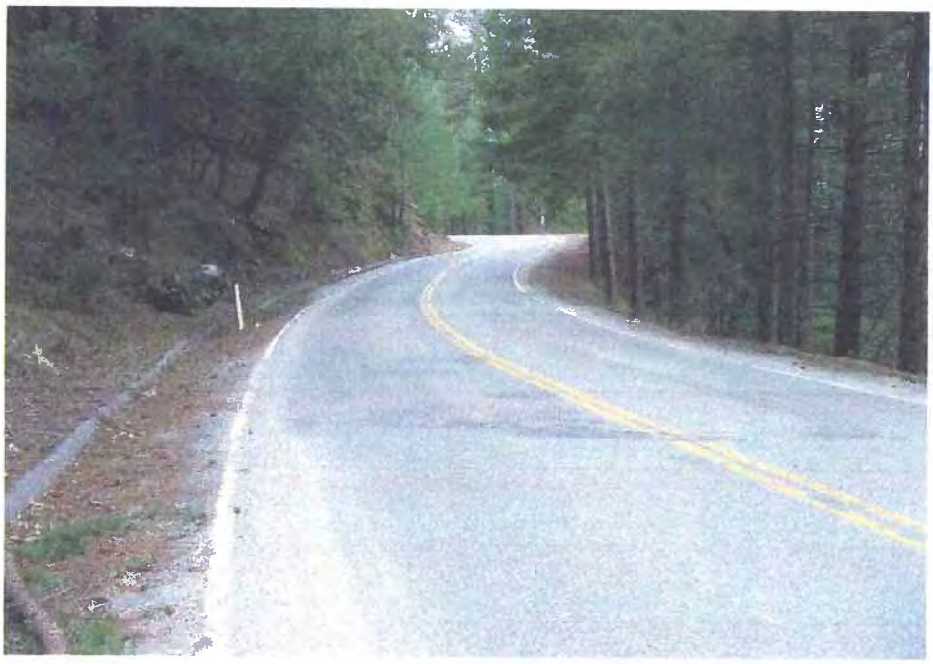
Photograph 16: MP 2.57-2.60 - Rock slide hazard signed for this portion of road. Road constricted by bedrock outcrop on southeast side and steep drop off on northwest side (looking northeast).

Photograph 17: MP 2.65-2.73 - Area of past mine adit raise failure has been repaired and covered, east lane, looking north.

Photograph 18: MP 2.90 - Recent slope failure shows debris filling drainage ditch.



Photograph 19:MP 3.25 - 1997 flood damage area shows settling; moderate to high severity diagonal transverse cracking on west end.



Photograph 20: MP 3.25 - 1997 flood damage area displays settlement area outlined with moderate to high severity transverse cracks with east end cracks in foreground.

Photograph 21:MP 3.79 - Moderate severity longitudinal cracking follows inside curve below failing culvert.

Photograph 22: MP 3.79 - Failure at culvert on west side of road.

Photograph 23:MP 4.03 - Box culvert looking upstream (south) shows wing walls on north side and elevated rail on south side.

Photograph 24: MP 4.03-Box culvert looking toward downstream (north) shows elevated wing walls on south side.

Photograph 25:MP 4.49 - Low area in pavement; possible snowplow damage.

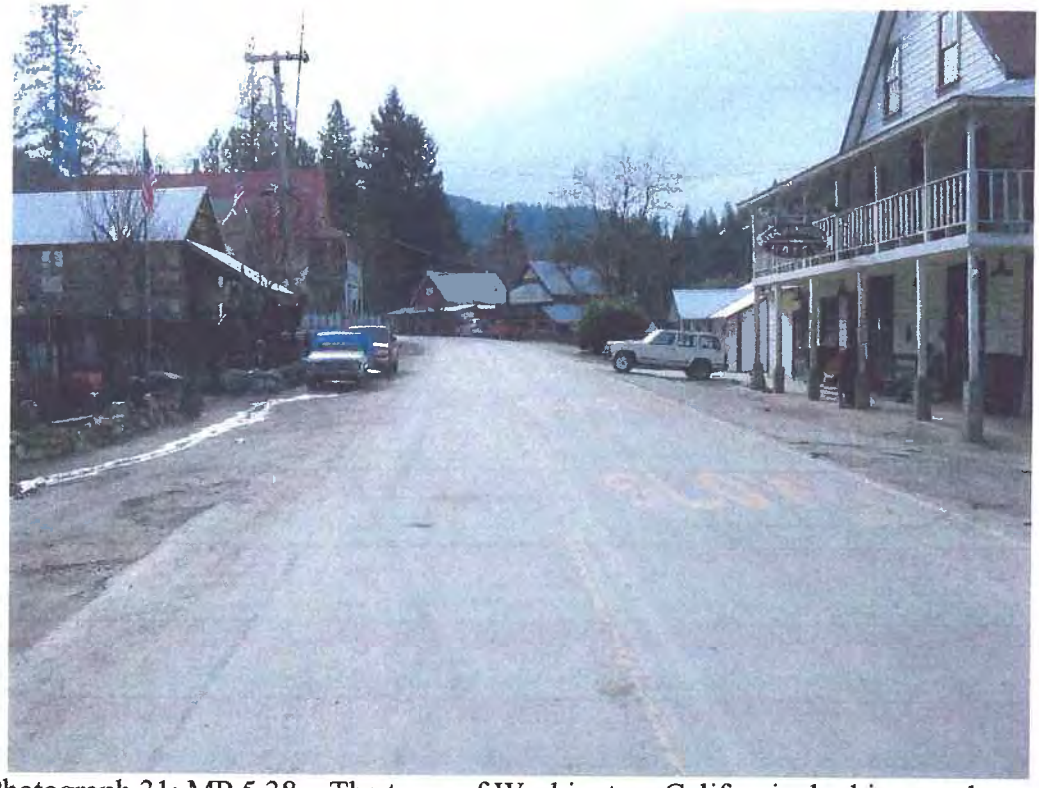
Photograph 26: MP 4.50 - Slope failure area.

Photograph 27:MP 4.61 - Slope failure area; 12-inch (30.5 centimeter) diameter orange measuring wheel at bottom of slide for scale.

Photograph 28: MP 4.61 - Slope failure area; 12-inch (30.5 centimeter) diameter measuring wheel at bottom of slide for scale; High severity raveling; Delamination in center of lane (possible snowplow damage).

Photograph 29:MP 4.61-4.65 - Delamination at centerline in roadway at slope failure area.

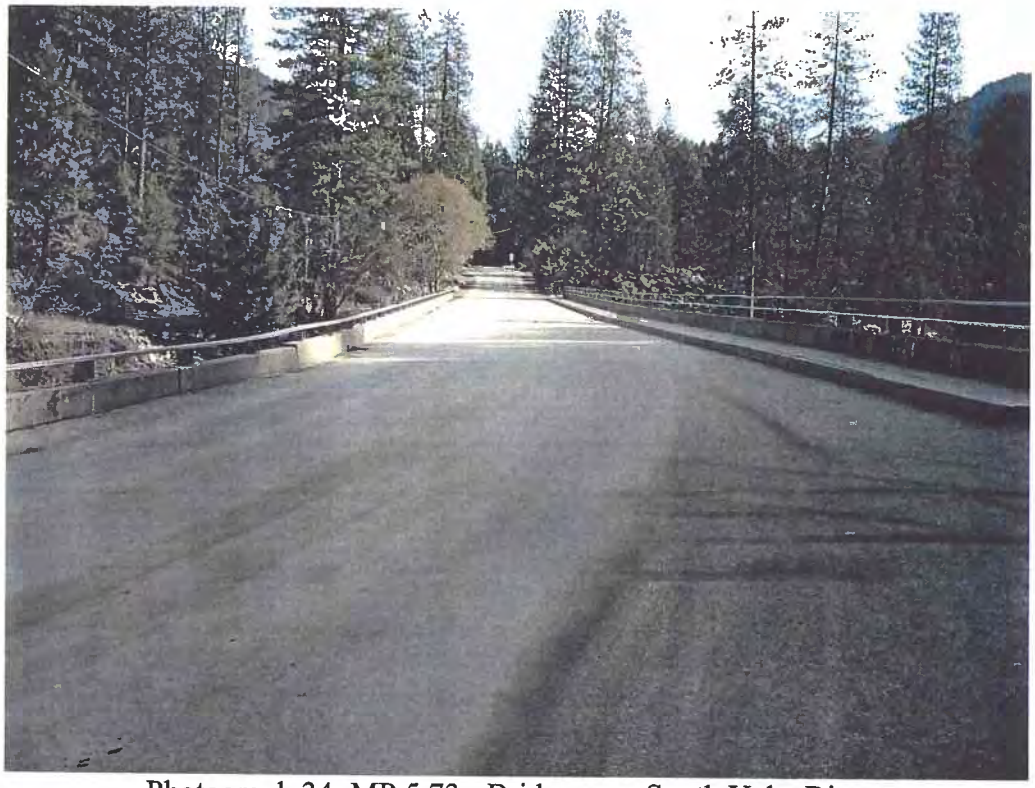
Photograph 30: MP 5.38 – The town of Washington, California, looking northeast.



Photograph 31: MP 5.38 – The town of Washington, California, looking southwest.

Photograph 32:MP 5.38 – The town of Washington, California looking southwest.

Photograph 33:MP 5.72-5.73 - Approach to bridge over South Yuba River north of Washington, California.



Photograph 34: MP 5.73 - Bridge over South Yuba River.

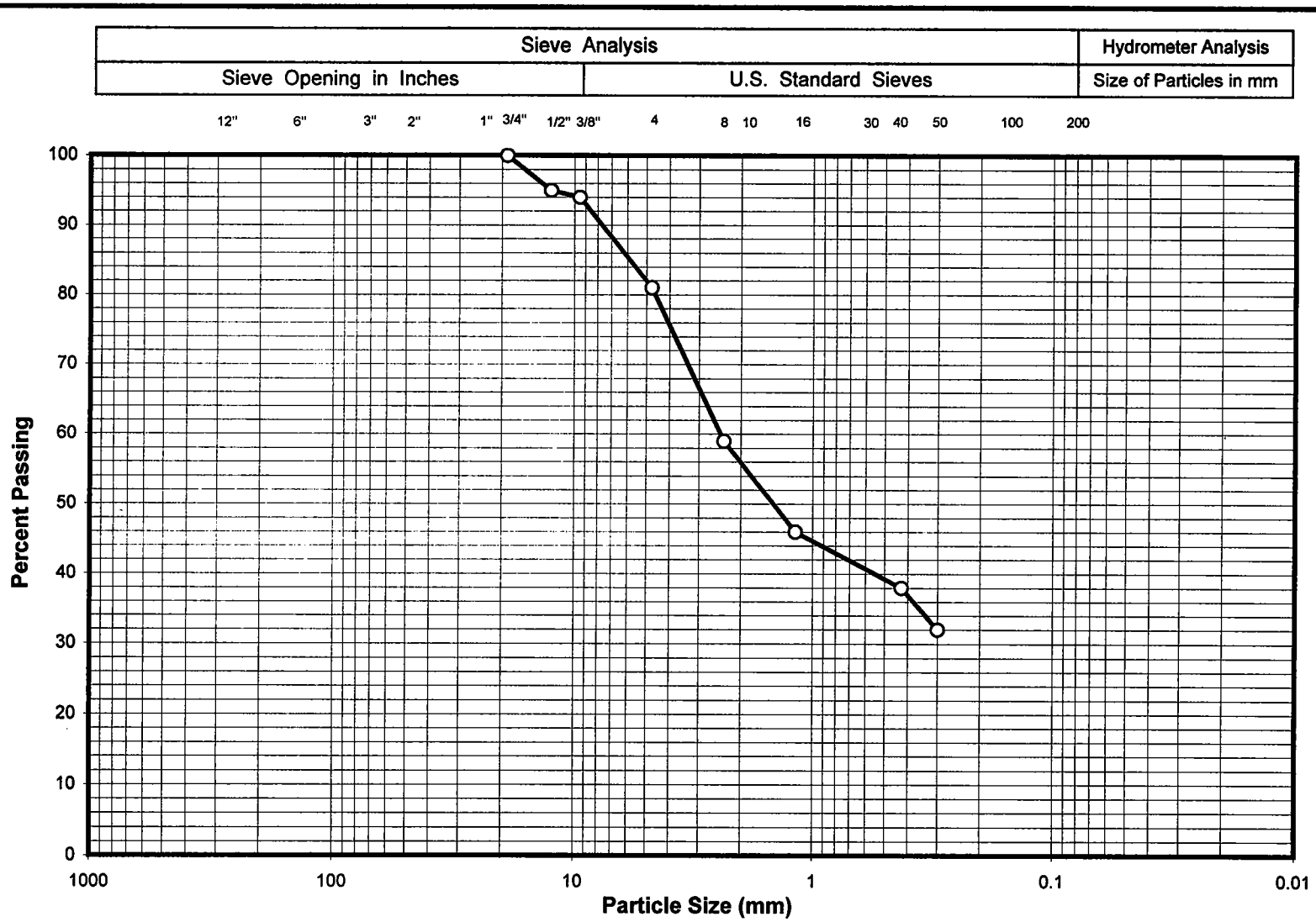
APPENDIX D
Laboratory Test Results

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 24-108 Project Name: Washington Rd. - California Date: 11/25/04

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg			pH	Water Soluble Sulfate %	Direct Shear Peak c (psf)/ϕ (deg.) Residual c (psf)/ϕ (deg.)	Unconf. Comp. Strength (psf)	Resistivity Ω-cm	R-VALUE	CLASSIFICATION		
Boring NO.	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI							AASHTO		USCS
YAR -01	5-6.5	CA	21.0		19	49	32	45	44	1	5.9	0.016			20000		A-2-5	(0)	SM
YAR-02	5-6.5	CA	20.7		22	38	40	NV	NP	NP							A-4	(0)	SM
YAR-03	5-6.5	CA	41.4	74.5	0	20	80	49	38	11							A-7-5	(11)	ML
YAR-05	5-6.5	CA	36.1		1	20	79	71	34	38				7030			A-7-5	(33)	CH
YAR-06	5-6.5	CA	4.7		8	74	18	NV	NP	NP	7.1	0			9259		A-1-b	(0)	SM
YAR-07	5-6.5	CA	8.5		16	50	34	25	20	5							A-2-4	(0)	SM-SC
YAR-07	0-5	CA / GRAB	1.9	126.4									1,858 / 37.9° 361 / 36.6°	1454			A-2-4	(0)	SM-SC
YAR-08	5-6.5	CA	7.1	90.6	0	16	84	41	30	11				4798			A-7-5	(11)	ML
YAR-09	5-6.5	CA	7.0	127.1	30	39	31	NV	NP	NP							A-2-4	(0)	SM
YAR-10	5-6.5	GRAB	8.8		36	37	27	32	24	8							A-2-4	(0)	SM
YAR-11	5-6.5	CA	9.5	115.6	36	39	25	NV	NP	NP							A-1-b	(0)	SM
YAR-11	0-5	GRAB											1,080 / 42.6° 199 / 39.6°	4209		33	A-1-b	(0)	SM
YAR-12	5-6.5	GRAB	4.8		33	43	24	NV	NP	NP	7	0.062			8403		A-1-b	(0)	SM
YA-01	5-6.5	CA	5.6		30	45	25	NV	NP	NP							A-2-4	(0)	SM
YA-02	5-6.5	CA									6.2	0.004					A-2-4	(0)	SM
YA-03	5-6.5	CA	16.8		38	46	16	NV	NP	NP							A-1-b	(0)	SM
TP-1	0-2.5	GRAB	16.9		7	63	30	NV	NP	NP						32	A-2-4	(0)	SM
TP-2	0-2.5	GRAB			84	14	2	36	26	10							A-2-4	(0)	GP
TP-2	0-2.5	GRAB			1	76	23	29	17	12						12	A-2-6	(0)	SC
TP-3	0-2.5	GRAB	9.4		41	42	17	NV	NP	NP						38	A-1-b	(0)	SM



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	95
⅜"	94
#4	81
#10	59
#40	46
#200	32

Gravel (%)	19	LL	45	Project Name:	Washington Road
Sand (%)	49	PL	44	Sample ID:	YAR-01
Fines (%)	32	PI	1	Sample Depth (ft.):	5-6.5
Sample Description:	Silty sand with gravel (SM / A-2-5 (0))				

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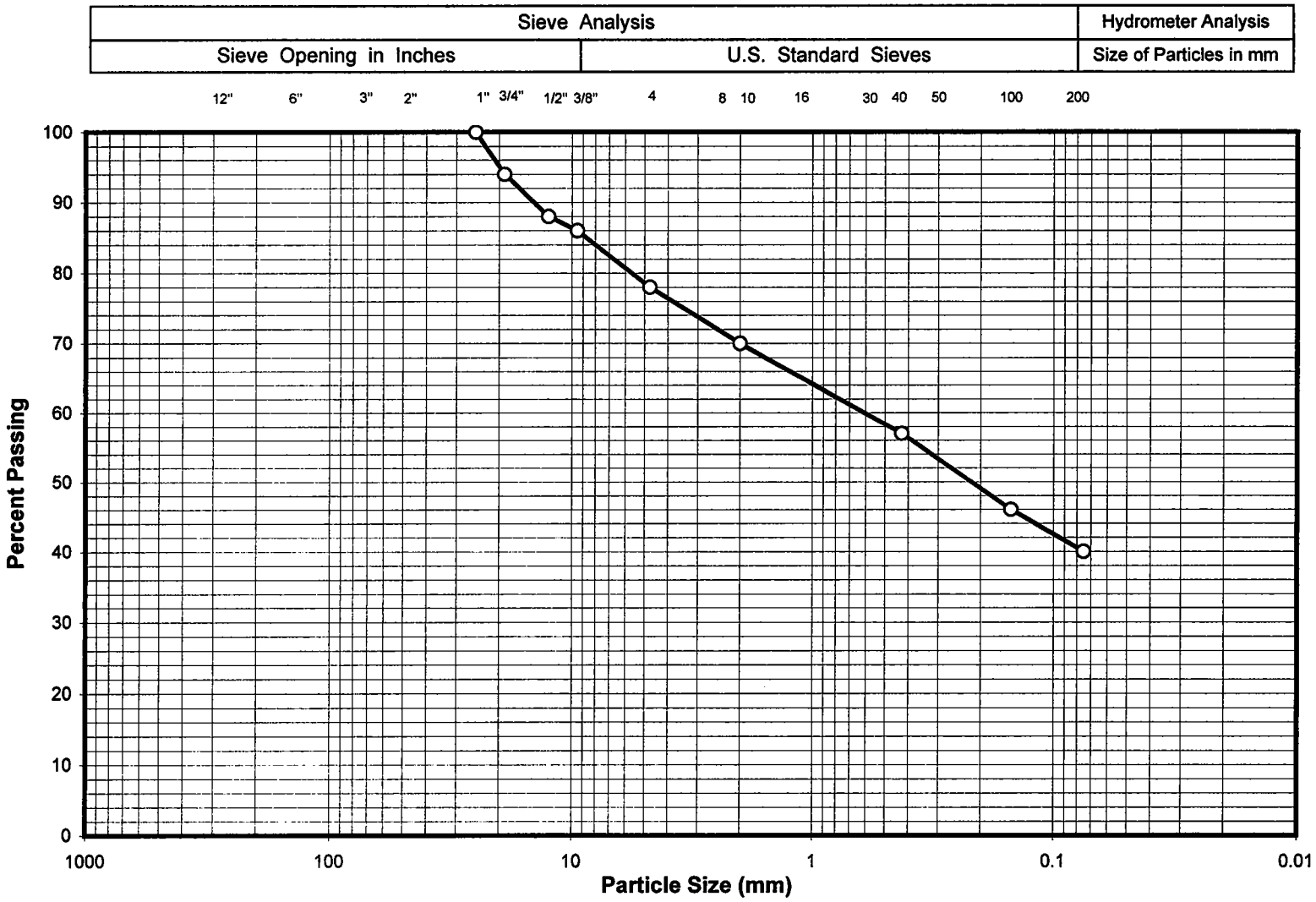
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	94
½"	88
⅜"	86
#4	78
#10	70
#40	57
#200	40

