The Tulalip Tribes of Washington

I-5/116th Street NE
Interchange Improvements

Phase 4 Ramps

Bid Solicitation No. 17-007

Contract Documents

Appendix A - C

September 2017

Volume 2 of 3

APPENDIX A

WAGE RATES

State of Washington
Department of Labor & Industries
Prevailing Wage Section - Telephone 360-902-5335
PO Box 44540, Olympia, WA 98504-4540

Washington State Prevailing Wage

The PREVAILING WAGES listed here include both the hourly wage rate and the hourly rate of fringe benefits. On public works projects, worker's wage and benefit rates must add to not less than this total. A brief description of overtime calculation requirements are provided on the Benefit Code Key.

Journey Level Prevailing Wage Rates for the Effective Date: 9/7/2017

County	Trade	Job Classification	Wage	Holiday	Overtime	Note
Snohomish	Asbestos Abatement Workers	Journey Level	$46.57	5D	1H	
Snohomish	Boilermakers	Journey Level	$64.54	5N	1C	
Snohomish	Brick Mason	Journey Level	$55.82	5A	1M	
Snohomish	Brick Mason	Pointer-Caulker-Cleaner	$55.82	5A	1M	
Snohomish	Building Service Employees	Janitor	$11.00		1	
Snohomish	Building Service Employees	Shampooer	$11.00		1	
Snohomish	Building Service Employees	Waxer	$11.00		1	
Snohomish	Building Service Employees	Window Cleaner	$13.48		1	
Snohomish	Cabinet Makers (In Shop)	Journey Level	$15.08		1	
Snohomish	Carpenters	Acoustical Worker	$57.18	5D	4C	
Snohomish	Carpenters	Bridge, Dock And Wharf Carpenters	$57.18	5D	4C	
Snohomish	Carpenters	Carpenter	$57.18	5D	4C	
Snohomish	Carpenters	Carpenters on Stationary Tools	$57.31	5D	4C	
Snohomish	Carpenters	Creosoted Material	$57.28	5D	4C	
Snohomish	Carpenters	Floor Finisher	$57.18	5D	4C	
Snohomish	Carpenters	Floor Layer	$57.18	5D	4C	
Snohomish	Carpenters	Scaffold Erector	$57.18	5D	4C	
Snohomish	Cement Masons	Journey Level	$55.56	7A	1M	
Snohomish	Divers & Tenders	Bell/Vehicle or Submersible Operator (Not Under Pressure)	$110.54	5D	4C	
Snohomish	Divers & Tenders	Dive Supervisor/Master	$72.97	5D	4C	
Snohomish	Divers & Tenders	Diver	$110.54	5D	4C	8V
Snohomish	Divers & Tenders	Diver On Standby	$67.97	5D	4C	
Snohomish	Divers & Tenders	Diver Tender	$61.65	5D	4C	
Snohomish	Divers & Tenders	Manifold Operator	$61.65	5D	4C	
Snohomish	Divers & Tenders	Manifold Operator Mixed Gas	$66.65	5D	4C	
Snohomish	Divers & Tenders		$61.65	5D	4C	

		Remote Operated Vehicle Operator/Technician				
Snohomish	Divers & Tenders	Remote Operated Vehicle Tender	$57.43	5A	4C	
Snohomish	Dredge Workers	Assistant Engineer	$56.44	5D	3F	
Snohomish	Dredge Workers	Assistant Mate (Deckhand)	$56.00	5D	3F	
Snohomish	Dredge Workers	Boatmen	$56.44	5D	3F	
Snohomish	Dredge Workers	Engineer Welder	$57.51	5D	3F	
Snohomish	Dredge Workers	Leverman, Hydraulic	$58.67	5D	3F	
Snohomish	Dredge Workers	Mates	$56.44	5D	3F	
Snohomish	Dredge Workers	Oiler	$56.00	5D	3F	
Snohomish	Drywall Applicator	Journey Level	$56.78	5D	1H	
Snohomish	Drywall Tapers	Journey Level	$57.43	5P	1E	
Snohomish	Electrical Fixture Maintenance Workers	Journey Level	$13.76		1	
Snohomish	Electricians - Inside	Cable Splicer	$68.09	7H	1E	
Snohomish	Electricians - Inside	Construction Stock Person	$33.86	7H	1D	
Snohomish	Electricians - Inside	Journey Level	$63.61	7H	1E	
Snohomish	Electricians - Motor Shop	Craftsman	$15.37		1	
Snohomish	Electricians - Motor Shop	Journey Level	$14.69		1	
Snohomish	Electricians - Powerline Construction	Cable Splicer	$73.93	5A	4D	
Snohomish	Electricians - Powerline Construction	Certified Line Welder	$67.60	5A	4D	
Snohomish	Electricians - Powerline Construction	Groundperson	$45.49	5A	4D	
Snohomish	Electricians - Powerline Construction	Heavy Line Equipment Operator	$67.60	5A	4D	
Snohomish	Electricians - Powerline Construction	Journey Level Lineperson	$67.60	5A	4D	
Snohomish	Electricians - Powerline Construction	Line Equipment Operator	$57.02	5A	4D	
Snohomish	Electricians - Powerline Construction	Pole Sprayer	$67.60	5A	4D	
Snohomish	Electricians - Powerline Construction	Powderperson	$50.76	5A	4D	
Snohomish	Electronic Technicians	Journey Level	$30.10		1	
Snohomish	Elevator Constructors	Mechanic	$90.39	7D	4A	
Snohomish	Elevator Constructors	Mechanic In Charge	$100.22	7D	4A	
Snohomish	Fabricated Precast Concrete Products	Journey Level - In-Factory Work Only	$13.50		1	
Snohomish	Fence Erectors	Fence Erector	$14.00		1	
Snohomish	Flaggers	Journey Level	$39.48	7A	3I	
Snohomish	Glaziers	Journey Level	$60.56	7L	1Y	
Snohomish	Heat & Frost Insulators And Asbestos Workers	Journeyman	$67.93	5J	4H	
Snohomish	Heating Equipment Mechanics	Journey Level	$78.17	7F	1E	

Snohomish	Hod Carriers & Mason Tenders	Journey Level	$48.02	7A	3I	
Snohomish	Industrial Power Vacuum Cleaner	Journey Level	$11.00		1	
Snohomish	Inland Boatmen	Boat Operator	$59.86	5B	1K	
Snohomish	Inland Boatmen	Cook	$56.18	5B	1K	
Snohomish	Inland Boatmen	Deckhand	$56.18	5B	1K	
Snohomish	Inland Boatmen	Deckhand Engineer	$57.26	5B	1K	
Snohomish	Inland Boatmen	Launch Operator	$58.59	5B	1K	
Snohomish	Inland Boatmen	Mate	$58.59	5B	1K	
Snohomish	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Cleaner Operator, Foamer Operator	$11.00		1	
Snohomish	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Grout Truck Operator	$11.48		1	
Snohomish	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Head Operator	$12.78		1	
Snohomish	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Technician	$11.00		1	
Snohomish	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Tv Truck Operator	$11.00		1	
Snohomish	Insulation Applicators	Journey Level	$57.18	5D	4C	
Snohomish	Ironworkers	Journeyman	$66.68	7N	1O	
Snohomish	Laborers	Air, Gas Or Electric Vibrating Screed	$46.57	7A	3I	
Snohomish	Laborers	Airtrac Drill Operator	$48.02	7A	3I	
Snohomish	Laborers	Ballast Regular Machine	$46.57	7A	3I	
Snohomish	Laborers	Batch Weighman	$39.48	7A	3I	
Snohomish	Laborers	Brick Pavers	$46.57	7A	3I	
Snohomish	Laborers	Brush Cutter	$46.57	7A	3I	
Snohomish	Laborers	Brush Hog Feeder	$46.57	7A	3I	
Snohomish	Laborers	Burner	$46.57	7A	3I	
Snohomish	Laborers	Caisson Worker	$48.02	7A	3I	
Snohomish	Laborers	Carpenter Tender	$46.57	7A	3I	
Snohomish	Laborers	Caulker	$46.57	7A	3I	
Snohomish	Laborers	Cement Dumper-paving	$47.44	7A	3I	
Snohomish	Laborers	Cement Finisher Tender	$46.57	7A	3I	
Snohomish	Laborers	Change House Or Dry Shack	$46.57	7A	3I	
Snohomish	Laborers	Chipping Gun (under 30 Lbs.)	$46.57	7A	3I	
Snohomish	Laborers	Chipping Gun(30 Lbs. And Over)	$47.44	7A	3I	
Snohomish	Laborers	Choker Setter	$46.57	7A	3I	
Snohomish	Laborers	Chuck Tender	$46.57	7A	3I	
Snohomish	Laborers	Clary Power Spreader	$47.44	7A	3I	

Snohomish	Laborers	Clean-up Laborer	$46.57	7A	3I	
Snohomish	Laborers	Concrete Dumper/chute Operator	$47.44	7A	3I	
Snohomish	Laborers	Concrete Form Stripper	$46.57	7A	3I	
Snohomish	Laborers	Concrete Placement Crew	$47.44	7A	3I	
Snohomish	Laborers	Concrete Saw Operator/core Driller	$47.44	7A	3I	
Snohomish	Laborers	Crusher Feeder	$39.48	7A	3I	
Snohomish	Laborers	Curing Laborer	$46.57	7A	3I	
Snohomish	Laborers	Demolition: Wrecking & Moving (incl. Charred Material)	$46.57	7A	3I	
Snohomish	Laborers	Ditch Digger	$46.57	7A	3I	
Snohomish	Laborers	Diver	$48.02	7A	3I	
Snohomish	Laborers	Drill Operator (hydraulic,diamond)	$47.44	7A	3I	
Snohomish	Laborers	Dry Stack Walls	$46.57	7A	3I	
Snohomish	Laborers	Dump Person	$46.57	7A	3I	
Snohomish	Laborers	Epoxy Technician	$46.57	7A	3I	
Snohomish	Laborers	Erosion Control Worker	$46.57	7A	3I	
Snohomish	Laborers	Faller & Bucker Chain Saw	$47.44	7A	3I	
Snohomish	Laborers	Fine Graders	$46.57	7A	3I	
Snohomish	Laborers	Firewatch	$39.48	7A	3I	
Snohomish	Laborers	Form Setter	$46.57	7A	3I	
Snohomish	Laborers	Gabian Basket Builders	$46.57	7A	3I	
Snohomish	Laborers	General Laborer	$46.57	7A	3I	
Snohomish	Laborers	Grade Checker & Transit Person	$48.02	7A	3I	
Snohomish	Laborers	Grinders	$46.57	7A	3I	
Snohomish	Laborers	Grout Machine Tender	$46.57	7A	3I	
Snohomish	Laborers	Groutmen (pressure) including Post Tension Beams	$47.44	7A	3I	
Snohomish	Laborers	Guardrail Erector	$46.57	7A	3I	
Snohomish	Laborers	Hazardous Waste Worker (level A)	$48.02	7A	3I	
Snohomish	Laborers	Hazardous Waste Worker (level B)	$47.44	7A	3I	
Snohomish	Laborers	Hazardous Waste Worker (level C)	$46.57	7A	3I	
Snohomish	Laborers	High Scaler	$48.02	7A	3I	
Snohomish	Laborers	Jackhammer	$47.44	7A	3I	
Snohomish	Laborers	Laserbeam Operator	$47.44	7A	3I	
Snohomish	Laborers	Maintenance Person	$46.57	7A	3I	
Snohomish	Laborers	Manhole Builder-mudman	$47.44	7A	3I	
Snohomish	Laborers	Material Yard Person	$46.57	7A	3I	
Snohomish	Laborers	Motorman-dinky Locomotive	$47.44	7A	3I	
Snohomish	Laborers		$47.44	7A	3I	

		Nozzleman (concrete Pump, Green Cutter When Using Combination Of High Pressure Air & Water On Concrete & Rock, Sandblast, Gunite, Shotcrete, Water Bla				
Snohomish	Laborers	Pavement Breaker	$47.44	7A	3I	
Snohomish	Laborers	Pilot Car	$39.48	7A	3I	
Snohomish	Laborers	Pipe Layer Lead	$48.02	7A	3I	
Snohomish	Laborers	Pipe Layer/tailor	$47.44	7A	3I	
Snohomish	Laborers	Pipe Pot Tender	$47.44	7A	3I	
Snohomish	Laborers	Pipe Reliner	$47.44	7A	3I	
Snohomish	Laborers	Pipe Wrapper	$47.44	7A	3I	
Snohomish	Laborers	Pot Tender	$46.57	7A	3I	
Snohomish	Laborers	Powderman	$48.02	7A	3I	
Snohomish	Laborers	Powderman's Helper	$46.57	7A	3I	
Snohomish	Laborers	Power Jacks	$47.44	7A	3I	
Snohomish	Laborers	Railroad Spike Puller - Power	$47.44	7A	3I	
Snohomish	Laborers	Raker - Asphalt	$48.02	7A	3I	
Snohomish	Laborers	Re-timberman	$48.02	7A	3I	
Snohomish	Laborers	Remote Equipment Operator	$47.44	7A	3I	
Snohomish	Laborers	Rigger/signal Person	$47.44	7A	3I	
Snohomish	Laborers	Rip Rap Person	$46.57	7A	3I	
Snohomish	Laborers	Rivet Buster	$47.44	7A	3I	
Snohomish	Laborers	Rodder	$47.44	7A	3I	
Snohomish	Laborers	Scaffold Erector	$46.57	7A	3I	
Snohomish	Laborers	Scale Person	$46.57	7A	3I	
Snohomish	Laborers	Sloper (over 20")	$47.44	7A	3I	
Snohomish	Laborers	Sloper Sprayer	$46.57	7A	3I	
Snohomish	Laborers	Spreader (concrete)	$47.44	7A	3I	
Snohomish	Laborers	Stake Hopper	$46.57	7A	3I	
Snohomish	Laborers	Stock Piler	$46.57	7A	3I	
Snohomish	Laborers	Tamper & Similar Electric, Air & Gas Operated Tools	$47.44	7A	3I	
Snohomish	Laborers	Tamper (multiple & Self-propelled)	$47.44	7A	3I	
Snohomish	Laborers	Timber Person - Sewer (lagger, Shorer & Cribber)	$47.44	7A	3I	
Snohomish	Laborers	Toolroom Person (at Jobsite)	$46.57	7A	3I	
Snohomish	Laborers	Topper	$46.57	7A	3I	
Snohomish	Laborers	Track Laborer	$46.57	7A	3I	
Snohomish	Laborers	Track Liner (power)	$47.44	7A	3I	
Snohomish	Laborers	Traffic Control Laborer	$42.22	7A	3I	8R
Snohomish	Laborers	Traffic Control Supervisor	$42.22	7A	3I	8R
Snohomish	Laborers	Truck Spotter	$46.57	7A	3I	
Snohomish	Laborers	Tugger Operator	$47.44	7A	3I	

Snohomish	Laborers	Tunnel Work-Compressed Air Worker 0-30 psi	$92.60	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Compressed Air Worker 30.01-44.00 psi	$97.63	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Compressed Air Worker 44.01-54.00 psi	$101.31	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Compressed Air Worker 54.01-60.00 psi	$107.01	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Compressed Air Worker 60.01-64.00 psi	$109.13	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Compressed Air Worker 64.01-68.00 psi	$114.23	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Compressed Air Worker 68.01-70.00 psi	$116.13	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Compressed Air Worker 70.01-72.00 psi	$118.13	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Compressed Air Worker 72.01-74.00 psi	$120.13	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Guage and Lock Tender	$48.12	7A	3I	8Q
Snohomish	Laborers	Tunnel Work-Miner	$48.12	7A	3I	8Q
Snohomish	Laborers	Vibrator	$47.44	7A	3I	
Snohomish	Laborers	Vinyl Seamer	$46.57	7A	3I	
Snohomish	Laborers	Watchman	$35.88	7A	3I	
Snohomish	Laborers	Welder	$47.44	7A	3I	
Snohomish	Laborers	Well Point Laborer	$47.44	7A	3I	
Snohomish	Laborers	Window Washer/cleaner	$35.88	7A	3I	
Snohomish	Laborers - Underground Sewer & Water	General Laborer & Topman	$46.57	7A	3I	
Snohomish	Laborers - Underground Sewer & Water	Pipe Layer	$47.44	7A	3I	
Snohomish	Landscape Construction	Irrigation Or Lawn Sprinkler Installers	$17.31		1	
Snohomish	Landscape Construction	Landscape Equipment Operators Or Truck Drivers	$20.06		1	
Snohomish	Landscape Construction	Landscaping Or Planting Laborers	$14.13		1	
Snohomish	Lathers	Journey Level	$56.78	5D	1H	
Snohomish	Marble Setters	Journey Level	$55.82	5A	1M	
Snohomish	Metal Fabrication (In Shop)	Fitter	$15.38		1	
Snohomish	Metal Fabrication (In Shop)	Laborer	$11.00		1	
Snohomish	Metal Fabrication (In Shop)	Machine Operator	$11.00		1	
Snohomish	Metal Fabrication (In Shop)	Painter	$11.00		1	
Snohomish	Metal Fabrication (In Shop)	Welder	$15.38		1	
Snohomish	Millwright	Journey Level	$58.68	5D	4C	
Snohomish	Modular Buildings	Journey Level	$11.00		1	
Snohomish	Painters	Journey Level	$41.60	6Z	2B	
Snohomish	Pile Driver	Crew Tender	$52.37	5D	4C	

Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 0-30.00 PSI	$71.35	5D	4C	
Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 30.01 - 44.00 PSI	$76.35	5D	4C	
Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 44.01 - 54.00 PSI	$80.35	5D	4C	
Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 54.01 - 60.00 PSI	$85.35	5D	4C	
Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 60.01 - 64.00 PSI	$87.85	5D	4C	
Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 64.01 - 68.00 PSI	$92.85	5D	4C	
Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 68.01 - 70.00 PSI	$94.85	5D	4C	
Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 70.01 - 72.00 PSI	$96.85	5D	4C	
Snohomish	Pile Driver	Hyperbaric Worker - Compressed Air Worker 72.01 - 74.00 PSI	$98.85	5D	4C	
Snohomish	Pile Driver	Journey Level	$57.43	5D	4C	
Snohomish	Plasterers	Journey Level	$53.20	7Q	1R	
Snohomish	Playground & Park Equipment Installers	Journey Level	$11.94		1	
Snohomish	Plumbers & Pipefitters	Journey Level	$67.47	5A	1G	
Snohomish	Power Equipment Operators	Asphalt Plant Operators	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Assistant Engineer	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Barrier Machine (zipper)	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Batch Plant Operator, Concrete	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Bobcat	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Brokk - Remote Demolition Equipment	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Brooms	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Bump Cutter	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Cableways	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Chipper	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Compressor	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Concrete Finish Machine -laser Screed	$56.90	7A	3C	8P

Snohomish	Power Equipment Operators	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure.	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Conveyors	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes Friction: 200 tons and over	$62.33	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes: 20 Tons Through 44 Tons With Attachments	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes: 100 Tons Through 199 Tons, Or 150' Of Boom (Including Jib With Attachments)	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes: 200 tons- 299 tons, or 250’ of boom including jib with attachments	$61.72	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes: 300 tons and over or 300’ of boom including jib with attachments	$62.33	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes: 45 Tons Through 99 Tons, Under 150' Of Boom (including Jib With Attachments)	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes: A-frame - 10 Tons And Under	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes: Friction cranes through 199 tons	$61.72	7A	3C	8P
Snohomish	Power Equipment Operators	Cranes: Through 19 Tons With Attachments A-frame Over 10 Tons	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Crusher	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Deck Engineer/deck Winches (power)	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Derricks, On Building Work	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Dozers D-9 & Under	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Drill Oilers: Auger Type, Truck Or Crane Mount	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Drilling Machine	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators	Elevator And Man-lift: Permanent And Shaft Type	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Forklift: 3000 Lbs And Over With Attachments	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Forklifts: Under 3000 Lbs. With Attachments	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$59.96	7A	3C	8P

Snohomish	Power Equipment Operators	Gradechecker/stakeman	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Guardrail Punch	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Horizontal/directional Drill Locator	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Horizontal/directional Drill Operator	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Hydralifts/boom Trucks Over 10 Tons	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Hydralifts/boom Trucks, 10 Tons And Under	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Loader, Overhead 8 Yards. & Over	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Loaders, Overhead Under 6 Yards	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Loaders, Plant Feed	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Loaders: Elevating Type Belt	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Locomotives, All	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Material Transfer Device	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Mechanics, All (leadmen - $0.50 Per Hour Over Mechanic)	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators	Motor Patrol Graders	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Outside Hoists (elevators And Manlifts), Air Tuggers,strato	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Overhead, Bridge Type Crane: 20 Tons Through 44 Tons	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Overhead, Bridge Type: 100 Tons And Over	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators	Overhead, Bridge Type: 45 Tons Through 99 Tons	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Pavement Breaker	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Pile Driver (other Than Crane Mount)	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Plant Oiler - Asphalt, Crusher	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Posthole Digger, Mechanical	$56.90	7A	3C	8P

Snohomish	Power Equipment Operators	Power Plant	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Pumps - Water	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Quad 9, Hd 41, D10 And Over	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Quick Tower - No Cab, Under 100 Feet In Height Based To Boom	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Remote Control Operator On Rubber Tired Earth Moving Equipment	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Rigger And Bellman	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Rigger/Signal Person, Bellman (Certified)	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Rollagon	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Roller, Other Than Plant Mix	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Roller, Plant Mix Or Multi-lift Materials	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Roto-mill, Roto-grinder	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Saws - Concrete	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Scraper, Self Propelled Under 45 Yards	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Scrapers - Concrete & Carry All	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Scrapers, Self-propelled: 45 Yards And Over	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Service Engineers - Equipment	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Shotcrete/gunite Equipment	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Shovel , Excavator, Backhoe, Tractors Under 15 Metric Tons.	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$61.72	7A	3C	8P
Snohomish	Power Equipment Operators	Slipform Pavers	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Spreader, Topsider & Screedman	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Subgrader Trimmer	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Tower Bucket Elevators	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Tower Crane Up To 175' In Height Base To Boom	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators		$61.72	7A	3C	8P

		Tower Crane: over 175' through 250' in height, base to boom				
Snohomish	Power Equipment Operators	Tower Cranes: over 250' in height from base to boom	$62.33	7A	3C	8P
Snohomish	Power Equipment Operators	Transporters, All Track Or Truck Type	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Trenching Machines	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Truck Crane Oiler/driver - 100 Tons And Over	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Truck Crane Oiler/driver Under 100 Tons	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators	Truck Mount Portable Conveyor	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators	Welder	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators	Wheel Tractors, Farmall Type	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators	Yo Yo Pay Dozer	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Asphalt Plant Operators	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Assistant Engineer	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Barrier Machine (zipper)	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Batch Plant Operator, Concrete	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Bobcat	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Brokk - Remote Demolition Equipment	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Brooms	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Bump Cutter	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cableways	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Chipper	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Compressor	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Concrete Finish Machine -laser Screed	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure.	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$59.96	7A	3C	8P

Snohomish	Power Equipment Operators-Underground Sewer & Water	Conveyors	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes Friction: 200 tons and over	$62.33	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes: 20 Tons Through 44 Tons With Attachments	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes: 100 Tons Through 199 Tons, Or 150' Of Boom (Including Jib With Attachments)	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	$61.72	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes: 300 tons and over or 300' of boom including jib with attachments	$62.33	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes: 45 Tons Through 99 Tons, Under 150' Of Boom (including Jib With Attachments)	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes: A-frame - 10 Tons And Under	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes: Friction cranes through 199 tons	$61.72	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Cranes: Through 19 Tons With Attachments A-frame Over 10 Tons	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Crusher	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Deck Engineer/deck Winches (power)	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Derricks, On Building Work	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Dozers D-9 & Under	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Drill Oilers: Auger Type, Truck Or Crane Mount	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Drilling Machine	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Elevator And Man-lift: Permanent And Shaft Type	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Forklift: 3000 Lbs And Over With Attachments	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Forklifts: Under 3000 Lbs. With Attachments	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Gradechecker/stakeman	$56.90	7A	3C	8P

Snohomish	Power Equipment Operators-Underground Sewer & Water	Guardrail Punch	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Horizontal/directional Drill Locator	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Horizontal/directional Drill Operator	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Hydralifts/boom Trucks Over 10 Tons	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Hydralifts/boom Trucks, 10 Tons And Under	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Loader, Overhead 8 Yards. & Over	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Loaders, Overhead Under 6 Yards	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Loaders, Plant Feed	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Loaders: Elevating Type Belt	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Locomotives, All	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Material Transfer Device	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Mechanics, All (leadmen - $0.50 Per Hour Over Mechanic)	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Motor Patrol Graders	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Outside Hoists (elevators And Manlifts), Air Tuggers,strato	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Overhead, Bridge Type Crane: 20 Tons Through 44 Tons	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Overhead, Bridge Type: 100 Tons And Over	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Overhead, Bridge Type: 45 Tons Through 99 Tons	$60.49	7A	3C	8P
Snohomish		Pavement Breaker	$56.90	7A	3C	8P

	Power Equipment Operators-Underground Sewer & Water					
Snohomish	Power Equipment Operators-Underground Sewer & Water	Pile Driver (other Than Crane Mount)	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Plant Oiler - Asphalt, Crusher	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Posthole Digger, Mechanical	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Power Plant	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Pumps - Water	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Quad 9, Hd 41, D10 And Over	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Quick Tower - No Cab, Under 100 Feet In Height Based To Boom	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Remote Control Operator On Rubber Tired Earth Moving Equipment	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Rigger And Bellman	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Rigger/Signal Person, Bellman (Certified)	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Rollagon	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Roller, Other Than Plant Mix	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Roller, Plant Mix Or Multi-lift Materials	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Roto-mill, Roto-grinder	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Saws - Concrete	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Scraper, Self Propelled Under 45 Yards	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Scrapers - Concrete & Carry All	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Scrapers, Self-propelled: 45 Yards And Over	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Service Engineers - Equipment	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Shotcrete/gunite Equipment	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Shovel , Excavator, Backhoe, Tractors Under 15 Metric Tons.	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$60.49	7A	3C	8P
Snohomish			$59.96	7A	3C	8P

	Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons				
Snohomish	Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$61.72	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Slipform Pavers	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Spreader, Topsider & Screedman	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Subgrader Trimmer	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Tower Bucket Elevators	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Tower Crane Up To 175' In Height Base To Boom	$61.10	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Tower Crane: over 175' through 250' in height, base to boom	$61.72	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Tower Cranes: over 250' in height from base to boom	$62.33	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Transporters, All Track Or Truck Type	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Trenching Machines	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Truck Crane Oiler/driver - 100 Tons And Over	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Truck Crane Oiler/driver Under 100 Tons	$59.49	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Truck Mount Portable Conveyor	$59.96	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Welder	$60.49	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Wheel Tractors, Farmall Type	$56.90	7A	3C	8P
Snohomish	Power Equipment Operators- Underground Sewer & Water	Yo Yo Pay Dozer	$59.96	7A	3C	8P
Snohomish	Power Line Clearance Tree Trimmers	Journey Level In Charge	$48.54	5A	4A	
Snohomish	Power Line Clearance Tree Trimmers	Spray Person	$46.03	5A	4A	
Snohomish	Power Line Clearance Tree Trimmers	Tree Equipment Operator	$48.54	5A	4A	
Snohomish	Power Line Clearance Tree Trimmers	Tree Trimmer	$43.32	5A	4A	
Snohomish	Power Line Clearance Tree Trimmers	Tree Trimmer Groundperson	$32.68	5A	4A	
Snohomish	Refrigeration & Air Conditioning Mechanics	Mechanic	$67.47	5A	1G	

Snohomish	Residential Brick Mason	Journey Level	$20.00		1	
Snohomish	Residential Carpenters	Journey Level	$42.86	5D	4C	
Snohomish	Residential Cement Masons	Journey Level	$14.00		1	
Snohomish	Residential Drywall Applicators	Journey Level	$42.86	5D	4C	
Snohomish	Residential Drywall Tapers	Journey Level	$57.43	5P	1E	
Snohomish	Residential Electricians	Journey Level	$32.24	7F	1D	
Snohomish	Residential Glaziers	Journey Level	$40.25	7L	1H	
Snohomish	Residential Insulation Applicators	Journey Level	$25.68		1	
Snohomish	Residential Laborers	Journey Level	$20.73		1	
Snohomish	Residential Marble Setters	Journey Level	$30.74		1	
Snohomish	Residential Painters	Journey Level	$17.46		1	
Snohomish	Residential Plumbers & Pipefitters	Journey Level	$28.99		1	
Snohomish	Residential Refrigeration & Air Conditioning Mechanics	Journey Level	$39.88	5A	1G	
Snohomish	Residential Sheet Metal Workers	Journey Level (Field or Shop)	$44.56	7F	1R	
Snohomish	Residential Soft Floor Layers	Journey Level	$47.61	5A	3D	
Snohomish	Residential Sprinkler Fitters (Fire Protection)	Journey Level	$44.98	5C	2R	
Snohomish	Residential Stone Masons	Journey Level	$30.74		1	
Snohomish	Residential Terrazzo Workers	Journey Level	$11.00		1	
Snohomish	Residential Terrazzo/Tile Finishers	Journey Level	$21.60		1	
Snohomish	Residential Tile Setters	Journey Level	$20.32		1	
Snohomish	Roofers	Journey Level	$49.27	5A	3H	
Snohomish	Roofers	Using Irritable Bituminous Materials	$52.27	5A	3H	
Snohomish	Sheet Metal Workers	Journey Level (Field or Shop)	$78.17	7F	1E	
Snohomish	Shipbuilding & Ship Repair	Boilermaker	$43.31	7M	1H	
Snohomish	Shipbuilding & Ship Repair	Carpenter	$41.56	7R	2B	
Snohomish	Shipbuilding & Ship Repair	Electrician	$42.34	5T	3E	
Snohomish	Shipbuilding & Ship Repair	Heat & Frost Insulator	$67.93	5J	4H	
Snohomish	Shipbuilding & Ship Repair	Laborer	$42.34	5T	3E	
Snohomish	Shipbuilding & Ship Repair	Machinist	$42.34	5T	3E	
Snohomish	Shipbuilding & Ship Repair	Painter	$41.60	6Z	2B	
Snohomish	Shipbuilding & Ship Repair	Shipfitter	$42.34	5T	3E	
Snohomish	Shipbuilding & Ship Repair	Welder/Burner	$42.34	5T	3E	
Snohomish	Sign Makers & Installers (Electrical)	Sign Installer	$26.56		1	
Snohomish	Sign Makers & Installers (Electrical)	Sign Maker	$20.50		1	
Snohomish	Sign Makers & Installers (Non-Electrical)	Sign Installer	$22.56		1	
Snohomish		Sign Maker	$20.50		1	

	Sign Makers & Installers (Non-Electrical)					
Snohomish	Soft Floor Layers	Journey Level	$47.61	5A	3D	
Snohomish	Solar Controls For Windows	Journey Level	$11.00		1	
Snohomish	Sprinkler Fitters (Fire Protection)	Journey Level	$74.49	5C	1X	
Snohomish	Stage Rigging Mechanics (Non Structural)	Journey Level	$13.23		1	
Snohomish	Stone Masons	Journey Level	$55.82	5A	1M	
Snohomish	Street And Parking Lot Sweeper Workers	Journey Level	$15.00		1	
Snohomish	Surveyors	Assistant Construction Site Surveyor	$59.49	7A	3C	8P
Snohomish	Surveyors	Chainman	$58.93	7A	3C	8P
Snohomish	Surveyors	Construction Site Surveyor	$60.49	7A	3C	8P
Snohomish	Telecommunication Technicians	Journey Level	$22.38		1	
Snohomish	Telephone Line Construction - Outside	Cable Splicer	$38.84	5A	2B	
Snohomish	Telephone Line Construction - Outside	Hole Digger/Ground Person	$21.45	5A	2B	
Snohomish	Telephone Line Construction - Outside	Installer (Repairer)	$37.21	5A	2B	
Snohomish	Telephone Line Construction - Outside	Special Aparatus Installer I	$38.84	5A	2B	
Snohomish	Telephone Line Construction - Outside	Special Apparatus Installer II	$38.03	5A	2B	
Snohomish	Telephone Line Construction - Outside	Telephone Equipment Operator (Heavy)	$38.84	5A	2B	
Snohomish	Telephone Line Construction - Outside	Telephone Equipment Operator (Light)	$36.09	5A	2B	
Snohomish	Telephone Line Construction - Outside	Telephone Lineperson	$36.09	5A	2B	
Snohomish	Telephone Line Construction - Outside	Television Groundperson	$20.33	5A	2B	
Snohomish	Telephone Line Construction - Outside	Television Lineperson/Installer	$27.21	5A	2B	
Snohomish	Telephone Line Construction - Outside	Television System Technician	$32.55	5A	2B	
Snohomish	Telephone Line Construction - Outside	Television Technician	$29.18	5A	2B	
Snohomish	Telephone Line Construction - Outside	Tree Trimmer	$36.09	5A	2B	
Snohomish	Terrazzo Workers	Journey Level	$51.36	5A	1M	
Snohomish	Tile Setters	Journey Level	$45.00		1	
Snohomish	Tile, Marble & Terrazzo Finishers	Finisher	$42.19	5A	1B	
Snohomish	Traffic Control Stripers	Journey Level	$44.93	7A	1K	
Snohomish	Truck Drivers		$52.70	5D	3A	8L

		Asphalt Mix Over 16 Yards (W. WA-Joint Council 28)				
Snohomish	Truck Drivers	Asphalt Mix To 16 Yards (W. WA-Joint Council 28)	$51.86	5D	3A	8L
Snohomish	Truck Drivers	Dump Truck	$37.94		1	
Snohomish	Truck Drivers	Dump Truck And Trailer	$38.52		1	
Snohomish	Truck Drivers	Other Trucks	$38.52		1	
Snohomish	Truck Drivers	Transit Mixer	$34.63		1	
Snohomish	Well Drillers & Irrigation Pump Installers	Irrigation Pump Installer	$17.05		1	
Snohomish	Well Drillers & Irrigation Pump Installers	Oiler	$13.93		1	
Snohomish	Well Drillers & Irrigation Pump Installers	Well Driller	$19.01		1	

****

Overtime Codes

Overtime calculations are based on the hourly rate actually paid to the worker. On public works projects, the hourly rate must be not less than the prevailing rate of wage minus the hourly rate of the cost of fringe benefits actually provided for the worker.

1. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

B. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

C. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

D. The first two (2) hours before or after a five-eight (8) hour workweek day or a four-ten (10) hour workweek day and the first eight (8) hours worked the next day after either workweek shall be paid at one and one-half times the hourly rate of wage. All additional hours worked and all worked on Sundays and holidays shall be paid at double the hourly rate of wage.

E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

G. The first ten (10) hours worked on Saturdays and the first ten (10) hours worked on a fifth calendar weekday in a four-ten hour schedule, shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

H. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions or equipment breakdown) shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

I. All hours worked on Sundays and holidays shall also be paid at double the hourly rate of wage.

J. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage.

K. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

M. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

N. All hours worked on Saturdays (except makeup days) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

1. O. The first ten (10) hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays, holidays and after twelve (12) hours, Monday through Friday and after ten (10) hours on Saturday shall be paid at double the hourly rate of wage.

P. All hours worked on Saturdays (except makeup days if circumstances warrant) and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

Q. The first two (2) hours after eight (8) regular hours Monday through Friday and up to ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays (except Christmas day) shall be paid at double the hourly rate of wage. All hours worked on Christmas day shall be paid at two and one-half times the hourly rate of wage.

R. All hours worked on Sundays and holidays shall be paid at two times the hourly rate of wage.

S. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays and all other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays (except Labor Day) shall be paid at two times the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

V. All hours worked on Sundays and holidays (except Thanksgiving Day and Christmas day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Thanksgiving Day and Christmas day shall be paid at double the hourly rate of wage.

W. All hours worked on Saturdays and Sundays (except make-up days due to conditions beyond the control of the employer)) shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

X. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage. When holiday falls on Saturday or Sunday, the day before Saturday, Friday, and the day after Sunday, Monday, shall be considered the holiday and all work performed shall be paid at double the hourly rate of wage.

Y. All hours worked outside the hours of 5:00 am and 5:00 pm (or such other hours as may be agreed upon by any employer and the employee) and all hours worked in excess of eight (8) hours per day (10 hours per day for a 4 x 10 workweek) and on Saturdays and holidays (except labor day) shall be paid at one and one-half times the hourly rate of wage. (except for employees who are absent from work without prior approval on a scheduled workday during the workweek shall be paid at the straight-time rate until they have worked 8 hours in a day (10 in a 4 x 10 workweek) or 40 hours during that workweek.) All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and Labor Day shall be paid at double the hourly rate of wage.

Z. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid the straight time rate of pay in addition to holiday pay.

Overtime Codes Continued

2. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

B. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

C. All hours worked on Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at two times the hourly rate of wage.

F. The first eight (8) hours worked on holidays shall be paid at the straight hourly rate of wage in addition to the holiday pay. All hours worked in excess of eight (8) hours on holidays shall be paid at double the hourly rate of wage.

G. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.

H. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

O. All hours worked on Sundays and holidays shall be paid at one and one-half times the hourly rate of wage.

R. All hours worked on Sundays and holidays and all hours worked over sixty (60) in one week shall be paid at double the hourly rate of wage.

U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked over 12 hours in a day or on Sundays and holidays shall be paid at double the hourly rate of wage.

W. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The first eight (8) hours worked on the fifth day shall be paid at one and one-half times the hourly rate of wage. All other hours worked on the fifth, sixth, and seventh days and on holidays shall be paid at double the hourly rate of wage.

3. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

A. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal shift, and all work on Saturdays shall be paid at time and one-half the straight time rate. Hours worked over twelve hours (12) in a single shift and all work performed after 6:00 pm Saturday to 6:00 am Monday and holidays shall be paid at double the straight time rate of pay. Any shift starting between the hours of 6:00 pm and midnight shall receive an additional one dollar ($1.00) per hour for all hours worked that shift. The employer shall have the sole discretion to assign overtime work to employees. Primary consideration for overtime work shall be given to employees regularly assigned to the work to be performed on overtime situations. After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

C. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays shall be paid at double the hourly rate of wage. After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

Overtime Codes Continued

3. D. All hours worked between the hours of 6:00 pm and 6:00 am, Monday through Saturday, shall be paid at a premium rate of 15% over the hourly rate of wage. All other hours worked after 6:00 am on Saturdays, shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

E. All hours worked Sundays and holidays shall be paid at double the hourly rate of wage. Each week, once 40 hours of straight time work is achieved, then any hours worked over 10 hours per day Monday through Saturday shall be paid at double the hourly wage rate.

F. All hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.

H. All work performed on Sundays between March 16th and October 14th and all Holidays shall be compensated for at two (2) times the regular rate of pay. Work performed on Sundays between October 15th and March 15th shall be compensated at one and one half (1-1/2) times the regular rate of pay.

I. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. In the event the job is down due to weather conditions during a five day work week (Monday through Friday,) or a four day-ten hour work week (Tuesday through Friday,) then Saturday may be worked as a voluntary make-up day at the straight time rate. However, Saturday shall not be utilized as a make-up day when a holiday falls on Friday. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

4. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

A. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage.

B. All hours worked over twelve (12) hours per day and all hours worked on holidays shall be paid at double the hourly rate of wage.

C. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay. On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay. All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

Overtime Codes Continued

4. D. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturday, Sundays and holidays shall be paid at double the hourly rate of pay. Rates include all members of the assigned crew.

EXCEPTION:
On all multipole structures and steel transmission lines, switching stations, regulating, capacitor stations, generating plants, industrial plants, associated installations and substations, except those substations whose primary function is to feed a distribution system, will be paid overtime under the following rates:

The first two (2) hours after eight (8) regular hours Monday through Friday of overtime on a regular workday, shall be paid at one and one-half times the hourly rate of wage. All hours in excess of ten (10) hours will be at two (2) times the hourly rate of wage. The first eight (8) hours worked on Saturday will be paid at one and one-half (1-1/2) times the hourly rate of wage. All hours worked in excess of eight (8) hours on Saturday, and all hours worked on Sundays and holidays will be at the double the hourly rate of wage.

All overtime eligible hours performed on the above described work that is energized, shall be paid at the double the hourly rate of wage.

E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one and one half (1½) times the regular shift rate for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

F. All hours worked between the hours of 6:00 pm and 6:00 am, Monday through Saturday, shall be paid at a premium rate of 20% over the hourly rate of wage. All hours worked on Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

G. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

H. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, and all hours on Sunday shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

Holiday Codes

5. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day (7).

B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, the day before Christmas, and Christmas Day (8).

C. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

Holiday Codes Continued

5. D. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8).

H. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Day after Thanksgiving Day, And Christmas (6).

I. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

J. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Eve Day, And Christmas Day (7).

K. Holidays: New Year’s Day, Presidents’ Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9).

L. Holidays: New Year’s Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (8).

N. Holidays: New Year's Day, Presidents’ Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, The Friday After Thanksgiving Day, And Christmas Day (9).

P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday And Saturday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9). If A Holiday Falls On Sunday, The Following Monday Shall Be Considered As A Holiday.

Q. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

R. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day After Thanksgiving Day, One-Half Day Before Christmas Day, And Christmas Day. (7 1/2).

S. Paid Holidays: New Year's Day, Presidents’ Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, And Christmas Day (7).

T. Paid Holidays: New Year's Day, Washington’s Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, Christmas Day, And The Day Before Or After Christmas (9).

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

6. A. Paid Holidays: New Year’s Day, Presidents’ Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

E. Paid Holidays: New Year's Day, Day Before Or After New Year's Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and a Half-Day On Christmas Eve Day. (9 1/2).

G. Paid Holidays: New Year's Day, Martin Luther King Jr. Day, Presidents’ Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Christmas Eve Day (11).

Holiday Codes Continued

6. H. Paid Holidays: New Year's Day, New Year's Eve Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, Christmas Day, The Day After Christmas, And A Floating Holiday (10).

I. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, And Christmas Day (7).

T. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Last Working Day Before Christmas Day, And Christmas Day (9).

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). If a holiday falls on Saturday, the preceding Friday shall be considered as the holiday. If a holiday falls on Sunday, the following Monday shall be considered as the holiday.

7. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any Holiday Which Falls On A Sunday Shall Be Observed As A Holiday On The Following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

C. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

D. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Unpaid Holidays: President's Day. Any paid holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any paid holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

E. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

F. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the last working day before Christmas day and Christmas day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

G. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Holiday Codes Continued

7. I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

J. Holidays: New Year's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

L. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Last Work Day before Christmas Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

M. Paid Holidays: New Year's Day, The Day after or before New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, And the Day after or before Christmas Day (10). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. When Christmas falls on a Saturday, the preceding Friday shall be observed as a holiday.

P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Q. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

R. Paid Holidays: New Year's Day, the day after or before New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day after or before Christmas Day (10). If any of the listed holidays fall on Saturday, the preceding Friday shall be observed as the holiday. If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

S. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, the Day after Christmas, and A Floating Holiday (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

Holiday Codes Continued

T. Paid Holidays: New Year's Day, the Day after or before New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and The Day after or before Christmas Day. (10). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Note Codes

8. D. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $0.75, Level B: $0.50, And Level C: $0.25.

M. Workers on hazmat projects receive additional hourly premiums as follows: Levels A & B: $1.00, Levels C & D: $0.50.

N. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.

P. Workers on hazmat projects receive additional hourly premiums as follows -Class A Suit: $2.00, Class B Suit: $1.50, Class C Suit: $1.00, And Class D Suit $0.50.

Q. The highest pressure registered on the gauge for an accumulated time of more than fifteen (15) minutes during the shift shall be used in determining the scale paid.

R. Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. These classifications are only effective on or after August 31, 2012.

S. Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

T. Effective August 31, 2012 – A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

Note Codes Continued

8. U. Workers on hazmat projects receive additional hourly premiums as follows – Class A Suit: $2.00, Class B Suit: $1.50, And Class C Suit: $1.00. Workers performing underground work receive an additional $0.40 per hour for any and all work performed underground, including operating, servicing and repairing of equipment. The premium for underground work shall be paid for the entire shift worked. Workers who work suspended by a rope or cable receive an additional $0.50 per hour. The premium for work suspended shall be paid for the entire shift worked. Workers who do "pioneer" work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation receive an additional $0.50 per hour.

V. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.

Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - $2.00 per foot for each foot over 50 feet. Over 101' to 150' - $3.00 per foot for each foot over 101 feet. Over 151' to 220' - $4.00 per foot for each foot over 220 feet. Over 221' - $5.00 per foot for each foot over 221 feet.

Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25' to 300' - $1.00 per foot from entrance. 300' to 600' - $1.50 per foot beginning at 300'. Over 600' - $2.00 per foot beginning at 600'.

FEDERAL WAGE RATES

General Decision Number: WA170001 08/25/2017 WA1

Superseded General Decision Number: WA20160001

State: Washington

Construction Type: Highway

Counties: Washington Statewide.

HIGHWAY (Excludes D.O.E. Hanford Site in Benton and Franklin Counties)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.20 for calendar year 2017 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.20 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2017. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2017
1	01/13/2017
2	02/03/2017
3	02/10/2017
4	03/03/2017
5	04/14/2017
6	05/19/2017
7	06/02/2017
8	06/09/2017
9	06/16/2017
10	06/30/2017
11	07/21/2017
12	07/28/2017
13	**08/25/2017**

*** CARP0001-008 06/01/2017**

	Rates	Fringes
CARPENTER		
GROUP 1	**$ 32.32**	**16.14**
GROUP 2	**$ 43.42**	**18.44**
GROUP 3	**$ 33.41**	**16.14**
GROUP 4	**$ 32.32**	**16.14**
GROUP 5	**$ 75.16**	**16.14**
GROUP 6	**$ 36.58**	**16.14**
GROUP 7	**$ 37.58**	**16.14**
GROUP 8	**$ 34.41**	**16.14**
GROUP 9	**$ 40.58**	**16.14**

CARPENTER & DIVER CLASSIFICATIONS:

GROUP 1: Carpenter

GROUP 2: Millwright, machine erector

GROUP 3: Piledriver - includes driving, pulling, cutting, placing collars, setting, welding, or creosote treated material, on all piling

GROUP 4: Bridge carpenters

GROUP 5: Diver Wet

GROUP 6: Diver Tender, Manifold Operator, ROV Operator

GROUP 7: Diver Standby, Bell/Vehicle or Submersible operator Not Under Pressure

GROUP 8: Assistant Tender, ROV Tender/Technician

GROUP 9: Manifold Operator-Mixed Gas

ZONE PAY:

ZONE 1	0-40 MILES	FREE
ZONE 2	41-65 MILES	$2.25/PER HOUR
ZONE 3	66-100 MILES	$3.25/PER HOUR
ZONE 4	OVER 100 MILES	$4.75/PER HOUR

DISPATCH POINTS:

CARPENTERS/MILLWRIGHTS: PASCO (515 N Neel Street) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

CARPENTERS/PILEDRIVER: SPOKANE (127 E. AUGUSTA AVE.) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

CARPENTERS: WENATCHEE (27 N. CHELAN) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

CARPENTERS: COEUR D' ALENE (1839 N. GOVERNMENT WAY) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

CARPENTERS: MOSCOW (302 N. JACKSON) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

DEPTH PAY FOR DIVERS BELOW WATER SURFACE:
50-100 feet $2.00 per foot
101-150 feet $3.00 per foot
151-220 feet $4.00 per foot
221 feet and deeper $5.00 per foot

PREMIUM PAY FOR DIVING IN ENCLOSURES WITH NO VERTICAL ASCENT:
0-25 feet Free
26-300 feet $1.00 per Foot

SATURATION DIVING:
The standby rate applies until saturation starts. The saturation diving rate applies when divers are under pressure continuously until work task and decompression are complete. the diver rate shall be paid for all saturation hours.

WORK IN COMBINATION OF CLASSIFICATIONS:
Employees working in any combination of classifications within the diving crew (except dive supervisor) in a shift are paid in the classification with the highest rate for that shift.

HAZMAT PROJECTS:

Anyone working on a HAZMAT job (task), where HAZMAT certification is required, shall be compensated at a premium, in addition to the classification working in as follows:

LEVEL D + $.25 per hour - This is the lowest level of protection. No respirator is used and skin protection is minimal.

LEVEL C + $.50 per hour - This level uses an air purifying respirator or additional protective clothing.

LEVEL B + $.75 per hour - Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "splash suit".

LEVEL A +$1.00 per hour - This level utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line.

CARP0003-006 10/01/2011

SOUTHWEST WASHINGTON: CLARK, COWLITZ, KLICKITAT, LEWIS(Piledriver only), PACIFIC (South of a straight line made by extending the north boundary line of Wahkiakum County west to Willapa Bay to the Pacific Ocean), SKAMANIA AND WAHKIAKUM COUNTIES and INCLUDES THE ENTIRE PENINSULA WEST OF WILLAPA BAY

SEE ZONE DESCRIPTION FOR CITIES BASE POINTS

ZONE 1:

	Rates	Fringes
Carpenters:		
CARPENTERS	$ 32.04	14.18
DIVERS TENDERS	$ 36.34	14.18
DIVERS	$ 77.08	14.18
DRYWALL	$ 27.56	14.18
MILLWRIGHTS	$ 32.19	14.18
PILEDRIVERS	$ 33.04	14.18

DEPTH PAY:
50 TO 100 FEET $1.00 PER FOOT OVER 50 FEET
101 TO 150 FEET $1.50 PER FOOT OVER 101 FEET
151 TO 200 FEET $2.00 PER FOOT OVER 151 FEET

Zone Differential (Add up Zone 1 rates):
Zone 2 - $0.85
Zone 3 - 1.25
Zone 4 - 1.70
Zone 5 - 2.00
Zone 6 - 3.00

BASEPOINTS: ASTORIA, LONGVIEW, PORTLAND, THE DALLES, AND VANCOUVER, (NOTE: All dispatches for Washington State Counties: Cowlitz, Wahkiakum and Pacific shall be from Longview Local #1707 and mileage shall be computed from that point.)

ZONE 1: Projects located within 30 miles of the respective city hall of the above mentioned cities
ZONE 2: Projects located more than 30 miles and less than 40 miles of the respective city of the above mentioned cities
ZONE 3: Projects located more than 40 miles and less than 50 miles of the respective city of the above mentioned cities
ZONE 4: Projects located more than 50 miles and less than 60 miles of the respective city of the above mentioned cities.
ZONE 5: Projects located more than 60 miles and less than 70 miles of the respective city of the above mentioned cities
ZONE 6: Projects located more than 70 miles of the respected city of the above mentioned cities

----

CARP0770-003 06/01/2015

	Rates	Fringes
CARPENTER		
CENTRAL WASHINGTON: CHELAN, DOUGLAS (WEST OF THE 120TH MERIDIAN), KITTITAS, OKANOGAN (WEST OF THE 120TH MERIDIAN) AND YAKIMA COUNTIES		
CARPENTERS ON CREOSOTE MATERIAL	$ 40.46	13.66
CARPENTERS	$ 40.36	13.66
DIVERS TENDER	$ 35.02	14.00
DIVERS	$ 73.44	14.00
MILLWRIGHT AND MACHINE ERECTORS	$ 41.86	13.66
PILEDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING OR CRESOTE TREATED MATERIAL, ALL PILING	$ 40.61	13.66

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - ALL CLASSIFICATIONS EXCEPT MILLWRIGHTS AND PILEDRIVERS

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

Zone Pay:

0 -25 radius miles	Free
26-35 radius miles	$1.00/hour
36-45 radius miles	$1.15/hour
46-55 radius miles	$1.35/hour
Over 55 radius miles	$1.55/hour

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - MILLWRIGHT AND PILEDRIVER ONLY)

Hourly Zone Pay shall be computed from Seattle Union Hall, Tacoma City center, and Everett City center

Zone Pay:

0 -25 radius miles	Free
26-45 radius miles	$ .70/hour
Over 45 radius miles	$1.50/hour

CARP0770-006 06/01/2016

	Rates	Fringes
CARPENTER		
WESTERN WASHINGTON: CLALLAM, GRAYS HARBOR,ISLAND, JEFFERSON, KING, KITSAP, LEWIS (excludes piledrivers only), MASON,PACIFIC (North of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean), PIERCE, SAN JUAN,SKAGIT, SNOHOMISH, THURSTON AND WHATCOM COUNTIES		
BRIDGE CARPENTERS..........	$ 40.92	14.59
CARPENTERS ON CREOSOTE MATERIAL..................	$ 40.46	13.66
CARPENTERS.................	$ 40.92	14.59
DIVERS TENDER..............	$ 44.67	13.66
DIVERS.....................	$ 93.56	13.66
MILLWRIGHT AND MACHINE ERECTORS...................	$ 41.86	13.66
PILEDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING OR CRESOTE TREATED MATERIAL, ALL PILING.......	$ 40.61	13.66

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - ALL CLASSIFICATIONS EXCEPT MILLWRIGHTS AND PILEDRIVERS

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

Zone Pay:

0 -25 radius miles	Free
26-35 radius miles	$1.00/hour
36-45 radius miles	$1.15/hour
46-55 radius miles	$1.35/hour
Over 55 radius miles	$1.55/hour

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - MILLWRIGHT AND PILEDRIVER ONLY)

Hourly Zone Pay shall be computed from Seattle Union Hall, Tacoma City center, and Everett City center

Zone Pay:

0 -25 radius miles	Free
26-45 radius miles	$ .70/hour
Over 45 radius miles	$1.50/hour

ELEC0046-001 02/06/2017

CALLAM, JEFFERSON, KING AND KITSAP COUNTIES

	Rates	Fringes
CABLE SPLICER....................	$ 46.87	3%+15.96
ELECTRICIAN......................	$ 47.56	3%+19.31

ELEC0048-003 01/01/2017

CLARK, KLICKITAT AND SKAMANIA COUNTIES

	Rates	Fringes
CABLE SPLICER....................	$ 44.22	21.50
ELECTRICIAN......................	$ 40.20	22.18

HOURLY ZONE PAY:

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Portland, The Dalles, Hood River, Tillamook, Seaside and Astoria

Zone Pay:
Zone 1: 31-50 miles $1.50/hour
Zone 2: 51-70 miles $3.50/hour
Zone 3: 71-90 miles $5.50/hour
Zone 4: Beyond 90 miles $9.00/hour

*These are not miles driven. Zones are based on Delorrne Street Atlas USA 2006 plus.

ELEC0048-029 01/01/2017

COWLITZ AND WAHKIAKUM COUNTY

	Rates	Fringes
CABLE SPLICER....................	$ 44.22	21.50
ELECTRICIAN......................	$ 40.20	22.18

ELEC0073-001 07/01/2017

ADAMS, FERRY, LINCOLN, PEND OREILLE, SPOKANE, STEVENS, WHITMAN COUNTIES

	Rates	Fringes
CABLE SPLICER....................	$ 34.10	16.68
ELECTRICIAN......................	$ 32.75	18.13

ELEC0076-002 09/01/2016

GRAYS HARBOR, LEWIS, MASON, PACIFIC, PIERCE, AND THURSTON COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 40.05	24.49
ELECTRICIAN	$ 36.41	24.38

ELEC0112-005 06/01/2017

ASOTIN, BENTON, COLUMBIA, FRANKLIN, GARFIELD, KITTITAS, WALLA WALLA, YAKIMA COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 42.95	20.06
ELECTRICIAN	$ 40.90	20.06

ELEC0191-003 06/01/2017

ISLAND, SAN JUAN, SNOHOMISH, SKAGIT AND WHATCOM COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 44.23	17.73
ELECTRICIAN	$ 43.45	19.69

ELEC0191-004 06/01/2017

CHELAN, DOUGLAS, GRANT AND OKANOGAN COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 40.82	17.63
ELECTRICIAN	$ 40.65	19.59

ENGI0302-003 06/01/2017

CHELAN (WEST OF THE 120TH MERIDIAN), CLALLAM, DOUGLAS (WEST OF THE 120TH MERIDIAN), GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, KITTITAS, MASON, OKANOGAN (WEST OF THE 120TH MERIDIAN), SAN JUNA, SKAGIT, SNOHOMISH, WHATCOM AND YAKIMA (WEST OF THE 120TH MERIDIAN) COUNTIES

Zone 1 (0-25 radius miles):

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
Group 1A	$ 41.90	19.20
Group 1AA	$ 42.52	19.20
Group 1AAA	$ 43.13	19.20
Group 1	$ 41.29	19.20
Group 2	$ 40.76	19.20
Group 3	$ 40.29	19.20
Group 4	$ 37.70	19.20

Zone Differential (Add to Zone 1 rates):
Zone 2 (26-45 radius miles) - $1.00
Zone 3 (Over 45 radius miles) - $1.30

BASEPOINTS: Aberdeen, Bellingham, Bremerton, Everett, Kent, Mount Vernon, Port Angeles, Port Townsend, Seattle, Shelton, Wenatchee, Yakima

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1AAA - Cranes-over 300 tons, or 300 ft of boom (including jib with attachments)

GROUP 1AA - Cranes 200 to 300 tons, or 250 ft of boom (including jib with attachments); Tower crane over 175 ft in height, base to boom

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

GROUP 1 - Cableway; Cranes 45 tons thru 99 tons, under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader- overhead 6 yards to, but not including 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9, HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self propelled 45 yards and over; Slipform pavers; Transporters, all truck or track type

GROUP 2 - Barrier machine (zipper); Batch Plant Operaor-Concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-overhead, bridge type-20 tons through 44 tons; Chipper; Concrete Pump-truck mount with boom attachment; Crusher; Deck Engineer/Deck Winches (power); Drilling machine; Excavator, shovel, backhoe-3yards and under; Finishing Machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Horizontal/directional drill operator; Loaders-overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics-all; Mixers-asphalt plant; Motor patrol graders-finishing; Piledriver (other than crane mount); Roto-mill,roto-grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self propelled, hard tail end dump, articulating off-road equipment-under 45 yards; Subgrade trimmer; Tractors, backhoes-over 75 hp; Transfer material service machine-shuttle buggy, blaw knox-roadtec; Truck crane oiler/driver-100 tons and over; Truck Mount portable conveyor; Yo Yo Pay dozer

GROUP 3 - Conveyors; Cranes-thru 19 tons with attachments; A-frame crane over 10 tons; Drill oilers-auger type, truck or crane mount; Dozers-D-9 and under; Forklift-3000 lbs. and over with attachments; Horizontal/directional drill locator; Outside hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loader-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler- asphalt, crusher; Pumps-concrete; Roller, plant mix or multi-lift materials; Saws-concrete; Scrpers-concrete and carry-all; Service engineer-equipment; Trenching machines; Truck Crane Oiler/Driver under 100 tons; Tractors, backhoe 75 hp and under

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete finish mahine-laser screed; Cranes-A frame-10 tons and under; Elevator and Manlift-permanent or shaft type; Gradechecker, Stakehop; Forklifts under 3000 lbs. with attachments; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger, mechanical; Power plant; Pumps, water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

HANDLING OF HAZARDOUS WASTE MATERIALS:

Personnel in all craft classifications subject to working inside a federally designated hazardous perimeter shall be elgible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing
H-2 Class "C" Suit - Base wage rate plus $ .25 per hour.
H-3 Class "B" Suit - Base wage rate plus $ .50 per hour.
H-4 Class "A" Suit - Base wage rate plus $ .75 per hour.

ENGI0370-002 06/01/2017

ADAMS, ASOTIN, BENTON, CHELAN (EAST OF THE 120TH MERIDIAN), COLUMBIA, DOUGLAS (EAST OF THE 120TH MERIDIAN), FERRY, FRANKLIN, GARFIELD, GRANT, LINCOLN, OKANOGAN (EAST OF THE 120TH MERIDIAN), PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA, WHITMAN AND YAKIMA (EAST OF THE 120TH MERIDIAN) COUNTIES

ZONE 1:

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 27.11	15.20
GROUP 2	$ 27.43	15.20
GROUP 3	$ 28.04	15.20
GROUP 4	$ 28.20	15.20
GROUP 5	$ 28.36	15.20
GROUP 6	$ 28.64	15.20
GROUP 7	$ 28.91	15.20
GROUP 8	$ 30.01	15.20

ZONE DIFFERENTIAL (Add to Zone 1 rate): Zone 2 - $2.00

Zone 1: Within 45 mile radius of Spokane, Pasco, Washington; Lewiston, Idaho

Zone 2: Outside 45 mile radius of Spokane, Pasco, Washington; Lewiston, Idaho

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Bit Grinders; Bolt Threading Machine; Compressors (under 2000 CFM, gas, diesel, or electric power); Deck Hand; Fireman & Heater Tender; Hydro-seeder, Mulcher, Nozzleman; Oiler Driver, & Cable Tender, Mucking Machine; Pumpman; Rollers, all types on subgrade, including seal and chip coatings (farm type, Case, John Deere & similar, or Compacting Vibrator), except when pulled by Dozer with operable blade; Welding Machine; Crane Oiler-Driver (CLD required) & Cable Tender, Mucking Machine

GROUP 2: A-frame Truck (single drum); Assistant Refrigeration Plant (under 1000 ton); Assistant Plant Operator, Fireman or Pugmixer (asphalt); Bagley or Stationary Scraper; Belt Finishing Machine; Blower Operator (cement); Cement Hog; Compressor (2000 CFM or over, 2 or more, gas diesel or electric power); Concrete Saw (multiple cut); Distributor Leverman; Ditch Witch or similar; Elevator Hoisting Materials; Dope Pots (power agitated); Fork Lift or Lumber Stacker, hydra-lift & similar; Gin Trucks (pipeline); Hoist, single drum; Loaders (bucket elevators and conveyors); Longitudinal Float; Mixer (portable-concrete); Pavement Breaker, Hydra-Hammer & similar; Power Broom; Railroad Ballast Regulation Operator (self-propelled); Railroad Power Tamper Operator (self-propelled); Railroad Tamper Jack Operator (self-propelled; Spray Curing Machine (concrete); Spreader Box (self-propelled); Straddle Buggy (Ross & similar on construction job only); Tractor (Farm type R/T with attachment, except Backhoe); Tugger Operator

GROUP 3: A-frame Truck (2 or more drums); Assistant Refrigeration Plant & Chiller Operator (over 1000 ton); Backfillers (Cleveland & similar); Batch Plant & Wet Mix Operator, single unit (concrete); Belt-Crete Conveyors with power pack or similar; Belt Loader (Kocal or similar); Bending Machine; Bob Cat (Skid Steer); Boring Machine (earth); Boring Machine (rock under 8 inch bit) (Quarry Master, Joy or similar); Bump Cutter (Wayne, Saginau or similar); Canal Lining Machine (concrete); Chipper (without crane); Cleaning & Doping Machine (pipeline); Deck Engineer; Elevating Belt-type Loader (Euclid, Barber Green & similar); Elevating Grader-type Loader (Dumor, Adams or similar); Generator Plant Engineers (diesel or electric); Gunnite Combination Mixer & Compressor; Locomotive Engineer; Mixermobile; Mucking Machine; Posthole Auger or Punch; Pump (grout or jet); Soil Stabilizer (P & H or similar); Spreader Machine; Dozer/Tractor (up to D-6 or equivalent) and Traxcavator; Traverse Finish Machine; Turnhead Operator

GROUP 4: Concrete Pumps (squeeze-crete, flow-crete, pump-crete, Whitman & similar); Curb Extruder (asphalt or concrete); Drills (churn, core, calyx or diamond); Equipment Serviceman; Greaser & Oiler; Hoist (2 or more drums or Tower Hoist); Loaders (overhead & front-end, under 4 yds. R/T); Refrigeration Plant Engineer (under 1000 ton); Rubber-tired Skidders (R/T with or without attachments); Surface Heater & Plant Machine; Trenching Machines (under 7 ft. depth capacity); Turnhead (with re-screening); Vacuum Drill (reverse circulation drill under 8 inch bit)

GROUP 5: Backhoe (under 45,000 gw); Backhoe & Hoe Ram (under 3/4 yd.); Carrydeck & Boom Truck (under 25 tons); Cranes (25 tons & under), all attachments including clamshell, dragline; Derricks & Stifflegs (under 65 tons); Drilling Equipment(8 inch bit & over) (Robbins, reverse circulation & similar); Hoe Ram; Piledriving Engineers; Paving (dual drum); Railroad Track Liner Operaotr (self-propelled); Refrigeration Plant Engineer (1000 tons & over); Signalman (Whirleys, Highline Hammerheads or similar); Grade Checker

GROUP 6: Asphalt Plant Operator; Automatic Subgrader (Ditches & Trimmers)(Autograde, ABC, R.A. Hansen & similar on grade wire); Backhoe (45,000 gw and over to 110,000 gw); Backhoes & Hoe Ram (3/4 yd. to 3 yd.); Batch Plant (over 4 units); Batch & Wet Mix Operator (multiple units, 2 & incl. 4); Blade Operator (motor patrol & attachments); Cable Controller (dispatcher); Compactor (self-propelled with blade); Concrete Pump Boom Truck; Concrete Slip Form Paver; Cranes (over 25 tons, to and including 45 tons), all attachments including clamshell, dragline; Crusher, Grizzle & Screening Plant Operator; Dozer, 834 R/T & similar; Drill Doctor; Loader Operator (front-end & overhead, 4 yds. incl. 8 yds.); Multiple Dozer Units with single blade; Paving Machine (asphalt and concrete); Quad-Track or similar equipment; Rollerman (finishing asphalt pavement); Roto Mill (pavement grinder); Scrapers, all, rubber-tired; Screed Operator; Shovel(under 3 yds.); Trenching Machines (7 ft. depth & over); Tug Boat Operator Vactor guzzler, super sucker; Lime Batch Tank Operator (REcycle Train); Lime Brain Operator (Recycle Train); Mobile Crusher Operator (Recycle Train)

GROUP 7: Backhoe (over 110,000 gw); Backhoes & Hoe Ram (3 yds & over); Blade (finish & bluetop) Automatic, CMI, ABC, Finish Athey & Huber & similar when used as automatic; Cableway Operators; Concrete Cleaning/Decontamination machine operator; Cranes (over 45 tons to but not including 85 tons), all attachments including clamshell and dragine; Derricks & Stiffleys (65 tons & over); Elevating Belt (Holland type); Heavy equipment robotics operator; Loader (360 degrees revolving Koehring Scooper or similar); Loaders (overhead & front-end, over 8 yds. to 10 yds.); Rubber-tired Scrapers (multiple engine with three or more scrapers); Shovels (3 yds. & over); Whirleys & Hammerheads, ALL; H.D. Mechanic; H.D. Welder; Hydraulic Platform Trailers (Goldhofer, Shaurerly andSimilar); Ultra High Pressure Wateriet Cutting Tool System Operator (30,000 psi); Vacuum Blasting Machine Operator

GROUP 8: Cranes (85 tons and over, and all climbing, overhead,rail and tower), all attachments including clamshell, dragline; Loaders (overhead and front-end, 10 yards and over); Helicopter Pilot

BOOM PAY: (All Cranes, Including Tower)
180 ft to 250 ft $ .50 over scale
Over 250 ft $ .80 over scale

NOTE:
In computing the length of the boom on Tower Cranes, they shall be measured from the base of the Tower to the point of the boom.