Gravel (%)	22	LL	NV	Project Name:	Washington Road
Sand (%)	38	PL	NP	Sample ID:	YAR-02
Fines (%)	40	PI	NP	Sample Depth (ft.):	5-6.5
Sample Description:	Silty sand with gravel (SM/ A-4 (1))				

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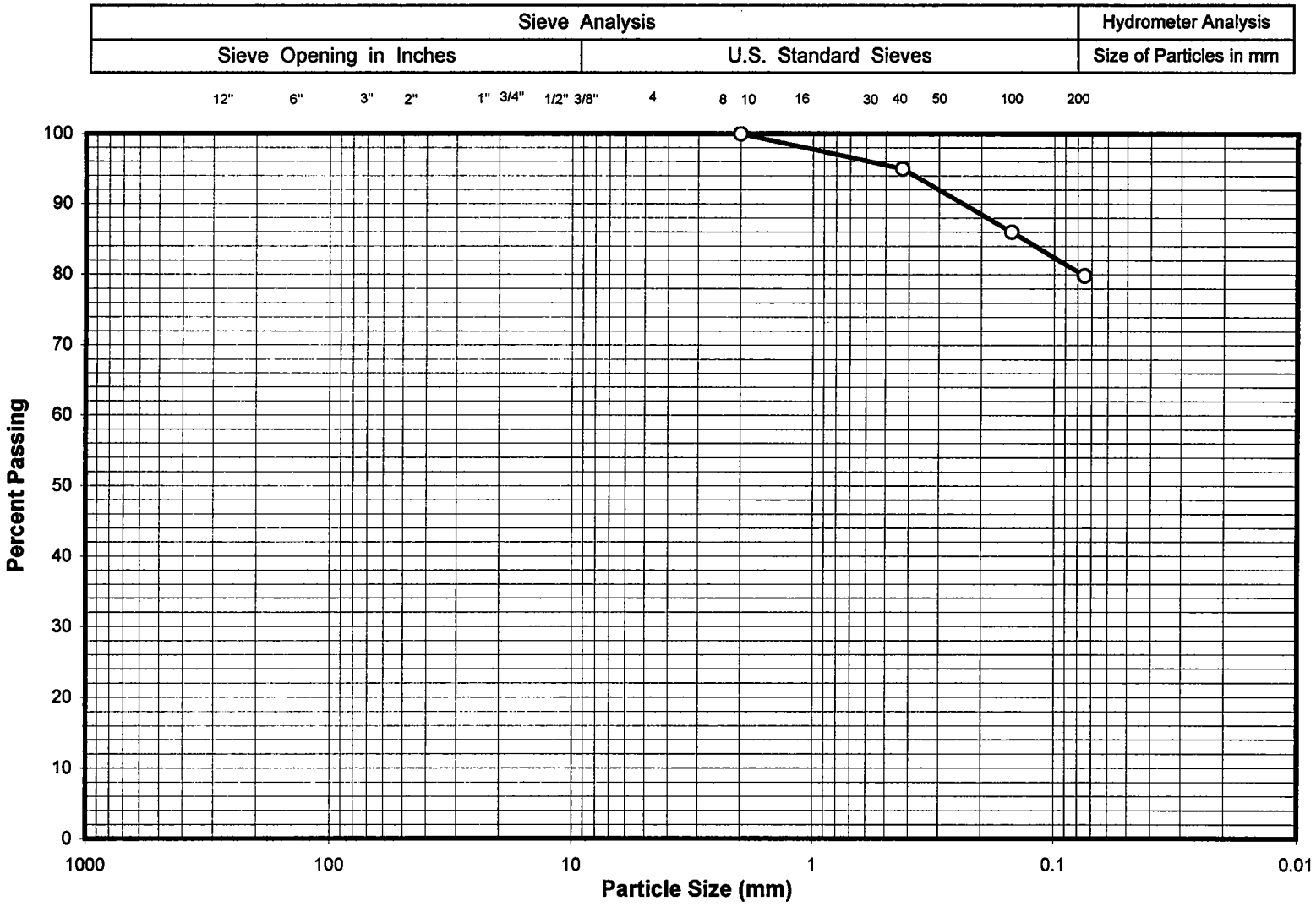
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	-
#4	100
#10	100
#40	95
#200	80

Gravel (%)	0	LL	49	Project Name:	Washington Road
Sand (%)	20	PL	38	Sample ID:	YAR-03
Fines (%)	80	PI	11	Sample Depth (ft.):	5-6.5
Sample Description:	Silt with sand (ML / A-7-5 (11))				

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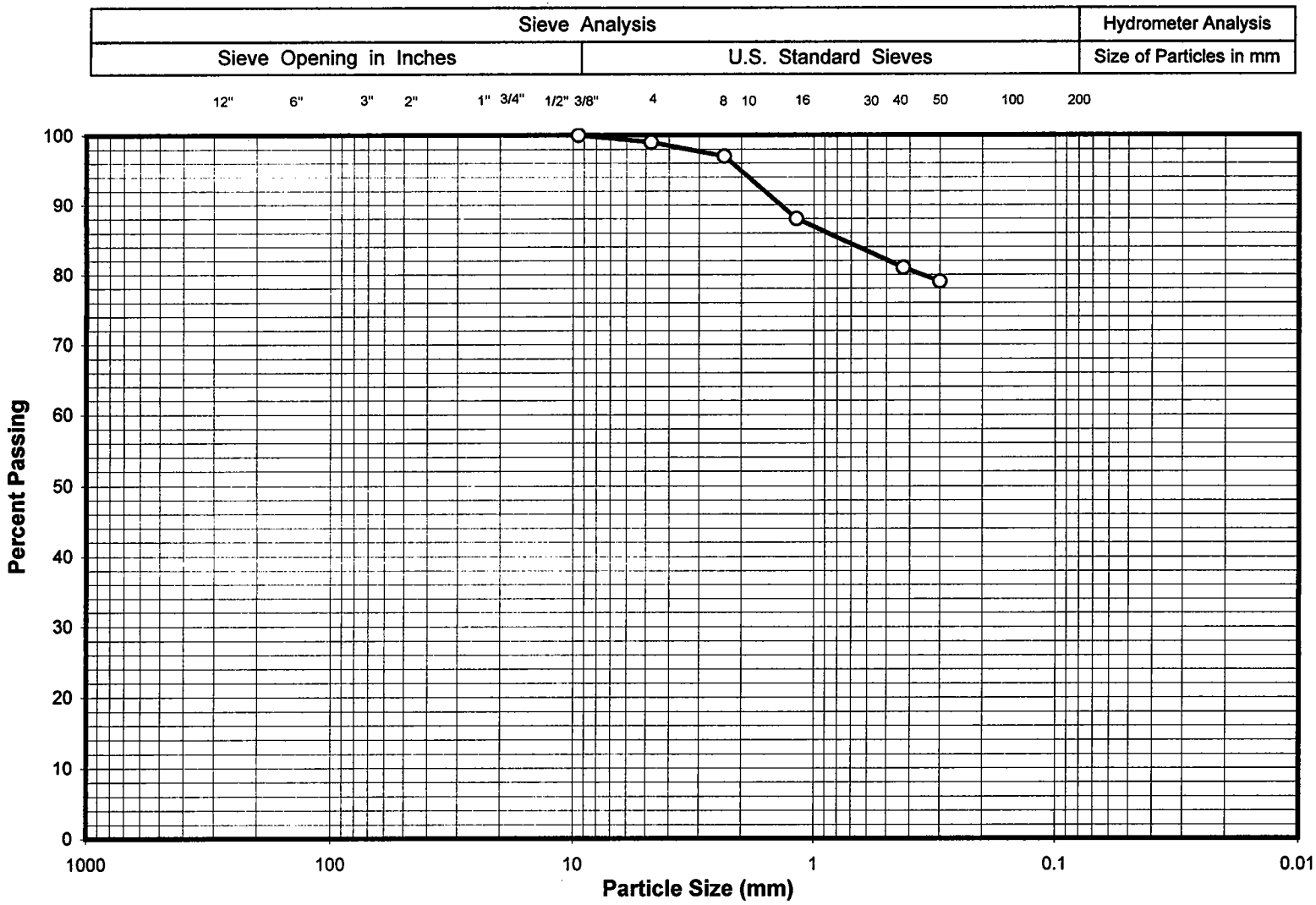
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	0
½"	0
⅜"	100
#4	99
#10	97
#40	88
#200	79

Gravel (%)	1	LL	71	Project Name:	Washington Road
Sand (%)	20	PL	34	Sample ID:	YAR-05
Fines (%)	79	PI	38	Sample Depth (ft.):	5-6.5
Sample Description:	Sandy clay (CH / A-7-5 (33))				

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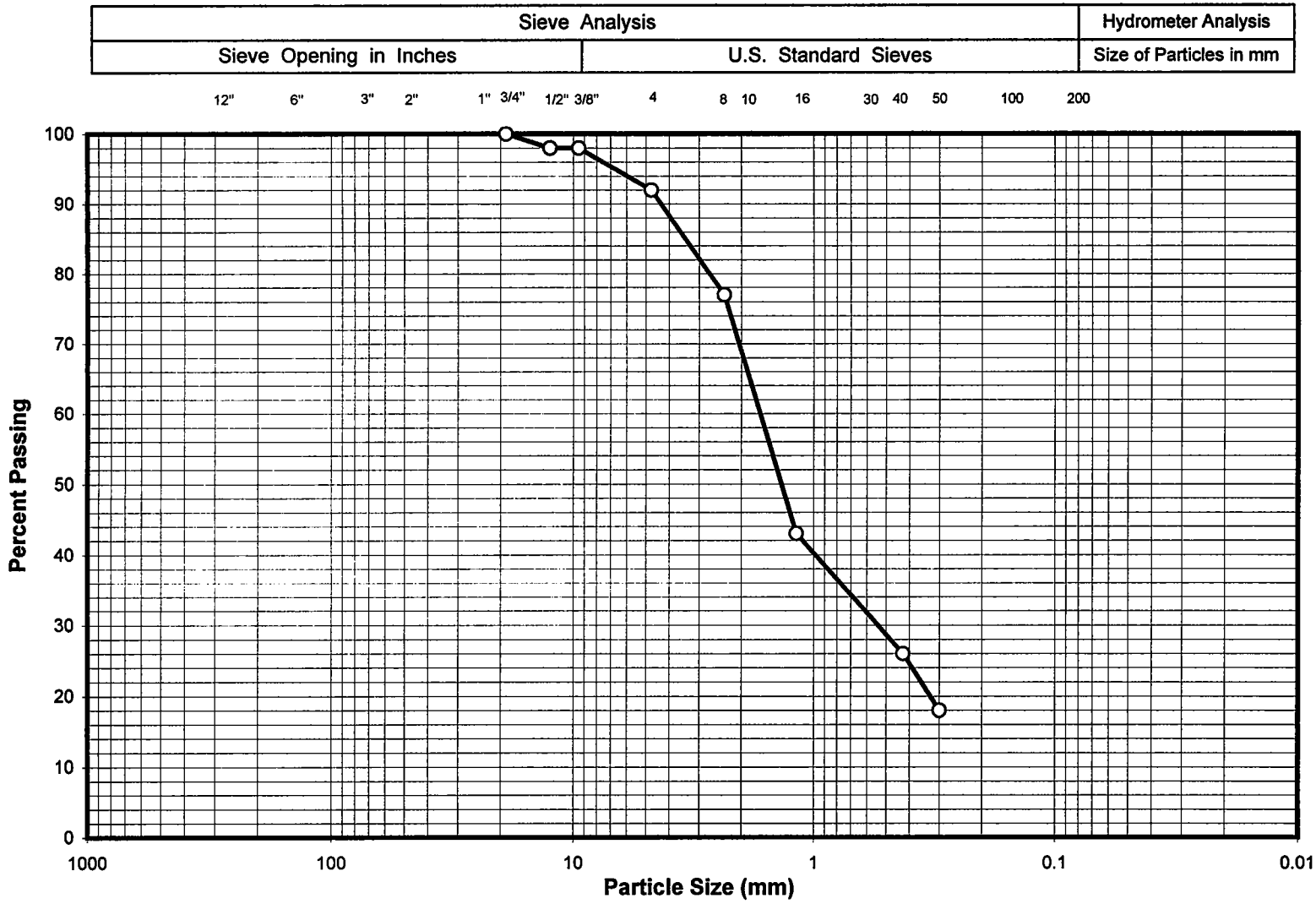
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	98
⅜"	98
#4	92
#10	77
#40	43
#200	18

Gravel (%)	8	LL	NV	Project Name:	Washington Road
Sand (%)	74	PL	NP	Sample ID:	YAR-06
Fines (%)	18	PI	NP	Sample Depth (ft.):	5-6.5
Sample Description:	Silty sand (SM / A-1-b (0))				

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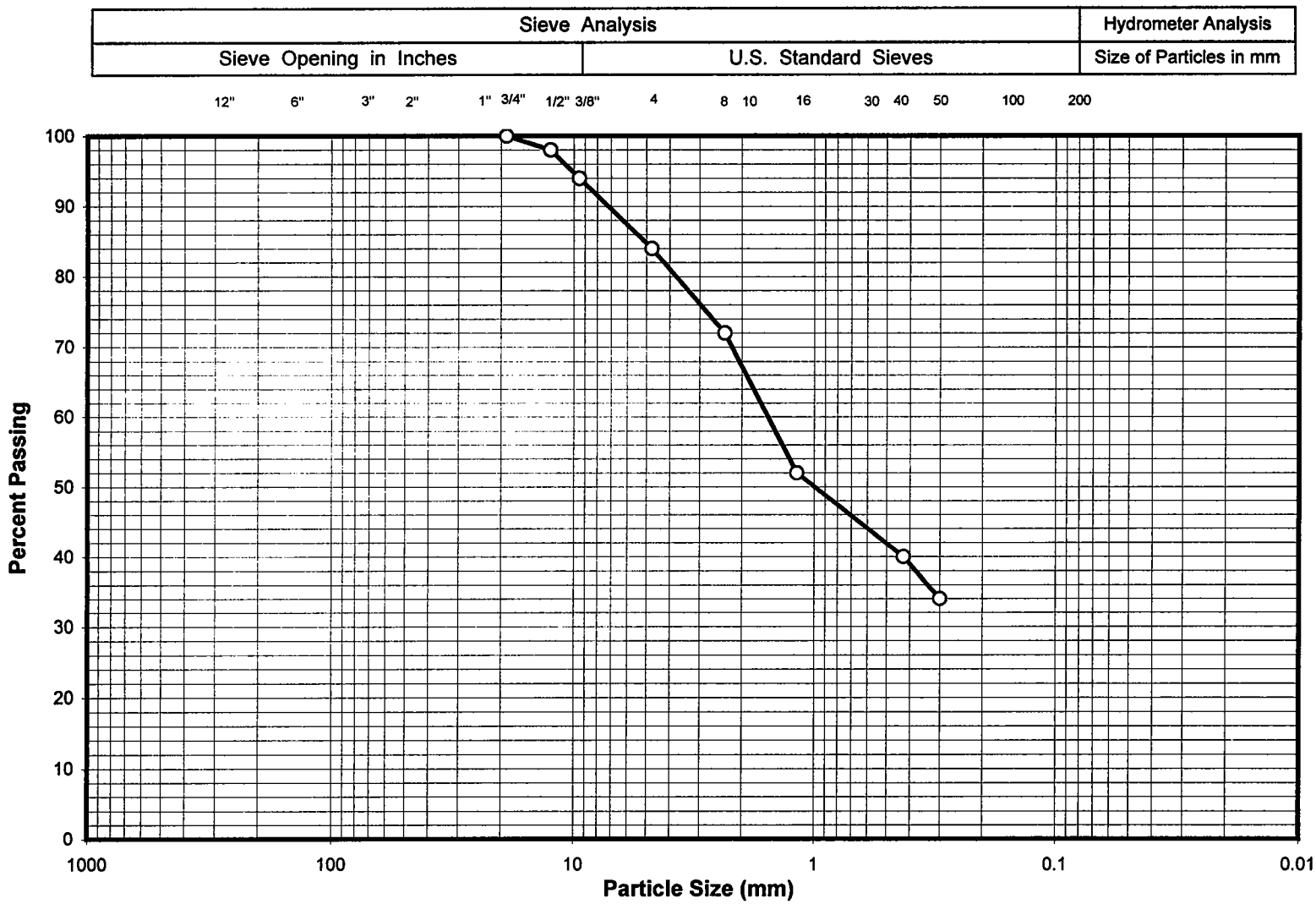
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	98
⅜"	94
#4	84
#10	72
#40	52
#200	34

Gravel (%)	16	LL	25	Project Name:	Washington Road
Sand (%)	50	PL	20	Sample ID:	YAR-07
Fines (%)	34	PI	5	Sample Depth (ft.):	5-6.5
Sample Description:	Silty, clayey sand with gravel (SM-SC / A-2-4 (0))				

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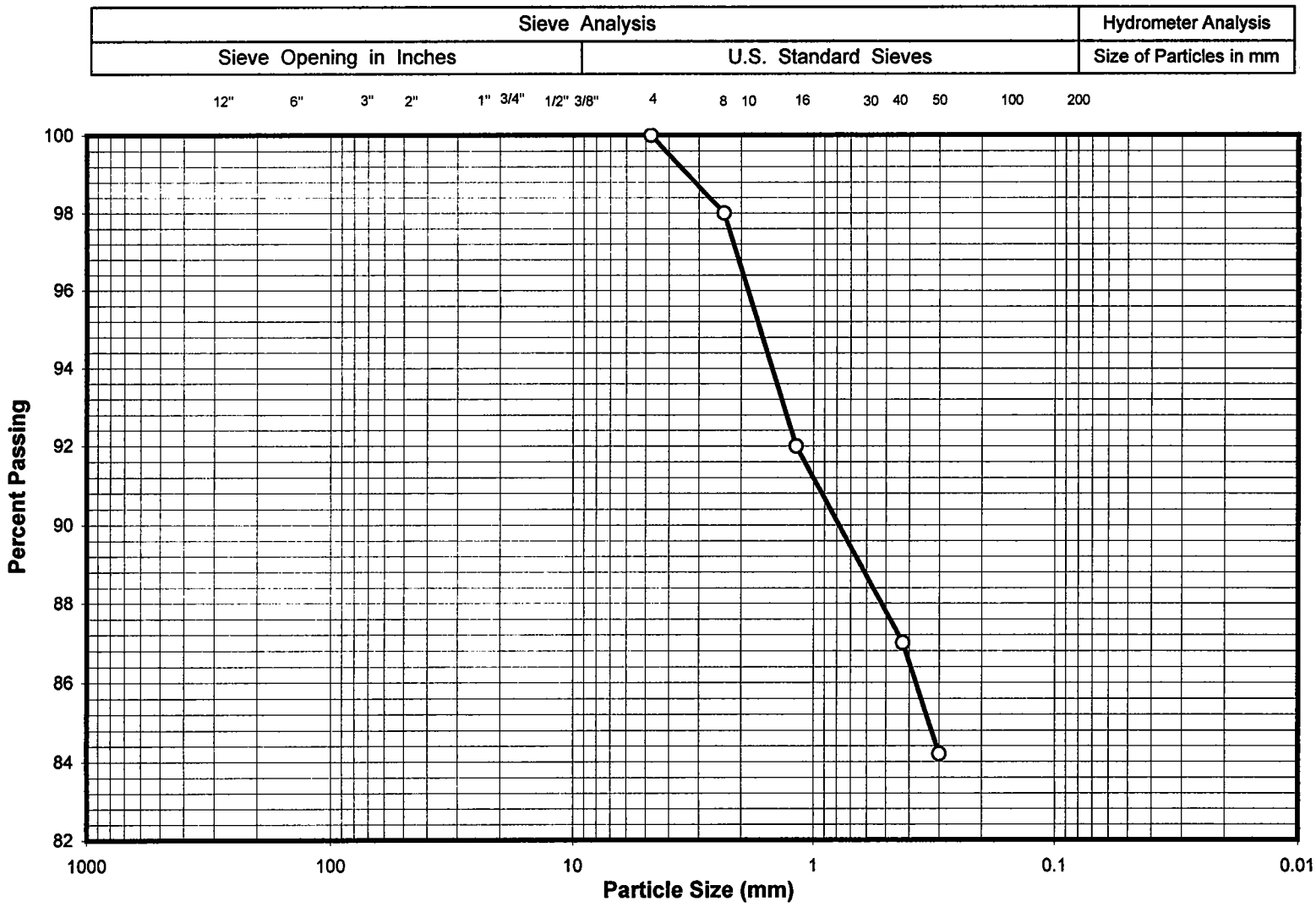
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD	Figure No.:	-
Date:	03/23/05		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	0
½"	0
⅜"	0
#4	100
#10	98
#40	92
#200	84

Gravel (%)	0	LL	41	Project Name:	Washington Road
Sand (%)	16	PL	30	Sample ID:	YAR-08
Fines (%)	84	PI	11	Sample Depth (ft.):	5-6.5
Sample Description:	Sandy silt (ML / A-7-5(0))				

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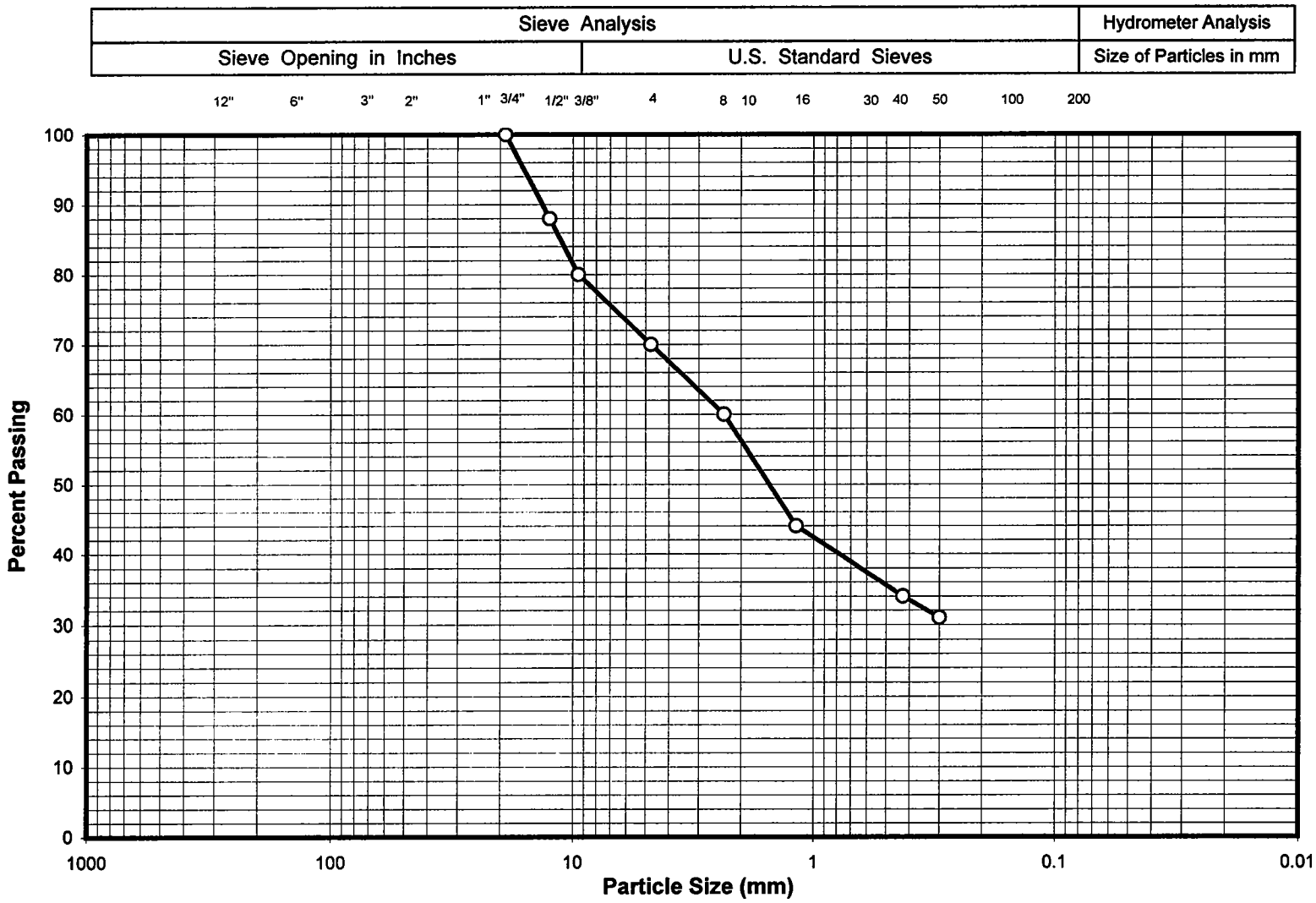
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD	Figure No.:	-
Date:	03/23/05		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	88
⅜"	80
#4	70
#10	60
#40	44
#200	31

Gravel (%)	30	LL	NV	Project Name:	Washington Road
Sand (%)	39	PL	NP	Sample ID:	YAR-09
Fines (%)	31	PI	NP	Sample Depth (ft.):	5-6.5
Sample Description:	Silty sand with gravel (SM / A-2-4 (0))				

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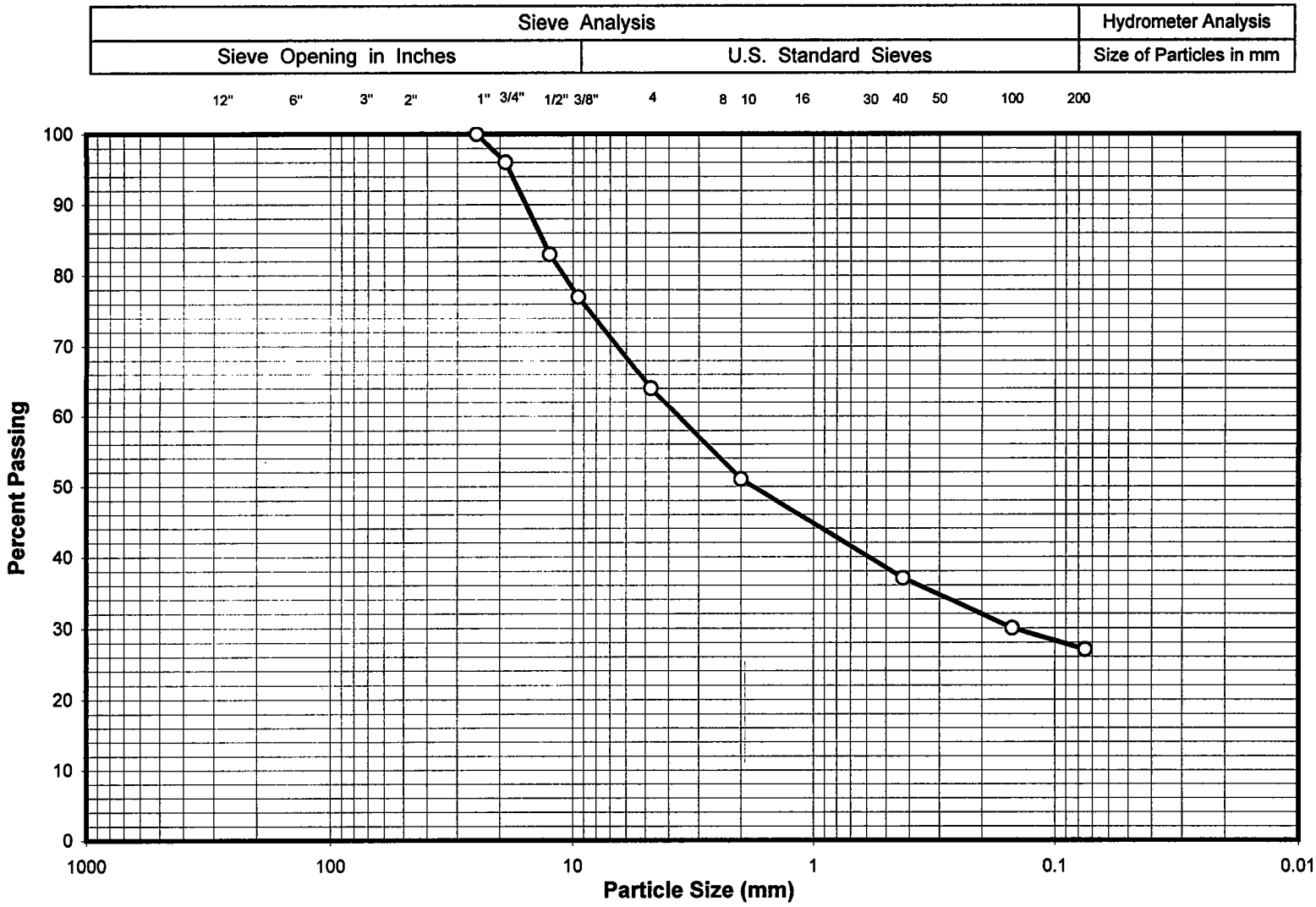
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	96
½"	83
⅜"	77
#4	64
#10	51
#40	37
#200	27

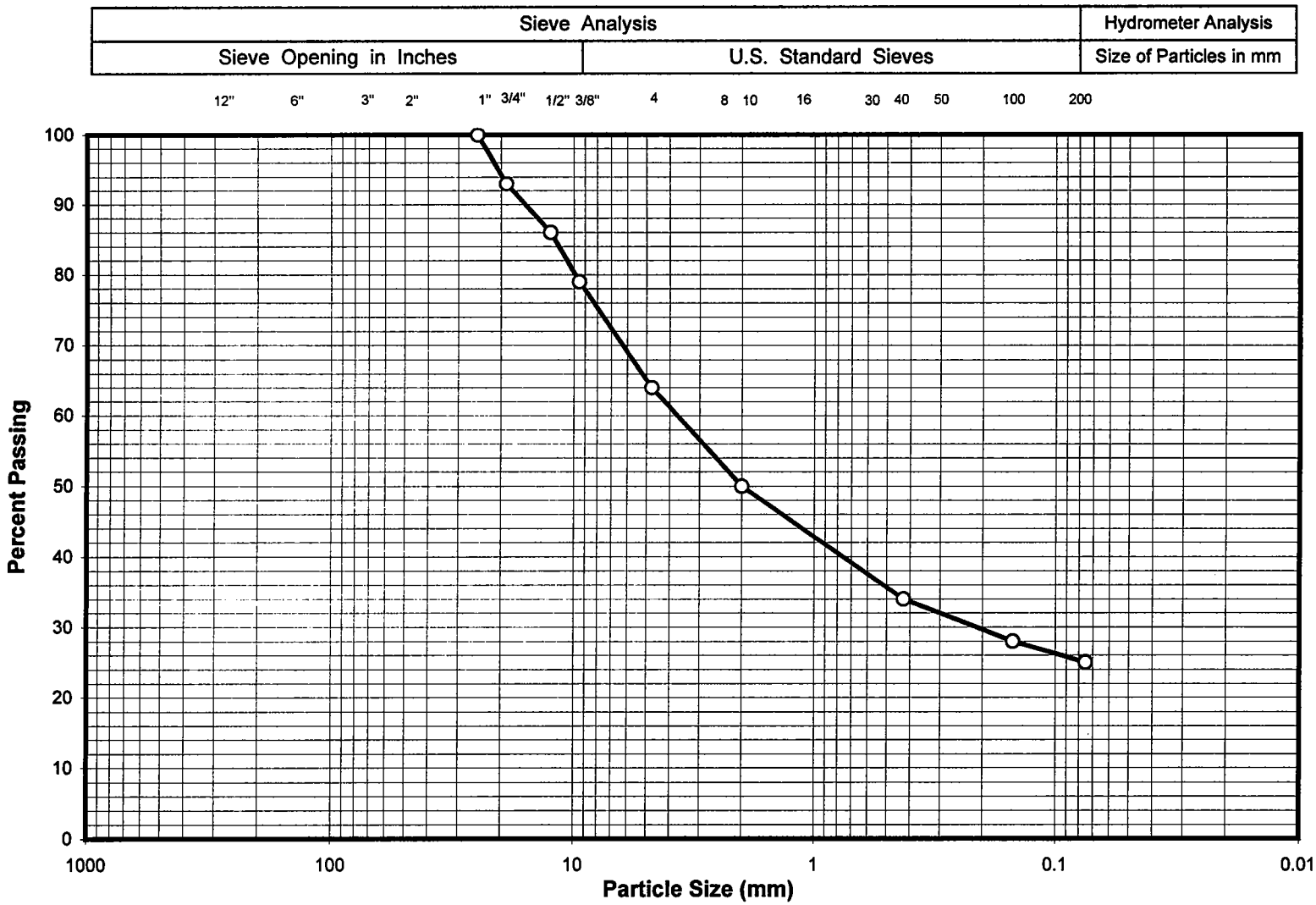
Gravel (%)	36	LL	32	Project Name:	Washington Road
Sand (%)	37	PL	24	Sample ID:	YAR-10
Fines (%)	27	PI	8	Sample Depth (ft.):	5-6.5
Sample Description:	Silty sand with gravel (SM / A-2-4 (0))				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD	Figure No.:	-
Date:	03/23/05		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	93
½"	86
⅜"	79
#4	64
#10	50
#40	34
#200	25

Gravel (%)	36	LL	NV	Project Name:	Washington Road
Sand (%)	39	PL	NP	Sample ID:	YAR-11
Fines (%)	25	PI	NP	Sample Depth (ft.):	5-6.5
Sample Description:	Silty sand with gravel (SM / A-1-b (0))				

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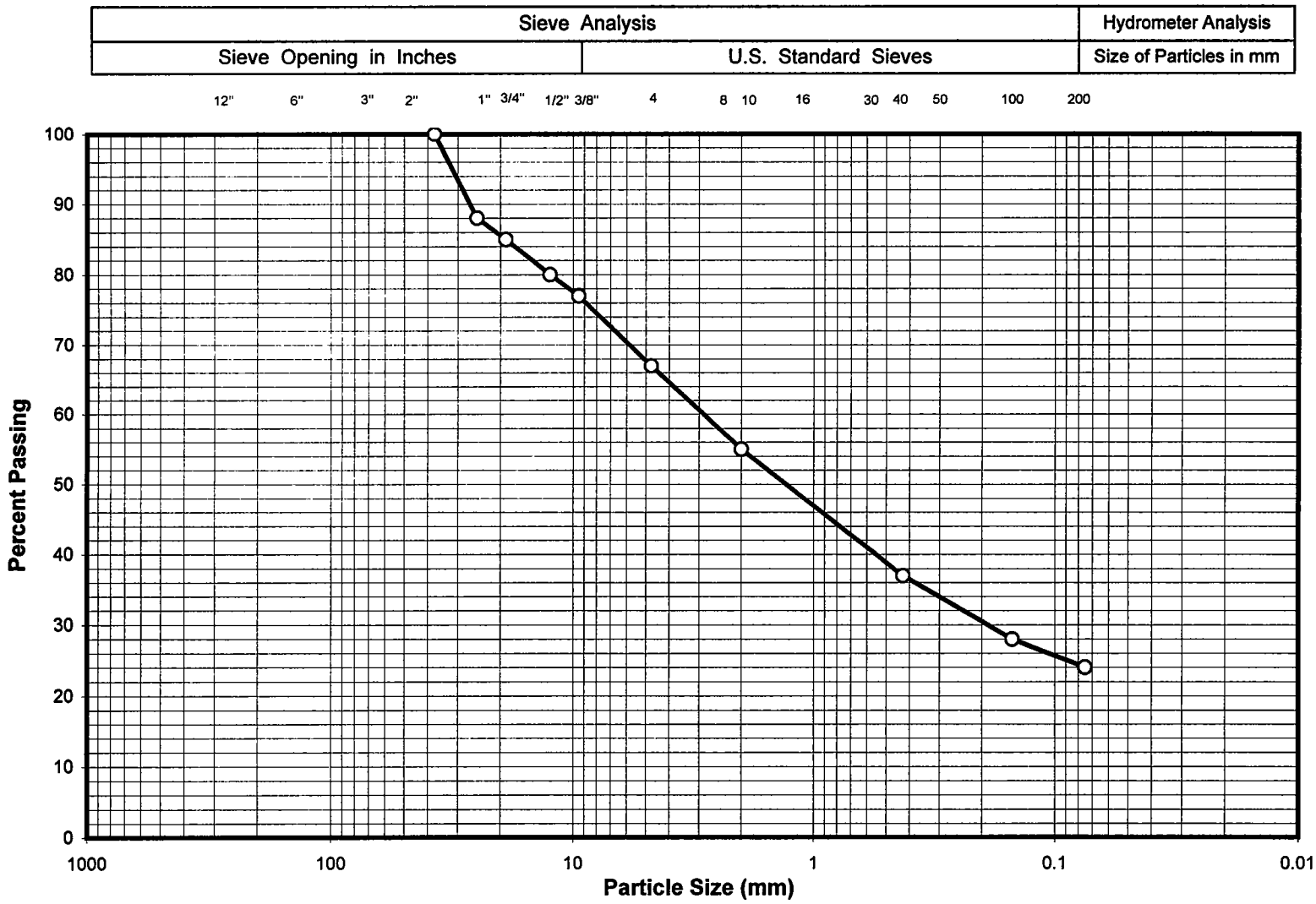
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	0
2"	0
1 ½"	100
1"	88
¾ "	85
½"	80
⅜"	77
#4	67
#10	55
#40	37
#200	24

Gravel (%)	33	LL	NV	Project Name:	Washington Road
Sand (%)	43	PL	NP	Sample ID:	TP-2
Fines (%)	24	PI	NP	Sample Depth (ft.):	0-1
Sample Description:	Poorly graded gravel (GP / A-2-4 (0))				