HAZMAT:
Anyone working on HAZMAT jobs, working with supplied air shall receive $1.00 an hour above classification.

ENGI0612-012 06/01/2014

LEWIS,PIERCE, PACIFIC (portion lying north of a parallel line extending west from the northern boundary of Wahkaikum County to the sea) AND THURSTON COUNTIES

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 90% OF THE BASE RATE PLUS FULL FRINGE BENEFITS. ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

Zone 1 (0-25 radius miles):

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1A	$ 38.39	17.40
GROUP 1AA	$ 38.96	17.40
GROUP 1AAA	$ 39.52	17.40
GROUP 1	$ 37.84	17.40
GROUP 2	$ 37.35	17.40
GROUP 3	$ 36.93	17.40
GROUP 4	$ 34.57	17.40

Zone Differential (Add to Zone 1 rates):
Zone 2 (26-45 radius miles) = $1.00
Zone 3 (Over 45 radius miles) - $1.30

BASEPOINTS: CENTRALIA, OLYMPIA, TACOMA

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1 AAA - Cranes-over 300 tons or 300 ft of boom (including jib with attachments)

GROUP 1AA - Cranes- 200 tonsto 300 tons, or 250 ft of boom (including jib with attachments; Tower crane over 175 ft in height, bas to boom

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

GROUP 1 - Cableway; Cranes 45 tons thru 99 tons under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader- overhead, 6 yards to, but not including, 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9 HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self-propelled 45 yards and over; Slipform pavers; Transporters, all track or truck type

GROUP 2 - Barrier machine (zipper); Batch Plant Operator-concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-Overhead, bridge type, 20 tons through 44 tons; Chipper; Concrete pump-truck mount with boom attachment; Crusher; Deck engineer/deck winches (power); Drilling machine; Excavator, shovel, backhoe-3 yards and under; Finishing machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Loaders, overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics- all; Mixers, asphalt plant; Motor patrol graders, finishing; Piledriver (other than crane mount); Roto-mill, roto-grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self- propelled, hard tail end dump, articulating off-road equipment- under 45 yards; Subgrader trimmer; Tractors, backhoe over 75 hp; Transfer material service machine-shuttle buggy, Blaw Knox- Roadtec; Truck Crane oiler/driver-100 tons and over; Truck Mount Portable Conveyor; Yo Yo pay

GROUP 3 - Conveyors; Cranes through 19 tons with attachments; Crane-A-frame over 10 tons; Drill oilers-auger type, truck or crane mount; Dozer-D-9 and under; Forklift-3000 lbs. and over with attachments; Horizontal/directional drill locator; Outside Hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loaders-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler- asphalt, crusher; Pump-Concrete; Roller, plant mix or multi-lfit materials; Saws-concrete; Scrapers, concrete and carry all; Service engineers-equipment; Trenching machines; Truck crane oiler/driver under 100 tons; Tractors, backhoe under 75 hp

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete Finish Machine-laser screed; Cranes A-frame 10 tons and under; Elevator and manlift (permanent and shaft type); Forklifts-under 3000 lbs. with attachments; Gradechecker, stakehop; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger-mechanical; Power plant; Pumps-water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

FOOTNOTE A- Reduced rates may be paid on the following:
1. Projects involving work on structures such as buildings and bridges whose total value is less than $1.5 million excluding mechanical, electrical, and utility portions of the contract.

2. Projects of less than $1 million where no building is involved. Surfacing and paving included, but utilities excluded.

3. Marine projects (docks, wharfs, etc.) less than $150,000.

HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designated hazardous perimeter shall be elgible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing, Class "D" Suit - Base wage rate plus $ .50 per hour.
H-2 Class "C" Suit - Base wage rate plus $1.00 per hour.
H-3 Class "B" Suit - Base wage rate plus $1.50 per hour.
H-4 Class "A" Suit - Base wage rate plus $2.00 per hour.

ENGI0701-002 01/01/2015

CLARK, COWLITZ, KLICKKITAT, PACIFIC (SOUTH), SKAMANIA, AND WAHKIAKUM COUNTIES

POWER RQUIPMENT OPERATORS: ZONE 1

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 39.47	14.10
GROUP 1A	$ 41.44	14.10
GROUP 1B	$ 43.42	14.10
GROUP 2	$ 37.58	14.10
GROUP 3	$ 36.44	14.10
GROUP 4	$ 35.36	14.10
GROUP 5	$ 34.13	14.10
GROUP 6	$ 30.94	14.10

Zone Differential (add to Zone 1 rates):
Zone 2 - $3.00
Zone 3 - $6.00

For the following metropolitan counties: MULTNOMAH; CLACKAMAS; MARION; WASHINGTON; YAMHILL; AND COLUMBIA; CLARK; AND COWLITZ COUNTY, WASHINGTON WITH MODIFICATIONS AS INDICATED:

All jobs or projects located in Multnomah, Clackamas and Marion Counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 on Interstate 84 and West of Mile Post 30 on State Highway 26 and West of Mile Post 30 on Highway 22 and all jobs or projects located in Yamhill County, Washington County and Columbia County and all jobs or porjects located in Clark & Cowlitz County, Washington except that portion of Cowlitz County in the Mt. St. Helens "Blast Zone" shall receive Zone I pay for all classifications.

All jobs or projects located in the area outside the identified boundary above, but less than 50 miles from the Portland City Hall shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone III pay for all classifications.

For the following cities: ALBANY; BEND; COOS BAY; EUGENE; GRANTS PASS; KLAMATH FALLS; MEDFORD; ROSEBURG

All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone I pay for all classifications.

All jobs or projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone III pay for all classifications.

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

Group 1 Concrete Batch Plan and or Wet mix three (3) units or more; Crane, Floating one hundred and fifty (150) ton but less than two hundred and fifty (250) ton; Crane, two hundred (200) ton through two hundred ninety nine (299) ton with two hundred foot (200') boom or less (including jib, inserts and/or attachments); Crane, ninety (90) ton through one hundred ninety nine (199) ton with over two hundred (200') boom Including jib, inserts and/or attachments); Crane, Tower Crane with one hundred seventy five foot (175') tower or less and with less than two hundred foot (200') jib; Crane, Whirley ninety (90) ton and over; Helicopter when used in erecting work

Group 1A Crane, floating two hundred fifty (250) ton and over; Crane, two hundred (200) ton through two hundred ninety nine (299) ton, with over two hundred foot (200') boom (including jib, inserts and/or attachments); Crane, three hundred (300) ton through three hundred ninety nine (399) ton; Crane, Tower Crane with over one hundred seventy five foot (175') tower or over two hundred foot (200') jib; Crane, tower Crane on rail system or 2nd tower or more in work radius

Group 1B Crane, three hundred (300) ton through three hundred ninety nine (399) ton, with over two hundred foot (200') boom (including jib, inserts and/or attachments); Floating crane, three hundred fifty (350) ton and over; Crane, four hundred (400) ton and over

Group 2 Asphalt Plant (any type); Asphalt Roto-Mill, pavement profiler eight foot (8') lateral cut and over; Auto Grader or "Trimmer"; Blade, Robotic; Bulldozer, Robotic Equipment (any type); Bulldozer, over one hundred twenty thousand (120,000) lbs. and above; Concrete Batch Plant and/or Wet Mix one (1) and two (2) drum; Concrete Diamond Head Profiler; Canal Trimmer; Concrete, Automatic Slip Form Paver (Assistant to the Operator required); Crane, Boom Truck fifty (50) ton and with over one hundred fifty foot (150') boom and over; Crane, Floating (derrick barge) thirty (30) ton but less than one hundred fifty (150) ton; Crane, Cableway twenty-five (25) ton and over; Crane, Floating Clamshell three (3) cu. Yds. And over; Crane, ninety (90) ton through one hundred ninety nine (199) ton up to and including two hundred foot (200') of boom (including jib inserts and/or attachments); Crane, fifty (50) ton through eighty nine (89) ton with over one hundred fifty foot (150') boom (including jib inserts and/or attachments); Crane, Whirley under ninety (90) ton; Crusher Plant; Excavator over one hundred thirty thousand (130,000) lbs.; Loader one hundred twenty thousand (120,000) lbs. and above; Remote Controlled Earth Moving Equipment; Shovel, Dragline, Clamshell, five (5) cu. Yds. And over; Underwater Equipment remote or otherwise, when used in construction work; Wheel Excavator any size

Group 3 Bulldozer, over seventy thousand (70,000) lbs. up to and including one hundred twenty thousand (120,000) lbs.; Crane, Boom Truck fifty (50) ton and over with less than one hundred fifty foot (150') boom; Crane, fifty (50) ton through eighty nine (89) ton with one hundred fifty foot (150') boom or less (including jib inserts and/or attachments); Crane, Shovel, Dragline or Clamshell three (3) cu. yds. but less than five (5) cu. Yds.; Excavator over eighty thousand (80,000) lbs. through one hundred thirty thousand (130,000) lbs.; Loader sixty thousand (60,000) lbs. and less than one hundred twenty thousand (120,000) lbs.

Group 4 Asphalt, Screed; Asphalt Paver; Asphalt Roto-Mill, pavement profiler, under eight foot (8') lateral cut; Asphalt, Material Transfer Vehicle Operator; Back Filling Machine; Backhoe, Robotic, track and wheel type up to and including twenty thousand (20,000) lbs. with any attachments; Blade (any type); Boatman; Boring Machine; Bulldozer over twenty thousand (20,000) lbs. and more than one hundred (100) horse up to seventy thousand (70,000) lbs.; Cable-Plow (any type); Cableway up to twenty five (25) ton; Cat Drill (John Henry); Chippers; Compactor, multi-engine; Compactor, Robotic; Compactor with blade self-propelled; Concrete, Breaker; Concrete, Grout Plant; Concrete, Mixer Mobile; Concrete, Paving Road Mixer; Concrete, Reinforced Tank Banding Machine; Crane, Boom Truck twenty (20) ton and under fifty (50) ton; Crane, Bridge Locomotive, Gantry and Overhead; Crane, Carry Deck; Crane, Chicago Boom and similar types; Crane, Derrick Operator, under one hundred (100) ton; Crane, Floating Clamshell, Dragline, etc. Operator, under three (3) cu. yds. Or less than thirty (30) ton; Crane, under fifty (50) ton; Crane, Quick Tower under one hundred foot (100') in height and less than one hundred fifty foot (150') jib (on rail included); Diesel-Electric Engineer (Plant or Floating); Directional Drill over twenty thousand (20,000) lbs. pullback; Drill Cat Operator; Drill Doctor and/or Bit Grinder; Driller, Percussion, Diamond, Core, Cable, Rotary and similar type; Excavator Operator over twenty thousand (20,000) lbs. through eighty thousand (80,000) lbs.; Generator Operator; Grade-all; Guardrail Machines, i.e. punch, auger, etc.; Hammer Operator (Piledriver); Hoist, stiff leg, guy derrick or similar type, fifty (50) ton and over; Hoist, two (2) drums or more; Hydro Axe (loader mounted or similar type); Jack Operator, Elevating Barges, Barge Operator, self-unloading; Loader Operator, front end and overhead, twenty five thousand (25,000) lbs. and less than sixty thousand (60,000) lbs.; Log Skidders; Piledriver Operator (not crane type); Pipe, Bending, Cleaning, Doping and Wrapping Machines; Rail, Ballast Tamper Multi-Purpose; Rubber-tired Dozers and Pushers; Scraper, all types; Side-Boom; Skip Loader, Drag Box; Strump Grinder (loader mounted or similar type); Surface Heater and Planer; Tractor, rubber-tired, over fifty (50) HP Flywheel; Trenching Machine three foot (3') depth and deeper; Tub Grinder (used for wood debris); Tunnel Boring Machine Mechanic; Tunnel, Mucking Machine;

Ultra High Pressure Water Jet Cutting Tool System Operator; Vacuum Blasting Machine Operator; Water pulls, Water wagons

Group 5 Asphalt, Extrusion Machine; Asphalt, Roller (any asphalt mix); Asphalt, Roto-Mill pavement profiler ground man; Bulldozer, twenty thousand (20,000) lbs. or less, or one hundred (100) horse or less; Cement Pump; Chip Spreading Machine; Churn Drill and Earth Boring Machine; Compactor, self-propelled without blade; Compressor, (any power) one thousand two hundred fifty (1,250) cu. ft. and over, total capacity; Concrete, Batch Plant Quality control; Concrete, Combination Mixer and compressor operator, gunite work; Concrete, Curb Machine, Mechanical Berm, Curb and/or Curb and Gutter; Concrete, Finishing Machine; Concrete, Grouting Machine; Concrete, Internal Full Slab Vibrator Operator; Concrete, Joint Machine; Concrete, Mixer single drum, any capacity; Concrete, Paving Machine eight foot (8') or less; Concrete, Planer; Concrete, Pump; Concrete, Pump Truck; Concrete, Pumpcrete Operator (any type); Concrete, Slip Form Pumps, power driven hydraulic lifting device for concrete forms; Conveyored Material Hauler; Crane, Boom Truck under twenty (20) tons; Crane, Boom Type lifting device, five (5) ton capacity or less; Drill, Directional type less than twenty thousand (20,000) lbs. pullback; Fork Lift, over ten (10) ton or Robotic; Helicopter Hoist; Hoist Operator, single drum; Hydraulic Backhoe track type up to and including twenty thousand (20,000) lbs.; Hydraulic Backhoe wheel type (any make); Laser Screed; Loaders, rubber-tired type, less than twenty five thousand (25,000) lbs.; Pavement Grinder and/or Grooving Machine (riding type); Pipe, cast in place Pipe Laying Machine; Pulva-Mixer or similar types; Pump Operator, more than five (5) pumps (any size); Rail, Ballast Compactor, Regulator, or Tamper machines; Service Oiler (Greaser); Sweeper Self-Propelled; Tractor, Rubber-Tired, fifty (50) HP flywheel and under; Trenching Machine Operator, maximum digging capacity three foot (3') depth; Tunnel, Locomotive, Dinkey; Tunnel, Power Jumbo setting slip forms, etc.

Group 6 Asphalt, Pugmill (any type); Asphalt, Raker; Asphalt, Truck Mounted Asphalt Spreader, with Screed; Auger Oiler; Boatman; Bobcat, skid steed (less than one (1) yard); Broom, self-propelled; Compressor Operator (any power) under 1,250 cu. ft. total capacity; Concrete Curing Machine (riding type); Concrete Saw; Conveyor Operator or Assistant; Crane, Tugger; Crusher Feederman; Crusher Oiler; Deckhand; Drill, Directional Locator; Fork Lift; Grade Checker; Guardrail Punch Oiler; Hydrographic Seeder Machine, straw, pulp or seed; Hydrostatic Pump Operator; Mixer Box (CTB, dry batch, etc.); Oiler; Plant Oiler; Pump (any power); Rail, Brakeman, Switchman, Motorman; Rail, Tamping Machine, mechanical, self-propelled; Rigger; Roller grading (not asphalt); Truck, Crane Oiler-Driver

----

IRON0014-005 07/01/2016

ADAMS, ASOTIN, BENTON, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT, LINCOLN, OKANOGAN, PEND ORIELLE, SPOKANE, STEVENS, WALLA WALLA AND WHITMAN COUNTIES

	Rates	Fringes
IRONWORKER......................	$ 32.89	24.56

IRON0029-002 07/01/2015

CLARK, COWLITZ, KLICKITAT, PACIFIC, SKAMANIA, AND WAHKAIKUM COUNTIES

	Rates	Fringes
IRONWORKER......................	$ 34.12	23.04

IRON0086-002 07/01/2016

YAKIMA, KITTITAS AND CHELAN COUNTIES

	Rates	Fringes
IRONWORKER......................	$ 32.89	24.56

IRON0086-004 07/01/2016

CLALLAM, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SKAGIT, SNOHOMISH, THURSTON, AND WHATCOM COUNTIES

	Rates	Fringes
IRONWORKER......................	$ 40.52	24.71

LABO0238-004 06/01/2017

PASCO AREA: ADAMS, BENTON, COLUMBIA,DOUGLAS (East of 120th Meridian), FERRY, FRANKLIN, GRANT, OKANOGAN, WALLA WALLA

SPOKANE AREA: ASOTIN, GARFIELD, LINCOLN, PEND OREILLE, SPOKANE, STEVENS & WHITMAN COUNTIES

	Rates	Fringes
LABORER (PASCO)		
GROUP 1	$ 24.66	11.30
GROUP 2	$ 26.76	11.30
GROUP 3	$ 27.03	11.30
GROUP 4	$ 27.30	11.30
GROUP 5	$ 27.58	11.30
LABORER (SPOKANE)		
GROUP 1	$ 24.66	11.30
GROUP 2	$ 26.76	11.30
GROUP 3	$ 27.03	11.30
GROUP 4	$ 27.30	11.30
GROUP 5	$ 27.58	11.30

Zone Differential (Add to Zone 1 rate): $2.00

BASE POINTS: Spokane, Pasco, Lewiston

Zone 1: 0-45 radius miles from the main post office.
Zone 2: 45 radius miles and over from the main post office.

LABORERS CLASSIFICATIONS

GROUP 1: Flagman; Landscape Laborer; Scaleman; Traffic Control Maintenance Laborer (to include erection and maintenance of barricades, signs and relief of flagperson); Window Washer/Cleaner (detail cleanup, such as, but not limited to cleaning floors, ceilings, walls, windows, etc. prior to final acceptance by the owner)

GROUP 2: Asbestos Abatement Worker; Brush Hog Feeder; Carpenter Tender; Cement Handler; Clean-up Laborer; Concrete Crewman (to include stripping of forms, hand operating jacks on slip form construction, application of concrete curing compounds, pumpcrete machine, signaling, handling the nozzle of squeezcrete or similar machine,6 inches and smaller); Confined Space Attendant; Concrete Signalman; Crusher Feeder; Demolition (to include clean-up, burning, loading, wrecking and salvage of all material); Dumpman; Fence Erector; Firewatch; Form Cleaning Machine Feeder, Stacker; General Laborer; Grout Machine Header Tender; Guard Rail (to include guard rails, guide and reference posts, sign posts, and right-of-way markers); Hazardous Waste Worker, Level D (no respirator is used and skin protection is minimal); Miner, Class "A" (to include all bull gang, concrete crewman, dumpman and pumpcrete crewman, including distributing pipe, assembly & dismantle, and nipper); Nipper; Riprap Man; Sandblast Tailhoseman; Scaffold Erector (wood or steel); Stake Jumper; Structural Mover (to include separating foundation, preparation, cribbing, shoring, jacking and unloading of structures); Tailhoseman (water nozzle); Timber Bucker and Faller (by hand); Track Laborer (RR); Truck Loader; Well-Point Man; All Other Work Classifications Not Specially Listed Shall Be Classified As General Laborer

GROUP 3: Asphalt Roller, walking; Cement Finisher Tender; Concrete Saw, walking; Demolition Torch; Dope Pot Firemen, non-mechanical; Driller Tender (when required to move and position machine); Form Setter, Paving; Grade Checker using level; Hazardous Waste Worker, Level C (uses a chemical "splash suit" and air purifying respirator); Jackhammer Operator; Miner, Class "B" (to include brakeman, finisher, vibrator, form setter); Nozzleman (to include squeeze and flo-crete nozzle); Nozzleman, water, air or steam; Pavement Breaker (under 90 lbs.); Pipelayer, corrugated metal culvert; Pipelayer, multi- plate; Pot Tender; Power Buggy Operator; Power Tool Operator, gas, electric, pneumatic; Railroad Equipment, power driven, except dual mobile power spiker or puller; Railroad Power Spiker or Puller, dual mobile; Rodder and Spreader; Tamper (to include operation of Barco, Essex and similar tampers); Trencher, Shawnee; Tugger Operator; Wagon Drills; Water Pipe Liner; Wheelbarrow (power driven)

GROUP 4: Air and Hydraulic Track Drill; Aspahlt Raker;Brush Machine (to include horizontal construction joint cleanup brush machine, power propelled); Caisson Worker, free air; Chain Saw Operator and Faller; Concrete Stack (to include laborers when laborers working on free standing concrete stacks for smoke or fume control above 40 feet high); Gunite (to include operation of machine and nozzle); Hazardous Waste Worker, Level B (uses same respirator protection as Level A. A supplied air line is provided in conjunction with a chemical "splash suit"); High Scaler; Laser Beam Operator (to include grade checker and elevation control); Miner, Class C (to include miner, nozzleman for concrete, laser beam operator and rigger on tunnels); Monitor Operator (air track or similar mounting); Mortar Mixer; Nozzleman (to include jet blasting nozzleman, over 1,200 lbs., jet blast machine power propelled, sandblast nozzle); Pavement Breaker (90 lbs. and over); Pipelayer (to include working topman, caulker, collarman, jointer, mortarman, rigger, jacker, shorer, valve or meter installer); Pipewrapper; Plasterer Tender; Vibrators (all)

GROUP 5 - Drills with Dual Masts; Hazardous Waste Worker, Level A (utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line); Miner Class "D", (to include raise and shaft miner, laser beam operator on riases and shafts)

LABO0238-006 06/01/2017

COUNTIES EAST OF THE 120TH MERIDIAN: ADAMS, ASOTIN, BENTON, CHELAN, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT, LINCOLN, OKANOGAN, PEND OREILLE, STEVENS, SPOKANE, WALLA WALLA, WHITMAN

	Rates	Fringes
Hod Carrier......................	$ 26.76	11.30

LABO0252-010 06/01/2017

CLALLAM, GRAYS HARBOR, JEFFERSON, KITSAP, LEWIS, MASON, PACIFIC (EXCLUDING SOUTHWEST), PIERCE, AND THURSTON COUNTIES

	Rates	Fringes
LABORER		
GROUP 1.....................	$ 24.85	10.99
GROUP 2.....................	$ 28.45	10.99
GROUP 3.....................	$ 35.54	10.99
GROUP 4.....................	$ 36.41	10.99
GROUP 5.....................	$ 36.99	10.99

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall
ZONE 3 - More than 45 radius miles from the respective city hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $1.00
ZONE 3 - $1.30

BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE, AND YAKIMA

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 radius miles from the respective city hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $2.25

LABORERS CLASSIFICATIONS

GROUP 1: Landscaping and Planting; Watchman; Window Washer/Cleaner (detail clean-up, such as but not limited to cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the owner)

GROUP 2: Batch Weighman; Crusher Feeder; Fence Laborer; Flagman; Pilot Car

GROUP 3: General Laborer; Air, Gas, or Electric Vibrating Screed; Asbestos Abatement Laborer; Ballast Regulator Machine; Brush Cutter; Brush Hog Feeder; Burner; Carpenter Tender; Cement Finisher Tender; Change House or Dry Shack; Chipping Gun (under 30 lbs.); Choker Setter; Chuck Tender; Clean-up Laborer; Concrete Form Stripper; Curing Laborer; Demolition (wrecking and moving including charred material); Ditch Digger; Dump Person; Fine Graders; Firewatch; Form Setter; Gabian Basket Builders; Grout Machine Tender; Grinders; Guardrail Erector; Hazardous Waste Worker (Level C: uses a chemical "splash suit" and air purifying respirator); Maintenance Person; Material Yard Person; Pot Tender; Rip Rap Person; Riggers; Scale Person; Sloper Sprayer; Signal Person; Stock Piler; Stake Hopper; Toolroom Man (at job site); Topper-Tailer; Track Laborer; Truck Spotter; Vinyl Seamer

GROUP 4: Cement Dumper-Paving; Chipping Gun (over 30 lbs.); Clary Power Spreader; Concrete Dumper/Chute Operator; Concrete Saw Operator; Drill Operator (hydraulic, diamond, aiartrac); Faller and Bucker Chain Saw; Grade Checker and Transit Person; Groutmen (pressure) including post tension beams; Hazardous Waste Worker (Level B: uses same respirator protection as Level A. A supplied air line is provided in conjunction with a chemical "splash suit"); High Scaler; Jackhammer; Laserbeam Operator; Manhole Builder-Mudman; Nozzleman (concrete pump, green cutter when using combination of high pressure air and water on concrete and rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster); Pavement Breaker; Pipe Layer and Caulker; Pipe Pot Tender; Pipe Reliner (not insert type); Pipe Wrapper; Power Jacks; Railroad Spike Puller-Power; Raker-Asphalt; Rivet Buster; Rodder; Sloper (over 20 ft); Spreader (concrete); Tamper and Similar electric, air and glas operated tool; Timber Person-sewer (lagger shorer and cribber); Track Liner Power; Tugger Operator; Vibrator; Well Point Laborer

GROUP 5: Caisson Worker; Miner; Mortarman and Hodcarrier; Powderman; Re-Timberman; Hazardous Waste Worker (Level A: utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line).

LABO0292-008 06/01/2017

ISLAND, SAN JUAN, SKAGIT, SNOHOMISH, AND WHATCOM COUNTIES

	Rates	Fringes
LABORER		
GROUP 1	$ 24.85	10.99
GROUP 2	$ 28.45	10.99
GROUP 3	$ 35.54	10.99
GROUP 4	$ 36.41	10.99
GROUP 5	$ 36.99	10.99

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall
ZONE 3 - More than 45 radius miles from the respective city hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $1.00
ZONE 3 - $1.30

BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE, AND YAKIMA

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 radius miles from the respective city hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $2.25

LABORERS CLASSIFICATIONS

GROUP 1: Landscaping and Planting; Watchman; Window Washer/Cleaner (detail clean-up, such as but not limited to cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the owner)

GROUP 2: Batch Weighman; Crusher Feeder; Fence Laborer; Flagman; Pilot Car

GROUP 3: General Laborer; Air, Gas, or Electric Vibrating Screed; Asbestos Abatement Laborer; Ballast Regulator Machine; Brush Cutter; Brush Hog Feeder; Burner; Carpenter Tender; Cement Finisher Tender; Change House or Dry Shack; Chipping Gun (under 30 lbs.); Choker Setter; Chuck Tender; Clean-up Laborer; Concrete Form Stripper; Curing Laborer; Demolition (wrecking and moving including charred material); Ditch Digger; Dump Person; Fine Graders; Firewatch; Form Setter; Gabian Basket Builders; Grout Machine Tender; Grinders; Guardrail Erector; Hazardous Waste Worker (Level C: uses a chemical "splash suit" and air purifying respirator); Maintenance Person; Material Yard Person; Pot Tender; Rip Rap Person; Riggers; Scale Person; Sloper Sprayer; Signal Person; Stock Piler; Stake Hopper; Toolroom Man (at job site); Topper-Tailer; Track Laborer; Truck Spotter; Vinyl Seamer

GROUP 4: Cement Dumper-Paving; Chipping Gun (over 30 lbs.); Clary Power Spreader; Concrete Dumper/Chute Operator; Concrete Saw Operator; Drill Operator (hydraulic, diamond, aiartrac); Faller and Bucker Chain Saw; Grade Checker and Transit Person; Groutmen (pressure) including post tension beams; Hazardous Waste Worker (Level B: uses same respirator protection as Level A. A supplied air line is provided in conjunction with a chemical "splash suit"); High Scaler; Jackhammer; Laserbeam Operator; Manhole Builder-Mudman; Nozzleman (concrete pump, green cutter when using combination of high pressure air and water on concrete and rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster); Pavement Breaker; Pipe Layer and Caulker; Pipe Pot Tender; Pipe Reliner (not insert type); Pipe Wrapper; Power Jacks; Railroad Spike Puller-Power; Raker-Asphalt; Rivet Buster; Rodder; Sloper (over 20 ft); Spreader (concrete); Tamper and Similar electric, air and glas operated tool; Timber Person-sewer (lagger shorer and cribber); Track Liner Power; Tugger Operator; Vibrator; Well Point Laborer

GROUP 5: Caisson Worker; Miner; Mortarman and Hodcarrier; Powderman; Re-Timberman; Hazardous Waste Worker (Level A: utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line).

LABO0335-001 06/01/2017

CLARK, COWLITZ, KLICKITAT, PACIFIC (SOUTH OF A STRAIGHT LINE MADE BY EXTENDING THE NORTH BOUNDARY LINE OF WAHKIAKUM COUNTY WEST TO THE PACIFIC OCEAN), SKAMANIA AND WAHKIAKUM COUNTIES

	Rates	Fringes
Laborers:		
ZONE 1:		
GROUP 1	$ 31.36	10.89
GROUP 2	$ 32.01	10.89
GROUP 3	$ 32.49	10.89
GROUP 4	$ 32.90	10.89
GROUP 5	$ 28.68	10.89
GROUP 6	$ 26.07	10.89
GROUP 7	$ 22.62	10.89

Zone Differential (Add to Zone 1 rates):
Zone 2 $ 0.65
Zone 3 - 1.15
Zone 4 - 1.70
Zone 5 - 2.75

BASE POINTS: GOLDENDALE, LONGVIEW, AND VANCOUVER

ZONE 1: Projects within 30 miles of the respective city all.
ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.
ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.
ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.
ZONE 5: More than 80 miles from the respective city hall.

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Plant Laborers; Asphalt Spreaders; Batch Weighman; Broomers; Brush Burners and Cutters; Car and Truck Loaders; Carpenter Tender; Change-House Man or Dry Shack Man; Choker Setter; Clean-up Laborers; Curing, Concrete; Demolition, Wrecking and Moving Laborers; Dumpers, road oiling crew; Dumpmen (for grading crew); Elevator Feeders; Median Rail Reference Post, Guide Post, Right of Way Marker; Fine Graders; Fire Watch; Form Strippers (not swinging stages); General Laborers; Hazardous Waste Worker; Leverman or Aggregate Spreader (Flaherty and similar types); Loading Spotters; Material Yard Man (including electrical); Pittsburgh Chipper Operator or Similar Types; Railroad Track Laborers; Ribbon Setters (including steel forms); Rip Rap Man (hand placed); Road Pump Tender; Sewer Labor; Signalman; Skipman; Slopers; Spraymen; Stake Chaser; Stockpiler; Tie Back Shoring; Timber Faller and Bucker (hand labor); Toolroom Man (at job site); Tunnel Bullgang (above ground); Weight-Man- Crusher (aggregate when used)

GROUP 2: Applicator (including pot power tender for same), applying protective material by hand or nozzle on utility lines or storage tanks on project; Brush Cutters (power saw); Burners; Choker Splicer; Clary Power Spreader and similar types; Clean- up Nozzleman-Green Cutter (concrete, rock, etc.); Concrete Power Buggyman; Concrete Laborer; Crusher Feeder; Demolition and Wrecking Charred Materials; Gunite Nozzleman Tender; Gunite or Sand Blasting Pot Tender; Handlers or Mixers of all Materials of an irritating nature (including cement and lime); Tool Operators (includes but not limited to: Dry Pack Machine; Jackhammer; Chipping Guns; Paving Breakers); Pipe Doping and Wrapping; Post Hole Digger, air, gas or electric; Vibrating Screed; Tampers; Sand Blasting (Wet); Stake-Setter; Tunnel-Muckers, Brakemen, Concrete Crew, Bullgang (underground)

GROUP 3: Asbestos Removal; Bit Grinder; Drill Doctor; Drill Operators, air tracks, cat drills, wagon drills, rubber-mounted drills, and other similar types including at crusher plants; Gunite Nozzleman; High Scalers, Strippers and Drillers (covers work in swinging stages, chairs or belts, under extreme conditions unusual to normal drilling, blasting, barring-down, or sloping and stripping); Manhole Builder; Powdermen; Concrete Saw Operator; Pwdermen; Power Saw Operators (Bucking and Falling); Pumpcrete Nozzlemen; Sand Blasting (Dry); Sewer Timberman; Track Liners, Anchor Machines, Ballast Regulators, Multiple Tampers, Power Jacks, Tugger Operator; Tunnel-Chuck Tenders, Nippers and Timbermen; Vibrator; Water Blaster

GROUP 4: Asphalt Raker; Concrete Saw Operator (walls); Concrete Nozzelman; Grade Checker; Pipelayer; Laser Beam (pipelaying)-applicable when employee assigned to move, set up, align; Laser Beam; Tunnel Miners; Motorman-Dinky Locomotive-Tunnel; Powderman-Tunnel; Shield Operator-Tunnel

GROUP 5: Traffic Flaggers

GROUP 6: Fence Builders

GROUP 7: Landscaping or Planting Laborers

LABO0335-019 09/01/2013

	Rates	Fringes
Hod Carrier......................	$ 30.47	10.05

LABO0348-003 06/01/2017

CHELAN, DOUGLAS (W OF 12TH MERIDIAN), KITTITAS, AND YAKIMA COUNTIES

	Rates	Fringes
LABORER		
GROUP 1	$ 21.21	10.99
GROUP 2	$ 24.31	10.99
GROUP 3	$ 26.60	10.99
GROUP 4	$ 27.24	10.99
GROUP 5	$ 27.70	10.99

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall
ZONE 3 - More than 45 radius miles from the respective city hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $1.00
ZONE 3 - $1.30

BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE, AND YAKIMA

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 radius miles from the respective city hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $2.25

LABORERS CLASSIFICATIONS

GROUP 1: Landscaping and Planting; Watchman; Window Washer/Cleaner (detail clean-up, such as but not limited to cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the owner)

GROUP 2: Batch Weighman; Crusher Feeder; Fence Laborer; Flagman; Pilot Car

GROUP 3: General Laborer; Air, Gas, or Electric Vibrating Screed; Asbestos Abatement Laborer; Ballast Regulator Machine; Brush Cutter; Brush Hog Feeder; Burner; Carpenter Tender; Cement Finisher Tender; Change House or Dry Shack; Chipping Gun (under 30 lbs.); Choker Setter; Chuck Tender; Clean-up Laborer; Concrete Form Stripper; Curing Laborer; Demolition (wrecking and moving including charred material); Ditch Digger; Dump Person; Fine Graders; Firewatch; Form Setter; Gabian Basket Builders; Grout

Machine Tender; Grinders; Guardrail Erector; Hazardous Waste Worker (Level C: uses a chemical "splash suit" and air purifying respirator); Maintenance Person; Material Yard Person; Pot Tender; Rip Rap Person; Riggers; Scale Person; Sloper Sprayer; Signal Person; Stock Piler; Stake Hopper; Toolroom Man (at job site); Topper-Tailer; Track Laborer; Truck Spotter; Vinyl Seamer

GROUP 4: Cement Dumper-Paving; Chipping Gun (over 30 lbs.); Clary Power Spreader; Concrete Dumper/Chute Operator; Concrete Saw Operator; Drill Operator (hydraulic, diamond, aiartrac); Faller and Bucker Chain Saw; Grade Checker and Transit Person; Groutmen (pressure) including post tension beams; Hazardous Waste Worker (Level B: uses same respirator protection as Level A. A supplied air line is provided in conjunction with a chemical "splash suit"); High Scaler; Jackhammer; Laserbeam Operator; Manhole Builder-Mudman; Nozzleman (concrete pump, green cutter when using combination of high pressure air and water on concrete and rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster); Pavement Breaker; Pipe Layer and Caulker; Pipe Pot Tender; Pipe Reliner (not insert type); Pipe Wrapper; Power Jacks; Railroad Spike Puller-Power; Raker-Asphalt; Rivet Buster; Rodder; Sloper (over 20 ft); Spreader (concrete); Tamper and Similar electric, air and glas operated tool; Timber Person-sewer (lagger shorer and cribber); Track Liner Power; Tugger Operator; Vibrator; Well Point Laborer

GROUP 5: Caisson Worker; Miner; Mortarman and Hodcarrier; Powderman; Re-Timberman; Hazardous Waste Worker (Level A: utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line).