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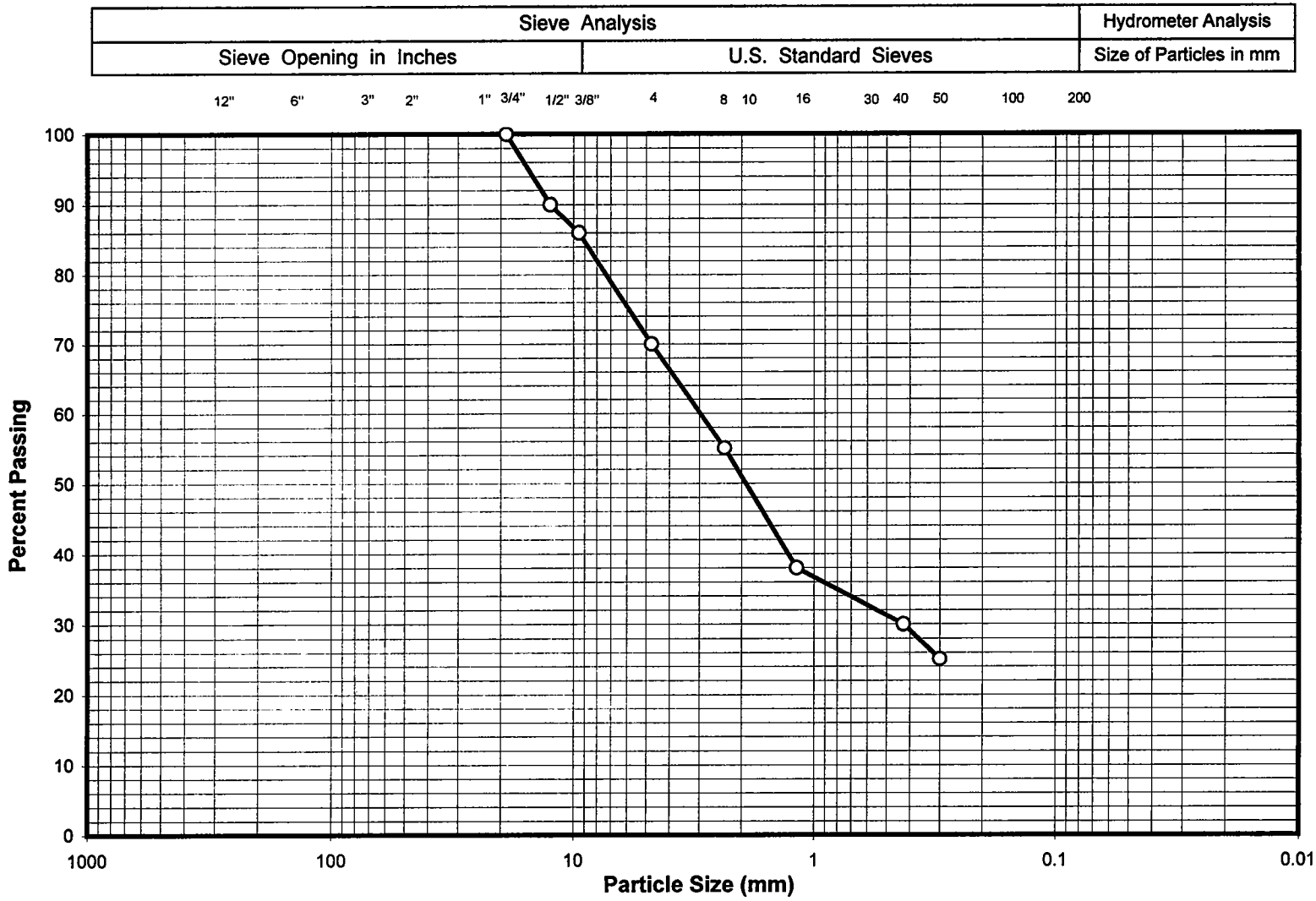
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	90
⅜"	86
#4	70
#10	55
#40	38
#200	25

Gravel (%)	30	LL	NV	Project Name:	Washington Road
Sand (%)	45	PL	NP	Sample ID:	YA-01
Fines (%)	25	PI	NP	Sample Depth (ft.):	5-6.5
Sample Description:	Silty sand with gravel (SM / A-2-4 (0))				

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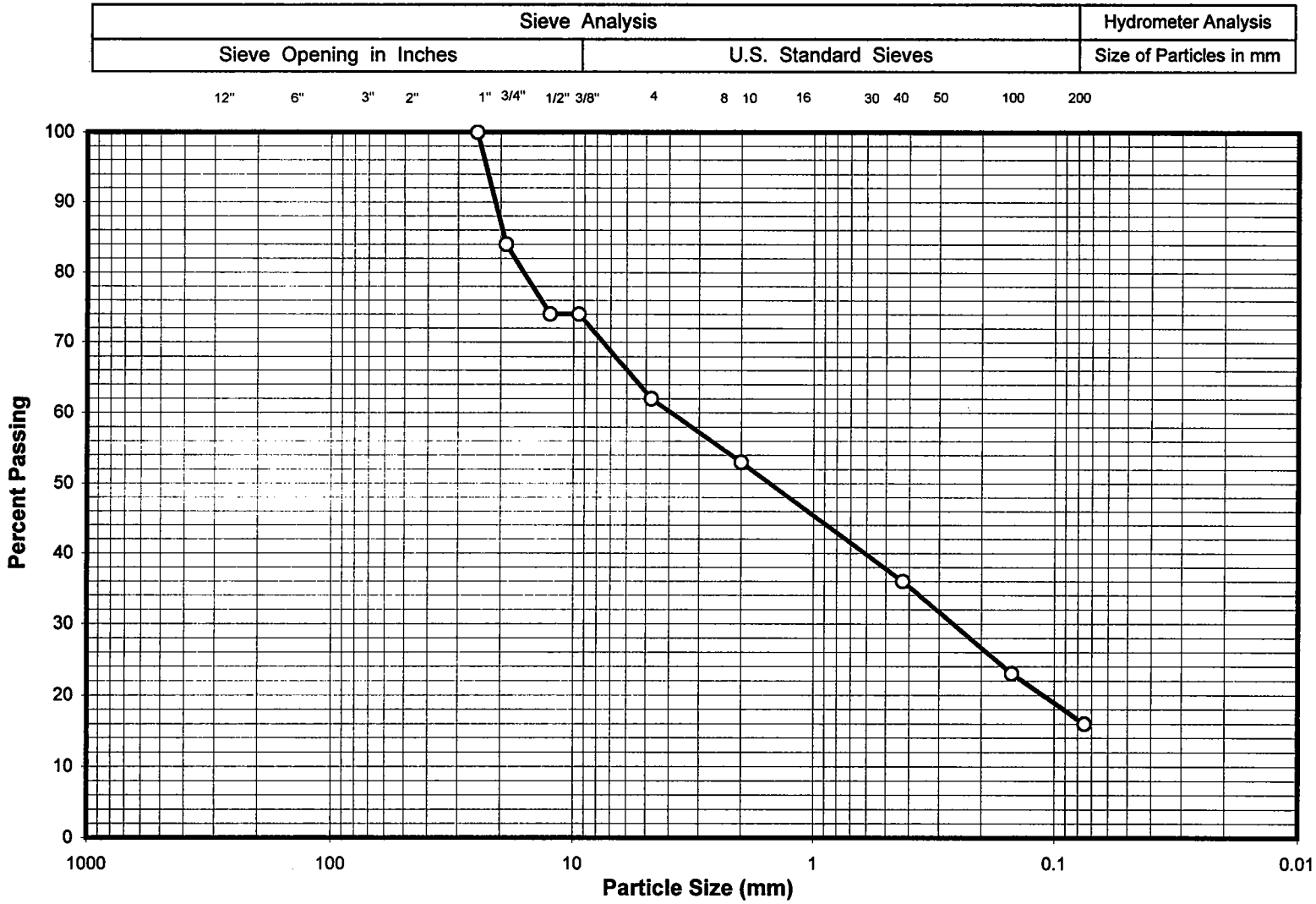
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD	Figure No.:	-
Date:	03/23/05		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	84
½"	74
⅜"	74
#4	62
#10	53
#40	36
#200	16

Gravel (%)	38	LL	NV	Project Name:	Washington Road
Sand (%)	46	PL	NP	Sample ID:	YA-03
Fines (%)	16	PI	NP	Sample Depth (ft.):	5-6.5
Sample Description:	Silty sand with gravel (SM / A-2-4 (0))				

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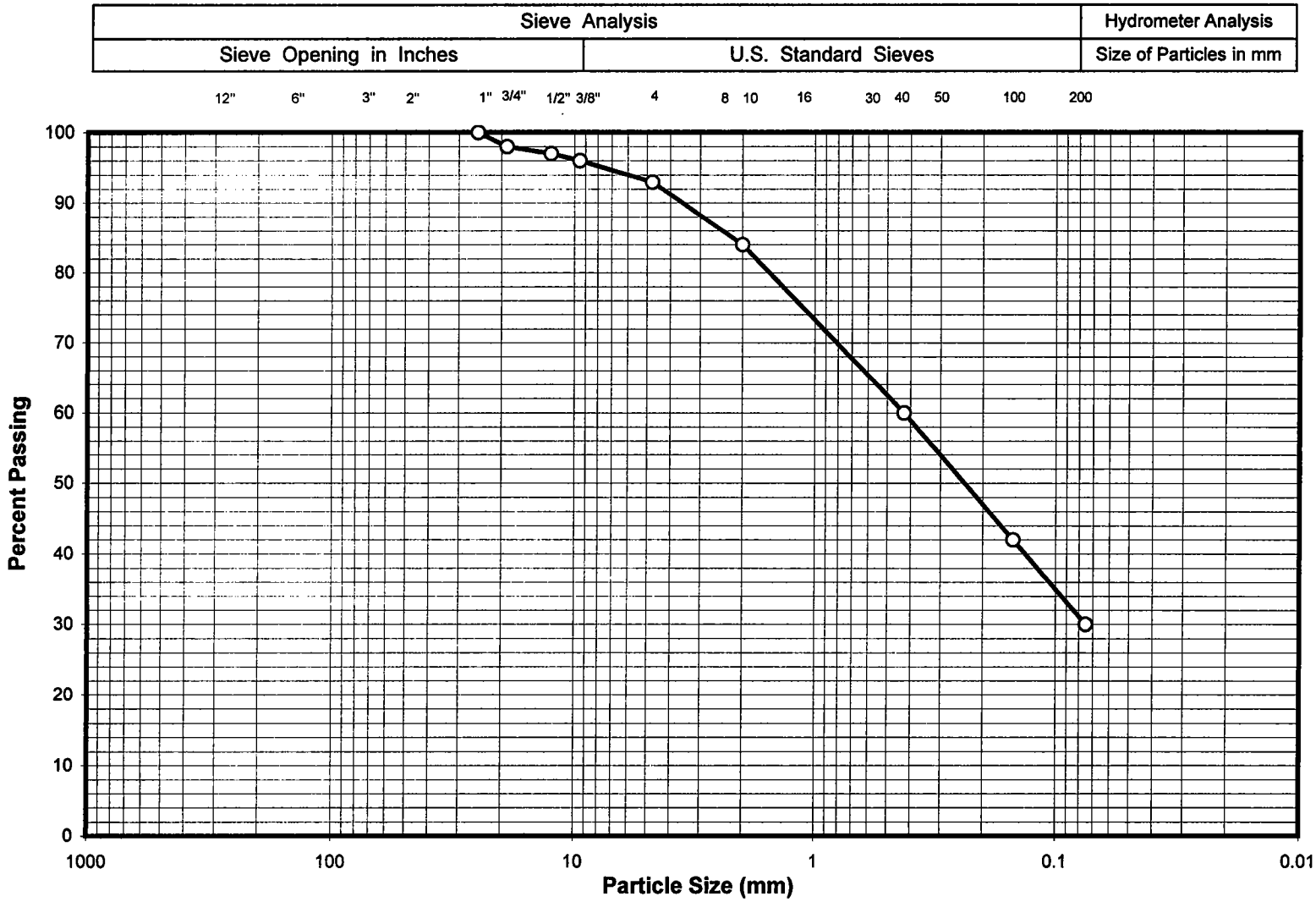
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	98
½"	97
⅜"	96
#4	93
#10	84
#40	60
#200	30

Gravel (%)	7	LL	NV	Project Name:	Washington Road
Sand (%)	63	PL	NP	Sample ID:	TP-1
Fines (%)	30	PI	NP	Sample Depth (ft.):	0-2.5
Sample Description:	Silty sand (SM / A-2-4 (0))				

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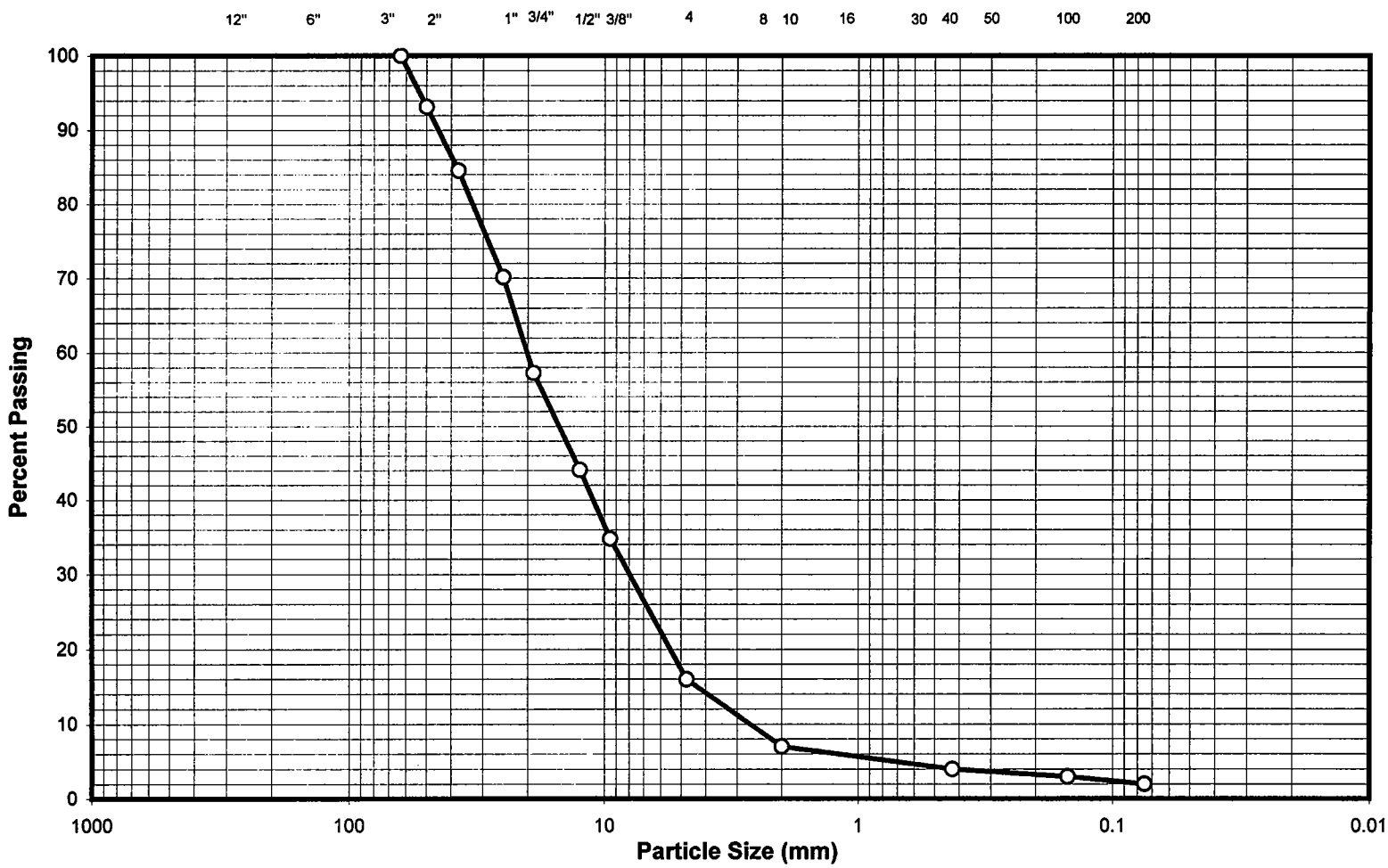
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	100
2"	93
1 ½"	85
1"	70
¾ "	57
½"	44
⅜"	35
#4	16
#10	7
#40	4
#200	2

Gravel (%)	84	LL	NV	Project Name:	Washington Road
Sand (%)	14	PL	NP	Sample ID:	TP-2
Fines (%)	2	PI	NP	Sample Depth (ft.):	0-1
Sample Description:	Poorly graded gravel (GP / A-2-4 (0))				

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SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD	Figure No.:	-
Date:	03/23/05		

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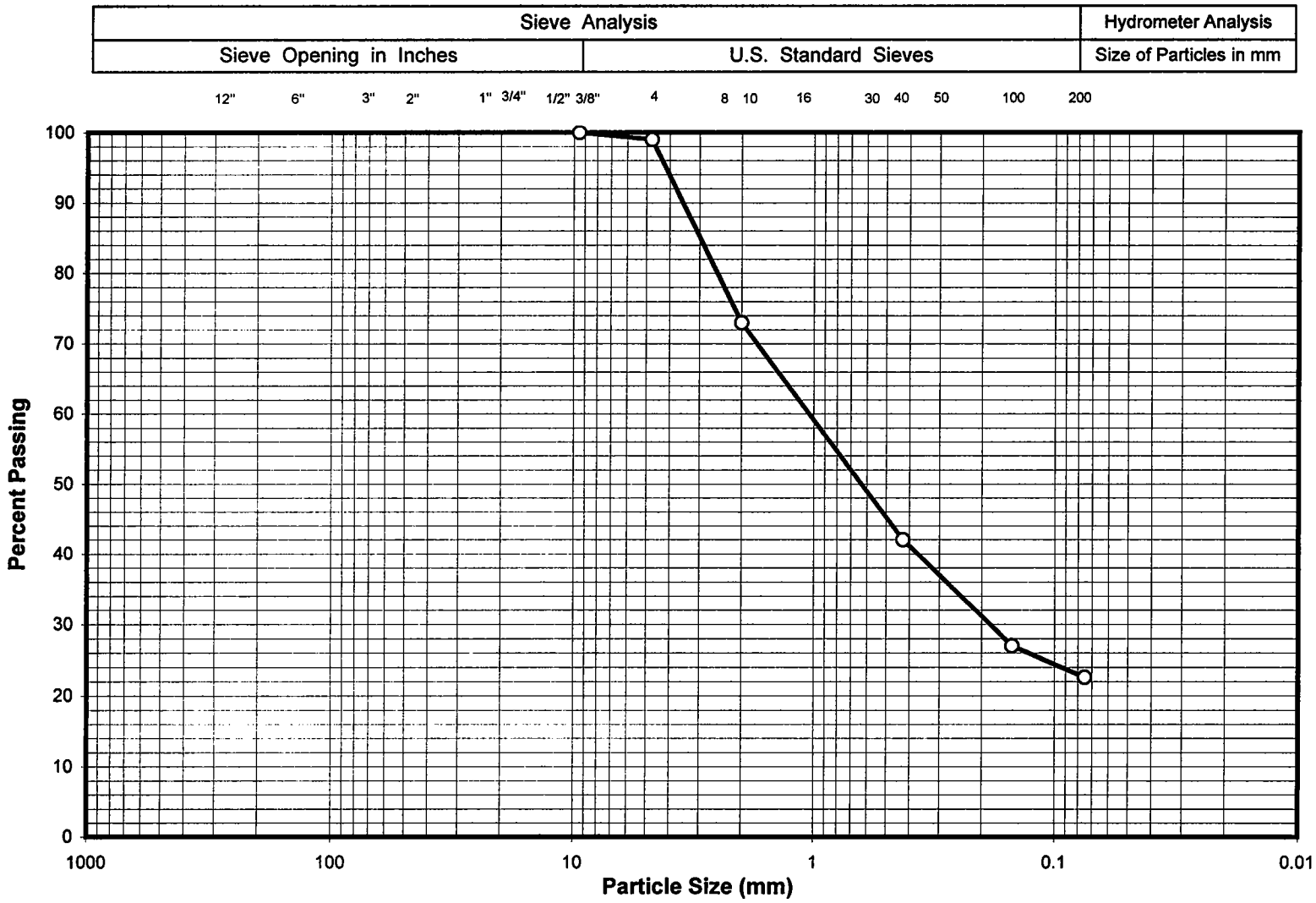

Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	0
½"	0
⅜"	100
#4	99
#10	73
#40	42
#200	23

Gravel (%)	1	LL	29	Project Name:	Washington Road
Sand (%)	76	PL	17	Sample ID:	TP-2
Fines (%)	23	PI	12	Sample Depth (ft.):	1-2.5
Sample Description:	Clayey sand (SC / A-2-6 (0))				

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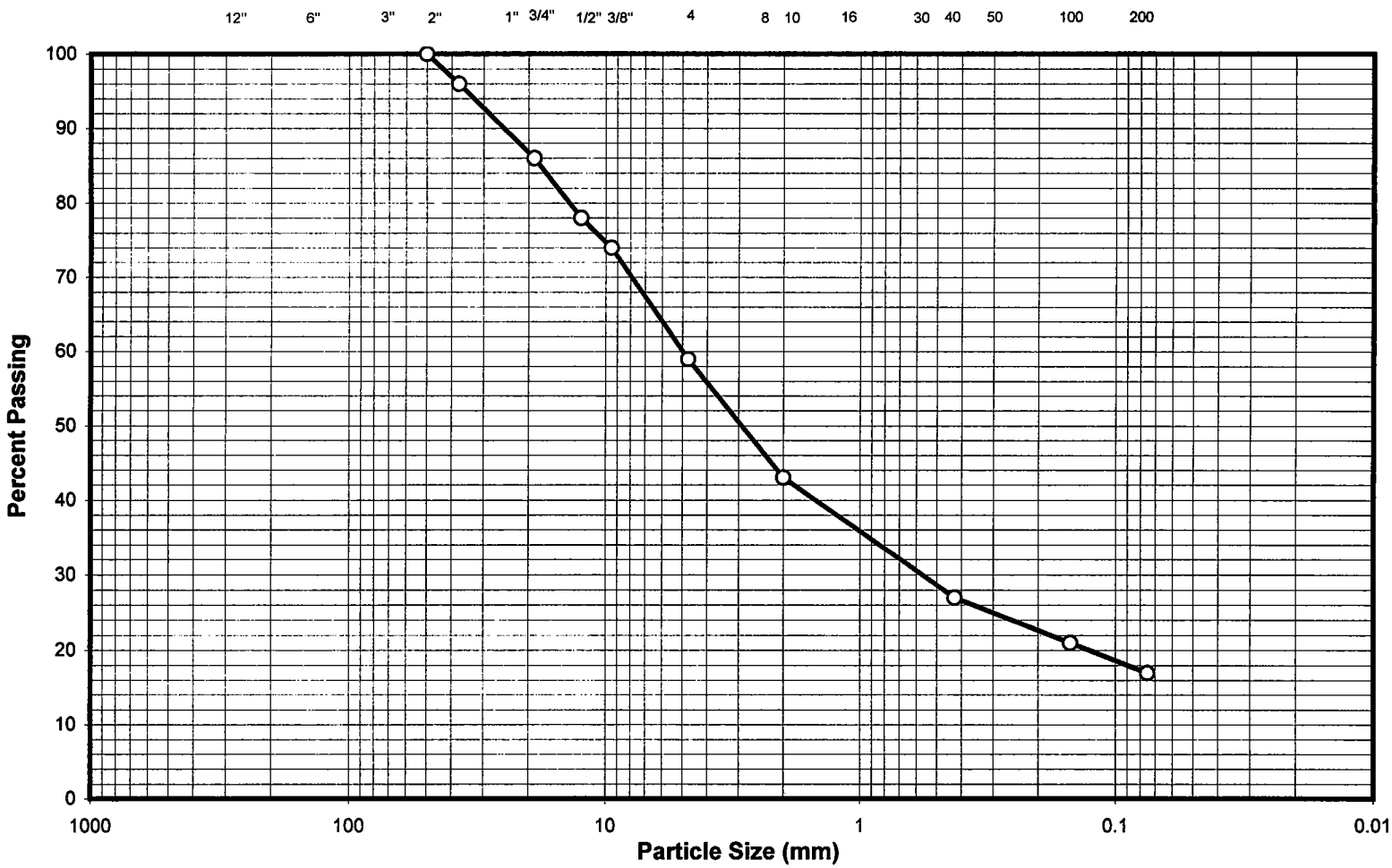
SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	100
1 ½"	96
1"	-
¾ "	86
½"	78
⅜"	74
#4	59
#10	43
#40	27
#200	17

Gravel (%)	41	LL	NV	Project Name:	Washington Road
Sand (%)	42	PL	NP	Sample ID:	TP-3
Fines (%)	17	PI	NP	Sample Depth (ft.):	0-2.5
Sample Description:	Silty sand with gravel (SM / A-1-b (0))				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	AC	Project No.:	24-108
Checked By:	MD		
Date:	03/23/05	Figure No.:	-

Revised 04/27/2004

Analytica Solutions, Inc.
12189 Pennsylvania Street
Thornton, Colorado 80241
(303) 469-8868
(800) 873-8707
Fax: (303) 469-5254

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RESULTS OF BULK ASBESTOS SAMPLE ANALYSIS BY POLARIZED LIGHT MICROSCOPY (PLM)

Client: **Yeh and Associates, Inc.**

LGN: **349268**

Project ID: **24-108 Washington Rd**

Sample Description:

Sample Number	Sample Date	Description
YAR-04	10/13/2004	Serpentine rock [green]
YAR-06	10/13/2004	Serpentine rock [green]
YAR-08	10/14/2004	Serpentine rock [tan]
YAR-11	10/14/2004	Serpentine rock [tan]
TP-2	10/15/2004	Serpentine rock [green]

Results of PLM Analysis: Visual Area Estimation: Percentages Detected

Sample Number:	YAR-04	YAR-06	YAR-08	YAR-11	TP-2
Asbestiform Minerals:					
Amosite					
Anthophyllite					
Chrysotile	5.0	Trace <1%			5.0
Crocidolite					
Tremolite-Actinolite					
TOTAL ASBESTOS	5.0	Trace <1%	0	0	5.0
Other Fibrous Materials:					
Fibrous Glass					
Cellulose					
Synthetics					
Other:	95.0 Antigorite	95.0 Antigorite			85.0 Antigorite
Percent Nonfibrous Material		4.9	100	100	10.0

Analyst: Bruce G. Sales

Bruce G. Sales

Date: 10/26/2004

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YEH & ASSOCIATES, INC

Direct Shear Test Report (AASHTO T 236)

Test #	1	Sample #	YAR-07	Depth	-
Y&A Project #	24-108	Project Name	Washington Road	Blow Counts	N/A
Date	1/12/2005			SAMPLED BY	JD
				TESTED BY	SM
				CHECKED BY	SY

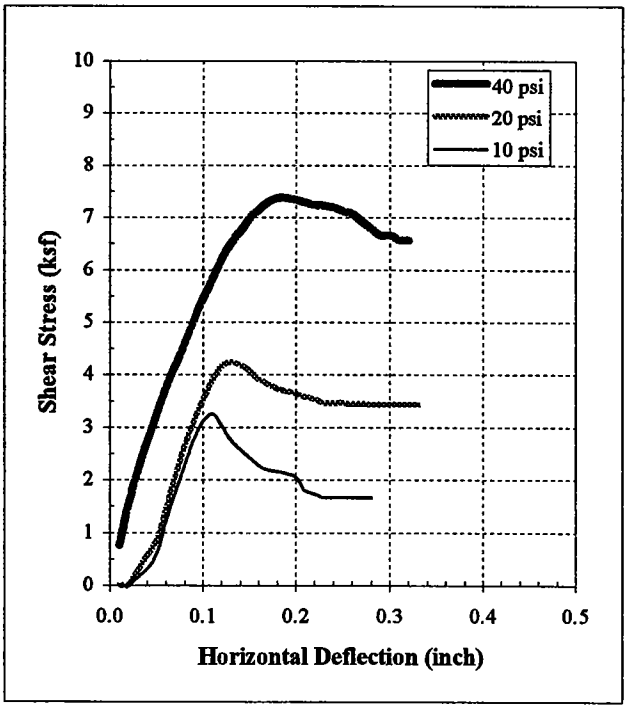
Liquid Limit	25
Plastic Limit	20
Plastic Index	5

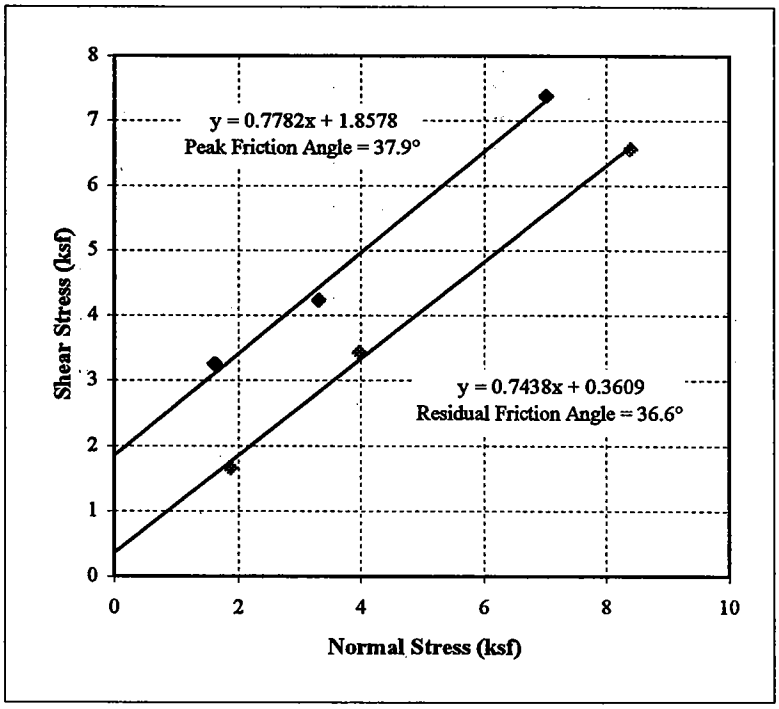
Compaction Method	-
Max. Dry Density	-
Optimum Moisture	-
Rate	0.01 in/min
Gear	B

Classification	
AASHTO	A-2-4 (0)
USCS	SM-SC

Note: Minus #4 materials were used and compacted to natural density and moisture content.

Specimen Preparation	Point 1	Point 2	Point 3
Normal Stress (ksf)	1.44	2.88	5.76
Compacted Natural Dry Density (pcf)	128.8	128.8	128.8
Natural Moisture Content (%)	1.9	1.9	1.9
Percent of Maximum Dry Density	-	-	-





Peak Friction Angle: **37.9°**
Cohesion: **1,858 psf**

Residual Friction Angle: **36.6°**
Cohesion: **361 psf**

Revised 01/03/05

YEH & ASSOCIATES, INC

Direct Shear Test Report (AASHTO T 236)

Test #	1	Sample #	YAR-11	Depth	0-5'
Y&A Project #	24-108	Project Name	Washington Road	Blow Counts	N/A
Date	1/12/2005			SAMPLED BY	JD
				TESTED BY	SM
				CHECKED BY	SY

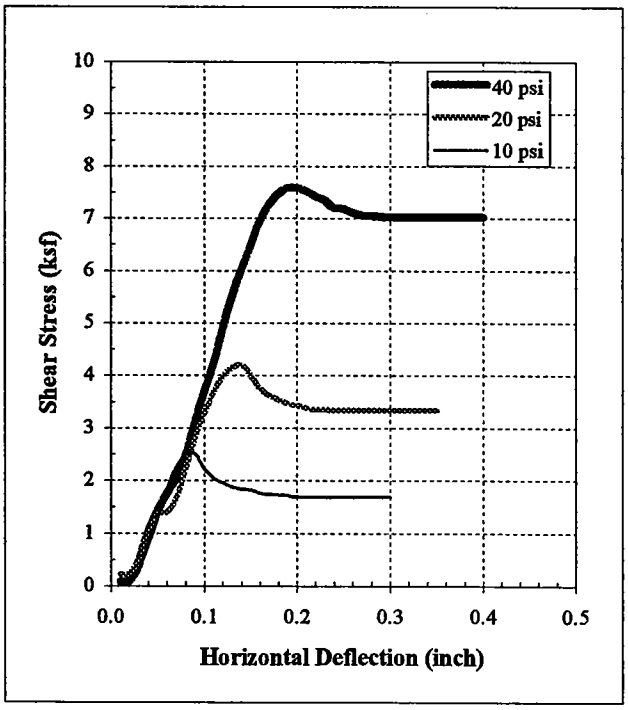
Liquid Limit	NV
Plastic Limit	NP
Plastic Index	NP

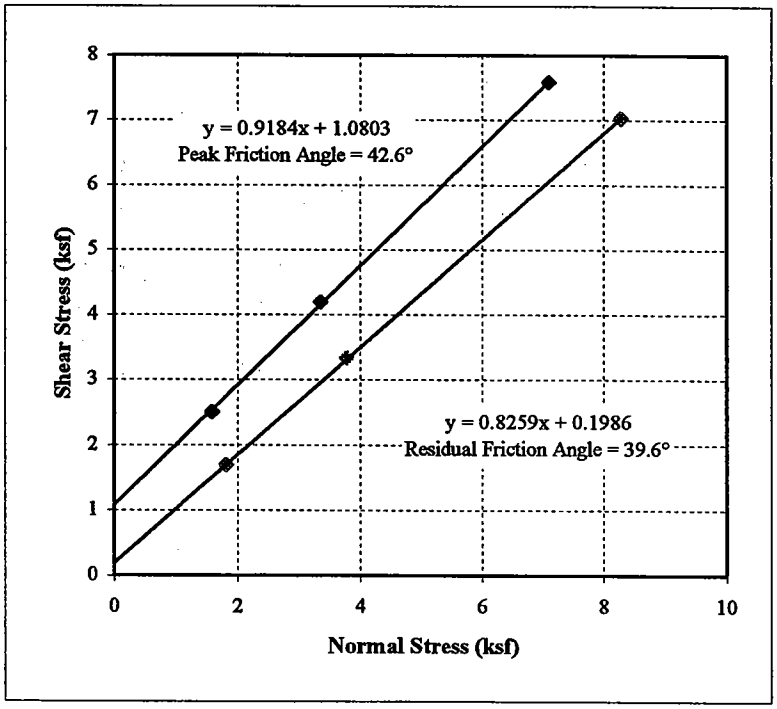
Compaction Method	AASHTO T180 (A)
Max. Dry Density	127.2
Optimum Moisture	9.0%
Rate	0.01 in/min
Gear	B

Classification	
AASHTO	A-1-b (0)
USCS	SM

Note: Minus #4 materials were used and compacted to 95% of maximum dry density at optimum moisture content.

Specimen Preparation	Point 1	Point 2	Point 3
Normal Stress (ksf)	1.44	2.88	5.76
Compacted Dry Density (pcf)	120.8	120.8	120.8
Moisture Content (%)	9.0	9.0	9.0
Percent of Maximum Dry Density	95	95	95





Peak Friction Angle: **42.6°**
Cohesion: **1,080 psf**

Residual Friction Angle: **39.6°**
Cohesion: **199 psf**

Revised 01/03/05

APPENDIX E
Pavement Design Analysis

Resilient Modulus M_R

R-Value= 30

S1=(R-Value-5)/11.29+3

S1= 5.21

M_R=10^((S1+18.72)/6.24)

M_R= 6849.1

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

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Flexible Structural Design Module

Washington Road
Overlay of Existing Pavement (R-value = 30)

Rigorous ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	426
Number of Lanes in Design Direction	1
Percent of All Trucks in Design Lane	100 %
Percent Trucks in Design Direction	100 %

Vehicle Class	Percent of ADT	Annual % Growth	Average Initial Truck Factor (ESALs/ Truck)	Annual % Growth in Truck Factor	Accumulated 18-kip ESALs over Performance Period
2	92.5	2	0.0004	0	1,370
8	5.5	2	1.35	0	274,962
9	2	2	2.2	0	162,941
Total	100	-	-	-	439,273

Growth	Simple
Total Calculated Cumulative ESALs	439,273

Design ESALs

Lane Distribution Factor = 0.6

439,273 X 0.6 = 263,563.8 ESALs

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

Washington Road
Cold Recycle Option
R- Value = 30

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Existing ABC	0.14	0.9	6	12	0.76
2	Cold Recycle of Existing	0.28	1	2.4	12	0.67
3	New HCAP	0.44	1	2.6	12	1.14
Total	-	-	-	11.00	-	2.57

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

Washington Road
Pulverization Option - 6 inches
R-value = 30

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Pulveize 6" HMA plus Base	0.12	0.9	6	12	0.65
2	New HMAC	0.44	1	4.4	12	1.94
Total	-	-	-	10.40	-	2.58

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

Washington Road
Pulverization Option - 8 inches
R-value = 30

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Pulverize 8" old HMAC plus Base	0.12	0.9	8	12	0.86
2	New HACP	0.44	1	3.9	12	1.72
Total	-	-	-	11.90	-	2.58

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

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Computer Software Product

Flexible Structural Design Module

Washington Road
Full Depth Reclamation (Foamed Asphalt)
R-value = 30

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Pulverized HMA plus Foamed AC	0.25	0.9	6	12	1.35
2	New HACP	0.44	1	2.8	12	1.23
Total	-	-	-	8.80	-	2.58

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

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Flexible Structural Design Module

Washington Road
R-value = 30
Full Depth Reclamation (Foamed Asphalt) at 8"

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Pulverized HMA plus Foam to 8"	0.2	0.9	8	12	1.44
2	New HACP	0.44	1	2.6	12	1.14
Total	-	-	-	10.60	-	2.58

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

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Flexible Structural Design Module

Washington Road
Emulsified Treated Base - 6 inches
R-value = 30

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Emulsified Treatment to 8" (HMA ...	0.25	0.9	6	12	1.35
2	New HCAP	0.44	1	2.8	12	1.23
Total	-	-	-	8.80	-	2.58

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

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Computer Software Product

Flexible Structural Design Module

Washington Road, R-value = 30
Emulsified Treated Base

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Emulsified Treatment to 8" (HMA ...	0.25	0.9	8	12	1.80
2	New HCAP	0.44	1	2	12	0.88
Total	-	-	-	10.00	-	2.68

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

Washington Road
(Cement Treated Base)
R-value = 30

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Pulverized HMA and base to 8"	0.2	0.9	6	12	1.08
2	New HCAP	0.44	1	3.4	12	1.50
Total	-	-	-	9.40	-	2.58

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare Computer Software Product

Flexible Structural Design Module

Washington Road
Full Depth Reclamation (Cement Treated Base)
R-value = 30

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	6,849 psi
Stage Construction	1
Calculated Design Structural Number	2.57 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Pulverized asphalt and base to 8"	0.2	0.9	8	12	1.44
2	New HACP	0.44	1	2.6	12	1.14
Total	-	-	-	10.60	-	2.58