LABO0440-001 06/01/2017

KING COUNTY

	Rates	Fringes
LABORER		
GROUP 1	$ 24.85	10.99
GROUP 2	$ 28.45	10.99
GROUP 3	$ 35.54	10.99
GROUP 4	$ 36.41	10.99
GROUP 5	$ 36.99	10.99

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall
ZONE 3 - More than 45 radius miles from the respective city hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $1.00
ZONE 3 - $1.30

BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE, AND YAKIMA

ZONE 1 - Projects within 25 radius miles of the respective city hall
ZONE 2 - More than 25 radius miles from the respective city hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - $2.25

LABORERS CLASSIFICATIONS

GROUP 1: Landscaping and Planting; Watchman; Window Washer/Cleaner (detail clean-up, such as but not limited to cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the owner)

GROUP 2: Batch Weighman; Crusher Feeder; Fence Laborer; Flagman; Pilot Car

GROUP 3: General Laborer; Air, Gas, or Electric Vibrating Screed; Asbestos Abatement Laborer; Ballast Regulator Machine; Brush Cutter; Brush Hog Feeder; Burner; Carpenter Tender; Cement Finisher Tender; Change House or Dry Shack; Chipping Gun (under 30 lbs.); Choker Setter; Chuck Tender; Clean-up Laborer; Concrete Form Stripper; Curing Laborer; Demolition (wrecking and moving including charred material); Ditch Digger; Dump Person; Fine Graders; Firewatch; Form Setter; Gabian Basket Builders; Grout

Machine Tender; Grinders; Guardrail Erector; Hazardous Waste Worker (Level C: uses a chemical "splash suit" and air purifying respirator); Maintenance Person; Material Yard Person; Pot Tender; Rip Rap Person; Riggers; Scale Person; Sloper Sprayer; Signal Person; Stock Piler; Stake Hopper; Toolroom Man (at job site); Topper-Tailer; Track Laborer; Truck Spotter; Vinyl Seamer

GROUP 4: Cement Dumper-Paving; Chipping Gun (over 30 lbs.); Clary Power Spreader; Concrete Dumper/Chute Operator; Concrete Saw Operator; Drill Operator (hydraulic, diamond, aiartrac); Faller and Bucker Chain Saw; Grade Checker and Transit Person; Groutmen (pressure) including post tension beams; Hazardous Waste Worker (Level B: uses same respirator protection as Level A. A supplied air line is provided in conjunction with a chemical "splash suit"); High Scaler; Jackhammer; Laserbeam Operator; Manhole Builder-Mudman; Nozzleman (concrete pump, green cutter when using combination of high pressure air and water on concrete and rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster); Pavement Breaker; Pipe Layer and Caulker; Pipe Pot Tender; Pipe Reliner (not insert type); Pipe Wrapper; Power Jacks; Railroad Spike Puller-Power; Raker-Asphalt; Rivet Buster; Rodder; Sloper (over 20 ft); Spreader (concrete); Tamper and Similar electric, air and glas operated tool; Timber Person-sewer (lagger shorer and cribber); Track Liner Power; Tugger Operator; Vibrator; Well Point Laborer

GROUP 5: Caisson Worker; Miner; Mortarman and Hodcarrier; Powderman; Re-Timberman; Hazardous Waste Worker (Level A: utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line).

PAIN0005-002 07/01/2017

STATEWIDE EXCEPT CLARK, COWLITZ, KLICKITAT, PACIFIC (SOUTH), SKAMANIA, AND WAHKIAKUM COUNTIES

	Rates	Fringes
Painters:		
STRIPERS....................	$ 29.50	15.43

PAIN0005-004 03/01/2009

CLALLAM, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SAN JUAN, SKAGIT, SNOHOMISH, THURSTON AND WHATCOM COUNTIES

	Rates	Fringes
PAINTER..........................	$ 20.82	7.44

```
 PAIN0005-006 08/01/2016

ADAMS, ASOTIN; BENTON AND FRANKLIN (EXCEPT HANFORD SITE);
CHELAN, COLUMBIA, DOUGLAS, FERRY, GARFIELD, GRANT, KITTITAS,
LINCOLN, OKANOGAN, PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA,
WHITMAN AND YAKIMA COUNTIES


                                  Rates          Fringes

PAINTER
     Application of Cold Tar
     Products, Epoxies, Polyure
     thanes, Acids, Radiation
     Resistant Material, Water
     and Sandblasting............$ 29.10           11.04
      Over 30'/Swing Stage Work..$ 22.20            7.98
     Brush, Roller, Striping,
     Steam-cleaning and Spray....$ 24.00           11.04
     Lead Abatement, Asbestos
     Abatement...................$ 21.50            7.98

  *$.70 shall be paid over and above the basic wage rates
  listed for work on swing stages and high work of over 30
  feet.

----------------------------------------------------------------
 PAIN0055-003 07/01/2017

CLARK, COWLITZ, KLICKITAT, PACIFIC, SKAMANIA, AND WAHKIAKUM
COUNTIES


                                  Rates          Fringes

PAINTER
     Brush & Roller..............$ 23.02           11.02
     High work - All work 60
     ft. or higher...............$ 23.77           11.02
     Spray and Sandblasting......$ 23.02           11.02
----------------------------------------------------------------
 PAIN0055-006 07/01/2017

CLARK, COWLITZ, KLICKITAT, SKAMANIA and WAHKIAKUM COUNTIES

                                  Rates          Fringes

Painters:
     HIGHWAY & PARKING LOT
     STRIPER.....................$ 34.87           11.46
----------------------------------------------------------------
```

PLAS0072-004 07/01/2016

ADAMS, ASOTIN, BENTON, CHELAN, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT, KITTITAS, LINCOLN, OKANOGAN, PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA, WHITMAN, AND YAKIMA COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER		
ZONE 1	$ 27.13	13.67

Zone Differential (Add to Zone 1 rate): Zone 2 - $2.00

BASE POINTS: Spokane, Pasco, Lewiston; Wenatchee
Zone 1: 0 - 45 radius miles from the main post office
Zone 2: Over 45 radius miles from the main post office

PLAS0528-001 06/01/2017

CLALLAM, COWLITZ, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC, PIERCE, SAN JUAN, SKAGIT, SNOHOMISH, THURSTON, WAHKIAKUM AND WHATCOM COUNTIES

	Rates	Fringes
CEMENT MASON		
CEMENT MASON	$ 40.52	16.54
COMPOSITION, TROWEL MACHINE, GRINDER, POWER TOOLS, GUNNITE NOZZLE	$ 41.02	16.54
TROWLING MACHINE OPERATOR ON COMPOSITION	$ 41.02	16.54

PLAS0555-002 06/01/2017

CLARK, KLICKITAT AND SKAMANIA COUNTIES

ZONE 1:

	Rates	Fringes
CEMENT MASON		
CEMENT MASONS DOING BOTH COMPOSITION/POWER MACHINERY AND SUSPENDED/HANGING SCAFFOLD	$ 32.87	17.62
CEMENT MASONS ON SUSPENDED, SWINGING AND/OR HANGING SCAFFOLD	$ 32.87	17.62
CEMENT MASONS	$ 31.50	17.62
COMPOSITION WORKERS AND POWER MACHINERY OPERATORS	$ 32.19	17.62

Zone Differential (Add To Zone 1 Rates):
Zone 2 - $0.65
Zone 3 - 1.15
Zone 4 - 1.70
Zone 5 - 3.00

BASE POINTS: BEND, CORVALLIS, EUGENE, MEDFORD, PORTLAND, SALEM, THE DALLES, VANCOUVER

ZONE 1: Projects within 30 miles of the respective city hall
ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.
ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.
ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.
ZONE 5: More than 80 miles from the respective city hall

TEAM0037-002 06/01/2017

CLARK, COWLITZ, KLICKITAT, PACIFIC (South of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean), SKAMANIA, AND WAHKIAKUM COUNTIES

	Rates	Fringes
Truck drivers:		
ZONE 1		
GROUP 1	$ 27.94	14.37
GROUP 2	$ 28.06	14.37
GROUP 3	$ 28.19	14.37
GROUP 4	$ 28.46	14.37
GROUP 5	$ 28.68	14.37
GROUP 6	$ 28.85	14.37
GROUP 7	$ 29.05	14.37

Zone Differential (Add to Zone 1 Rates):
Zone 2 - $0.65
Zone 3 - 1.15
Zone 4 - 1.70
Zone 5 - 2.75

BASE POINTS: ASTORIA, THE DALLES, LONGVIEW AND VANCOUVER

ZONE 1: Projects within 30 miles of the respective city hall.
ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.
ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.
ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.
ZONE 5: More than 80 miles from the respective city hall.

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: A Frame or Hydra lifrt truck w/load bearing surface; Articulated Dump Truck; Battery Rebuilders; Bus or Manhaul Driver; Concrete Buggies (power operated); Concrete Pump Truck; Dump Trucks, side, end and bottom dumps, including Semi Trucks and Trains or combinations there of: up to and including 10 cu. yds.; Lift Jitneys, Fork Lifts (all sizes in loading, unloading and transporting material on job site); Loader and/or Leverman on Concrete Dry Batch Plant (manually operated); Pilot Car; Pickup Truck; Solo Flat Bed and misc. Body Trucks, 0-10 tons; Truck Tender; Truck Mechanic Tender; Water Wagons (rated capacity) up to 3,000 gallons; Transit Mix and Wet or Dry Mix - 5 cu. yds. and under; Lubrication Man, Fuel Truck Driver, Tireman, Wash Rack, Steam Cleaner or combinations; Team Driver; Slurry Truck Driver or Leverman; Tireman

GROUP 2: Boom Truck/Hydra-lift or Retracting Crane; Challenger; Dumpsters or similar equipment all sizes; Dump Trucks/Articulated Dumps 6 cu to 10 cu.; Flaherty Spreader Driver or Leverman; Lowbed Equipment, Flat Bed Semi-trailer or doubles transporting equipment or wet or dry materials; Lumber Carrier, Driver-Straddle Carrier (used in loading, unloading and transporting of materials on job site); Oil Distributor Driver or Leverman; Transit mix and wet or dry mix trcuks: over 5 cu. yds. and including 7 cu. yds.; Vacuum Trucks; Water truck/Wagons (rated capacity) over 3,000 to 5,000 gallons

GROUP 3: Ammonia Nitrate Distributor Driver; Dump trucks, side, end and bottom dumps, including Semi Trucks and Trains or combinations thereof: over 10 cu. yds. and including 30 cu. yds. includes Articulated Dump Trucks; Self-Propelled Street Sweeper; Transit mix and wet or dry mix truck: over 7 cu yds. and including 11 cu yds.; Truck Mechanic-Welder-Body Repairman; Utility and Clean-up Truck; Water Wagons (rated capacity) over 5,000 to 10,000 gallons

GROUP 4: Asphalt Burner; Dump Trucks, side, end and bottom cumps, including Semi-Trucks and Trains or combinations thereof: over 30 cu. yds. and including 50 cu. yds. includes Articulated Dump Trucks; Fire Guard; Transit Mix and Wet or Dry Mix Trucks, over 11 cu. yds. and including 15 cu. yds.; Water Wagon (rated capacity) over 10,000 gallons to 15,000 gallons

GROUP 5: Composite Crewman; Dump Trucks, side, end and bottom dumps, including Semi Trucks and Trains or combinations thereof: over 50 cu. yds. and including 60 cu. yds. includes Articulated Dump Trucks

GROUP 6: Bulk Cement Spreader w/o Auger; Dry Pre-Batch concrete Mix Trucks; Dump trucks, side, end and bottom dumps, including Semi Trucks and Trains of combinations thereof: over 60 cu. yds. and including 80 cu. yds., and includes Articulated Dump Trucks; Skid Truck

GROUP 7: Dump Trucks, side, end and bottom dumps, including Semi Trucks and Trains or combinations thereof: over 80 cu. yds. and including 100 cu. yds., includes Articulated Dump Trucks; Industrial Lift Truck (mechanical tailgate)

----

* TEAM0174-001 01/01/2017

CLALLAM, GRAYS HARBOR, ISLAND, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean), PIERCE, SAN JUAN, SKAGIT, SNOHOMISH, THURSTON AND WHATCOM COUNTIES

	Rates	Fringes
Truck drivers:		
ZONE A:		
GROUP 1:..................	$ 34.13	18.57
GROUP 2:..................	$ 33.29	18.57
GROUP 3:..................	$ 30.48	18.57
GROUP 4:..................	$ 25.51	18.57
GROUP 5:..................	$ 33.68	18.57

ZONE B (25-45 miles from center of listed cities*): Add $.70 per hour to Zone A rates.
ZONE C (over 45 miles from centr of listed cities*): Add $1.00 per hour to Zone A rates.

*Zone pay will be calculated from the city center of the following listed cities:

BELLINGHAM	CENTRALIA	RAYMOND	OLYMPIA
EVERETT	SHELTON	ANACORTES	BELLEVUE
SEATTLE	PORT ANGELES	MT. VERNON	KENT
TACOMA	PORT TOWNSEND	ABERDEEN	BREMERTON

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 - "A-frame or Hydralift" trucks and Boom trucks or similar equipment when "A" frame or "Hydralift" and Boom truck or similar equipment is used; Buggymobile; Bulk Cement Tanker; Dumpsters and similar equipment, Tournorockers, Tournowagon, Tournotrailer, Cat DW series, Terra Cobra, Le Tourneau, Westinghouse, Athye Wagon, Euclid Two and Four-Wheeled power tractor with trailer and similar top-loaded equipment transporting material: Dump Trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with 16 yards to 30 yards capacity: Over 30 yards $.15 per hour additional for each 10 yard increment; Explosive Truck (field mix) and similar equipment; Hyster Operators (handling bulk loose aggregates); Lowbed and Heavy Duty Trailer; Road Oil Distributor Driver; Spreader, Flaherty Transit mix used exclusively in heavy construction; Water Wagon and Tank Truck-3,000 gallons and over capacity

GROUP 2 - Bulllifts, or similar equipment used in loading or unloading trucks, transporting materials on job site; Dumpsters, and similar equipment, Tournorockers, Tournowagon, Turnotrailer, Cat. D.W. Series, Terra Cobra, Le Tourneau, Westinghouse, Athye wagon, Euclid two and four-wheeled power tractor with trailer and similar top-loaded equipment transporting material: Dump trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with less than 16 yards capacity; Flatbed (Dual Rear Axle); Grease Truck, Fuel Truck, Greaser, Battery Service Man and/or Tire Service Man; Leverman and loader at bunkers and batch plants; Oil tank transport; Scissor truck; Slurry Truck; Sno-Go and similar equipment; Swampers; Straddler Carrier (Ross, Hyster) and similar equipment; Team Driver; Tractor (small, rubber-tired)(when used within Teamster jurisdiction); Vacuum truck; Water Wagon and Tank trucks-less than 3,000 gallons capacity; Winch Truck; Wrecker, Tow truck and similar equipment

GROUP 3 - Flatbed (single rear axle); Pickup Sweeper; Pickup Truck. (Adjust Group 3 upward by $2.00 per hour for onsite work only)

GROUP 4 - Escort or Pilot Car

GROUP 5 - Mechanic

HAZMAT PROJECTS

Anyone working on a HAZMAT job, where HAZMAT certification is required, shall be compensated as a premium, in addition to the classification working in as follows:
LEVEL C: +$.25 per hour - This level uses an air purifying respirator or additional protective clothing.
LEVEL B: +$.50 per hour - Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "splash suit."
LEVEL A: +$.75 per hour - This level utilizes a fully-encapsulated suit with a self-contained breathing apparatus or a supplied air line.

TEAM0690-004 06/01/2017

ADAMS, ASOTIN, BENTON, CHELAN, COLUMBIA, DOUGLAS, FERRY, FRANKLIN, GARFIELD, GRANT KITTITAS, LINCOLN, OKANOGAN, PEND OREILLE, SPOKANE, STEVENS, WALLA WALLA, WHITMAN AND YAKIMA COUNTIES

	Rates	Fringes
Truck drivers: (AREA 1: SPOKANE ZONE CENTER: Adams, Chelan, Douglas, Ferry, Grant, Kittitas, Lincoln, Okanogan, Pen Oreille, Spokane, Stevens, and Whitman Counties AREA 1: LEWISTON ZONE CENTER: Asotin, Columbia, and Garfield Counties AREA 2: PASCO ZONE CENTER: Benton, Franklin, Walla Walla and Yakima Counties)		
AREA 1:		
GROUP 1	$ 21.82	17.30
GROUP 2	$ 24.09	17.30
GROUP 3	$ 24.59	17.30
GROUP 4	$ 24.92	17.30
GROUP 5	$ 25.03	17.30
GROUP 6	$ 25.20	17.30
GROUP 7	$ 25.73	17.30
GROUP 8	$ 26.09	17.30
AREA 2:		
GROUP 1	$ 23.96	17.30
GROUP 2	$ 26.20	17.30
GROUP 3	$ 26.71	17.30
GROUP 4	$ 27.04	17.30
GROUP 5	$ 27.15	17.30
GROUP 6	$ 27.15	17.30
GROUP 7	$ 28.05	17.30
GROUP 8	$ 28.01	17.30

Zone Differential (Add to Zone 1 rate: Zone 1 + $2.00)

BASE POINTS: Spokane, Pasco, Lewiston
Zone 1: 0-45 radius miles from the main post office.
Zone 2: Outside 45 radius miles from the main post office

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Escort Driver or Pilot Car; Employee Haul; Power Boat Hauling Employees or Material

GROUP 2: Fish Truck; Flat Bed Truck; Fork Lift (3000 lbs. and under); Leverperson (loading trucks at bunkers); Trailer Mounted Hydro Seeder and Mulcher; Seeder & Mulcher; Stationary Fuel Operator; Tractor (small, rubber-tired, pulling trailer or similar equipment)

GROUP 3: Auto Crane (2000 lbs. capacity); Buggy Mobile & Similar; Bulk Cement Tanks & Spreader; Dumptor (6 yds. & under); Flat Bed Truck with Hydraullic System; Fork Lift (3001-16,000 lbs.); Fuel Truck Driver, Steamcleaner & Washer; Power Operated Sweeper; Rubber-tired Tunnel Jumbo; Scissors Truck; Slurry Truck Driver; Straddle Carrier (Ross, Hyster, & similar); Tireperson; Transit Mixers & Truck Hauling Concrete (3 yd. to & including 6 yds.); Trucks, side, end, bottom & articulated end dump (3 yards to and including 6 yds.); Warehouseperson (to include shipping & receiving); Wrecker & Tow Truck

GROUP 4: A-Frame; Burner, Cutter, & Welder; Service Greaser; Trucks, side, end, bottom & articulated end dump (over 6 yards to and including 12 yds.); Truck Mounted Hydro Seeder; Warehouseperson; Water Tank truck (0-8,000 gallons)

GROUP 5: Dumptor (over 6 yds.); Lowboy (50 tons & under); Self- loading Roll Off; Semi-Truck & Trailer; Tractor with Steer Trailer; Transit Mixers and Trucks Hauling Concrete (over 6 yds. to and including 10 yds.); Trucks, side, end, bottom and end dump (over 12 yds. to & including 20 yds.); Truck-Mounted Crane (with load bearing surface either mounted or pulled, up to 14 ton); Vacuum Truck (super sucker, guzzler, etc.)

GROUP 6: Flaherty Spreader Box Driver; Flowboys; Fork Lift (over 16,000 lbs.); Dumps (Semi-end); Mechanic (Field); Semi- end Dumps; Transfer Truck & Trailer; Transit Mixers & Trucks Hauling Concrete (over 10 yds. to & including 20 yds.); Trucks, side, end, bottom and articulated end dump (over 20 yds. to & including 40 yds.); Truck and Pup; Tournarocker, DWs & similar with 2 or more 4 wheel-power tractor with trailer, gallonage or yardage scale, whichever is greater Water Tank Truck (8,001- 14,000 gallons); Lowboy(over 50 tons)

GROUP 7: Oil Distributor Driver; Stringer Truck (cable oeprated trailer); Transit Mixers & Trucks Hauling Concrete (over 20 yds.); Truck, side, end, bottom end dump (over 40 yds. to & including 100 yds.); Truck Mounted Crane (with load bearing surface either mounted or pulled (16 through 25 tons);

GROUP 8: Prime Movers and Stinger Truck; Trucks, side, end, bottom and articulated end dump (over 100 yds.); Helicopter Pilot Hauling Employees or Materials

Footnote A - Anyone working on a HAZMAT job, where HAZMAT certification is required, shall be compensated as a premium, in additon to the classification working in as follows:

LEVEL C-D: - $.50 PER HOUR (This is the lowest level of protection. This level may use an air purifying respirator or additional protective clothing.

LEVEL A-B: - $1.00 PER HOUR (Uses supplied air is conjunction with a chemical spash suit or fully encapsulated suit with a self-contained breathing apparatus.

Employees shall be paid Hazmat pay in increments of four(4) and eight(8) hours.

NOTE:
Trucks Pulling Equipment Trailers: shall receive $.15/hour over applicable truck rate

----

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==

END OF GENERAL DECISION

APPENDIX B

PERMITS

CITY OF Marysville WASHINGTON

MARYSVILLE POLICE DEPARTMENT

Richard L. Smith, Chief of Police

February 14, 2017

Debbie Bray
8802 27th Avenue NE
Tulalip, WA 98271

Re: I-5 / 116th Street NE Interchange Improvements – Phase IV (SPUI)

Ms. Bray:

The Community Development Department has reviewed your request for an exemption from strict application of the maximum noise allowances outlined in Marysville Municipal Code (MMC) Chapter 6.76. Based on your scope of work, it is anticipated that approximately 15-months of noise exemption is needed in order to perform work within the 116th Street NE/I-5 interchange from May 2017 – July 2018. Work proposed to the interchange includes the following:
Re-configure the diamond interchange into a Single-Point Urban Interchange (SPUI) layout with one signal. The realigned off-ramps will include additional left and right turning lanes to provide adequate storage lengths for traffic queues. Additional improvements include: retaining walls and noise walls, storm water detention facilities, illumination and other safety improvements.

Pursuant to WAC 173-60-050(4)(f), sounds created by equipment and work necessary for health safety and welfare of the community is exempt from all provisions of WAC 173-60-040 *Maximum permissible environmental noise levels,* adopted by reference in MMC 6.76.040. The Community Development Department has determined that due to heavy traffic on I-5 during daytime hours, the proposed evening work in order to construct the SPUI is exempt from strict application of the maximum permissible noise levels outlined in WAC 173-60-040, and is necessary to protect the health safety and welfare of the community, subject to the following conditions:

1. All vehicles shall be equipped with ambient sensitive backup warning devices. The Contractor may use back-up observers in lieu of back-up warning devices for all equipment except dump trucks in compliance with WAC Chapter 296-155-610 and 296-155-615. The Contractor shall use back-up observers and back-up warning devices for dump trucks in compliance with WAC Chapter 296-155-610.

2. All trucks performing export haul shall have well maintained bed liners as inspected and approved by the Engineer.

3. Truck tailgate banging is prohibited. All truck tailgates shall be secured to prevent excessive noise from banging.

4. The Contractor shall mail Nighttime Work Notifications to residents within 500 feet if applicable.

5. A copy of each noise / exemption shall be kept on the project site at all times.

If you have any questions regarding the noise level exemption approval, please contact me at 360.363.8380 or by e-mail kdavis@marysvillewa.gov.

Sincerely,

Sergeant Kawika Davis
Marysville Police Department – Community Services Unit

cc: Richard Smith, Police Chief
Mark Thomas, Commander
Jeff Laycock, PE, City Engineer
Dave Koenig, CD Director
Chris Holland, Planning Manager
Doug VanGelder, PE, Engineering Services Manager

APPENDIX C

GEOTECHNICAL REPORTS

GEOTECHNICAL REPORT
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Prepared for:

Parametrix

Project No. 10-069
November 2011

PanGEO
INCORPORATED

Geotechnical & Earthquake
Engineering Consultants

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES (follows text)

LIST OF FIGURES (continued)

November 30, 2011
Project No. 10-069

GEOTECHNICAL REPORT
I-5 116TH STREET NE
INTERCHANGE IMPROVEMENTS
THE TULALIP TRIBES
SNOHOMISH COUNTY, WASHINGTON

PROJECT DESCRIPTION

The Tulalip Tribe plans to replace the existing full diamond interchange at the I-5 undercrossing of 116th Street NE with a single-point urban interchange (SPUI) for improved traffic movements and to relieve congestion. The project includes a new bridge, retaining walls, stormwater management facilities, minor structures such a noise walls, luminaires, signs and new roadway construction including surfacing.

SITE DESCRIPTION

The existing interchange is located in the west central portion of Snohomish County, north of the city of Marysville. The alignment location is shown on Figure 1, Vicinity Map and Figures 2 through 4, Site and Exploration Plans.

The project site lies in a broad, relative level valley between two ridges that are elongated in the north-south direction. The project site is at an elevation of roughly 80 feet above sea level, while the ridges rise up as high as 400 feet. The topography immediately surrounding the project site is relatively level, with generally little relief except that associated with streams, drainages and the existing embankments built as part of the original interchange construction.

FIELD EXPLORATIONS

The subsurface exploration program consisted of a site reconnaissance and several subsurface exploration programs. The shallow borings for the infiltration ponds and other facilities (THT-01-10 to THT-19-10, and THT-23-10) were performed using hollow-stem auger drilling equipment. The drill used was a limited access, rubber tracked drill provided by Geologic Drill of Spokane, Washington. The deep borings for the new interchange bridge foundations (THT-20-10 and THT-22-10) were accomplished using mud rotary drilling equipment. The drill was a tire mounted, Mobil B-61 drill provided by Holocene Drilling of Edgewood, Washington. An additional boring for the central bridge pier (THT-21-10) was performed in the I-5 median by WSDOT crews using State-owned equipment. One additional boring for an alternative pond site (THT-23-10) was drilled using a trailer-mounted hollow stem auger drill provided by Geologic Drill. Finally, three test pits (TP-1 to TP-3) were excavated for proposed CAVFS and a relocated infiltration pond. The test pits were excavated with a rubber-tracked mini-excavator owned and operated by Northwest Excavating & Trucking Co., Inc. Most of the field explorations were accomplished between June 28 and July 28, 2010, with THT-23-10 drilled on October 26, 2010, and the test pits excavated on September 8, 2011.

The soils encountered in the test borings were generally sampled using conventional standard penetration test (SPT) split-spoon samplers. A standard sampling interval of 5 feet was used for most of the borings, except those intended for stormwater infiltration facility design. The borings for stormwater infiltration facility design (THT-06-10, THT-08-10 through THT-12-10, THT-14-10 and THT-23-10) were continuously sampled starting at the anticipated bottom depth for the individual facility, to the maximum depth of the boring. The continuous sampling was generally accomplished using a 24-inch split-spoon sampler. A representative of either PanGEO or WSDOT was on site during all drilling operations to supervise drilling, select sample intervals and log the test borings.

The locations of subsurface explorations are indicated on Figures 2 through 4, Site and Exploration Plans.

Appendix A contains summary logs of test borings and test pits completed during PanGEO's scope of work and describes the field exploration methodology in greater detail.

LABORATORY TESTING

Laboratory testing of soil materials included determination of moisture content, plasticity, grain size distribution, cation exchange capacity, pH, resistivity, chlorides, and sulfates. Testing was in accordance with appropriate ASTM, AASHTO and/or EPA standards. The test results and a discussion of laboratory test methodology are presented in Appendix B. Where appropriate, test results are displayed on the summary boring and test pit logs, Appendix A.

PREVIOUS GEOTECHNICAL STUDIES

A Phase 2 geotechnical study was completed by Shannon & Wilson, Inc., and is described in their report dated December 7, 2007. Copies of the borings logs are included in Appendix C, Logs of Test Borings from Previous Geotechnical Studies. The locations of these previous explorations are also indicated on Figures 2 through 4, Site and Exploration Plan.

Other previous existing information was also available from WSDOT records. This subsurface information was used to supplement recent data in support of foundation design recommendations for the bridge foundations. The logs of these previous explorations are also included in Appendix C.

REGIONAL GEOLOGY

The project site is located in the north central portion of the Western Washington Puget Lowland, an area that was occupied by the Puget Lobe of the Vashon ice sheet during the most recent ice advance. The topography was formed by the advance and retreat of the Puget Lobe ice, which carved a characteristic series of elongated, generally north-south oriented ridges with intervening valleys. The valleys became marine embayments, such as Puget Sound, and/or were filled with sediment during de-glaciation and later times. The Marysville valley appears to have been filled with outwash sediment as the glaciers retreated, leaving an expansive, relatively flat-floored valley.

The area was mapped at a 1:24,000 scale by Minard (1985). He maps the entire area around the 116th Street NE interchange as underlain by the Marysville Sand Member of a unit of recessional outwash. Minard (1985) describes the Marysville Sand as consisting of sand with a little gravel and some interbeds of silt and/or clay. Minard (1985) also mapped a Clay Member for the recessional materials, which has limited surface outcrop to the east of Marysville. The recessional materials are underlain by Vashon till, which also underlies the ridges to the east and west of the project area.

SUBSURFACE CONDITIONS

SOILS

The soil borings drilled as part of the field exploration program encountered relatively consistent soil conditions throughout the project area. The predominant soil found was fine to medium grained recessional outwash. This material was found to the maximum depth drilled, approximately 150 feet. Fill material for the existing overpass approaches and the access ramps appears to have been borrowed locally, and consists of silty fine sand. At depth the borings encountered interbeds of elastic silt to lean clay within the recessional outwash sands. The soil units found at the project site are as follows:

Fill. Fill material was identified in only a few borings, specifically in THT-05-10 and THT-20-10. In THT-05-10 the fill material consisted of loose, brown, silty sand with scattered organics. This boring was located on the in the southeast portion of the interchange, and penetrated roughly 5½ feet of road fill before entering native material. THT-20-10 encountered up to 9 feet of medium dense, brown and gray, fine to coarse sand above 1.2 foot thick bed of organic sand, which was interpreted as a topsoil layer. WSDOT boring H-5-67 and H-4-67 also reported fill materials at surface. The boring was roughly in the area of a former stream bed, which may have been filled to allow road construction for I-5.

Younger Alluvium (Qyal). In THT-20-10, the topsoil layer is underlain by up to 19 feet of very loose, brown, fine to medium sand with silt. Similar very loose material was observed in WSDOT borings H-5-67 and H-4-67, though the unit was included in the fill layer described above. The soil contains woody debris throughout, and is laminated to finely bedded. Based on the organic content, the soil structure and composition, this unit is interpreted as a recent alluvial deposit that was buried during construction of the I-5 corridor.

Recessional Outwash – Marysville Sand Member (Qvrm). The recessional outwash consists mainly of interbeds of silty, fine sand to fine to medium sand, with occasional fine to coarse sand beds. The material in generally poorly graded, and is mostly medium dense, though the soil can be loose or dense in some layers. Some layers also contain traces of fine gravel. Soil color ranges from brown to gray at depth, with rusty mottling places. Occasional fine scattered organics were observed in the soil.

Recessional Outwash – Clay Member (Qyal). Several deep borings encountered interbeds of fine grained material, including THT-20-10, THT-21-10, THT-22-10, H-5-67 and H-4-67. The shallowest such interbed was encountered in THT-20-10 at a depth of 45 feet below ground surface. In THT-21-10, the shallowest fine grained bed was found at 125 feet below surface, while the shallowest bed was at about 51 feet in THT-22-10. The fine grained beds consist of gray, lean silty clay to elastic silt material, generally non-plastic to low plastic, with rapid dilatancy. Beds range from less than 4 feet thick up to over 14 feet thick. The deposit is usually stiff, but varies in consistency from soft to very stiff.

A subsurface profile along the centerline of 116th Street NE is included as Figure 5. Subsurface profiles along the major retaining wall elements of the NE-Line, WN-Line, ES-Line, SW-Line and the Southwest Pond Wall are included as Figures 6 through 10, respectively.

GROUND WATER

Free water was encountered in all the test borings. In additional, piezometers were installed in several of the previous borings. PanGEO monitored the existing piezometers, but installed no new groundwater monitoring wells. Table 1 summarizes the groundwater measurements made in the existing piezometers.

Table 1
Summary of Groundwater Measurements

Date of Reading	Well Designation (1)					
	GW-1-03 SE Quad		GW-2-03 NE Quad		GW-3-03 NW Quad	
	Depth (ft) (3)	Elev. (ft) (2)	Depth (ft)	Elev. (ft)	Depth (ft)	Elev. (ft)
Feb. 17, 2005	10.4	54.3	16.0	56.6	13.5	55.0
Mar. 16, 2005	10.6	54.0	16.3	56.3	13.7	54.8
Apr. 8, 2005	10.3	54.4	16.1	56.6	13.3	55.1
May. 18, 2005	9.8	54.9	15.4	57.2	13.1	55.4
Jul. 25, 2005	10.7	54.0	16.4	56.2	13.9	54.5
Sep. 9, 2005	11.5	53.2	17.3	55.3	14.6	53.8
Oct. 21, 2005	12.0	52.6	18.0	54.6	15.1	53.3
Nov. 30, 2005	12.0	52.7	18.0	54.6	14.9	53.6
Dec. 15, 2005	11.7	52.9	17.8	54.8	14.7	53.7
June 10, 2010	9.6	55.1	15.3	57.3	13.5	55.1
June 29, 2010	9.4	55.3	15.1	57.5	13.7	54.9
July 14, 2010	9.5	55.2	15.1	57.5	13.6	55.0
July 27, 2010	10.1	54.6	15.6	57.0	14.2	54.4
Oct. 26, 2010	11.3	53.4	17.0	55.6	15.2	53.4
May 3, 2011	7.5	57.2	12.6	60.0	11.9	56.7
May. 17, 2011	7.1	57.6	12.4	60.2	11.4	57.0

Notes:
1. Well designations taken for Shannon & Wilson Report (December 7, 2007).

2. Surveyed monument elevations 64.65 ft., 72.60 ft., and 68.64 ft. for GW-1-03, GW-2-03 and GW-3-03, respectively.
3. Measurements taken from the top of the PVC Standpipes.

SEISMIC CONSIDERATIONS

SITE SEISMICITY

The project site is located on the uplands between the Snohomish River and the Stillaguamish River deltas. This area is seismically active as the South Whidbey Island fault zone is located less than 15 miles to the south (Johnson and others, 1996, Blakely and others, 2004). Studies suggest that the Snohomish River delta has been affected by at least two and as many as five seismic events since roughly 800 AD (Bourgeois and Johnson, 2001). Evidence has been found for some three instances of liquefaction and one instance of rapid subsidence in the delta (Bourgeois and Johnson, 2001). Seismic activity on this fault is generally attributed to the intraplate seismicity within the Juan de Fuca plate. It is similar in nature to the notable Puget Lowland earthquakes, including the April 13, 1949 Olympia earthquake (Richter magnitude 7.1), the April 29, 1965 Seattle earthquake (Richter magnitude 6.5) and the February 28, 2001 Nisqually earthquake (Richter magnitude 6.8).

SEISMIC DESIGN PARAMETERS

For seismic design, an acceleration coefficient of 0.35g is recommended per the current acceleration map in AASHTO (2010). The recommended acceleration coefficient is based on expected ground motion at the project site that has a 7 percent probability of exceedance in a 75-year period for non-critical structures.

Design response spectra presented in AASHTO (2010) are considered appropriate for seismic design of the bridge. A horizontal response spectral acceleration coefficient at a period of 0.2 seconds (S_S) is 0.78 and the horizontal response spectral acceleration coefficient at a period of 1.0 seconds (S_1) is 0.27.

The soils at the site are considered Site Class D, with associated site factors F_{pga}, F_a and F_v of 1.15, 1.19 and 1.86, respectively. The site is in Seismic Performance Zone 3, bordering on Zone 4.

LIQUEFACTION POTENTIAL

The liquefaction potential of the soils at the interchange site was evaluated using the procedure originally developed by Seed and modified in the 1996 and 1998 NCEER/NSF workshops (Youd et al., 2001). The liquefaction analyses were conducted using a Magnitude 7.5 event with PGA = 0.35g, which is consistent with the WSDOT Geotechnical Design Manual (GDM, 2010a) design criteria. Settlement estimates were made using the procedures of Tokimatsu and Seed (1987) or Ishihara and Yoshimine (1992) as recommended in the GDM (2010a).

Our analysis indicated there is high potential for liquefaction during the design earthquake at all three piers of the proposed new bridge. Factors of safety against liquefaction are plotted versus depth on Figure 11 for the borings drilled at the new abutment and pier locations. Liquefaction is expected to occur between depths of 15 to 30 feet below the ground surface at the western abutment in the Younger Alluvium deposits. Between 40 and 75 feet below the ground surface widespread liquefaction is expected to occur at all substructure locations. Although factors of safety less than 1.0 may be computed below a depth of 75 feet, the maximum considered depth of liquefaction is limited to this depth in accordance with the GDM (2010a).

Liquefaction induced settlement is estimated to be on order of 10 to 12 inches at the interior pier and east abutment, while up to 20 inches of settlement could occur at the west abutment. The recommended p-y curve data have been adjusted to account for this liquefaction potential for these piers (see p-y data tables, below). Downdrag loads on deep foundations should be considered due to liquefaction-induced settlement. Estimates of downdrag forces are provided below.

CONCLUSIONS AND RECOMMENDATIONS

STORMWATER MANAGEMENT CONSIDERATIONS

This section describes the geotechnical conditions affecting the feasibility of the proposed stormwater management locations. This section addresses the issues affecting the potential suitability of the sites for quantity treatment of the storm water runoff. The two main geotechnical issues affecting the suitability of sites for storm water facilities are the rate at which the site soils allow infiltration, and the depth to the water table or a confining low permeability layer. The results of our assessment are summarized in Table 2a (on page 9 through 11).

Infiltration Rates Based on ASTM Gradation Tests

Five infiltration facilities were originally planned for the project. Infiltration ponds are planned in the southeast, northeast and northwest quadrants of the interchange. In addition two potential infiltration swales were planned, one along the west side I-5 in the southwest quadrant of the interchange and one along the west side of 34th Avenue NE. Lastly, CAVFS are planned along the east side of the I-5 northbound lanes, and the west side of the I-5 southbound lanes, north of the interchange.

The subsurface soil conditions in the proposed pond area in the northwest quadrant were originally explored with borings THT-9-10, THT-10-10 and THT-11-10, with supplemental information provided by existing borings B-10-07, B-11-07 and GW-3-03 (Appendix C). Because the pond may be relocated to the northwest, test pit TP-1 was excavated to the northwest of the originally proposed pond location to obtain additional site specific subsurface information. The soil conditions beneath the pond in the northeast quadrant were explored with boring THT-14-10, with supplemental information provided by existing boring GW-2-03 (Appendix C). The soil conditions beneath the pond in the southeast quadrant were explored with boring THT-06-10, with supplemental information provided by existing boring GW-1-03 (Appendix C). The drainage swales were tested with borings THT-08-10, along I-5, and THT-23-10, along 34th Avenue NE. Lastly, TP-2 and TP-3 were excavated for the CAVFS north of the interchange, with additional information provided by borings THT-13-10, THT-17-10 and THT-18-10. To provide soil samples to test the infiltration capabilities of the soils, borings THT-06-10, THT-08-10, THT-09-10, THT-10-10, THT-11-10, THT-14-10 and THT-23-10 were continuously sampled from the approximate proposed depth of the facility to the total depth of exploration in each boring.

To evaluate the potential long-term (design) infiltration rates, we tested selected soil samples from the test borings and test pits for gradation. The samples were selected to provide data from critical depths within the pond areas. For THT-06-10 the samples tested were from 18 to 26 feet below present surface. For THT-09-10 the samples were selected from 16 to 24 feet below surface. In THT-10-10 and THT-11-10, the samples were selected from 10 to 16 feet and 10 to 18 feet below surface, respectively. One sample, from 4 feet, was tested for THT-08-10. Three samples between 1 and 10 feet were selected from THT-13-10, and four samples, from 14 to 22 feet were selected from THT-14-10. In test borings THT-17-10 and THT-18-10, two samples were tested from 1 to 5 feet below existing grade. Four samples, from 2 to 8 feet and 11 to 12½ feet, were tested from THT-23-10. Lastly, grab samples from the test pits were collected for testing at depths between 1 and 9½ feet below the ground surface. All samples were selected to best represent conditions at the planned bottom of the stormwater facilities.

The Highway Runoff Manual (HRM, WSDOT, 2008) allows for infiltration rates to be estimated based on ASTM gradation testing (page 4-63). The rates are estimated based on the D_{10} values (i.e., the particle diameter at which 10 percent, by weight, of the sample is smaller), using ASTM Test Method D422. Infiltration rates were estimated for the selected sampling and testing intervals, based on the HRM methodology. For samples that had more than 10% fines (i.e., particle sizes smaller than the U.S. Standard No. 200 sieve), no D_{10} values were calculated; however, the D_{10} value for sample from 24 feet in THT-06-10 was obtained using hydrometer testing equipment to extend the gradation curve. Using the results of the hydrometer as a control, other D_{10} values could be estimated by projecting the gradation curves to the D_{10} gridline. Table 2a summarizes the D_{10} values available and the associated estimated infiltration rates.

Most of the D_{10} values from the stormwater borings lie within a range from 0.05 to 0.1, with occasional values lying above or below this range. Based on the infiltration values from Table 4.8 of the HRM, we anticipate that the estimated long-term (design) infiltration rates will be between 0.8 to 2.0 in/hr for most of the strata within the project area. The infiltration rates from the WSDOT HRM are considered conservative for the purpose of determining the size of infiltration facilities.

SSC-4 Depth to Bedrock, Water Table, or Impermeable Layer

The Highway Runoff Manual (WSDOT, 2008) defines one of the nine Site Suitability Criteria (SSC's) as *Depth to bedrock, water table or impermeable layer* (SSC-4). The Manual specifies that the base (bottom elevation) of infiltration basins or trenches shall be at least 5 feet above the seasonal high water mark or limiting aquitard unit. The bottom of pond elevations may need to be adjusted based on this criterion, especially with regard to the higher groundwater elevations measured in May of 2011.

Mitigation measures for SSC-4 may include construction of berms around the pond or trench area and raising the facility bottom grade sufficiently to provide the required separation of 5 feet.

Dewatering Considerations

Based on the groundwater level measurements in the piezometers installed at the pond sites, excavations for pond construction are not likely to extend below the static water table. Dewatering is therefore not expected in order to construct the ponds.

SSC-7 – Soil Physical and Chemical Suitability for Treatment

The Highway Runoff Manual (WSDOT, 2008) defines one of the nine Site Suitability Criteria (SSC's) as *Soil Physical and Chemical Suitability for Treatment* (SSC-7). The Manual specifies that the cation exchange capacity (CEC) of treatment soils must be considered when determining if the soil can adequately remove the target pollutants. As such, CEC tests were performed on soil samples collected from the proposed infiltration facility areas. Table 2b on page 12 summarizes the results of the CEC tests.

Table 2a
Summary of Stormwater Infiltration Feasibility

Facility	Exploration Number	Depth (in feet)	Station	Offset	D_{10} value	Long-term Infiltration rate (in/hr)(4)	Water Table Below Facility(5)	Grading Mitigation Measures Needed to Meet SSC-4
SE Quadrant Pond	THT-06-10	18	221+10	310' RT	0.166	2.0	5'–10'	Berms
		20			~0.05 (1)	0.8	5'–10'	
		22			0.146	2.0	5'-10'	
		24			0.036 (2)	n/a	5'-10'	
NE Quadrant Pond	THT-14-10	14	225+05	260' RT	0.108	2.0	<5'	Berms, Raise Bottom Grade
		16			0.088	0.8	<5'	Berms, Raise Bottom Grade
		18			0.156	2.0	<5'	
		20			0.077	0.8	<5'	Berms
Original NW Quadrant Pond	THT-09-10	16	223+93	312' LT	0.227	3.5	5'–10'	Berms
		18			0.095	2.0	5'–10'	
		20			0.089	1.5	5'–10'	
		22			0.090	1.7	5'–10'	
	THT-10-10	10	224+76	250' LT	~0.02 (1)	n/a	<5'	Berms, Raise Bottom Grade
		12			0.079	0.8	<5'	
		14			~0.06 (1)	0.8	<5'	
	THT-11-10	10	226+05	200' LT	~0.07 (1)	0.8	<5'	Berms, Raise Bottom Grade
		12			0.077	0.8	<5'	
		14			~0.01 (1)	n/a	<5'	
		16			~0.06 (1)	0.8	<5'	

Table 2a (continued)
Summary of Stormwater Infiltration Feasibility

Facility	Borehole Number	Depth (in feet)	Station	Offset	D_{10} value	Long-term Infiltration rate (in/hr) (4)	Water Table Below Facility(5)	Grading Mitigation Measures Needed to Meet SSC-4
NW Quadrant Pond	TP-1	2.5	226+90	240’ LT	~0.06 (1)	0.8	>5’	None
		9.5			0.101	2.0	>5’	
NE CAVFS	TP-2	1	232+60	100’ RT	0.262	3.5	>5’	None
		4.0			0.162	2.0	>5’	
	THT-17-10	0	235+30	103’RT	0.081	1.5	>5’	None
		5			~0.06 (1)	0.8	>5’	
	THT-18-10	1	239+71	108’RT	0.08	1.5	>5’	None
		5			0.169	2.0	>5’	
NW CAVFS	THT-13-10	1	232+62	102’LT	~0.06 (1)	0.8	>5’	None
		5			0.087	1.5	>5’	
		10			0.164	2.0	>5’	
	TP-3	1	235+45	105’ LT	0.362	8.0	>5’	None
		4			0.278	5.0	>5’	
I-5 Swale	THT-08-10	4	218+28	90’ LT	~0.5 (1)	0.8	<5’	Berms
34th Ave NE Swale	THT-23-10	1.5			~0.5 (1)	0.8	>10’	None
		3.5			0.167	2.0		
		5.5			0.255	3.5		
		11.0			0.103	2.0		

Table 2a Notes:

(1) More than 10 percent fines; D_{10} estimated.
(2) More than 10 percent fines; D_{10} value obtained from hydrometer results.
(3) No groundwater data available.
(4) These are “design” infiltration rates based on ASTM D422 gradation D_{10} value, per 2008 WSDOT Highway Runoff Manual
(5) Depth in feet below.

Table 2b Cation Exchange Capacity

Facility	Exploration Number	Depth (in feet)	Station	Offset	Cation Exchange Capacity (meq/100g)
SE Quadrant Pond	THT-06-10(1)	18	221+10	310' RT	2.49
		20			2.92
		22			2.45
		24			2.80
NE Quadrant Pond	THT-14-10(1)	14	225+05	260’ RT	1.10
		16			1.24
		18			1.02
		20			1.85
Original NW Quadrant Pond	THT-09-10(1)	16	223+93	312’ LT	1.26
		18			2.11
		20			2.74
		22			3.69
	THT-10-10(1)	10	224+76	250’ LT	3.14
		12			2.05
		14			27.76
	THT-11-10(1)	10	226+05	200’ LT	22.65
		12			3.24
		14			4.66
		16			2.69
	B-10-07(2)	6.5	224+45	190’ LT	3.4
		8			9.1
	B-11-07(2)	6.5	223+90	220’ LT	1.6
		11.5			2.7
NW Quadrant Pond	TP-1(1)	2.5	226+90	240’ LT	1.74
		9.5			1.57
NE CAVFS	TP-2(1)	1	232+60	100’ RT	1.01
	THT-18-10(1)	1	239+71	108’ RT	2.48
NW CAVFS	THT-13-10(1)	1	232+62	102’LT	2.21
		5			0.92
	TP-3(1)	1	235+45	105’ LT	0.95

(1) Chemistry parameters were determined by Analytical Resources, Inc, of Tukwila, WA.
(2) Chemistry parameters were determined by Am Test Laboratories of Redmond, WA, as part of a previous study.

ROADWAY EMBANKMENTS AND RETAINING STRUCTURES

New embankments should be constructed with slopes no steeper 2:1V for slope stability considerations. New embankment material should conform to the specification requirements for Select or Gravel Borrow (Section 9-03.14, WSDOT Standard Specifications, 2010b). Embankments should be constructed in accordance with the requirements of Section 2-03 of the Standard Specifications (2010b).

Current project plans call for 9 new retaining structures, all of which are fill applications. The 4 largest walls retain the approach fills on all four ramps of the SPUI that face mainline I-5. These walls have maximum exposed heights ranging up to 32 feet. A wall up to 20 feet in exposed height is also planned for retaining fill between the northbound off-ramp and the SE stormwater pond. The remaining 4 walls retain relatively minor fill heights up to 12 feet along various segments of the on and off ramps. Structural earth walls (SEW) are generally recommended on the basis of relative cost and tolerance for modest settlements. Structural earth walls (SEW) should be constructed in accordance with Section 6-13 of the Standard Specifications (WSDOT, 2010b), with the following information included in the general special provisions.

Global Stability of Retaining Walls

Overall stability analysis for the walls was assessed using limit equilibrium methods with the computer program XSTABL™. The critical wall section for the stability analyses was established based on wall height and subsurface soil and groundwater conditions. The seismic stability was analyzed using pseudo-static procedures, where the effect of earthquake ground shaking is represented by the use of a "seismic coefficient" in the stability calculations. One-half of the design peak ground acceleration was used for the seismic coefficient in our pseudo-static stability analysis. Soil strength parameters were assigned based on soil and groundwater conditions in the test borings. Based on our analyses, minimum static and seismic factors of safety for the critical wall section were found to be above 1.35 and 1.1, respectively.
A compound stability analysis is also conducted for the static condition assuming the failure plane goes through the bottom 20 to 30% of the reinforcement. The factor of safety for the compound stability analysis is found to be 1.35.

An exception to the above general conclusions for global stability of retaining walls is the NE Line wall as it approaches the bridge. As discussed under Seismic Considerations, above, there is liquefaction potential in a zone from about 15 to 30 feet below the ground surface in this area. Post-liquefaction, residual strength analysis of global stability indicates that under these conditions the factor of safety was found to be between 1.0 and 1.1. Considering the post-liquefaction settlement potential and the marginal post-liquefaction stability, ground improvement in this area is recommended, regardless of whether ground improvement is used at the other bridge substructure locations. Ground improvement recommendations are provided below, under Bridge Foundations.

NE Line SEW Retaining Wall Design Recommendations

The retaining wall supporting the NE Line will be constructed over very loose recent alluvium and is therefore expected to experience larger settlements than the other walls for the project. A separate special provision is therefore recommended for this wall.

The following criteria should be met to provide overall stability of the NE Line SEW wall:

1. The wall may be constructed near vertical, without a specified batter.
2. The wall should be placed on a level foundation in the horizontal direction perpendicular to the wall face.
3. The base width of the wall should not be less than 70 percent of the wall height. Greater wall base widths may be needed to provide adequate internal stability.
4. The uppermost reinforcing layer should be placed no lower than 2 feet below the top of wall. Welded wire faced systems should include a top mat at the top of the wall.
5. Since the wall will be constructed above existing grades, there is limited potential for water to reach or build up in the reinforced zone. Special drainage elements are therefore not required.

Table 3 lists design parameters that should also be included in the special provision for a pre-approved, proprietary SEW wall for the NE Line ramp.

Table 3
Design Parameters for Pre-approved, Proprietary SEW Wall for the NE Line Wall

Soil Properties	Wall Backfill[1]	Retained Soil	Foundation Soil	
Unit Weight (pcf)	125	125	120	
Friction Angle (deg)	38	32	34	
Cohesion (psf)	0	0	0	
			AASHTO Service Limit State	**AASHTO Strength & Extreme Limit State**
Nominal Bearing Resistance (psf)			4,000	6,000
Service Limit State Settlement (per 100′ of wall length)			3 inches	n/a
Horizontal Acceleration Coefficient, (k_h, g)			n/a	0.20
Vertical Acceleration Coefficient, (k_v, g)			n/a	0

Notes: [1] – Wall backfill should be good quality, free-draining, granular material such as Gravel Backfill for Walls (WSDOT, 2010b).

General SEW Retaining Wall Design Recommendations

The following criteria should be met to provide overall stability of the remaining proposed SEW walls:

1. The walls may be constructed near vertical, without a specified batter.
2. The walls should be placed on a level foundation in the horizontal direction perpendicular to the wall face.
3. The base width of the walls should not be less than 70 percent of the wall height. Greater wall base widths may be needed to provide adequate internal stability.
4. The uppermost reinforcing layer should be placed no lower than 2 feet below the top of walls. Welded wire faced systems should include a top mat at the top of the walls.
5. Since the walls will be constructed above existing grades, there is limited potential for water to reach or build up in the reinforced zone. Special drainage elements are therefore not required.

Table 4 lists design parameters that should also be included in the special provision for pre-approved, proprietary SEW walls.

Table 4
General Design Parameters for Pre-approved, Proprietary SEW Walls

Soil Properties	Wall Backfill[1]	Retained Soil	Foundation Soil	
Unit Weight (pcf)	125	125	120	
Friction Angle (deg)	38	32	36	
Cohesion (psf)	0	0	0	
			AASHTO Service Limit State	**AASHTO Strength & Extreme Limit State**
Nominal Bearing Resistance (psf)			4,000	6,000
Service Limit State Settlement (per 100′ of wall length)			2 inches	n/a
Horizontal Acceleration Coefficient, (k_h, g)			n/a	0.20
Vertical Acceleration Coefficient, (k_v, g)			n/a	0

Notes: [1] – Wall backfill should be good quality, free-draining, granular material such as Gravel Backfill for Walls (WSDOT, 2010b).

BRIDGE FOUNDATIONS

Lateral Earth Pressures on Abutment Walls

The new abutment walls should be designed for the lateral earth pressures provided in Table 5. For walls that are free to translate or rotate (i.e., flexible walls), active earth pressures shall be used in the retained soil. Flexible walls are defined as being able to displace laterally at least 0.001H, where H is the height of the wall. Non-yielding walls should use at-rest earth pressure parameters.

The seismic earth pressure is computed according to the Mononobe-Okabe method described in the LRFD Bridge Design Specifications (AASHTO, 2010). The walls are assumed free to move and to develop the active earth pressure conditions during a seismic event. The seismic earth pressure is a total pressure including the active static earth pressure, and is in a uniform distribution, applied at 0.5H from the bottom of the pressure distribution.

Table 5
Abutment Wall Lateral Earth Pressures

Active (Equivalent Fluid Pressure)	31 pcf
At-Rest (Equivalent Fluid Pressure)	50 pcf
Seismic (Total Pressure, Uniform Distribution)	22 H

The recommended lateral pressures in Table 5 assume that the walls will be backfilled with a free-draining material, such as Gravel Backfill for Walls (WSDOT, 2010b) or equivalent. All backfill should be placed and compacted in accordance with Method C (Article 2-03.3(14)C, WSDOT, 2010b).

Surcharge loads, where present behind a wall, should be included in the design of the abutment walls. For uniform surcharge loads, earth pressure coefficients of 0.24 and 0.39 may be used to compute the lateral pressures on the wall face resulting from uniform vertical surcharge loads for the active and at-rest conditions, respectively. Earth pressures due to point, line, and strip loads should be computed according to Article 3.11.6 in the AASHTO LRFD Bridge Design Specifications (AASHTO, 2010).

Abutment wall drainage should be designed in accordance with Figure 7.5.10-1 of the Bridge Design Manual (WSDOT, 2010a).

Foundation Alternatives

Due to the presence of liquefiable soils in the subsurface profile beneath the bridge site, structure support should be either on deep foundations such as driven piles or drilled shafts, or on spread footings bearing on soils that have been densified by ground improvement such that the liquefaction hazard is mitigated.

Driven piles would be used in groups to support the abutments and piers for the proposed structure layout. Based on our experience, the downdrag forces that act on a group of deep foundations is considerably larger than those acting on discrete foundation elements. We therefore recommend drilled shafts over piles driven in groups for this application.

Drilled shafts with large diameters should be feasible at large enough center-to-center spacings to ignore the potential for group effects when considering axial resistance combined with downdrag forces (i.e., center-to-center spacing of 3D or more with one row of shafts per pier or abutment).

As an alternative to drilled shafts, the site conditions at this location should be amenable to use of shallow spread footings if the liquefaction potential is mitigated by ground improvement. Ground improvement recommendations are discussed separately, below.

Shaft Axial Resistance

Shaft axial compressive resistance is plotted versus shaft tip elevation for the nominal (ultimate), factored (strength), service and post-liquefaction nominal load cases on Figures 12 through 14 for 7-foot diameter shafts at Piers 1 to 3, respectively. Similar plots of axial resistance for 8- and 10-foot diameters shafts are provided on Figures 15 through 20. Note that the resistances were calculated for the nominal diameter of the smaller of the English (Imperial) and metric unit equivalent so that the resistance values provided are applicable regardless of the actual dimension of the equipment used to construct the shaft.

Downdrag

Downdrag loads are anticipated within upper 75 feet of the soil profile. Estimated downdrag loads are provided in Table 6. A load factor of 1.25 should be used for the downdrag force for design at the Strength and Extreme Limit States. At the Service Limit State, the load factor is 1.0.

Table 6
Estimated Post-liquefaction Downdrag Load

Pier Location	7-foot Diameter Shaft	8-foot Diameter Shaft	10-foot Diameter Shaft
Pier 1	1150 kips	1380 kips	1690 kips
Pier 2	1280 kips	1530 kips	1890 kips
Pier 3	1180 kips	1420 kips	1750 kips

Lateral Shaft Resistance

Recommended parameters for analysis of lateral shaft resistance using a soil-structure interaction analysis tool such as LPILE© or DFSAP are presented in Tables 7 to 9. Note that the soil layers are referenced to the general existing ground surface and do not take into consideration the depth of any foundation cap or depth to top of shaft below the existing ground surface. Also note that DFSAP should not be used for the liquefied case, but may be used for non-liquefied conditions.

Table 7 Recommended p-y Curve Parameters for Pier 1 (West Abutment)

Reference Elevation: +68 feet

				STATIC ANALYSIS						
Soil Layer	**Bottom of Layer Elevation**	**Soil Type**	**Soil Type (KSOIL)**	**Effective Unit Weight of Soil**		**Cohesion**		**Axial Strain ε50**	**Friction Angle ϕ**	**Modulus of Subgrade Reaction**
	ft			**pci**	**pcf**	**psi**	**psf**		**(deg)**	**pci**
1	+53	Sand	4	0.072	125	0.0	0		34	110
2	+38	Sand	4	0.031	53	0.0	0		28	5
3	+23	Sand	4	0.034	58	0.0	0		34	70
4	-7	Sand	4	0.036	63	0.0	0		35	80
5	-32	Sand	4	0.036	63	0.0	0		36	95
6	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

				POST-LIQUEFACTION ANALYSIS						
Soil Layer	**Bottom of Layer Depth**	**Soil Type**	**Soil Type (KSOIL)**	**Effective Unit Weight of Soil**		**Cohesion**		**Axial Strain ε50**	**Friction Angle ϕ**	**Modulus of Subgrade Reaction**
	ft			**pci**	**pcf**	**psi**	**psf**		**(deg)**	**pci**
1	+53	Sand	4	0.072	125	0.0	0		34	110
2	+38	liquefied	4	0.034	58	0.0	0		2	5
3	+23	part. liq.	4	0.036	63	0.0	0		10	10
4	-7	liquefied	4	0.034	58	0.0	0		2	5
5	-58	Sand	4	0.036	63	0.0	0		36	95
6	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

Table 8 Recommended p-y Curve Parameters for Pier 2 (I-5 Median)

Reference Elevation: +68 feet

STATIC ANALYSIS										
Soil Layer	Bottom of Layer Elevation	Soil Type	Soil Type (KSOIL)	Effective Unit Weight of Soil		Cohesion		Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction
	ft			pci	pcf	psi	psf		(deg)	pci
1	+53	Sand	4	0.072	125	0.0	0		35	135
2	+33	Sand	4	0.036	63	0.0	0		36	95
3	+23	Sand	4	0.034	58	0.0	0		34	70
4	-7	Sand	4	0.036	63	0.0	0		33	60
5	-57	Sand	4	0.036	63	0.0	0		36	95
6	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

POST-LIQUEFACTION ANALYSIS										
Soil Layer	Bottom of Layer Depth	Soil Type	Soil Type (KSOIL)	Effective Unit Weight of Soil		Cohesion		Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction
	ft			pci	pcf	psi	psf		(deg)	pci
1	+53	Sand	4	0.072	125	0.0	0		35	135
2	+23	part. liq.	4	0.036	63	0.0	0		10	10
3	-7	liquefied	4	0.034	58	0.0	0		2	5
4	-58	Sand	4	0.036	63	0.0	0		36	95
5	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

Table 9 Recommended p-y Curve Parameters for Pier 3 (East Abutment)

Reference Elevation: +68 feet

STATIC ANALYSIS										
Soil Layer	Bottom of Layer Elevation	Soil Type	Soil Type (KSOIL)	Effective Unit Weight of Soil		Cohesion		Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction
	ft			pci	pcf	psi	psf		(deg)	pci
1	+53	Sand	4	0.072	125	0.0	0		36	160
2	+23	Sand	4	0.036	63	0.0	0		35	80
3	-7	Sand	4	0.034	58	0.0	0		33	60
4	-58	Sand	4	0.036	63	0.0	0		36	95
5	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

POST-LIQUEFACTION ANALYSIS										
Soil Layer	Bottom of Layer Depth	Soil Type	Soil Type (KSOIL)	Effective Unit Weight of Soil		Cohesion		Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction
	ft			pci	pcf	psi	psf		(deg)	pci
1	+53	Sand	4	0.072	125	0.0	0		36	160
2	+23	part. liq.	4	0.036	63	0.0	0		10	10
3	-7	liquefied	4	0.034	58	0.0	0		2	5
4	-58	Sand	4	0.036	63	0.0	0		36	95
5	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

Ground Improvement

Soils under the bridge alignment are likely to liquefy during a design seismic event. Ground improvement by vibro-compaction (stone columns) may be used to mitigate the liquefaction potential and allow the use of abutment and pier support on shallow spread footings. As described above, ground improvement is also recommended below the NE Line wall.

The limits of ground improvement should provide for an area of treatment that is a minimum of 10 feet beyond the edges of spread footings or retaining walls based on the final configuration of the structures, and should extend to a minimum distance of 100 feet behind the Pier 1 (west) abutment. Plan limits of ground improvement should be established collaboratively with PanGEO as final plans are developed. Stone columns should extend to an elevation +40 feet at the Pier 1 (west) abutment.

The recommended ratios of stone column to untreated soil area (area replacement ratios) are provided in Table 10. Three different area replacement ratios are recommended to create a transition from the improved foundation conditions beneath spread footing foundations or the higher portions of the approach fills (denoted Pattern A) to lesser embankment or wall heights (Patterns B and C). This is to prevent abrupt differential settlements in the roadway surface and permanent wall supporting the approach fills. Note that the minimum Standard Penetration Test (SPT) resistance or Cone Penetrometer Test (CPT) tip resistance values recommended below as performance criteria in improvement area(s) ‘A’ need not be achieved in transitional improvement areas ‘B’ and ‘C’.

Stone columns should be installed using a method that minimizes the return of water and soil to the ground surface. Stone columns should be circular in cross-section and continuous. Stone columns should have a minimum diameter of 2 feet, be plumb, and of sufficient length to reach the minimum treatment elevations shown in the plans. The stone columns should meet the minimum requirements outlined in Table 10.

Table 10
Recommended Stone Column Minimum Requirements

			Minimum Area Replacement Ratio	
Pattern	**Minimum Diameter (ft)**	**Max. Center-to-Center Distance (ft)**	**Square Pattern**	**Equilateral Triangular Pattern**
A	2	10	0.18	0.20
B	2	12	0.09	0.10
C	2	12	0.05	0.06

The stone column diameters and spacings should be determined using the minimum area replacement ratios and the following equations:

$$R_s = 0.785(D/S)^2$$
$$R_t = 0.907(D/S)^2$$

Where: R_s = Area Replacement Ratio for a Square Pattern
R_t = Area Replacement Ratio for an Equilateral Triangular Pattern
D = Diameter of Stone Column
S = Spacing of Stone Column (center to center)

To ensure compaction of the stone column, the gravel should be vibrated. The Contractor should demonstrate that the installation procedures and methods meet the densification requirements by completing a test section and obtaining field SPT or CPT measurements of the completed installation. Production installation of stone columns should be subject to approval of the QCM and Engineer based on the performance of the test section installations.

Performance criteria presented in Table 11 should be met for acceptance of test section and production stone columns installed within improvement areas 'A'.