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare Computer Software Product

Flexible Structural Design Module

Washington Road Through Town with milling
to remove old pavement and replace with new HMA
R-value = 33

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	263,563.8
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	75 %
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	7,555 psi
Stage Construction	1
Calculated Design Structural Number	2.48 in

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	Existing Base	0.14	0.9	6	12	0.76
2	New HMA	0.44	1	4	12	1.76
Total	-	-	-	10.00	-	2.52

APPENDIX F
Preliminary Slope Stability Analysis

Washington Road, California Landslide Stability (3:1 Slope)

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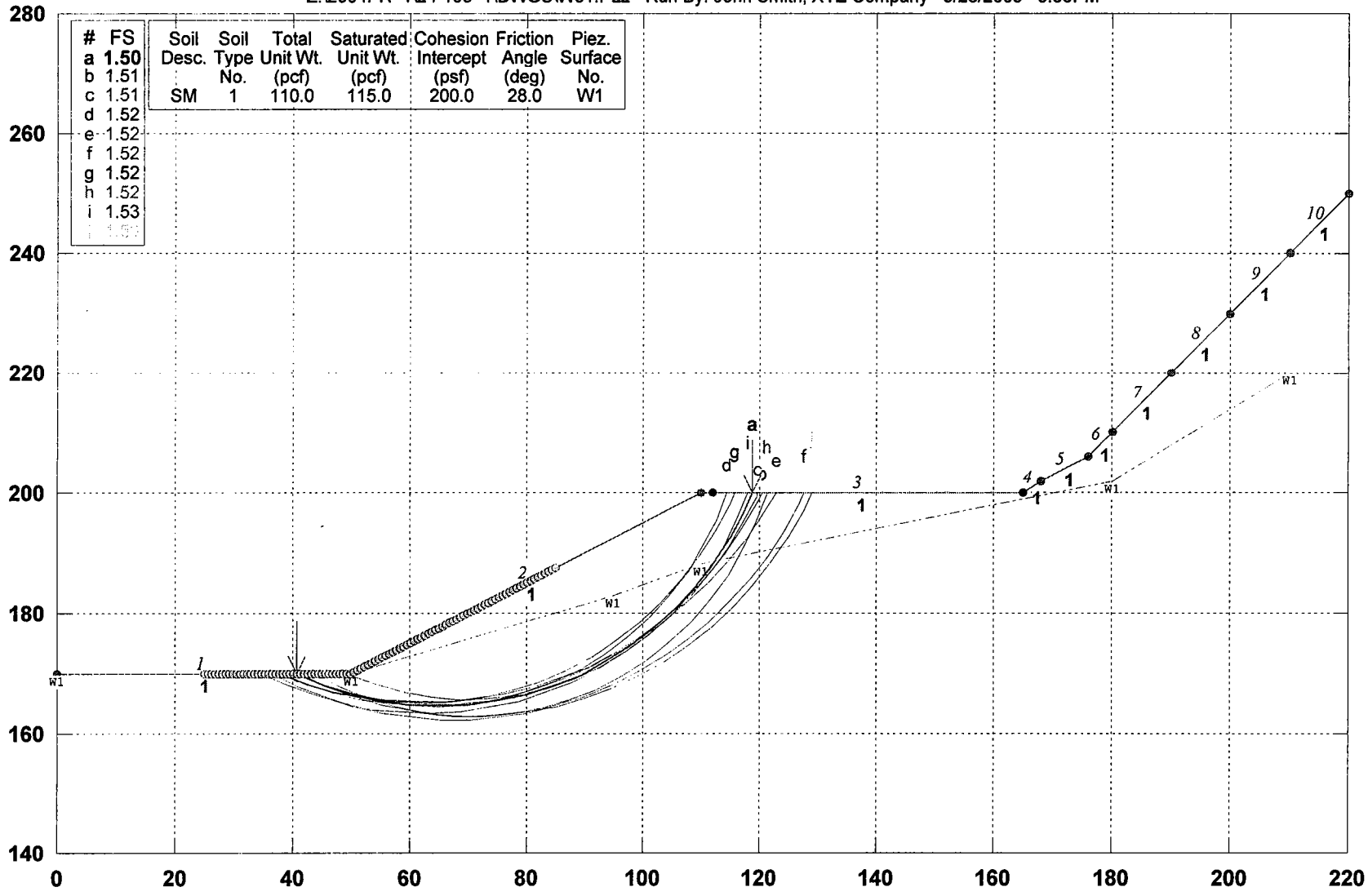

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Safety Factors Are Calculated By The Modified Bishop Method

Yeh & Associates

Washington Road, California Landslide Stability (Buttress)

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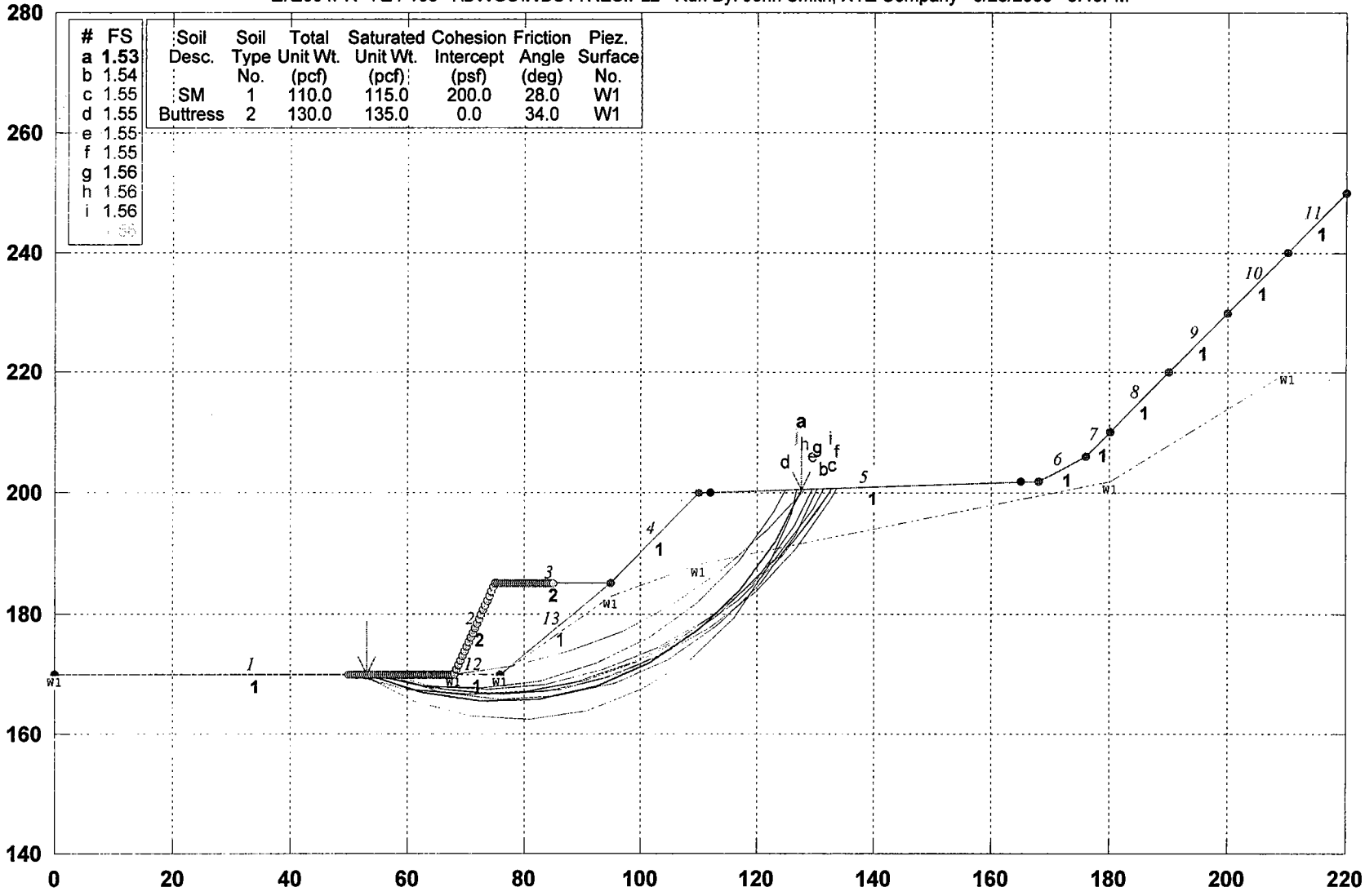

#	FS
a	1.53
b	1.54
c	1.55
d	1.55
e	1.55
f	1.55
g	1.56
h	1.56
i	1.56

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
SM	1	110.0	115.0	200.0	28.0	W1
Buttress	2	130.0	135.0	0.0	34.0	W1

PCSTABL6/si FSmin=1.53

Safety Factors Are Calculated By The Modified Bishop Method

Yeh & Associates

Washington Road, California Landslide Stability - Existing

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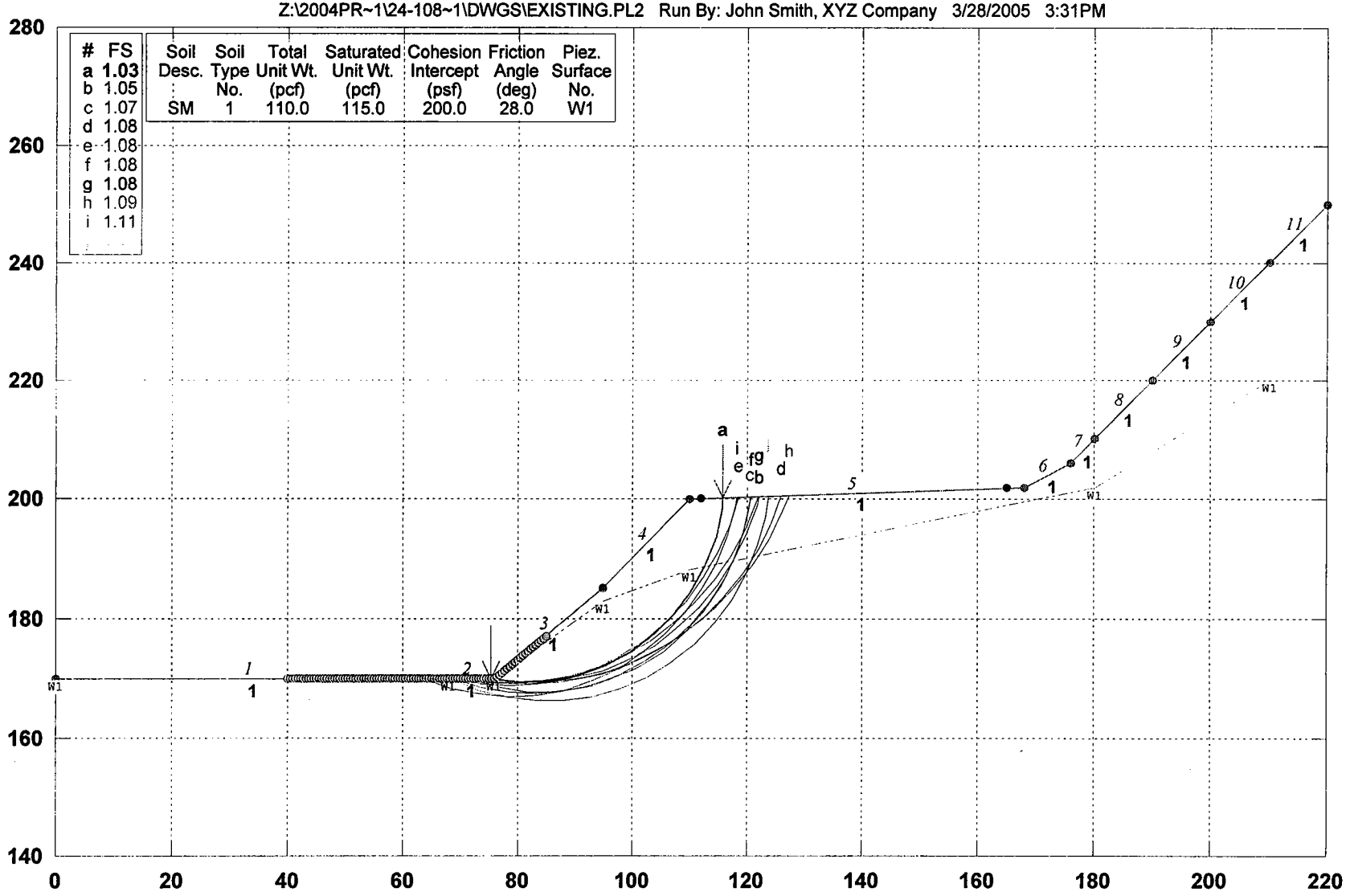

PCSTABL6/si FSmin=1.03

Safety Factors Are Calculated By The Modified Bishop Method

Yeh & Associates

APPENDIX G
Asbestos Regulations for Construction

Cal/EPA - Air Resources Board

July 29, 2002 Asbestos ATCM for Construction, Grading, Quarrying, and Surface Mining Operations

This page updated March 10, 2004.

Final Regulation Order

ASBESTOS AIRBORNE TOXIC CONTROL MEASURE FOR CONSTRUCTION, GRADING, QUARRYING, AND SURFACE MINING OPERATIONS

Section 93105. Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations

(a) Effective Date.

(1) No later than 120 days after the approval of this section by the Office of Administrative Law, each air pollution control and air quality management district must:

(A) Implement and enforce the requirements of this section; or

(B) Propose their own asbestos airborne toxic control measure as provided in Health and Safety Code section 39666(d).

(2) ***Pre-Existing Operations*:** The owner / operator of any project in which the construction, grading, quarrying, or surface mining operation started before the effective date of this section shall comply with this section by:

(A) The date the district begins implementing and enforcing this section as required in subsection (a)(1)(A);

(B) The compliance date specified in the airborne toxic control measure adopted by the district as required in subsection (a)(1)(B).

(b) Applicability. Unless one of the specific exemptions specified in subsection (c) applies, this section shall apply to any construction, grading, quarrying, or surface mining operation on any property that meets any of the following criteria:

(1) Any portion of the area to be disturbed is located in a geographic ultramafic rock unit; or

(2) Any portion of the area to be disturbed has naturally-occurring asbestos, serpentine, or ultramafic rock as determined by the owner / operator, or the Air Pollution Control Officer (APCO); or

(3) Naturally-occurring asbestos, serpentine, or ultramafic rock is discovered by the owner / operator, a registered geologist, or the APCO in the area to be disturbed after the start of any construction, grading, quarrying, or surface mining operation.

(c) General Exemptions.

(1) ***Geologic Evaluation*:** The APCO may provide an exemption from this section for any property that meets the criterion in subsection (b)(1) if a registered geologist has conducted a geologic evaluation of the property and determined that no serpentine or ultramafic rock is likely to be found in the area to be disturbed. Before an exemption can be granted, the owner/operator must provide a copy of a report detailing the geologic evaluation to the APCO for his or her consideration.

(A) At a minimum, the geologic evaluation must include:

1. A general description of the property and the proposed use;

2. A detailed site characterization which may include:
    i. A physical site inspection;
    ii. Offsite geologic evaluation of adjacent property;
    iii. Evaluation of existing geological maps and studies of the site and surrounding area;
    iv. Development of geologic maps of the site and vicinity;
    v. Identification and description of geologic units, rock and soil types, and features that could be related to the presence of ultramafic rocks, serpentine, or asbestos mineralization; and
    vi. A subsurface investigation to evaluate the nature and extent of geologic materials in the subsurface where vertical excavation is planned; methods of subsurface investigation may include, but are not limited to borings, test pits, trenching, and geophysical surveys;
3. A classification of rock types found must conform to the nomenclature based on the International Union of Geological Science system;
4. A description of the sampling procedures used;
5. A description of the analytical procedures used, which may include mineralogical analyses, petrographic analyses, chemical analyses, or analyses for asbestos content;
6. An archive of collected rock samples for third party examination; and
7. A geologic evaluation report documenting observations, methods, data, and findings; the format and content of the report should follow the Guidelines for Engineering Geologic Reports issued by the State Board of Registration for Geologists and Geophysicists.

(B) The district may request any additional tests or other information needed to evaluate an application for exemption.

(C) The district shall grant or deny a request for an exemption within 90 days of the receipt of a complete application.

(D) If the request for an exemption is denied, the APCO shall provide written reasons for the denial.

(E) ***Expiration of the Geologic Exemption:*** If the owner / operator discovers any naturally-occurring asbestos, serpentine, or ultramafic rock in the area to be disturbed after the exemption is granted, then:

1. The owner / operator must comply with the requirements of this section;
2. The owner / operator must report the discovery of the naturally-occurring asbestos, serpentine, or ultramafic rock to the APCO no later than the next business day; and
3. The exemption under subsection (c)(1) shall expire and cease to be effective.

(2) If a method is developed to accurately demonstrate that property located in a geographic ultramafic rock unit has no detectable asbestos in the area to be disturbed, then the ARB Executive Officer shall propose to the Board for adoption a regulatory amendment allowing the method to be utilized, as appropriate, to obtain an exemption from the requirements specified in this section.

(3) ***Agriculture and Timber Harvesting***: This section shall not apply to agricultural operations

or timber harvesting except for construction of roads and buildings. Construction of roads is subject to the requirements of subsection (e) if the road is part of a construction or grading operation, quarry, or surface mine, and is subject to the requirements of subsection (d) if the road is not part of a construction or grading operation, quarry, or surface mine.

(4) ***Homeowners and Tenants*:** Individuals engaged in covered activities on residential property they own or occupy are exempt from subsections (e)(1) and (e)(3)(A).

(5) ***Sand and Gravel Operations*:** The APCO may provide an exemption for crushing, screening and conveying equipment, stockpiles, and off-site material transport at a sand and gravel operation if the operation processes only materials from an alluvial deposit.

(A) The district shall grant or deny a request for an exemption within ninety (90) days of the receipt of a complete application.

(B) If the request for an exemption is denied, the APCO shall provide written reasons for the denial.

(d) Requirements for Road Construction and Maintenance. These requirements shall apply to roads that are not part of a construction or grading project, quarry, or surface mine.

(1) No person shall conduct any road construction or maintenance activities that disturb any area that meets any criterion listed in subsections (b)(1) or (b)(2) unless all of the following conditions are met.

(A) The APCO is notified in writing at least fourteen (14) days before the beginning of the activity or in accordance with a procedure approved by the district.

(B) All the following dust control measures are implemented during any road construction or maintenance activity:

1. Unpaved areas subject to vehicle traffic must be stabilized by being kept adequately wetted, treated with a chemical dust suppressant, or covered with material that contains less than 0.25 percent asbestos;

2. The speed of any vehicles and equipment traveling across unpaved areas must be no more than fifteen (15) miles per hour unless the road surface and surrounding area is sufficiently stabilized to prevent vehicles and equipment traveling more than 15 miles per hour from emitting dust that is visible crossing the project boundaries;

3. Storage piles and disturbed areas not subject to vehicular traffic must be stabilized by being kept adequately wetted, treated with a chemical dust suppressant, or covered with material that contains less than 0.25 percent asbestos; and

4. Activities must be conducted so that no track-out from any road construction project is visible on any paved roadway open to the public.

(C) Equipment and operations must not cause the emission of any dust that is visible crossing the project boundaries.