Table 11
Stone Column Performance Criteria

Depth Below Existing Ground Surface (feet)	Minimum Uncorrected SPT Blowcount[1]	Minimum CPT Tip Resistance[2] (tons per square foot)
15-30	20	125
30-75	26	170

Notes: [1] – Field measured blows per foot over the last 12 inches of an 18-inch drive using an Auto-trip Safety Hammer obtained in accordance with ASTM D-1586. Wireline or cathead operated hammers should not be used.
[2] – Minimum CPT tip resistance should be calculated as the average over any consecutive 5-foot penetration.

The contractor should provide the final stone column design.

Spread Footings Supported on Improved Ground

For improved ground conditions that meet the performance requirements described above, spread footings for structure support may be preliminarily proportioned using the bearing resistances provided in Table 12. The nominal bearing pressure for the service limit state is selected to limit the foundation settlement to be less than 1-inch based on an assumed footing width of about 15 to 20 feet. Final settlement estimates should be based on the actual spread footing dimensions when they are available. The minimum required footing embedment depth is 5 feet. Service Limit State total settlements are expected to occur rapidly, as loads are applied.

Table 12
Spread Footing Foundation Resistances

Load Case	Nominal Resistance	Resistance Factor	Total Settlement
Service	6,000 psf	1.0	1-inch
Strength	18,000 psf	0.45	Not limited
Extreme	18,000 psf	0.9	Not limited

Spread Footing Lateral Resistance

Resistance to lateral loads on the lid structure will be provided by a combination of passive lateral earth pressure of the footing backfill and base friction. Passive pressure acts over the embedded portion of the footing (neglecting the upper 2 feet), whereas base friction acts along the bottom of the footings. Assuming generally level ground conditions at the pier locations, the values in Table 13 may be used to compute lateral resistance. The recommended values are considered nominal values. Base friction can be combined with passive pressure to resist the loads. The base friction coefficients assume concrete cast directly against soil.

Table 13
Spread Footing Lateral Resistances

Load Case	Passive Pressure Resistance (Equivalent Unit Weight)	Base Friction Coefficient	Resistance Factor	
			Passive Pressure	Base Friction
Strength	500 pcf	0.6	0.5	0.8
Extreme	500 pcf	0.6	1.0	1.0

Recommended parameters for computing spring constants for foundations bearing on improved ground soil are shown in Table 14. The shear modulus may be linearly interpolated for intermediate strain values.

Table 14
Spread Footing Spring Constant Parameters

Strain	G (ksf)	ν
0.02%	3600	0.35
0.2%	1400	0.35

NOISE BARRIER FOUNDATIONS

New noise barrier construction is planned for the southeast quadrant of the interchange. Foundation conditions were explored with three test borings, THT-01-10, THT-02-10 and THT-03-10. Standard Plan (WSDOT, 2010c) noise barrier foundations may be used based on the soils encountered in these test borings. The plans should specify soil type D1 with an associated friction angle of 32 degrees. The spread footing option for noise barrier may also be used, as the allowable bearing capacity is calculated to be above the 2,000 pounds per square foot value used for the standard plan design. The ground conditions indicated by the borings are relatively consistent between the exploration points, therefore differential settlement is expected to be less than one-half the estimated total settlement of ¾-inch.

SIGNAL, ILLUMINATION AND MINOR STRUCTURE FOUNDATIONS

In general, the new interchange construction will establish new grades with compacted granular fill materials as described above under general roadway embankments. For these conditions, the foundation of minor structures such as signals and illumination may be sized using the WSDOT Standard Plans (WSDOT, 2010c) and an allowable lateral bearing pressure of 2,500 pounds per square foot. In addition, based on the results of the test borings at the site and our understanding of site conditions, the upper 10 feet of native soil generally consists of medium dense outwash. As such, we also recommend that signal and illumination foundations located outside the new fill areas within the native outwash soils may be sized using the WSDOT Standard Plans (WSDOT, 2010c) and an allowable lateral bearing pressure of 2,500 pounds per square foot. Should minor structure foundation locations not be consistent with the above design assumption, PanGEO should be contacted to review the specific minor structure foundation location.

PAVEMENT DESIGN

Based on information provided by Parametrix, we understand that the design traffic loading for the new ramps is 3.1 million ESAL (18-kip equivalent single axle load) for a design life of 40 years. According to the WSDOT Pavement Policy (2011), the design life of new pavements is typically 50 years. Assuming an annual traffic growth rate of 4%, we determined the ESAL for a 50-year design life to be about 4.6 million, which was used for pavement design. It may be noted that according to our design calculations, the difference between the 40-year and 50-year traffic loading only results in a difference of about 1½ inches of crushed surfacing base course.

Because the ramp pavement will be constructed on new, properly compacted granular fill, we estimate that a resilient modulus (M_R) of 15,000 pounds per square inch (psi) is appropriate for the subgrade soils. The pavement analysis was performed using the AASHTO Guide for Design of Pavement Structures (1993) and the WSDOT Pavement Policy (2011) pavement design methodology and the following parameters:

Pavement Design life	50 years
Design Traffic (18-kip ESAL)	4,600,000
Reliability	85%
Overall Standard Deviation	0.5

Design Serviceability Loss (ΔPSI)	1.5
Drainage Coefficient	1.0
Layer Coefficient: HMA	0.44
Layer Coefficient: Crushed Surfacing	0.13
Resilient Modulus	15,000 psi

Based on the design information and parameters discussed above, we recommend the flexible pavement section described in Table 15 below:

Table 15
Flexible Pavement Section

Material Description	Recommended Minimum Thickness (inches)	WSDOT Standard Specification for Aggregates
HMA	6	9-03.8
CSBC	6	9-03.9 (3)
Gravel Borrow	As needed	9-03.14 (1)

HMA: Hot Mix Asphalt, Class ½-inch PG 58-22
CSBC: Crushed Surfacing Base Course. The uppermost 2 inches of CSBC may be replaced with Crushed Surfacing Top Course (CSTC)
Gravel Borrow: Compacted to at least 95 percent of the maximum dry density, as determined by the tests described in Section 2-03.3(14)D, (WSDOT, 2010b).
WSDOT: Washington State Department of Transportation, 2010, Standard Specifications for Road, Bridge, and Municipal Construction.

It should be noted that actual pavement performance over the design period assumed in our analysis would depend on a number of factors, including the actual traffic loading conditions. The recommended pavement section will need to be revised if the traffic level (ESAL's) will be more or less than our assumed value.

Subgrade Preparation for Pavements

Pavement subgrades should be prepared in accordance with Section 2-06 of the WSDOT Standard Specifications (WSDOT, 2010b). All unsuitable soils should be removed during stripping operations and either exported from the site, or stockpiled for later re-use in landscaping areas. Following removal of the surficial unsuitable soils, the exposed subgrade should be moisture conditioned, if necessary, and compacted to a firm condition. The upper 6 inches of material should be compacted to at least 95 percent of the maximum dry density, as determined by the tests described in Section 2-03.3(14)D.

Any soft, yielding areas identified during the compaction process or proof-rolling should be over-excavated and backfilled with properly compacted CSBC, as described in Section 9-03.9(3) of the WSDOT Standard Specifications (WSDOT, 2010b), or gravel borrow as described in Section 9-03.14 (1) of the Standard Specifications.

Pond Access Roadway Surfacing

We understand that full vactor trucks, with a weight of 71,000 lbs, will utilize the pond access roads several times a year for pond maintenance and cleaning. We recommend the surfacing of the access roads consist of a minimum of 12 inches of quarry spalls, as described in Section 9-13.6 (WSDOT, 2010b), over a nonwoven geotextile for separation as described in Section 9-33.2(1), Table 3 (WSDOT, 2010b). The access road subgrade should be prepared in accordance with Section 2-06 of the WSDOT Standard Specifications (WSDOT, 2010b).

ELECTROCHEMICAL PROPERTY TESTING

Electrochemical property testing was conducted on representative soil samples throughout the project area to help determine the corrosiveness of the soil and to aid in pipe selection. The test results are summarized in Table 16 below.

Table 16
Electrochemical Properties

Exploration Number	Depth Interval (in feet)	pH	Resistivity (ohms-cm)	Chlorides (ug/g)	Sulfates (ug/g)
THT-04-10(1)	0 - 1.5	5.1	3,700	< 8.4	47.3
THT-05-10(1)	5.0 – 6.5	4.9	not tested	<8.1	56.2
THT-08-10(1)	2.0 – 4.0	5.9	76,000	<9.8	19.8
THT-12-10(1)	10 – 11.5	6.1	22,500	56.8	398
THT-15-10(1)	5.0 – 6.5	6.0	19,000	<51.2	212
THT-20-10(1)	10.0 – 11.5	6.2	1,000	99.8	609
THT-22-10(1)	10.0 – 11.5	6.4	12,500	74.0	461
B-2-03(2)	2.5 – 4.0	5.2	40,000	<10	150
B-3-07(2)	5.0 – 6.5	5.7	82,000	<10	<11
B-4-03(2)	7.5 – 9.0	5.8	130,000	<10	<10
B-5-03(2)	35 – 36.5	5.5	14,000	<10	67
B-7-07(2)	30.0 – 31.5	6.2	25,000	<10	<12

(1) Chemistry parameters were determined by Analytical Resources, Inc, of Tukwila, WA
(2) Chemistry parameters were determined by Am Test Laboratories of Redmond, WA, as part of a previous study.

CONSTRUCTION CONSIDERATIONS

The following items should be considered during the final roadway design and development of the contract specifications and special provisions.

1. Temporary shoring and/or slopes will be required during construction of the various structures discussed above. The design and construction of temporary shoring/slopes

should be the responsibility of the contractor.

2. Depending on the time of year, groundwater seepage into excavations could occur. Depending on the depth of excavation below the water, inflows may be controllable with sumps and pumps.

3. Installation of stone columns may require significant amperage rise to penetrate locally dense layers above the target layers of liquefaction mitigation.

4. Shaft construction should anticipate wet construction methods. Caving ground conditions are likely, especially in the upper portion of the soil profile. Consideration may be given to requiring temporary casing for shaft construction.

ADDITIONAL SERVICES

PanGEO should review the final project plans and specifications to confirm that our recommendations were properly incorporated into the contract documents.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

PanGEO, Inc. (PanGEO) prepared this report for use by Parametrix, Inc, the Tulalip Tribe, and the Washington State Department of Transportation in the design and construction of the I-5 116th Street NE Interchange improvements project. The recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project.

Variations in soil conditions may exist between the locations of the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, PanGEO should be immediately notified to review the applicability of the recommendations presented herein. Additionally, PanGEO should also be notified to review the applicability of these recommendations if there are any changes in the project scope.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 36 months from its issuance. PanGEO should be notified if the project is delayed by more than 36 months from the date of this report so that the applicability of the conclusions and recommendations presented herein may be evaluated considering the time lapse.

Within the limitations of scope, schedule and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time this report and/or its contents was prepared. No warranty, express or implied, is made. The scope of PanGEO's work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water or ground water at this site. PanGEO does not practice or consult in the field of safety engineering. PanGEO does not direct the contractor's operations, and cannot be held responsible for the safety of personnel other than our own on the site; the safety of others is the responsibility of the contractor.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes shall be at the contractor's sole option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

CLOSURE

PanGEO is pleased to support Parametrix, the Tulalip Tribe, WSDOT and the design team with geotechnical engineering recommendations. If you have any questions regarding this report, please call (206) 262-0370.

ROBERT E. KIMMERLING
STATE OF WASHINGTON
PROFESSIONAL ENGINEER
11/30/11
EXPIRES 10/9/12

Robert E. Kimmerling, P.E.
Principal Geotechnical Engineer

JON C. REHKOPF
STATE OF WASHINGTON
40412
REGISTERED
PROFESSIONAL ENGINEER
11/30/2011
EXPIRES 7/4/2012

Jon C. Rehkopf, P.E.
Senior Project Geotechnical Engineer

Siew L. Tan, P.E.
Principal Geotechnical Engineer

REK/SHE/JCR/rek

REFERENCES

AASHTO, 1993 Guide for Design of Pavement Structures, American Association of State Highway and Transportation Officials.

AASHTO, 2010 LRFD bridge design specifications, 5th edition, American Association of State Highway and Transportation Officials

Blakely, R.J., Sherrod, B.L., Wells, R.E., Weaver, C.S., McCormack, D.H., Troost, K.G., and Haugerud, R.A., 2004, The Cottege Lake aeromagnetic lineament: a possible onshore extension of the Southern Whidbey Island fault, Washington. U.S.G.S. Open-file Report 2004-1204.

Bourgeois, J., and Johnson, S.Y., 2001, Geologic evidence of earthquakes at the Snohomish delta, Washington, in the past 1200 years: Geological Society of America Bulletin, v. 113, p. 482-494.

Johnson, S.Y., Potter, C.J., Armentrout, J.M., Miller, J.J., Finn, C., and Weaver, C.S., 1996, The southern Whidbey Island fault: an active structure in the Puget Lowland, Washington: Geological Society of America Bulletin, v. 108, p. 334-354.

Minard, J.P., 1985, Geologic map of the Marysville Quadrangle, Snohomish County, Washington. U.S.G.S. Miscellaneous Field Studies Map MF-1743.

WSDOT, 2008. Highway Runoff Manual, M 31-16, Washington State Department of Transportation, June 2008.

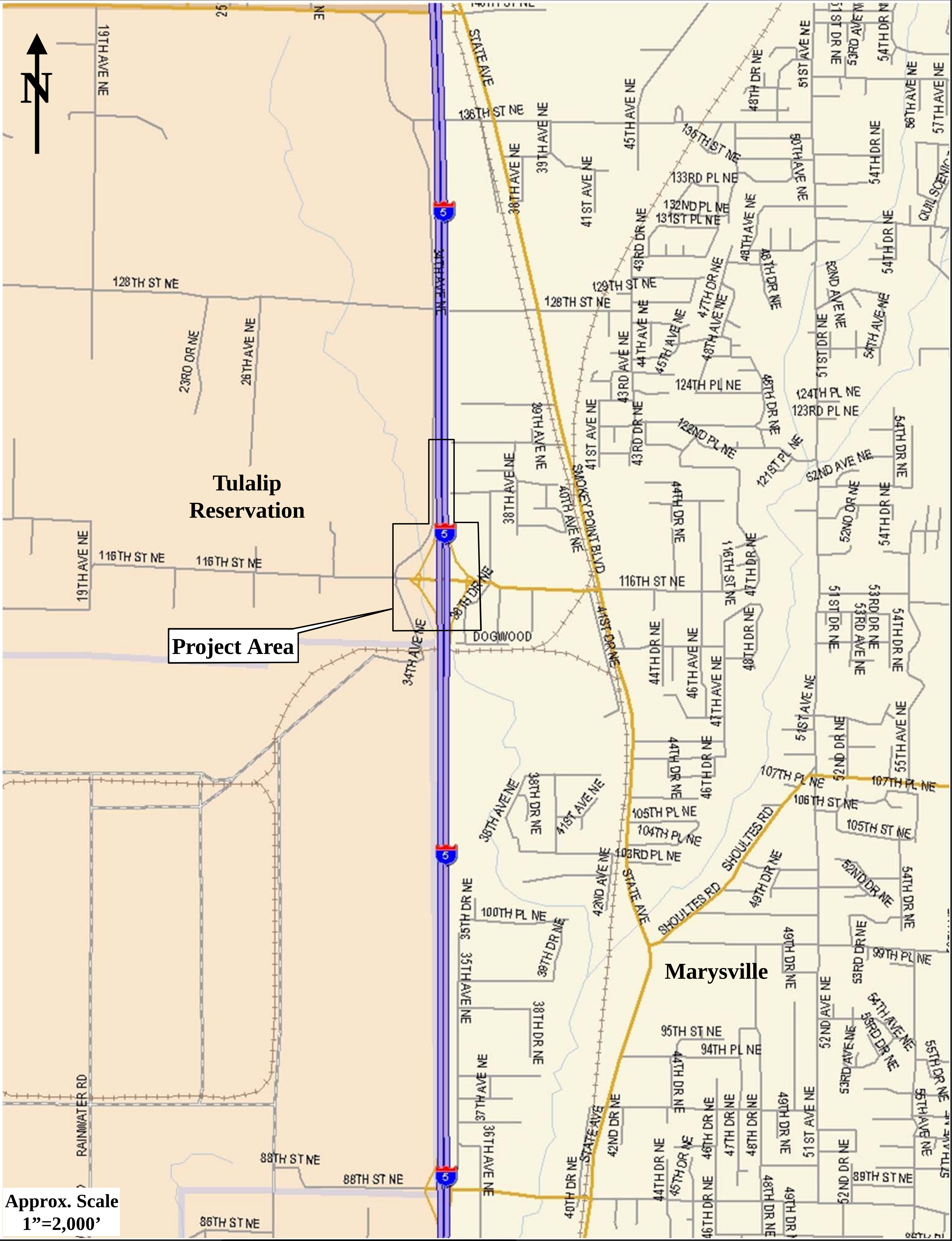
WSDOT, 2010a. Geotechnical Design Manual, M 46-03.02, Washington State Department of Transportation, 2010.

WSDOT, 2010b. Standard Specifications for Road, Bridge and Municipal Construction, M41-10, Washington State Department of Transportation, 2010.

WSDOT, 2010c. Standard Plans, M21-01, Washington State Department of Transportation, 2010.

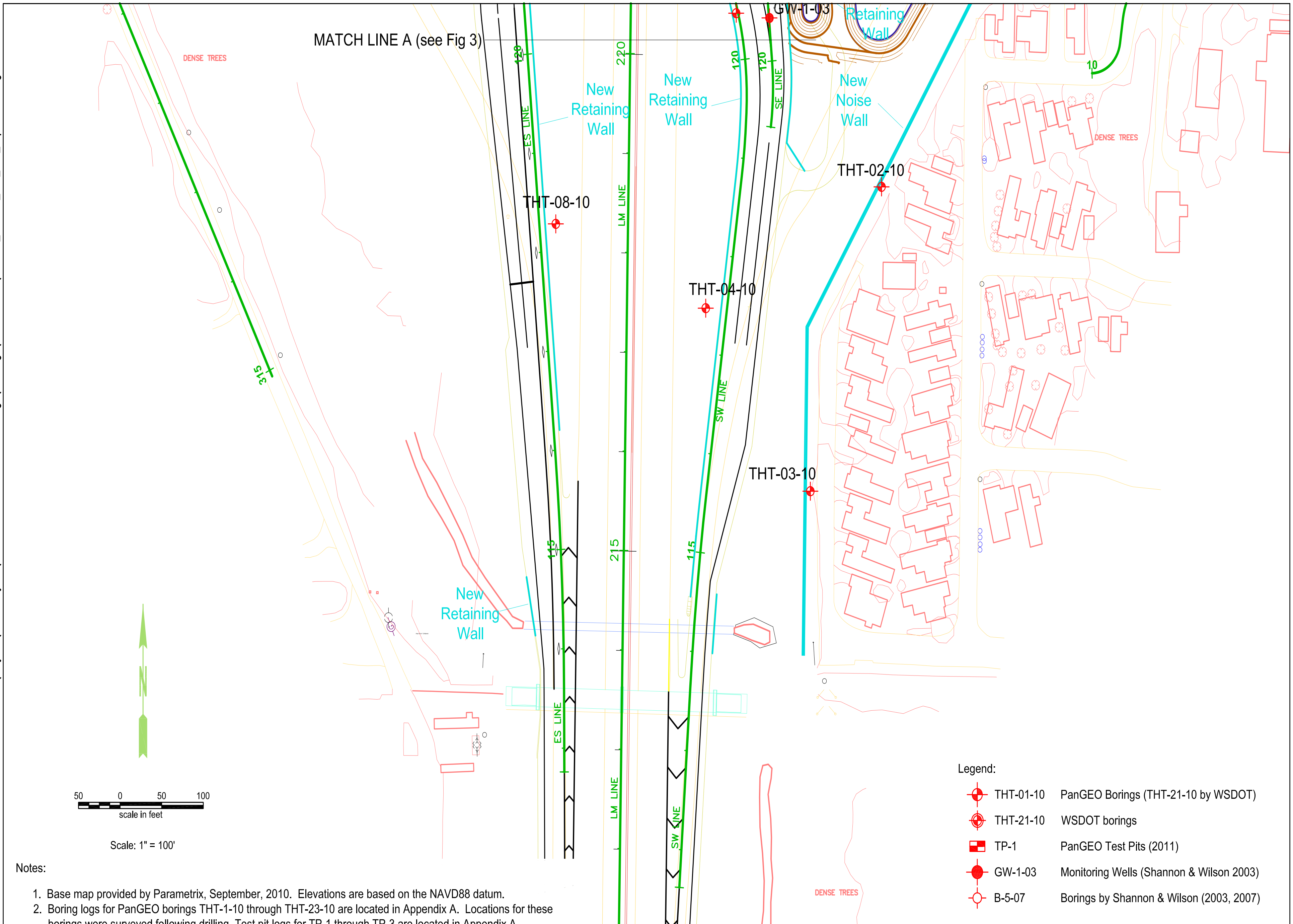
WSDOT, 2011. WSDOT Pavement Policy, Washington State Department of Transportation, June 2011.

FIGURES



PanGEO INCORPORATED	**I-5, 116th St. NE** **Interchange Improvements** **The Tulalip Tribes** **Snohomish Co., Washington**	**VICINITY MAP**
	Project No. 10-069	Figure No. 1

10-069_Vic_Map_Fig-1.ppt 5/17/2011(10:12 AM) SHE



Legend:

THT-01-10	PanGEO Borings (THT-21-10 by WSDOT)
THT-21-10	WSDOT borings
TP-1	PanGEO Test Pits (2011)
GW-1-03	Monitoring Wells (Shannon & Wilson 2003)
B-5-07	Borings by Shannon & Wilson (2003, 2007)

Notes:

1. Base map provided by Parametrix, September, 2010. Elevations are based on the NAVD88 datum.
2. Boring logs for PanGEO borings THT-1-10 through THT-23-10 are located in Appendix A. Locations for these borings were surveyed following drilling. Test pit logs for TP-1 through TP-3 are located in Appendix A.
3. Boring logs for historic investigations are located in Appendix C. Historic boring numbers were modified by adding the year of the investigation to the end of the boring numbers. Locations for most of these borings are approximate and based on the relative locations of the borings to known site features on report drawings. Borings where surface evidence for the location remains (such as the piezometer installations) were surveyed concurrent with the survey of the recent borings.

PanGEO INCORPORATED

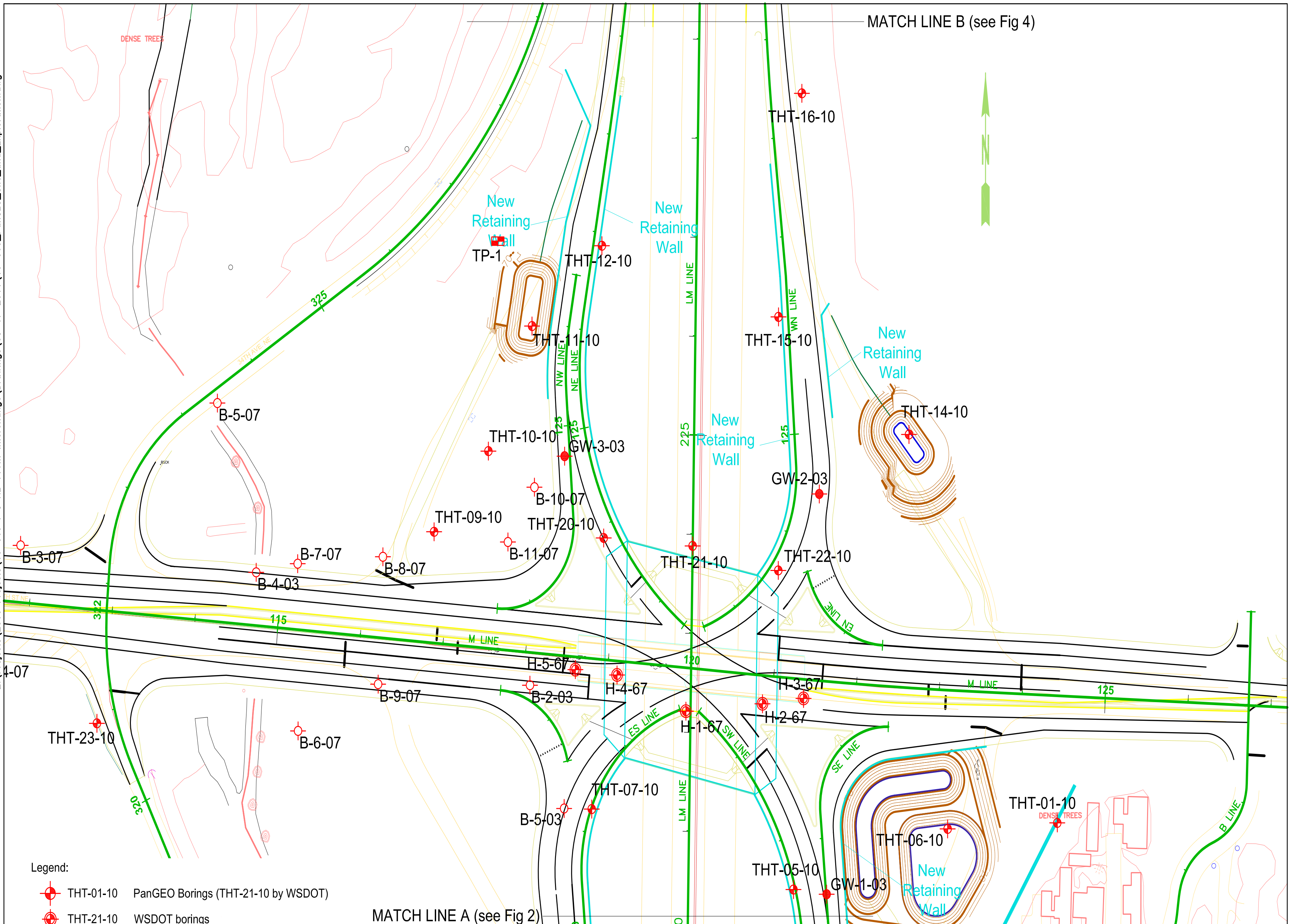
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SITE AND EXPLORATION PLAN
SOUTH

PROJECT NO. 10-069

FIGURE NO. 2

DRAWN BY: SHE CHECKED BY: REK DATE: 05.23.2011 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Site_and_Exploration.dwg



Legend:

THT-01-10	PanGEO Borings (THT-21-10 by WSDOT)
THT-21-10	WSDOT borings
TP-1	PanGEO Test Pits (2011)
GW-1-03	Monitoring Wells (Shannon & Wilson 2003)
B-5-07	Borings by Shannon & Wilson (2003, 2007)

50 0 50 100
scale in feet

Scale: 1" = 100'

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SITE AND EXPLORATION PLAN
CENTRAL

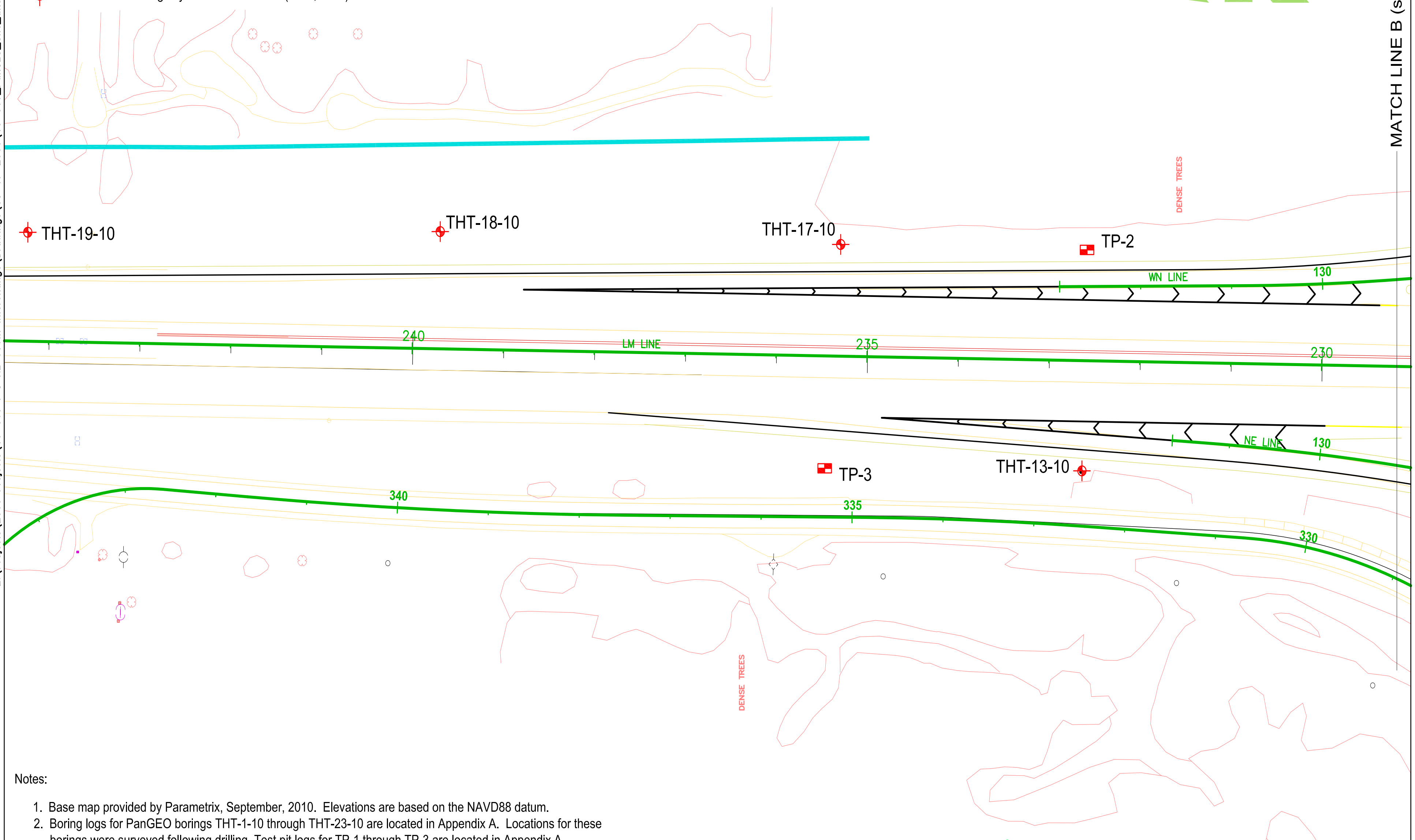
PROJECT NO. 10-069
FIGURE NO. 3

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Site_and_Exploration.dwg

DATE: 05.23.2011 CHECKED BY: REK DRAWN BY: SHE

Legend:

THT-01-10	PanGEO Borings (THT-21-10 by WSDOT)
THT-21-10	WSDOT borings
TP-1	PanGEO Test Pits (2011)
GW-1-03	Monitoring Wells (Shannon & Wilson 2003)
B-5-07	Borings by Shannon & Wilson (2003, 2007)



Notes:

1. Base map provided by Parametrix, September, 2010. Elevations are based on the NAVD88 datum.
2. Boring logs for PanGEO borings THT-1-10 through THT-23-10 are located in Appendix A. Locations for these borings were surveyed following drilling. Test pit logs for TP-1 through TP-3 are located in Appendix A.
3. Boring logs for historic investigations are located in Appendix C. Historic boring numbers were modified by adding the year of the investigation to the end of the boring numbers. Locations for most of these borings are approximate and based on the relative locations of the borings to known site features on report drawings. Borings where surface evidence for the location remains (such as the piezometer installations) were surveyed concurrent with the survey of the recent borings.