(2) No person shall conduct any road construction or maintenance activity that disturbs the ground surface in an area that meets the criteria in subsection (b)(3) unless:

(A) The APCO is notified no later than the next business day of the discovery that the area meets the criteria in subsection (b)(3); and

(B) The requirements of subsections (d)(1)(B) through (d)(1)(C), are implemented within twenty-four (24) hours of the discovery.

(3) ***Exemptions from the Requirements for Road Construction and Maintenance.*** The following exemptions may apply in addition to the applicable general exemptions specified in subsection (c).

(A) ***Emergency Road Repairs:*** Subsection (d)(1)(A) shall not apply when construction

of a road or firebreak, or a road repair is necessary due to a landslide, flood, or other emergency or to mitigate a condition that constitutes an imminent hazard to the public. The owner / operator shall notify the APCO no later than the next business day of the action taken and the condition establishing the applicability of this subsection.

(B) ***Remote Locations:*** The APCO may provide an exemption from the requirements of subsection (d) for any activity which will occur at a remote location.

1. The district shall grant or deny a request for an exemption within ninety (90) days of the receipt of a complete application.
2. If the request for an exemption is denied, the APCO shall provide written reasons for the denial.

(e) Requirements for Construction and Grading Operations.

(1) ***Areas of One Acre or Less Meeting the Criteria in Subsections (b)(1) or (b)(2)*:** No person shall engage in any construction or grading operation on property where the area to be disturbed is **one (1.0) acre or less** unless all of the following dust mitigation measures are initiated at the start and maintained throughout the duration of the construction or grading activity:

(A) Construction vehicle speed at the work site must be limited to fifteen (15) miles per hour or less;

(B) Prior to any ground disturbance, sufficient water must be applied to the area to be disturbed to prevent visible emissions from crossing the property line;

(C) Areas to be graded or excavated must be kept adequately wetted to prevent visible emissions from crossing the property line;

(D) Storage piles must be kept adequately wetted, treated with a chemical dust suppressant, or covered when material is not being added to or removed from the pile;

(E) Equipment must be washed down before moving from the property onto a paved public road; and

(F) Visible track-out on the paved public road must be cleaned using wet sweeping or a HEPA filter equipped vacuum device within twenty-four (24) hours.

(2) ***Areas Greater Than One Acre Meeting the Criteria in Subsections (b)(1) or (b)(2)*:** No person shall engage in any construction or grading operation on property where the area to be disturbed is **greater than one (1.0) acre** unless:

(A) An Asbestos Dust Mitigation Plan for the operation has been:

1. Submitted to and approved by the district before the start of any construction or grading activity; and
2. The provisions of that dust mitigation plan are implemented at the beginning and maintained throughout the duration of the construction or grading activity; and

(B) For a project started before the effective date of this section for which an asbestos dust mitigation plan was submitted at least sixty (60) days before the effective date, and for which the district has not yet approved the asbestos dust mitigation plan:

1. The measures in subsection (e)(1) must be implemented and maintained until the district-approved asbestos dust mitigation plan is implemented; and
2. The provisions of the district-approved asbestos dust mitigation plan must be implemented within fourteen (14) days of district approval of the plan and maintained throughout the remainder of the construction or grading activity.

(3) ***Property That Meets the Criteria in Subsection (b)(3)***: No person shall engage in any construction or grading operation unless the following requirements are met:

(A) The owner / operator notifies the district of the discovery of naturally-occurring asbestos, serpentine, or ultramafic rock no later than the next business day;

(B) The dust mitigation measures in subsection (e)(1) are implemented within twenty-four (24) hours after determining that the property meets the criteria in subsection (b)(3); and

(C) For operations in which the area to be disturbed is **one (1.0) acre or less**, the dust mitigation measures in subsection (e)(1) are maintained throughout the duration of the construction or grading activity; or

(D) For operations in which the area to be disturbed is **greater than one (1.0) acre**, the owner / operator must:

1. Submit an asbestos dust mitigation plan to the district within fourteen (14) days of the discovery of naturally-occurring asbestos, serpentine, or ultramafic rock;
2. Maintain the dust mitigation measures in subsection (e)(1) until the provisions of the district-approved asbestos dust mitigation plan are implemented;
3. Implement the provisions of the district-approved asbestos dust mitigation plan within fourteen (14) days of district approval of the plan; and
4. Maintain the provisions of the district-approved asbestos dust mitigation plan throughout the remainder of the construction or grading activity.

(4) ***Asbestos Dust Mitigation Plans***: An Asbestos Dust Mitigation Plan must specify dust mitigation practices which are sufficient to ensure that no equipment or operation emits dust that is visible crossing the property line, and must include one or more provisions addressing **each** of the following topics.

(A) Track-out prevention and control measures which shall include:

1. Removal of any visible track-out from a paved public road at any location where vehicles exit the work site; this shall be accomplished using wet sweeping or a HEPA filter equipped vacuum device at the end of the work day or at least one time per day; and
2. Installation of one or more of the following track-out prevention measures:
   i. A gravel pad designed using good engineering practices to clean the tires of exiting vehicles;
   ii. A tire shaker;
   iii. A wheel wash system;
   iv. Pavement extending for not less than fifty (50) consecutive feet from the intersection with the paved public road; or
   v. Any other measure as effective as the measures listed above.

(B) Keeping active storage piles adequately wetted or covered with tarps.

(C) Control for disturbed surface areas and storage piles that will remain inactive for more than seven (7) days, which shall include one or more of the following:

1. Keep the surface adequately wetted;
2. Establishment and maintenance of surface crusting sufficient to satisfy the test in subsection (h)(6);
3. Application of chemical dust suppressants or chemical stabilizers according to

the manufacturers' recommendations;

4. Covering with tarp(s) or vegetative cover;
5. Installation of wind barriers of fifty (50) percent porosity around three (3) sides of a storage pile;
6. Installation of wind barriers across open areas; or
7. Any other measure as effective as the measures listed above.

(D) Control for traffic on on-site unpaved roads, parking lots, and staging areas which shall include:

1. A maximum vehicle speed limit of fifteen (15) miles per hour or less; and
2. One or more of the following:
   i. Watering every two hours of active operations or sufficiently often to keep the area adequately wetted;
   ii. Applying chemical dust suppressants consistent with manufacturer's directions;
   iii. Maintaining a gravel cover with a silt content that is less than five (5) percent and asbestos content that is less than 0.25 percent, as determined using an approved asbestos bulk test method, to a depth of three (3) inches on the surface being used for travel; or
   iv. Any other measure as effective as the measures listed above.

(E) Control for earthmoving activities which shall include one or more of the following:

1. Pre-wetting the ground to the depth of anticipated cuts;
2. Suspending grading operations when wind speeds are high enough to result in dust emissions crossing the property line, despite the application of dust mitigation measures;
3. Application of water prior to any land clearing; or
4. Any other measure as effective as the measures listed above.

(F) ***Control for Off-Site Transport.*** The owner / operator shall ensure that no trucks are allowed to transport excavated material off-site unless:

1. Trucks are maintained such that no spillage can occur from holes or other openings in cargo compartments; and
2. Loads are adequately wetted and either:
   i. Covered with tarps; or
   ii. Loaded such that the material does not touch the front, back, or sides of the cargo compartment at any point less than six inches from the top and that no point of the load extends above the top of the cargo compartment.

(G) ***Post Construction Stabilization of Disturbed Areas.*** Upon completion of the project, disturbed surfaces shall be stabilized using one or more of the following methods:

1. Establishment of a vegetative cover;

2. Placement of at least three (3.0) inches of non-asbestos-containing material;
3. Paving;
4. Any other measure deemed sufficient to prevent wind speeds of ten (10) miles per hour or greater from causing visible dust emissions.

(H) ***Air Monitoring for Asbestos (If Required by the APCO).***

1. If required by the district APCO, the plan must include an air-monitoring component.
2. The air monitoring component shall specify the following:
   i. Type of air sampling device(s);
   ii. Siting of air sampling device(s);
   iii. Sampling duration and frequency; and
   iv. Analytical method.

(I) ***Frequency of Reporting*:** The plan shall state how often the items specified in subsection (e)(5)(B), and any other items identified in the plan, will be reported to the district.

(5) ***Recordkeeping and Reporting Requirements.***

(A) *Recordkeeping Requirements:* The owner / operator shall maintain all of the following records for at least seven (7) years following the completion of the construction project:

1. The results of any air monitoring conducted at the request of the APCO;
2. The documentation for any geologic evaluation conducted on the property for the purposes of obtaining an exemption, except the archive of collected samples which may be discarded at the expiration of the exemption or one (1) year after the exemption is granted whichever is less; and
3. The results of any asbestos bulk sampling that meets any of the following conditions:
   i. The asbestos bulk sampling was conducted by the owner / operator to document the applicability of or compliance with this section, or
   ii. The asbestos bulk sampling was done at the request of the district APCO.

(B) ***Reporting Requirements:*** The owner / operator of any grading or construction operation subject to this section shall submit the following to the District:

1. The results of any air monitoring conducted at the request of the APCO; and
2. The results of any asbestos bulk sampling that meets any of the following conditions:
   i. Asbestos bulk sampling conducted by the owner / operator to document applicability of or compliance with this section; or
   ii. Asbestos bulk sampling done at the request of the APCO.

(f) Requirements for Quarrying and Surface Mining Operations.

(1) No person shall engage in any quarrying or surface mining operation that meets the criteria of subsections (b)(1) or (b)(2) unless an Asbestos Dust Mitigation Plan for the operation has been

submitted to and approved by the District and the fugitive dust mitigation measures specified in the Plan are implemented and maintained throughout the duration of any quarrying or surface mining operation except,

(A) ***Pre-Existing Operations***: The owner or operator of any quarrying or surface mining operation that was in operation before the date this section is implemented as determined pursuant to subsection (a) that has not obtained district approval of the asbestos dust mitigation plan may continue operating if all the following conditions are met:

1. The owner / operator has submitted an asbestos dust mitigation plan to the district at least sixty (60) days prior to the date specified in subsection (a);
2. The owner / operator implements all of the dust mitigation measures specified in subsections (f)(2)(B) and (f)(2)(C) by the effective date specified in subsection (a) and maintains them until the provisions of an approved asbestos dust mitigation plan are implemented; and
3. The owner / operator implements the provisions of the asbestos dust mitigation plan within fourteen (14) days following district approval of the plan.

(B) ***Mineral Exploration Activities***: Mineral exploration activities as defined in the California Public Resources Code section 2714(d) in an area meeting any of the conditions of subsection (b) are not required to submit an asbestos dust mitigation plan but shall instead implement and maintain the following measures throughout the duration of the activity:

1. Limit vehicle speeds on the site to fifteen (15) miles per hour or less;
2. Apply sufficient water during any ground disturbance to prevent visible dust from crossing the property line;
3. Keep disturbed areas and storage piles adequately wetted until they are permanently stabilized;
4. Install a track-out prevention device designed to prevent track-out onto any paved public road;
5. Clean up any visible track-out at the end of the workday or at a minimum within twenty-four (24) hours; and
6. Cover, treat with a chemical dust suppressant, or otherwise stabilize any disturbed areas when operations cease for more than seven (7) days.

(2) The owner / operator of any quarry or surface mine that meets any of the criteria in subsection (b) (3) shall:

(A) Notify the APCO no later than the next business day of the discovery.

(B) Implement all the following measures within twenty-four (24) hours following the discovery:

1. Keep stock and working piles adequately wetted during the addition and removal of material;
2. Keep on-site unpaved roads, parking lots, and staging areas stabilized using one of the following measures:
   - i. Adequately Wetted; or
   - ii. Controlled Using Dust Palliatives or Suppressants; or
   - iii. Paving; or
   - iv. Covered to a depth of three (3) inches with gravel that contains less than 0.25 percent asbestos as determined using an approved asbestos bulk test method;

3. Keep exposed areas and inactive stockpiles that are prone to mechanical or wind disturbances:

   i. Adequately Wetted; or

   ii. Controlled Using Dust Palliatives or Suppressants, Paving, Wind Berms or Breaks; or

   iii. Covered with tarps or material that contains less than 0.25 percent asbestos as determined using an approved asbestos bulk test method;

4. Ensure that materials to be quarried, excavated, or graded are adequately wetted;

5. Ensure that all loads are adequately wetted before and during truck loading operations;

6. Ensure that all trucks transporting materials off-site meet the conditions of either paragraph i or paragraph ii at the time the truck leaves the site:

   i. Loads are adequately wetted and covered with tarps; or

   ii. Loads are adequately wetted and the material does not touch the front back or sides of the cargo compartment at any point less than six (6) inches from the top and no point of the load extends above the top of the cargo compartment; and

7. Limit vehicle speeds within the quarry or surface mining operation to fifteen (15) miles per hour or less.

(C) Implement all of the following measures within fourteen (14) days of the determination that the operation meets any of the criteria in subsection (b)(3).

1. Measures to ensure that material being excavated, crushed, screened, loaded, transferred or conveyed does not result in any dust that is visible crossing the property line.

2. Measures to ensure that no grinding mill, screening operation, or transfer point on a belt conveyor discharges into the air any visible emissions other than uncombined water vapor, for a period aggregating more than three minutes in any one hour which are:

   i. Fifty percent as dark or darker in shade as that designated as number one on the Ringlemann Chart, as published by the United States Bureau of Mines; or

   ii. Of such opacity as to obscure an observers view to a degree equal to or greater than smoke as described in subsection (f)(2)(C)2.i. or ten (10) percent opacity.

3. Measures to ensure that no crusher discharges into the air any visible emissions other than uncombined water vapor, for a period aggregating more than three minutes in any one hour which are:

   i. Seventy-five percent as dark or darker in shade as that designated as number one on the Ringlemann Chart, as published by the United States Bureau of Mines; or

   ii. Of such opacity as to obscure an observers view to a degree equal to or greater than smoke as described in subsection (f)(3)(C)3.i. or fifteen (15) percent opacity.

4. Measures for material handling sufficient to meet the requirements of subsections (f)(2)(C)1. through (f)(2)(C)3. Such measures may include

the following:

i. Installation and operation of spraybars on all conveyors; and

ii. Installation of shrouds at all drop points.

5. Track-out control and prevention measures which shall include:

i. Installation of a gravel pad, grizzly, tire washing system, or paving at least fifty (50) feet of the access road, and

ii. Cleaning any visible track-out off the paved public road using wet sweeping or a HEPA filter equipped vacuum device at the end of each workday.

6. Stabilization of all on-site roads, parking lots, and staging areas open to the public by one of the following methods:

i. Pave with asphalt or concrete, or

ii. Treat with a chemical dust suppressant applied according to manufacturers directions, or

iii. Maintain a gravel cover that has a depth of at least three (3) inches and contains less than 0.25 percent asbestos as determined using an approved asbestos bulk test method.

(D) Submit an Asbestos Dust Mitigation Plan to the District within fourteen (14) days and maintain the measures specified in subsections (f)(2)(B) and (f)(2)(C) until the asbestos dust mitigation measures in the district-approved Asbestos Dust Mitigation Plan are implemented.

(3) An Asbestos Dust Mitigation Plan required by subsections (f)(1) and (f)(2)(D) must include sections which address each of the following topics.

(A) A Fugitive Dust Mitigation Component which shall, at a minimum, include the measures specified in subsections (f)(2)(B) and (f)(2)(C), unless the APCO determines that it is appropriate to add, omit, or modify these measures depending on site-specific parameters. The plan shall also require that:

1. Equipment and operations do not emit dust that is visible crossing the property line;

2. Crushers do not discharge into the air any visible emissions other than uncombined water vapor, for a period aggregating more than three minutes in any one hour, which is:

i. Seventy-five percent as dark or darker in shade as that designated as number one on the Ringlemann Chart, as published by the United States Bureau of Mines; or

ii. Of such opacity as to obscure an observers view to a degree equal to or greater than smoke as described in subsection (f)(3)(A)2.i. or fifteen (15) percent opacity; and

3. Grinding mills, screening operations, and transfer points on belt conveyors do not discharge into the air any visible emissions other than uncombined water vapor, for a period aggregating more than three minutes in any one hour, which is:

i. Fifty percent as dark or darker in shade as that designated as number one on the Ringlemann Chart, as published by the United States Bureau of Mines; or

ii. Of such opacity as to obscure an observers view to a degree equal to or greater than smoke as described in subsection (f)(3)(A)3.i. or ten (10) percent opacity.

(B) ***Air Monitoring for Asbestos (If Required by the APCO).***

1. If required by the district APCO, the plan must include an air monitoring component.
2. The air monitoring component shall specify the following:
   i. Type of air sampling device(s);
   ii. Siting of air sampling device(s);
   iii. Sampling duration and frequency; and
   iv. Analytical method.

(C) ***Frequency of Reporting.*** The plan shall state how often the items specified in subsection (f)(5)(B), and any other items identified in the plan, will be reported to the district.

(4) Upon petition by the owner / operator the APCO may approve the use of requirements or restrictions established under other regulatory programs to meet the requirements of subsection (f) under the following conditions:

(A) The requirements or restrictions are equivalent to or more stringent than the requirements of subsection (f); and

(B) The requirements or restrictions are enforceable by the APCO.

(5) ***Recordkeeping and Reporting Requirements:*** The owner / operator of a surface mining or quarrying operation subject to this section must comply with the following recordkeeping and reporting requirements.

(A) ***Recordkeeping Requirements:*** The owner / operator shall maintain all of the following records for at least seven (7) years:

1. The results of any air monitoring conducted at the request of the APCO;
2. The documentation for any geologic evaluation conducted on the property for the purpose of obtaining an exemption except, the archive of collected rock samples which may be discarded at the expiration of the exemption or one (1) year after the district granted or denied the exemption, whichever comes first; and
3. The results of any asbestos bulk sampling that meets any of the following conditions:
   i. The asbestos bulk sampling was conducted by the owner / operator to document the applicability of, or compliance with this section; or
   ii. The asbestos bulk sampling was done at the request of the district APCO.

(B) ***Reporting Requirements:*** The owner / operator shall submit the following to the District:

1. The results of any air monitoring conducted at the request of the APCO;
2. The documentation of any geologic evaluation conducted on the property in question; and

3. The results of any asbestos bulk sampling that meets any of the following conditions:

   i. Asbestos bulk sampling conducted by the owner / operator to document applicability of or compliance with this section; or

   ii. Asbestos bulk sampling done at the request of the district APCO.

(g) Air Monitoring for Asbestos. Pursuant to the requirements of Health and Safety Code section 41511:

(1) Air monitoring may be required by the district APCO.

(2) The APCO may revise the asbestos dust mitigation plan on the basis of the results of the air monitoring.

(h) Test Methods.

(1) ***Ultramafic Rock*:** The ultramafic rock composition of any material shall be determined using standard analysis techniques including, but not limited to, color index assessment, microscopic examination, petrographic analysis or rock thin sections, or chemical analysis techniques, such as X-ray fluorescence spectrometry or inductively coupled plasma analysis.

(2) ***Bulk Sampling Methods*:** ARB Test Method 435, or an alternative asbestos bulk test method approved in writing by the Executive Officer of the California Air Resources Board, shall be used to determine the asbestos content of a bulk sample. For the purposes of determining compliance with this section, references in ARB Test Method 435 to "serpentine aggregate" shall mean "gravel" or other "bulk materials" to be tested for asbestos content.

(3) ***Analysis of Air Samples*:** Analysis of all air samples shall follow the analytical method specified by the United States Environmental Protection Agency, Asbestos Hazard Emergency Response Act (AHERA) criteria for asbestos (40 CFR, Part 763 Subpart E, Appendix A, adopted October 30, 1987), with the following exceptions:

   (A) The analytical sensitivity shall be 0.001 structures per cubic centimeter (0.001 s/cc); and

   (B) All asbestos structures with an aspect ratio greater than three to one (3 to1) shall be counted irrespective of length.

(4) The results of the analysis of air samples shall be reported as transmission electron microscopy (TEM) asbestos structures per cubic centimeter (s/cc).

(5) ***Adequately Wetted*:** Field determination of "adequately wetted" shall be as follows:

   (A) If the district-approved asbestos dust mitigation plan has specified a percent moisture content for specific materials the determination shall be as specified in the district-approved asbestos dust mitigation plan; or

   (B) If no moisture threshold is specified in a district-approved asbestos dust mitigation plan, a sample of at least one (1) quart in volume shall be taken from the top three (3) inches of a road, or bare area or from the surface of a stockpile. The sample shall be poured out from a height of four (4) feet onto a clean hard surface. The material shall be considered to be adequately wetted if there is no observable dust emitted when the material is dropped.

(6) ***Surface Crusting*:** "Measurement of the stability of surface crusting on horizontal surfaces" shall be as follows:

   (A) Where a visible crust exists, drop a steel ball with a diameter of 15.9 millimeters (0.625 inches) and a mass ranging from 16 to 17 grams from a distance of 30 centimeters (one foot) directly above (at a 90 degree angle perpendicular to) the ground surface. If blowsand (thin deposits of loose grains covering less than 50 percent of the surface that have not originated from the surface being tested) is present, clear the blowsand from the surfaces to be tested before dropping the steel ball.

   (B) A sufficient crust is determined to exist if, when the ball is dropped according to

subsection (h)(6)(A), the ball does not sink into the surface so that it is partially or fully surrounded by loose grains and, upon removing the ball, the surface on which it was dropped has not been pulverized so that loose grains are visible.

(C) Drop the ball three times each in three representative test areas within a survey area measuring 1 foot by 1 foot that represents a random portion of the surface being evaluated. The test area shall be deemed to have passed if at least two of the three times the ball was dropped, the results met the criteria in subsection (h)(6)(B). If all three test areas pass, the area shall be deemed to be "sufficiently crusted".

(i) Definitions. For the purposes of this section, the following definitions shall apply:

(1) **"Access Road"** means any road extending from a public thoroughfare onto the property of a construction project, quarry, or surface mining operation.

(2) **"Adequately Wetted"** means sufficiently moistened with water to minimize the release of particulate matter into the ambient air as determined by the test method (s) in subsection (h)(5).

(3) **"Agricultural Operation"** means activities necessary for the growing and harvesting of crops or raising of fowl or animals.

(4) **"APCO"** means the executive officer, air pollution control officer, or the designee of the executive officer or air pollution control officer of any air pollution control or air quality management district created or continued in existence pursuant to Part 3 (commencing with section 40000), Division 26, Health and Safety Code.

(5) **"Approved Asbestos Bulk Test Method"** means ARB Test Method 435 or an alternative asbestos bulk test method approved in writing by the Executive Officer of the California Air Resources Board.

(6) **"ARB"** means the California Air Resources Board.

(7) **"ARB Test Method 435"** means the test method specified in title 17, California Code of Regulations, section 94147.

(8) **"Asbestos"** means asbestiforms of the following minerals: chrysotile (fibrous serpentine), crocidolite (fibrous riebeckite), amosite (fibrous cummingtonite--grunerite), fibrous tremolite, fibrous actinolite, and fibrous anthophyllite.

(9) **"Asbestos-Containing Material"** means any material that has an asbestos content of 0.25 percent or greater.

(10) **"Asbestos Dust Mitigation Plan"** means a detailed written document specifying measures that would be implemented to minimize the emissions of asbestos-laden dust.

(11) **"Carry-Out" or "Track-Out"** means any bulk material that adheres to and agglomerates on the exterior surfaces of motor vehicles, haul trucks, and/or equipment, including tires, and that has fallen or been deposited onto a paved public roadway.

(12) **"Construction," "Grading," "Construction or Grading Operation" and "Construction or Grading Activity"** mean any surface disturbance conducted with powered equipment or any related activity, including, but not limited to, all surface and subsurface cuts and fills, excavation, trenching, stockpiling, bulldozing, and landfills.

(13) **"District"** means any air pollution control or air quality management district created or continued in existence pursuant to Part 3 (commencing with section 40000), Division 26, Health and Safety Code.

(14) **"Geographic Ultramafic Rock Unit"** means a geographic area that is designated as an ultramafic rock unit or ultrabasic rock unit, including the unit boundary line, on any of the maps referenced in Appendix A.

(15) **"Geologic Evaluation"** means an evaluation of a property to determine the presence of various types of rocks, including ultramafic rock, serpentinite, or other metamorphic derivatives of ultramafic rock.

(16) **"Gravel Pad"** means a layer of gravel, rock, or crushed rock which is at least one inch or larger in diameter and less than five (5) percent silt content, maintained at the point of intersection of a paved public roadway and a work site entrance to dislodge mud, dirt, and debris from tires of motor vehicles and haul trucks prior to leaving a worksite.

(17) **"Grizzly"** means a device used to dislodge mud, dirt, and debris from the tires and undercarriage of motor vehicles and haul trucks prior to leaving the work site.

(18) **"HEPA Filter"** means a High Efficiency Particulate Air filter used to remove particles less than one (1) micron in aerodynamic diameter and operates at removal efficiencies of 99.9 percent or greater.

(19) **"Naturally-Occurring Asbestos"** means asbestos that has not been processed in an asbestos mill.

(20) **"Owner / Operator"** or **"Person"** includes, but is not limited to:

(A) An individual, trust, firm, joint stock company, business concern, partnership, limited liability company, association, or corporation including, but not limited, to a government corporation;

(B) Any city, county, district, commission, the state or any department, agency, or political subdivision thereof, any interstate body, and the federal government or any department or agency thereof to the extent permitted by law; or

(C) A project proponent and any of its contractors or subcontractors.

(21) **"Paving"** means creating a cover consisting of portland cement, asphalt concrete, or chip seal.

(22) **"Project Boundaries"** means the right-of-way and any construction easements adjacent to and necessary for the purposes of a specific road construction project or maintenance activity.

(23) **"Property"** means any real property including, but not limited to, any contiguous parcel or parcels of land and anything attached to, or erected on it.

(24) **"Quarrying"** means the act of obtaining stone from the earth by means of cutting, digging, excavating, or blasting and includes processes used to convert the excavated material into commercial products.

(25) **"Registered Geologist"** means an individual that is currently licensed as a geologist with the State of California, Department of Consumer Affairs, Board of Geology and Geophysicists.

(26) **"Remote Location"** means any location that is at least one (1.0) mile from the location of a receptor. **"Receptor"** includes, but is not limited to, any hospital, school, day care center, work site, business, residence, and permanent campground. The distance to the nearest receptor is to be measured from the outermost limit of the area to be disturbed or road surface, whichever is closer.

(27) **"Road Construction and Maintenance"** means the activities undertaken to build roads, highways, railroads, bridges, culverts, drains and other works incidental to road or highway construction, and maintenance activities that involve grading or excavation. Road Construction and Maintenance does not include the construction of rest stops, maintenance buildings, or parking lots. These excluded activities are subject to the requirements of subsection (e).

(28) **"Road Surface"** means the traveled way of a road and any shoulder which may extend up ten (10) feet from the edge of the traveled way.

(29) **"Sand and Gravel Operation"** means any facility operating in alluvial deposits.

(30) **"Serpentine"** means any form of the following hydrous magnesium silicate minerals: antigorite, lizardite, and chrysotile.

(31) **"Serpentinite"** means a rock consisting almost entirely of serpentine, although small amounts of other minerals such as magnetite, chromite, talc, brucite, and tremolite-actinolite may also be present. **"Serpentinite"** is also a metamorphic derivative of the ultramafic rocks, peridotite,

pyroxenite, or dunite.

(32) **"Surface Mining"** means all, or any part of, the process involved in the mining of minerals on mined lands by removing overburden and mining directly from the mineral deposit, open-pit mining of minerals naturally exposed, mining by the auger method, dredging and quarrying, or surface work incident to an underground mine. "Surface mining" includes, but is not limited to, in place distillation or retorting or leaching, the production and disposal of mining waste, prospecting and exploratory activities or any activity subject to regulation under the Surface Mining and Reclamation Act of 1975, Public Resources Code section 2700 et seq.

(33) **"Ultrabasic Rock"** means ultramafic rock.

(34) **"Ultramafic Rock"** means an igneous rock composed of 90 percent or greater of one or a combination of the following iron / magnesium-rich, dark-colored silicate minerals: olivine, pyroxene, or more rarely amphibole. For the purposes of this section, "ultramafic rock" includes the following rock types: dunite, pyroxenite, and peridotite; and their metamorphic derivatives.

(35) **"Visible Emissions"** means any particulate matter that is visually detectable without the aid of instruments other than corrective lenses.

NOTE: Authority Cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, and 41511, Health and Safety Code

Reference: Sections 39650, 39658, 39659, 39666, and 41511, Health and Safety Code

APPENDIX A

Division of Mines and Geology
California Department of Conservation

AVAILABLE GEOLOGIC MAPS FOR CALIFORNIA

GEOLOGIC ATLASES OF CALIFORNIA - Scale: 1:250,000

GEOLOGIC ATLAS OF CALIFORNIA: ALTURAS Compiled by Gay, T.E. and Others, 1958

GEOLOGIC ATLAS OF CALIFORNIA: BAKERSFIELD Compiled by Smith, A.R., 1964 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: DEATH VALLEY Compiled by Streitz, R.L. and Stinson, M.C., 1974 (Reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: FRESNO Compiled by Matthews, R.A. and Burnett, J.L., 1965 (Reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: KINGMAN Compiled by Jennings, C.W., 1961

GEOLOGIC ATLAS OF CALIFORNIA: LONG BEACH Compiled by Jennings, C.W., 1962 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: LOS ANGELES Compiled by Jennings, C.W. and Strand, R.G., 1969 (Reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: MARIPOSA Compiled by Strand, R.G., 1967 (Reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: NEEDLES Compiled by Bishop, C.C., 1963 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: REDDING Compiled by Strand, R.G., 1962

GEOLOGIC ATLAS OF CALIFORNIA: SALTON SEA Compiled by Jennings, C.W., 1967 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SAN LUIS OBISPO Compiled by Jennings, C.W., 1958 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SAN DIEGO - EL CENTRO Compiled by Strand, R.G., 1962 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA ANA Compiled by Rogers, T.H., (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA CRUZ Compiled by Jennings, C.W. and Strand, R.G., 1958 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA MARIA Compiled by Jennings, C.W., 1959 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: TRONA Compiled by Jennings, C.W., 1962

GEOLOGIC ATLAS OF CALIFORNIA: UKIAH Compiled by Jennings, C.W. and Strand, R.G., 1960 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: WALKER LAKE Compiled by Koenig, J.B., 1963 (Reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: WESTWOOD Compiled by Lyndon, P.A. and Others, 1960

REGIONAL GEOLOGIC MAP SERIES
Scale 1:250,000

GEOLOGIC MAP OF THE CHICO QUADRANGLE (set of five sheets) By Saucedo, G.J. and Wagner, D.L., 1992

GEOLOGIC MAP OF THE SACRAMENTO QUADRANGLE (set of four sheets) Compiled by Wagner, D.L. and Others, 1981

GEOLOGIC MAP OF THE SANTA ROSA QUADRANGLE (set of five sheets) Compiled by Wagner, D.L. and Bortugno, E.J. (Reprinted 1999)

GEOLOGIC MAP OF THE SAN BERNARDINO QUADRANGLE (set of five sheets) Compiled by Bortugno, E.J. and Spittler, T.E. (Reprinted 1998)

GEOLOGIC MAP OF THE WEED QUADRANGLE (set of four sheets) By Wagner, D.L. and Saucedo, G.J., 1987

GEOLOGIC MAP OF THE SAN FRANCISCO-SAN JOSE QUADRANGLE (set of five sheets) By Wagner, D.L., Bortugno, E.J. and McJunkin, R.D., 1990 Color-Coded Faults

LOCAL GEOLOGIC MAPS

AREAS MORE LIKELY TO CONTAIN NATURALLY-OCCURRING ASBESTOS IN WESTERN EL DORADO COUNTY, CALIFORNIA By Ron Churchill, March 2000, **Scale:** 1:100,000

SERPINTINITE SURVEY OF LAKE COUNTY, CALIFORNIA - MAP A, ULTRAMAFIC, ULTRABASIC, AND SERPENTINE ROCK AND SOILS OF LAKE COUNTY, Adopted: March 2, 1992, **Scale:** 1:100,000

ATCMs

APPENDIX H
Road Condition Survey

Washington Road - State Highway 20 to bridge north of Washington, California
Northbound lane = toward Washington Southbound lane = toward SH 20

Mile marker		Road width	Road features
From:	To:	(on average)	
0	0	24 ft EOP	At intersection of SH 20 and Washington Road = High severity edge cracking 36 ft, northbound lane Moderate severity pothole between wheel paths, northbound lane
0.03	0.26		Moderate severity, 33 ft longitudinal cracking between wheel paths, southbound lane; Moderate severity 100 ft longitudinal cracking inner wheel path, southbound lane; Low to high severity 10 to 300 ft longitudinal cracking at center line; 53 ft of 6 in by 2 in, ¼ in deep ruts cut by snowplow
0.20	0.33		Moderate, occasionally high, severity 10 –20 ft transverse cracking every 30 ft
0.29	0.30		High severity, 60 ft edge cracking, northbound lane
0.33	Pullout		Moderate to high severity raveling entire pullout area on southbound side
0.33	0.34		Moderate severity 50 ft longitudinal cracking in wheel path and between wheel path, southbound lane
0.40	0.50		Moderate severity 10-20 ft transverse cracking every 30 ft
0.47	0.48		Moderate severity longitudinal cracking 20 ft with 20 ft of 6 in by 2 in, ¼ in deep ruts cut by snowplow, inner wheel path, northbound lane
0.48	0.56		Moderate to high severity, 30 to 71 ft longitudinal cracking with moderate severity 5 ft diameter pothole, at center line; Moderate severity 10 ft transverse cracking every 20 ft; one set of low severity 24 ft transverse cracks from 2.5 ft wide cut, patched.
0.61	0.63		High severity, 80 ft edge cracking, northbound lane
0.64	0.65		Moderate severity, 40 sq ft fatigue cracking at center line
0.74	0.75	23-24 ft EOP	Low, occasionally moderate severity, 5-10 ft block cracking (25-100 sq ft areas) and moderate severity 10 ft transverse cracking every 20 ft, southbound lane
0.79	1.15		High severity, 5 to 20 ft edge cracking; Moderate severity, 10-24 ft transverse cracking every 30-50 ft; 30-60 ft lengths of 6 in by 2in by ¼ in deep ruts cut by snowplow; all in northbound lane; Low severity 50 to 600 ft longitudinal cracking, outer wheel path, northbound lane
1.16	1.33		Moderate to high severity 5-20 ft block cracking (25-400 sq ft areas) at center line; Moderate severity, 30 sq ft fatigue cracking, northbound lane
1.40	1.40		Low severity 6-in by 12-in pothole, between wheel paths, southbound lane
1.44	1.53		High severity 5 to 30 ft edge cracking, northbound lane
1.54	2.69		Moderate severity, 10-20 ft transverse cracking, every 10-20 ft
1.70	1.76		Moderate severity, 250 ft longitudinal cracking with moderate severity 500 sq ft fatigue cracking and 40 ft length of 6 in by 2in by ¼ in deep ruts cut by snowplow, all at center line
1.86	1.86		Low severity 9-in by 12-in pothole, southbound lane
1.99	2.00		High severity 5 ft edge cracking, northbound lane
2.23	2.23		Low severity 6-in by 9-in pothole, northbound lane; Moderate severity longitudinal cracking connecting previously noted moderate severity transverse cracking

2.34	2.34	23-24 ft EOP	Low severity 30-in diameter pothole, northbound lane (delaminated-one layer of asphalt is gone revealing previous white line markings); at 2.33, utility cut in road
2.99	3.00		Moderate severity 20 ft longitudinal cracking, between wheel paths, southbound lane
3.09	3.16		Low to moderate severity 20 ft transverse cracking every 10 ft; High severity 30 ft edge cracking northbound lane
3.14	3.19		Low severity 20 ft longitudinal cracking with 10 ft length of 6 in by 2in by ¼ in deep ruts cut by snowplow, all at center line
3.21	3.25	26 ft EOP	Moderate to high severity 25 ft transverse cracking outlines previous (1997) flood settlement damage
3.27	3.33	23-24 ft EOP	High severity 2 ft edge cracking, northbound lane; Moderate severity 20 ft transverse cracking every 20 ft
3.38	3.70		Low severity 10-50 ft longitudinal cracking, between wheel paths, southbound lane; Moderate severity 10-24 ft transverse cracking every 10-20 ft
3.78	3.84		Moderate severity 10-20 ft longitudinal cracks, southbound lane-series of cracks inside curve
3.86	3.91		Moderate severity 120 sq ft fatigue cracking, southbound lane; High severity 20 ft edge cracking, northbound lane; 1.5 ft length of 6 in by 2in by ¼ in deep ruts cut by snowplow at center line
3.92	3.92		Deteriorated patching, southbound lane
4.00	4.10	21-25 ft EOP	BOX CULVERT area-roadway covered with sand; road width 25 ft at curve
4.27	4.30	23 ft EOP	15 ft length of 6 in by 2in by ¼ in deep ruts cut by snowplow, outer wheel path, southbound lane; Moderate severity 120 sq ft fatigue cracking, southbound lane
4.36	4.45		Moderate severity 240 sq ft fatigue cracking
4.50	4.50		High severity 25 sq ft raveling-delamination; possible snowplow damage, southbound lane; low area in pavement below landslide area
4.64	4.64	22 ft EOP	Moderate severity 8 sq ft raveling-delamination, northbound lane
4.65	4.78	22-24 ft EOP	Moderate severity 20 ft longitudinal cracking with moderate severity 30 sq ft fatigue cracking at center line
4.83	4.85		Moderate severity 120 sq ft fatigue cracking, outer wheel path, northbound lane
4.85	4.86		Moderate severity 20 ft longitudinal cracking with moderate severity 5 ft transverse cracking every 10 ft at center line
4.90	4.92		Low severity 80 sq ft fatigue cracking, outer edge of northbound lane
4.96	4.96		2 ft length of 6 in by 2in by 1 in deep ruts cut by snowplow, southbound lane
5.02	5.05		10 ft length of 6 in by 2in by ½ in deep ruts cut by snowplow, diagonal across center line; Moderate severity 20 sq ft fatigue cracking at center line
5.06	5.07		Moderate severity 40 sq ft fatigue cracking, southbound lane
5.10	5.11	24 ft EOP	Low severity 20 ft longitudinal cracking, both lanes outer wheel path and inner wheel path northbound and at center line
5.12	5.12		Low severity 24 ft transverse cracking

5.18	5.19		Low severity 40 sq ft fatigue cracking at edge southbound lane; 12 in by 6 in by ½ in deep rut cut by snowplow, southbound lane
5.22	5.22	24 ft EOP	WASHINGTON SIGN
5.31	5.34	20 ft EOP	Low severity 24 ft transverse cracking every 20 ft
5.35	5.48	21-24 ft EOP	Moderate severity 24 ft transverse cracking every 10-20 ft
5.73	5.78	24-32 ft EOP	BRIDGE over Yuba River