PanGEO INCORPORATED

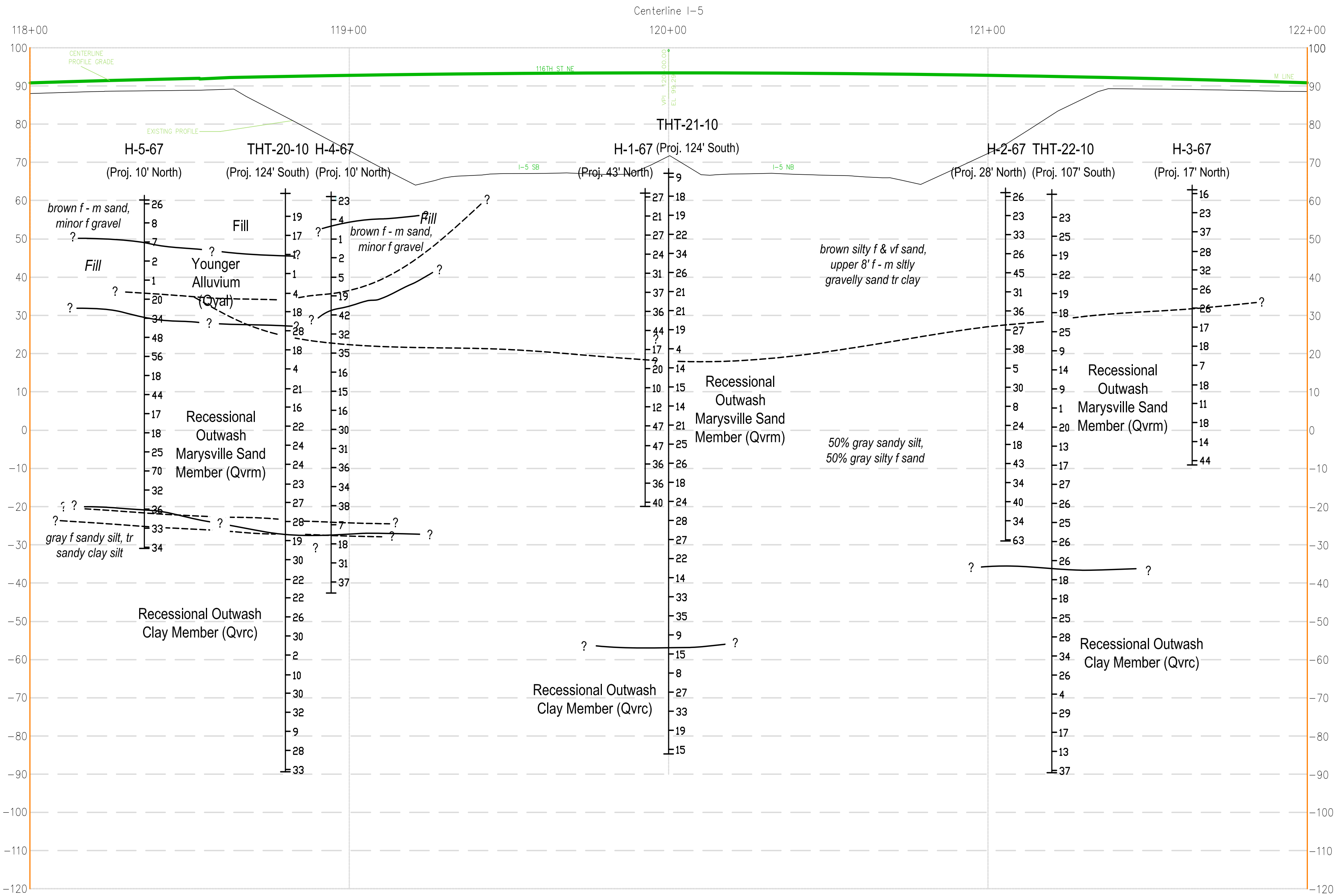
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SITE AND EXPLORATION PLAN
NORTH

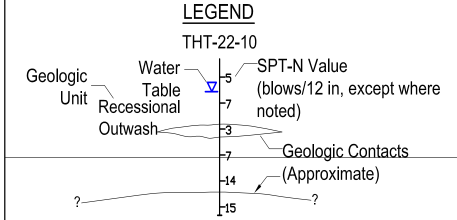
PROJECT NO. 10-069

FIGURE NO. 4

DRAWN BY: SHE CHECKED BY: REK DATE: 05.23.2011 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Site_and_Exploration.dwg



LEGEND



Geologic Unit Descriptions:

Fill: brown silty fine SAND and medium SAND.

Younger Alluvium (Qyal): loose, brown, silty SAND with wood debris.

Recessional Outwash - Marysville Sand Member (Qvrm): medium dense to loose, brown to gray, SAND with silt to silty SAND, occasional silt or silty clay interbeds.

Recessional Outwash - Clay Member (Qvrc): soft to stiff, green gray silty CLAY to gray SILT, occassional silty sand interbeds. (after Minard, 1985)

15 0 15 30
scale in feet

Scale: 1" = 30'

Note: THT-20-10 and THT-22-10 drilled under direction of PanGEO personnel. All other borings donw by WSDOT. Borings with "H" designation from 1967. THT-21-10 was done in 2010.

PanGEO INCORPORATED

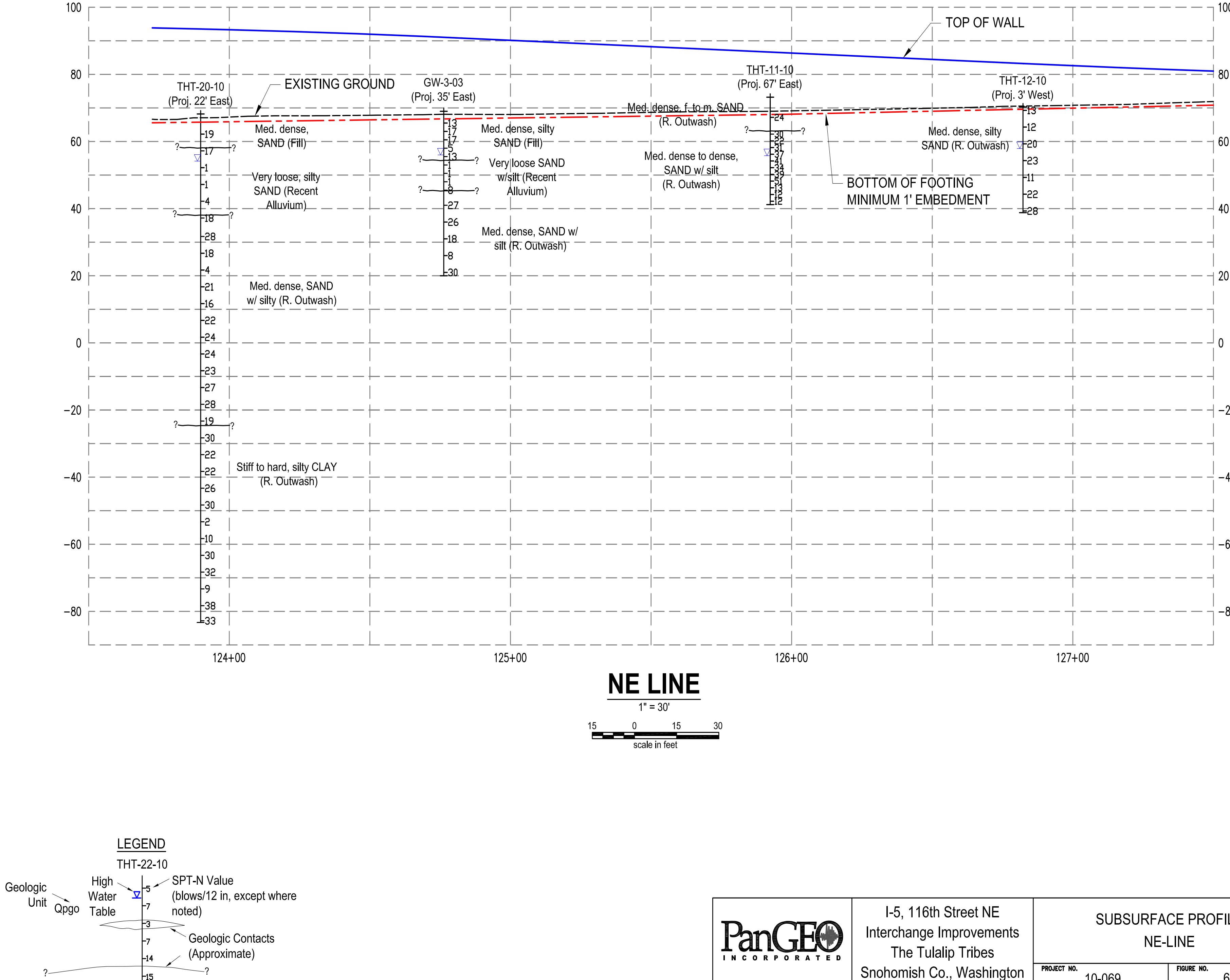
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SUBSURFACE PROFILE
CENTERLINE 116TH STREET NE

PROJECT NO. 10-069
FIGURE NO. 5

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Site_and_Exploration.dwg

DATE: 05.23.2011
CHECKED BY: REK
DRAWN BY: SHE



PanGEO INCORPORATED

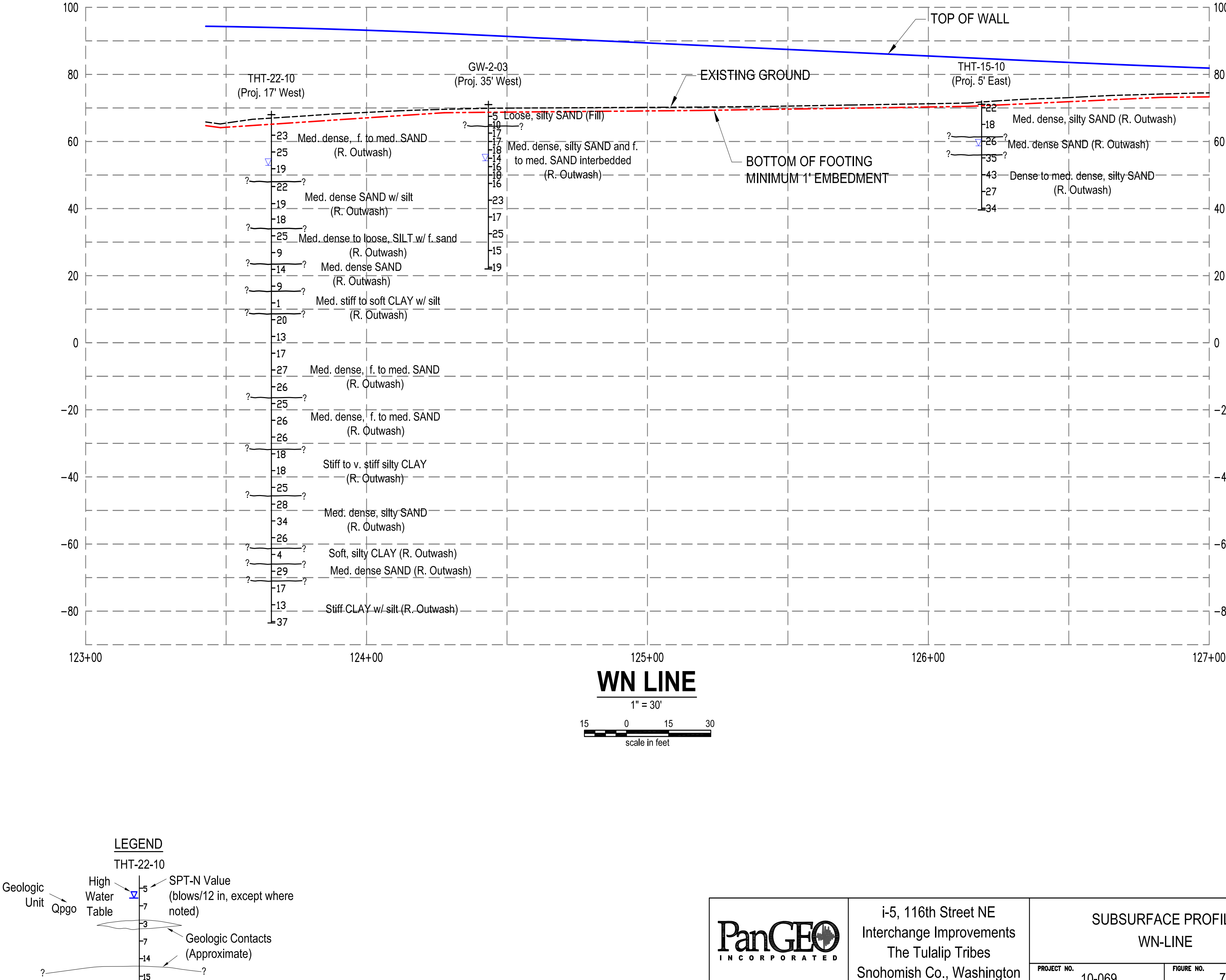
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SUBSURFACE PROFILE
NE-LINE

PROJECT NO. 10-069

FIGURE NO. 6

DRAWN BY: NTW CHECKED BY: REK DATE: 05.23.2011 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg



WN LINE

1" = 30'

15 0 15 30
scale in feet

PanGEO INCORPORATED

i-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

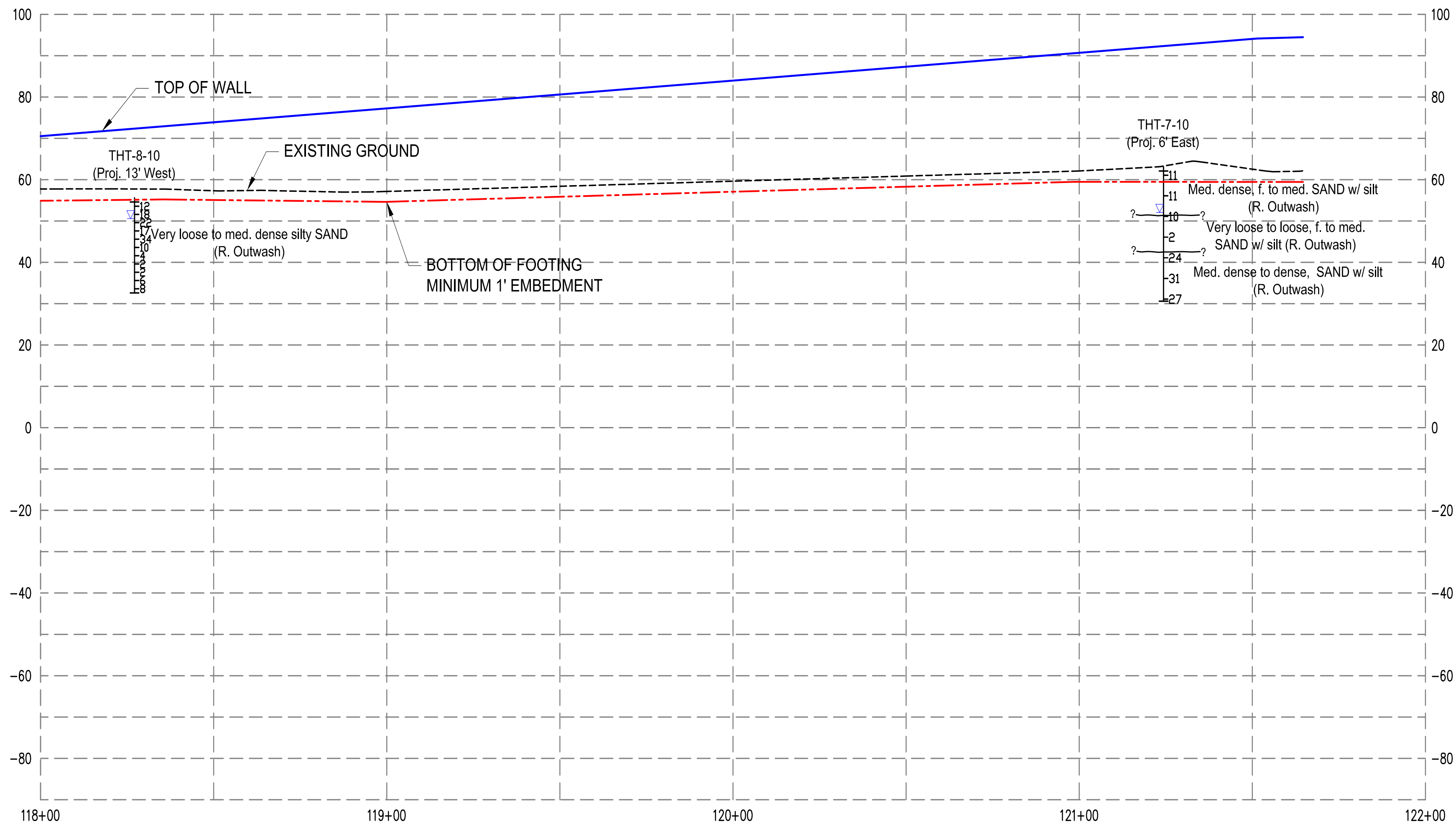
SUBSURFACE PROFILE
WN-LINE

PROJECT NO. 10-069

FIGURE NO. 7

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg

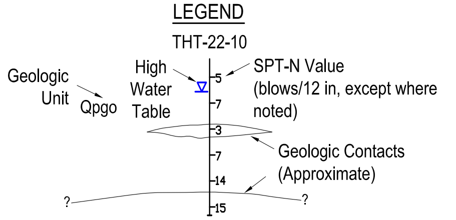
DATE: 05.23.2011 CHECKED BY: REK DRAWN BY: NTW



ES LINE

1" = 30'

scale in feet



PanGEO INCORPORATED

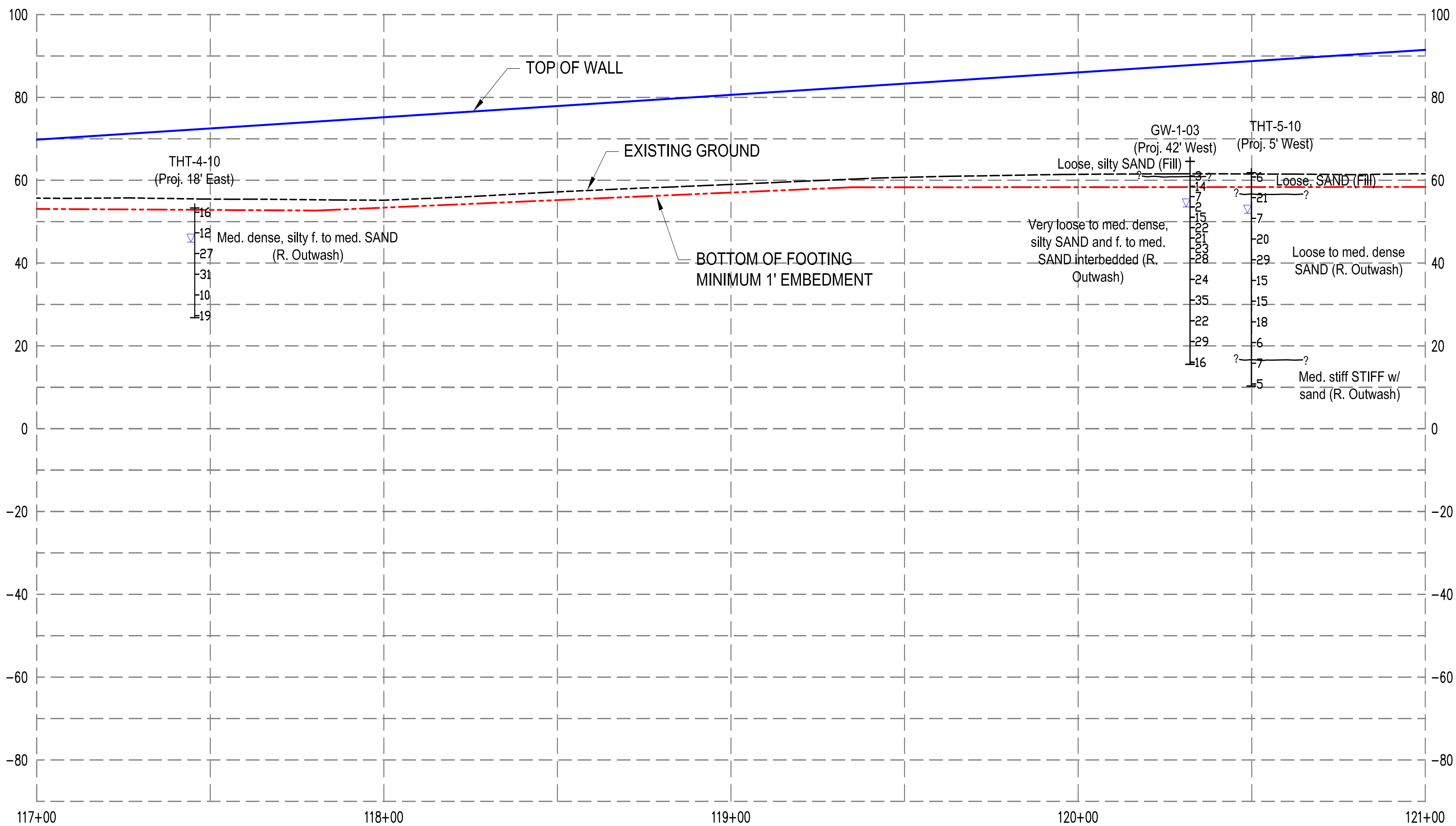
i-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SUBSURFACE PROFILE
ES-LINE

PROJECT NO. 10-069

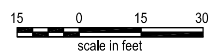
FIGURE NO. 8

DRAWN BY: NTW CHECKED BY: REK DATE: 05.23.2011 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg

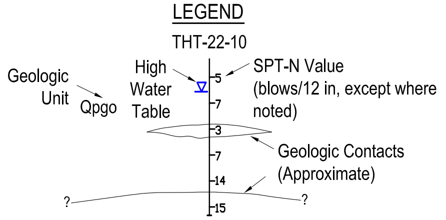


SW LINE

1" = 30'

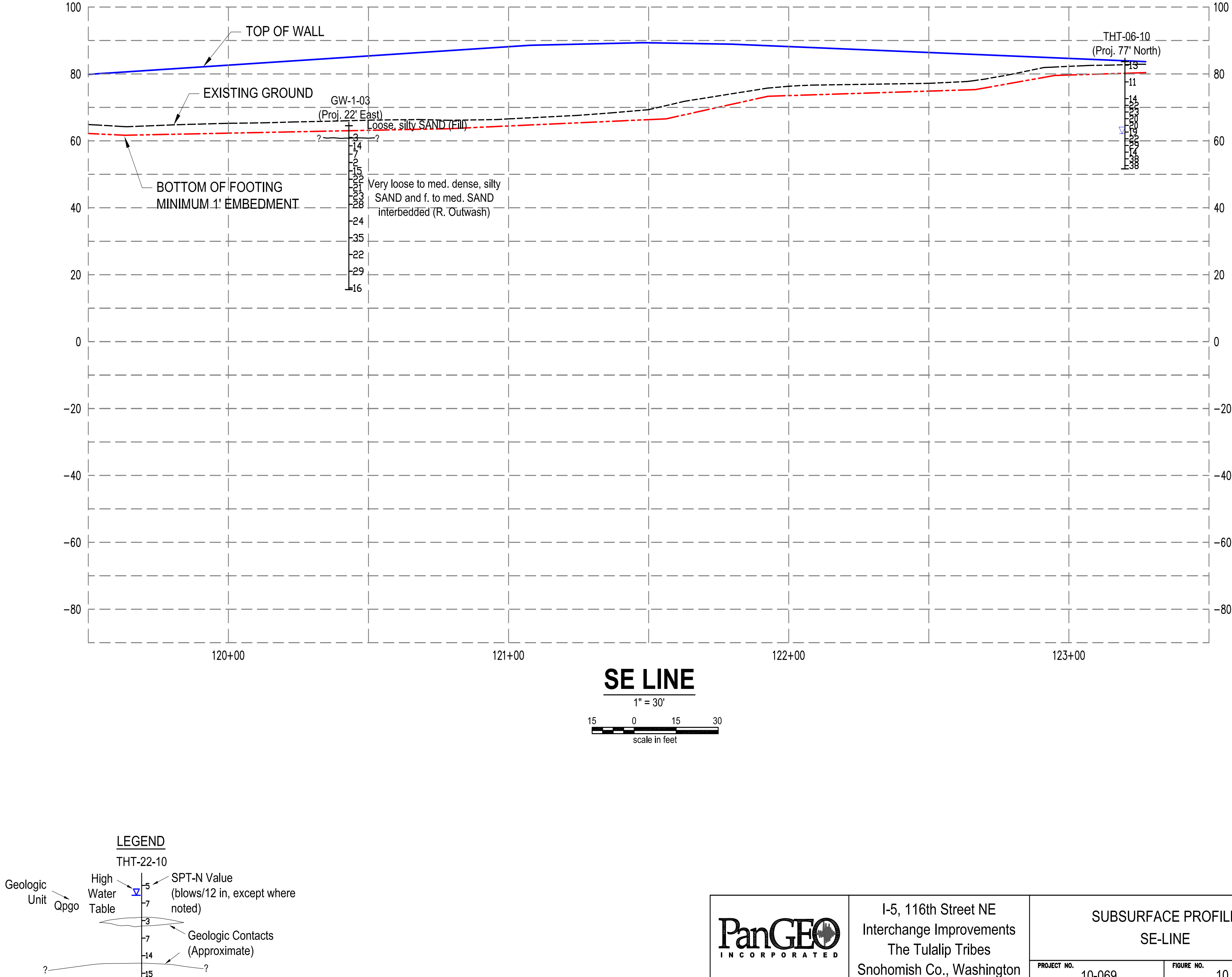


LEGEND



PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	SUBSURFACE PROFILE SW-LINE
	PROJECT NO. 10-069	FIGURE NO. 9

DRAWN BY: NTW CHECKED BY: REK DATE: 05.23.2011 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg



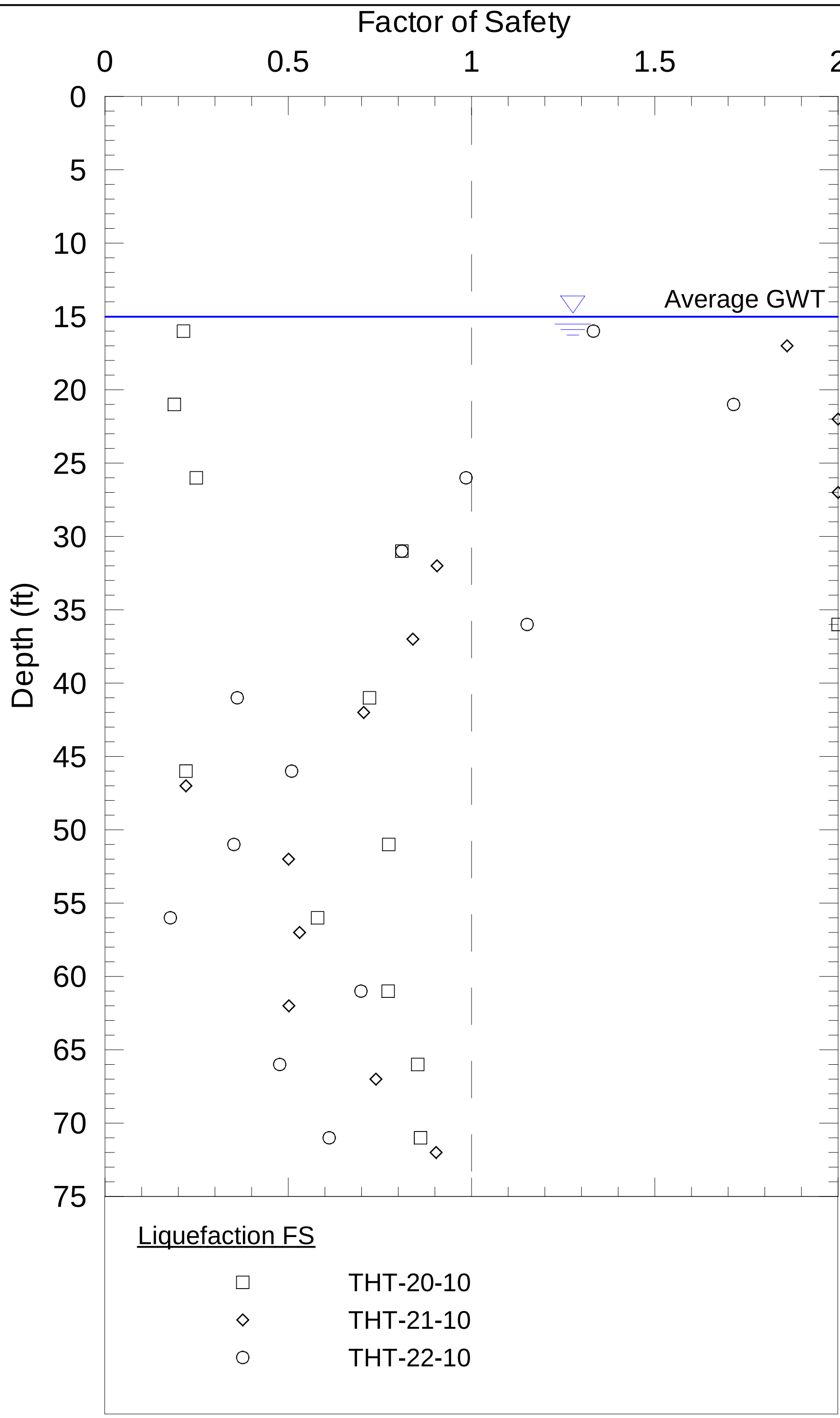
SE LINE

1" = 30'

15 0 15 30
scale in feet

PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	SUBSURFACE PROFILE SE-LINE PROJECT NO. 10-069 FIGURE NO. 10

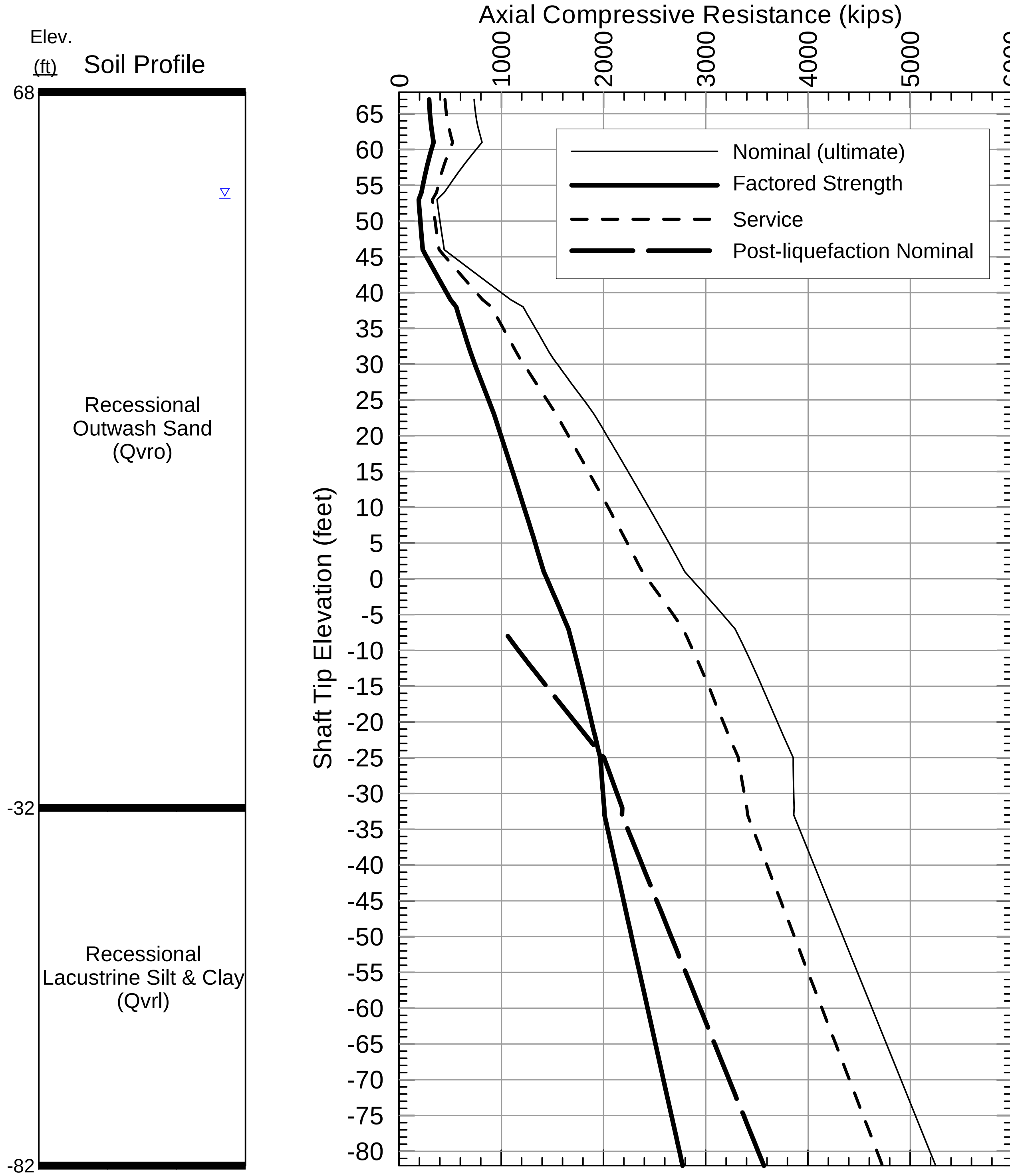
DRAWN BY: NTW CHECKED BY: REK DATE: 05.23.2011 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg



Notes:
1) Design event: 7% probability in 75 years (M=7.5 event, with a PGA of 0.35g).
2) Samples with computed $(N_1)_{60cs}$ values greater than 30 or computed factors of safety greater than 2.0 were considered not liquefiable and are plotted on this chart as FS=2.

10-069 Bridge Borings Liquefaction.grf w/ 10-069 Liquefaction Bridge Borings.xls 5/17/11 (7:56) REK

PanGEO INCORPORATED	**I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington**	**LIQUEFACTION ASSESSMENT TEST BORINGS THT-20-10, THT-21-10 & THT-22-10**
		Project No. **10-069** — Figure No. **11**



Notes:

1) Axial resistance values are for a 7-ft (or the 2.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

PanGEO INCORPORATED

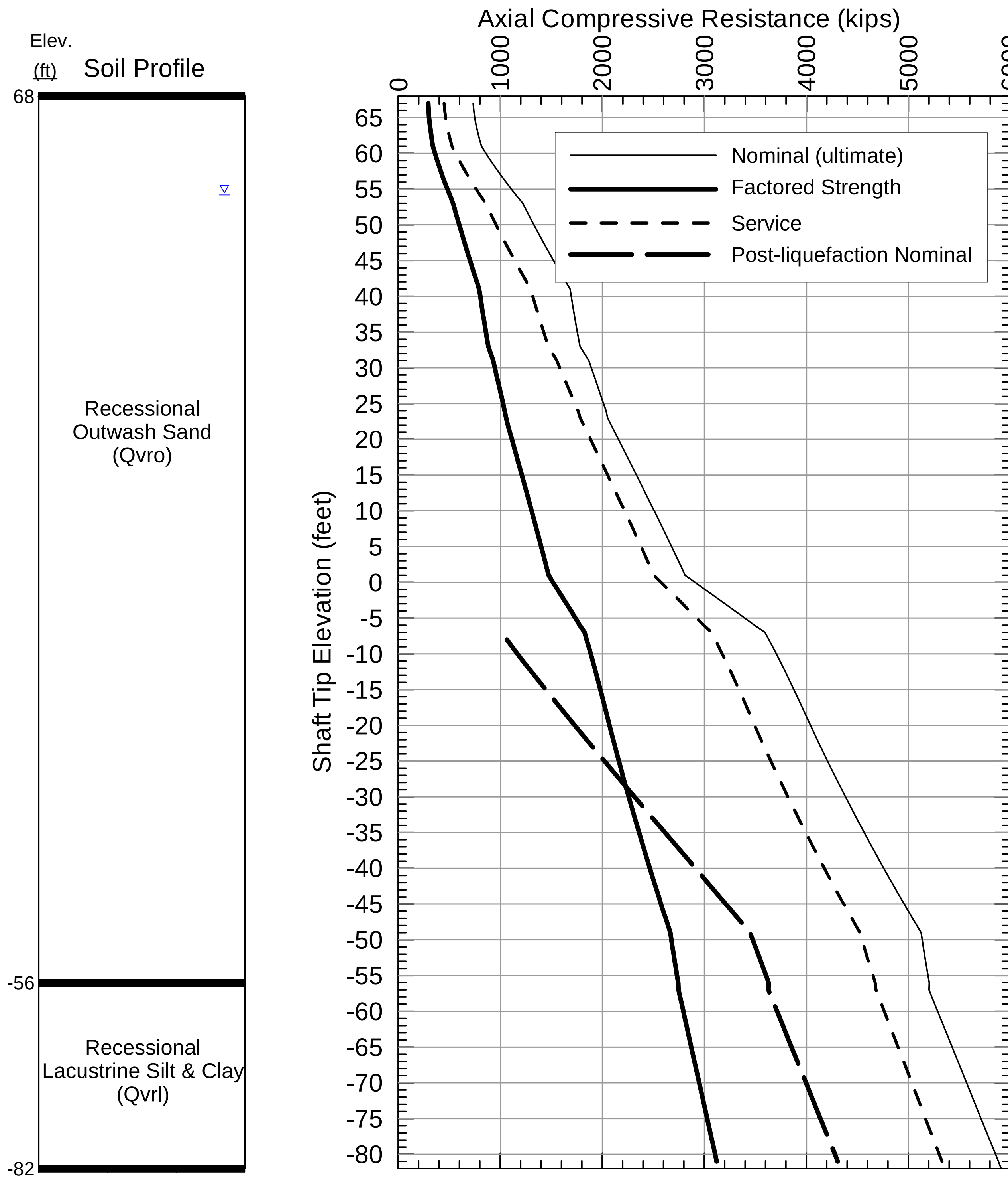
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE
7-FT DIAMETER SHAFT
PIER 1 (WEST ABUTMENT)

Project No. **10-069**

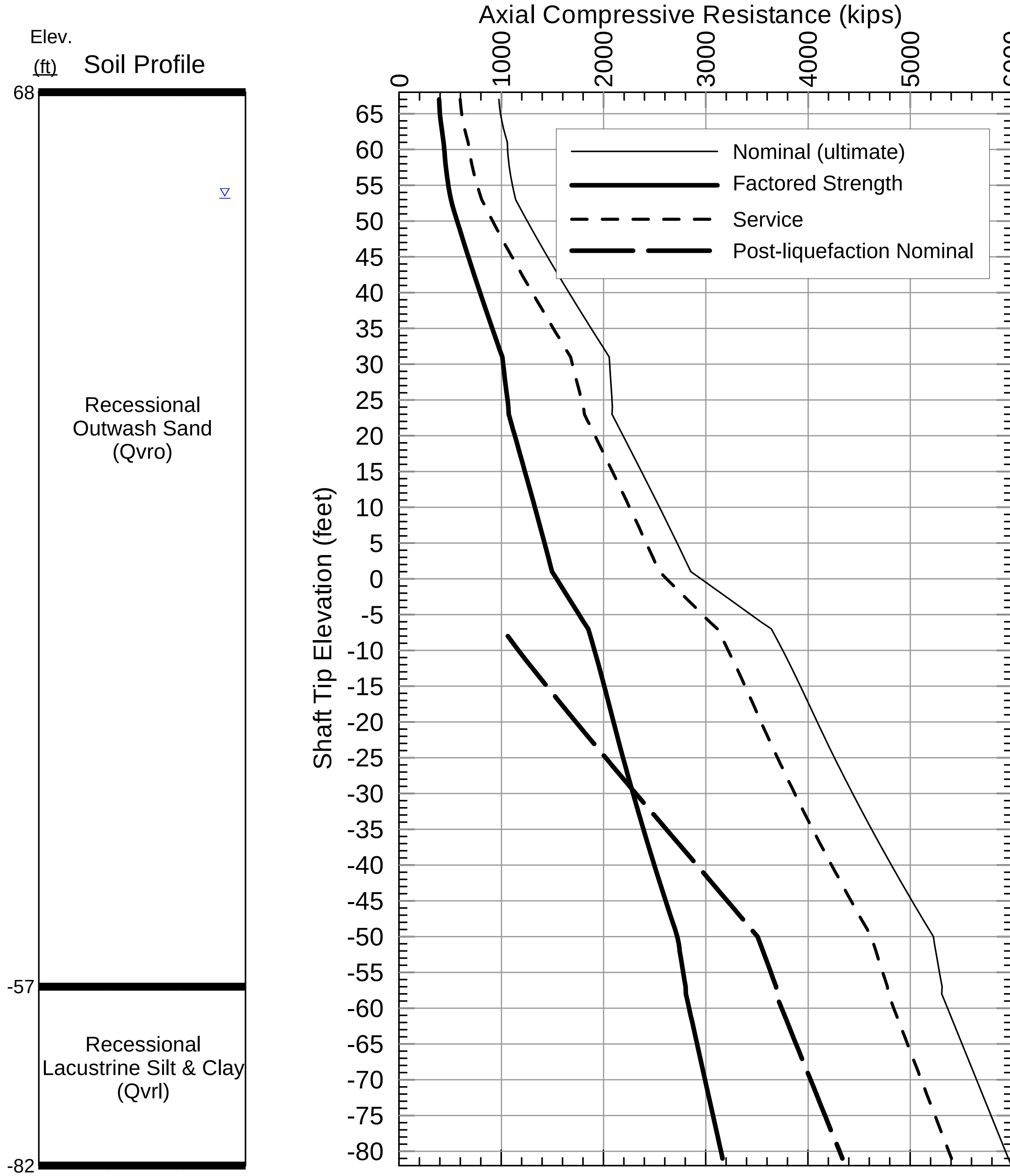
Figure No. **12**

10-069 7-ft Shaft Axial Pier 1.grf w/ 10-069 7-ft Axial Shaft Resistance.xls 6/27/11 (9:26) REK



Notes:
1) Axial resistance values are for a 7-ft (or the 2.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has <u>not</u> been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

PanGEO INCORPORATED	**I-5, 116th Street NE** **Interchange Improvements** **The Tulalip Tribes** **Snohomish Co., Washington**	**AXIAL COMPRESSIVE RESISTANCE** **7-FT DIAMETER SHAFT** **PIER 2**	
		Project No. **10-069**	Figure No. **13**



Notes:
1) Axial resistance values are for a 7-ft (or the 2.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

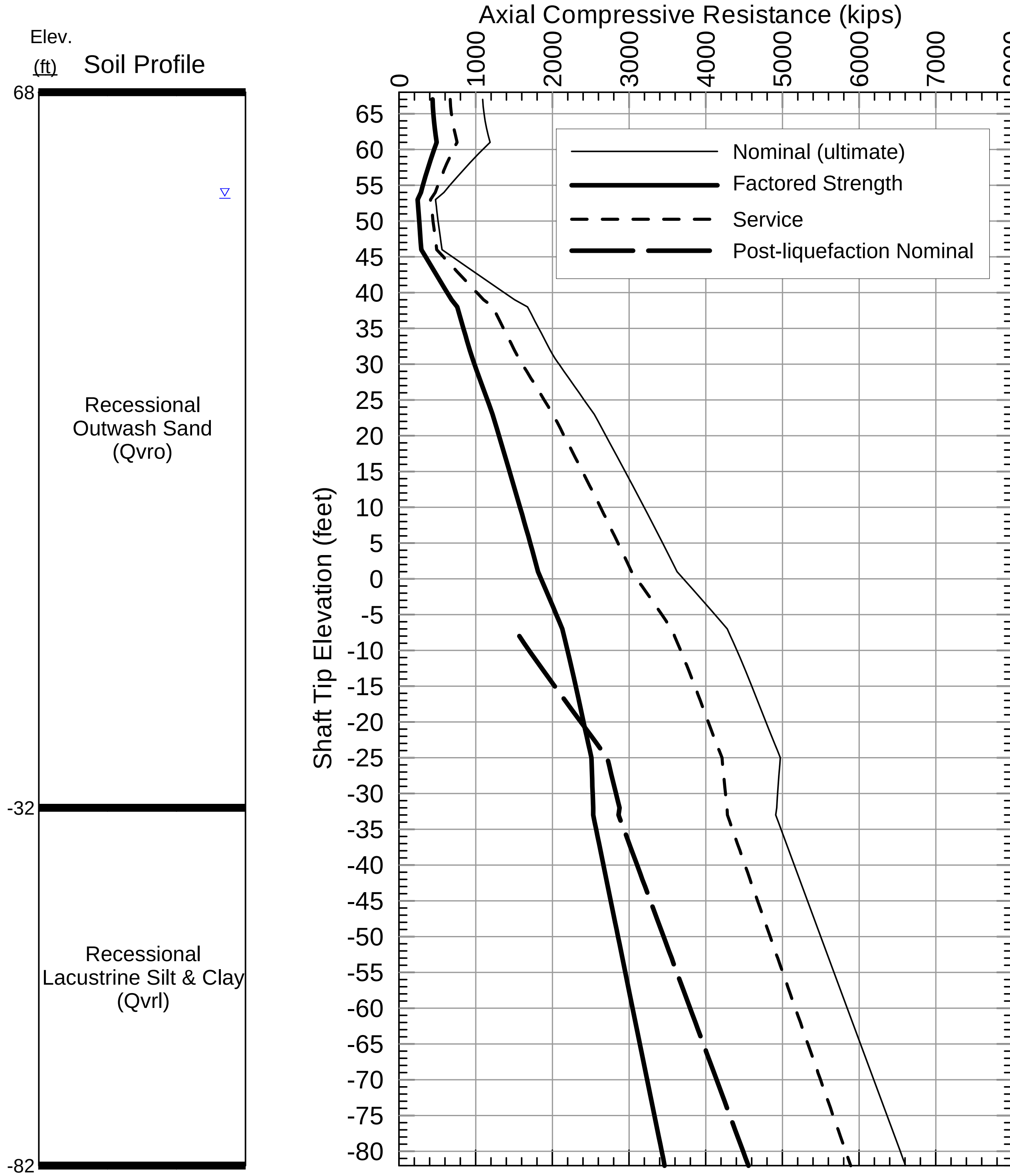
10-069 7-ft Shaft Axial Pier 3.grf w/ 10-069 7-ft Axial Shaft Resistance.xls 6/27/11 (9:29) REK

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE
7-FT DIAMETER SHAFT
PIER 3 (EAST ABUTMENT)

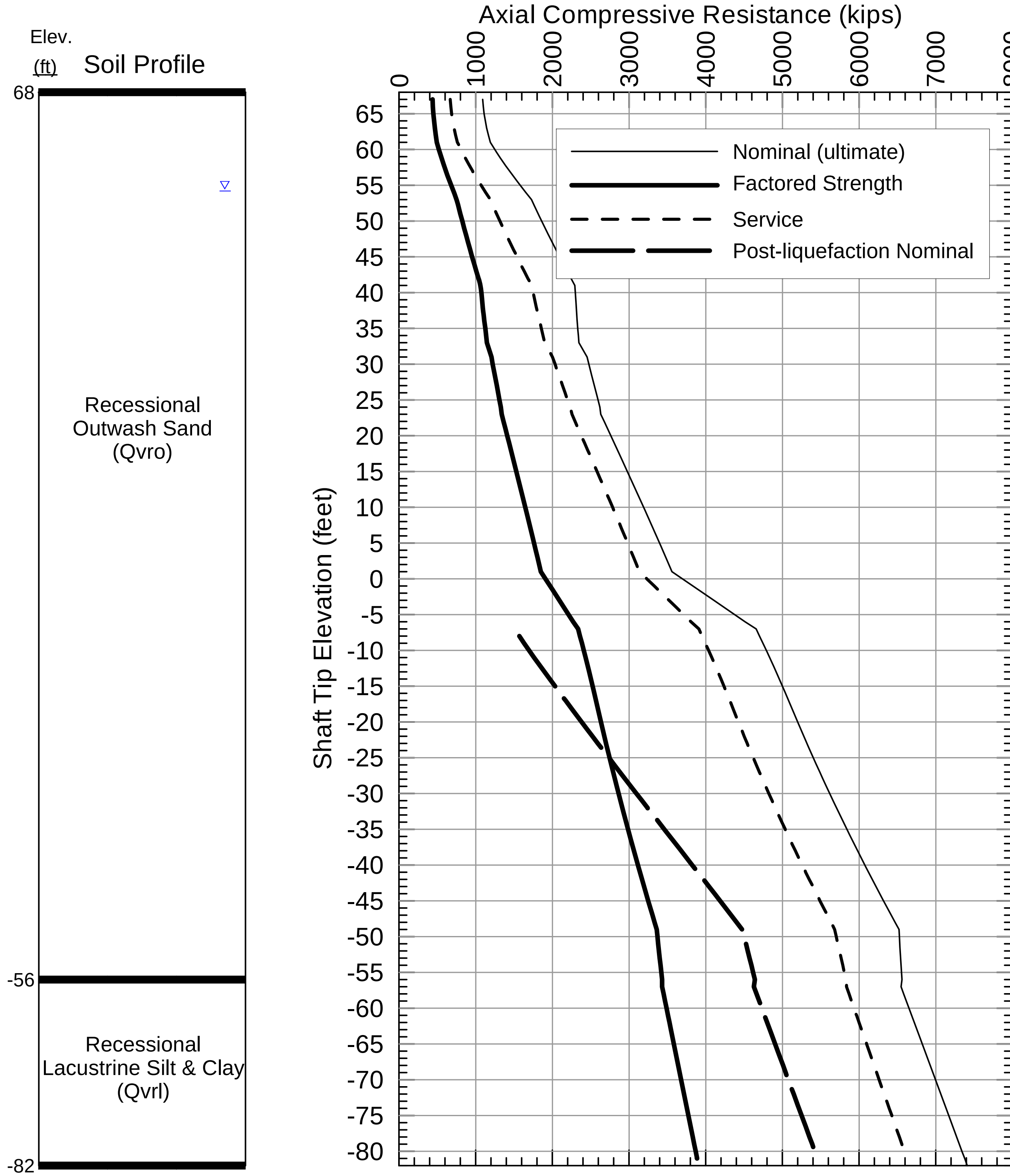
Project No.	Figure No.
10-069	**14**



Notes:
1) Axial resistance values are for an 8-ft (or the 2.5 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

10-069 8-ft Shaft Axial Pier 1.grf w/ 10-069 8-ft Axial Shaft Resistance.xls 6/27/11 (8:57) REK

PanGEO INCORPORATED	**I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington**	**AXIAL COMPRESSIVE RESISTANCE 8-FT DIAMETER SHAFT PIER 1 (WEST ABUTMENT)**	
		Project No. **10-069**	Figure No. **15**



Notes:
1) Axial resistance values are for an 8-ft (or the 2.5 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes $\varphi_{side} = 0.55$ and $\varphi_{tip} = 0.40$.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

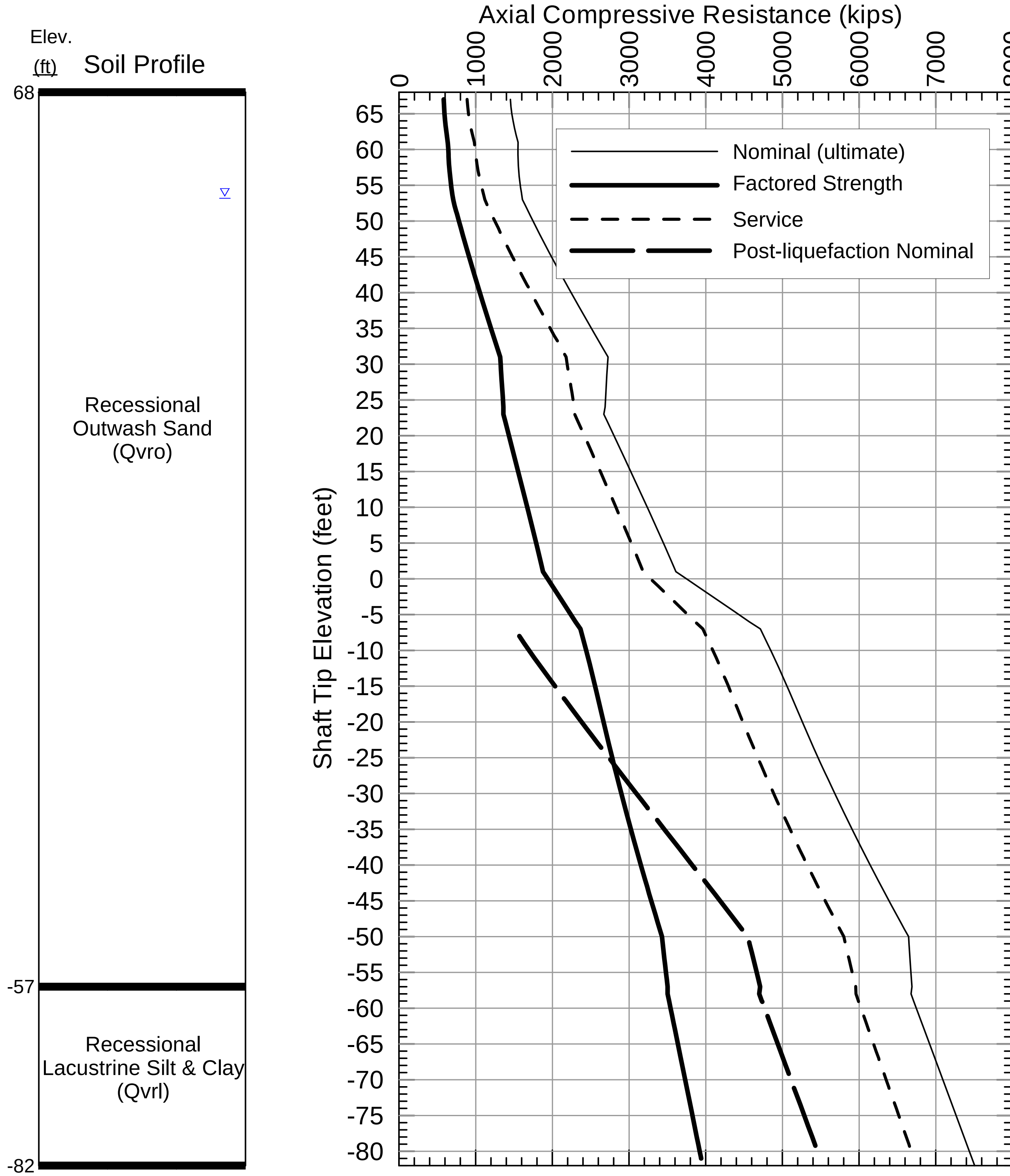
10-069 8-ft Shaft Axial Pier 2.grf w/ 10-069 8-ft Axial Shaft Resistance.xls 6/27/11 (8:59) REK

PanGEO INCORPORATED

I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE 8-FT DIAMETER SHAFT PIER 2

Project No.	Figure No.
10-069	**16**



Notes:

1) Axial resistance values are for an 8-ft (or the 2.5 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

10-069 8-ft Shaft Axial Pier 3.grf w/ 10-069 8-ft Axial Shaft Resistance.xls 6/27/11 (9:21) REK

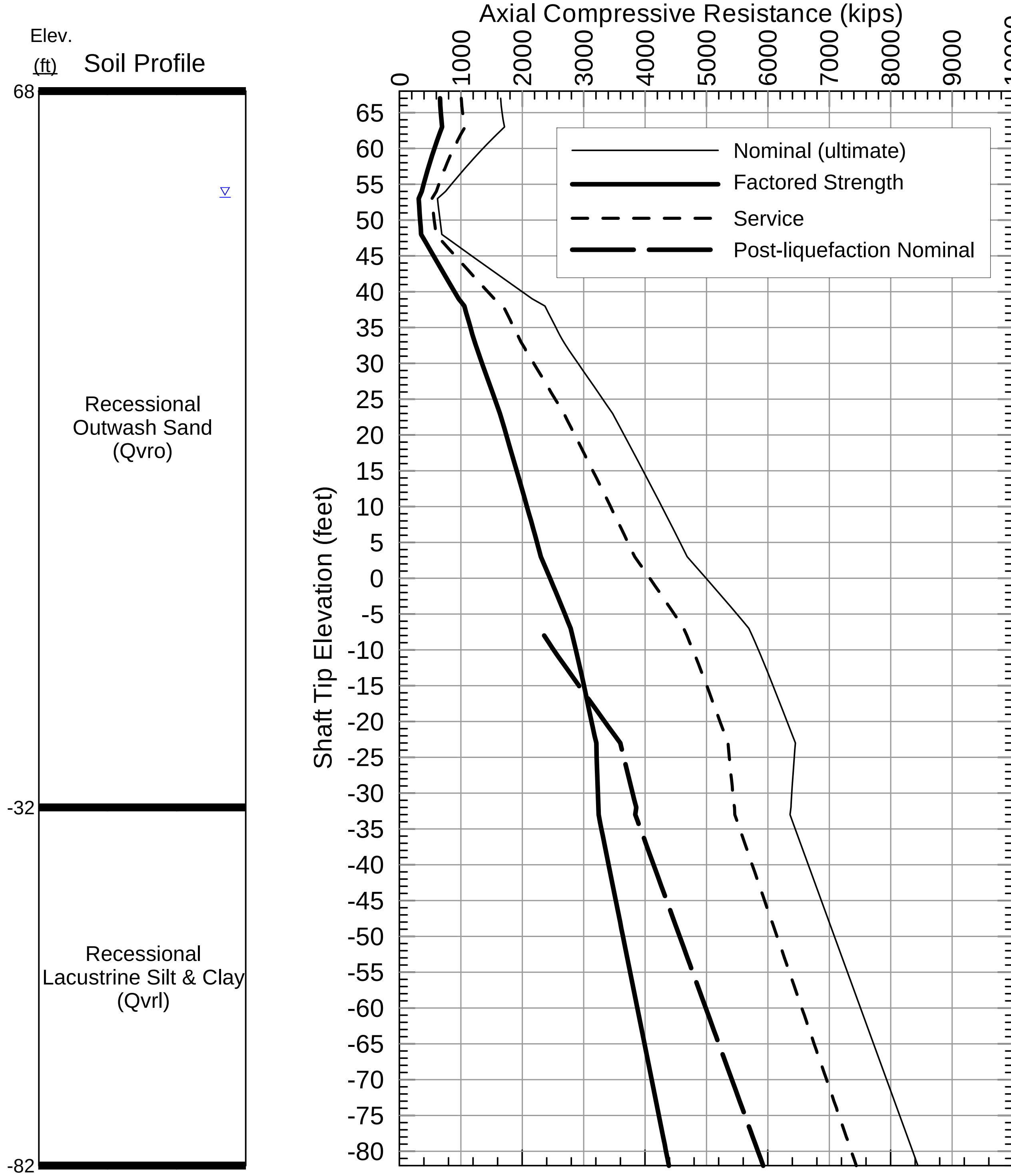
PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE
8-FT DIAMETER SHAFT
PIER 3 (EAST ABUTMENT)

Project No. **10-069**

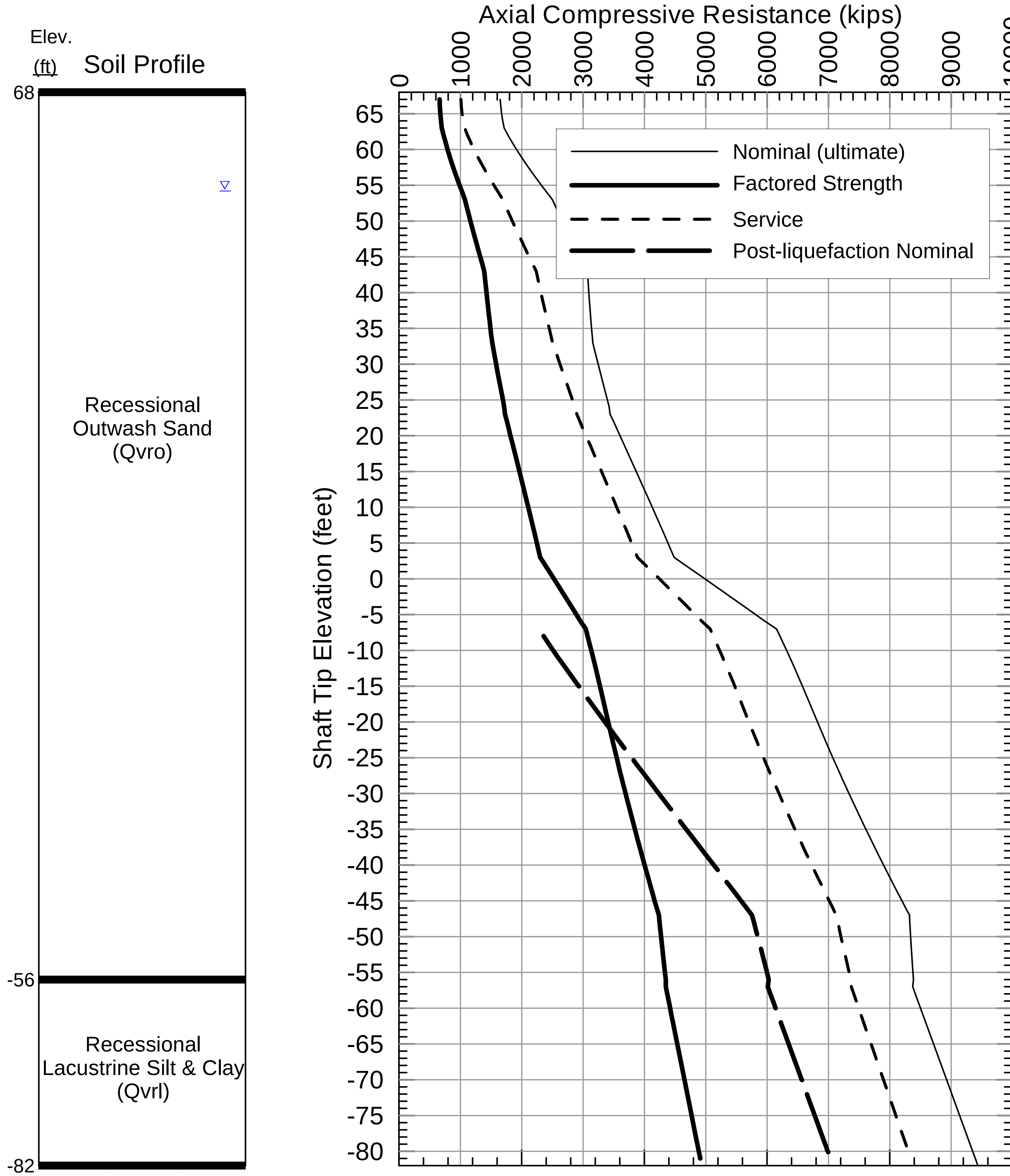
Figure No. **17**



Notes:
1) Axial resistance values are for a 10-ft (or the 3.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has <u>not</u> been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	**AXIAL COMPRESSIVE RESISTANCE** **10-FT DIAMETER SHAFT** **PIER 1 (WEST ABUTMENT)** Project No. **10-069** Figure No. **18**

10-069 10-ft Shaft Axial Pier 1.grf w/ 10-069 10-ft Axial Shaft Resistance.xls 6/27/11 (9:35) REK



Notes:

1) Axial resistance values are for a 10-ft (or the 3.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

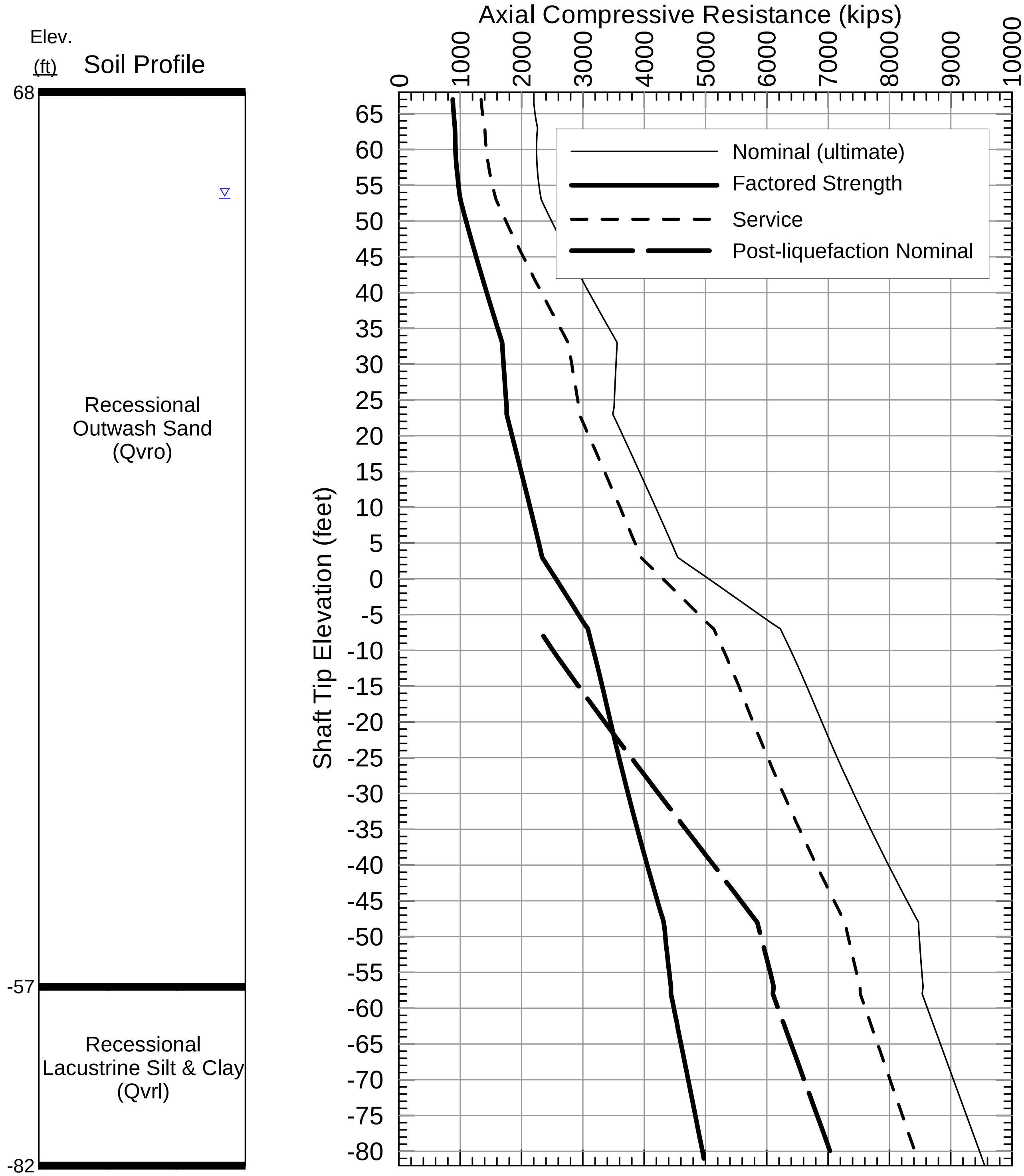
PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE
10-FT DIAMETER SHAFT
PIER 2

Project No.	Figure No.
10-069	**19**

10-069 10-ft Shaft Axial Pier 2.grf w/ 10-069 10-ft Axial Shaft Resistance.xls 6/27/11 (9:37) REK



Notes:

1) Axial resistance values are for a 10-ft (or the 3.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes $\varphi_{side} = 0.55$ and $\varphi_{tip} = 0.40$.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

10-069 10-ft Shaft Axial Pier 3.grf w/ 10-069 10-ft Axial Shaft Resistance.xls 6/27/11 (9:43) REK

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE
10-FT DIAMETER SHAFT
PIER 3 (EAST ABUTMENT)

Project No. **10-069**

Figure No. **20**

APPENDIX A

FIELD EXPLORATIONS
&
LOGS OF TEST BORINGS AND TEST PITS

APPENDIX A: FIELD EXPLORATIONS

Appendix A contains written and graphical logs of test borings and test pits presenting the factual and interpretive results of our exploration program at the subject site. The descriptions of the materials encountered in the test borings are primarily based on the soil samples extracted from the borings. The sample descriptions are augmented by observation of the drilling action and drill cuttings brought to the surface during field operations. The paragraphs below describe the field operations and sampling procedures used during the geotechnical field explorations.

FIELD EXPLORATIONS – TEST BORINGS

The 2010 subsurface exploration program consisted of twenty-three test borings, which were completed in four phases. The boring sites were marked in the field prior to drilling, based on the mapped locations of specific facilities. Following drilling, the final locations of the borings were marked with survey stakes and surveyed in. The first PanGEO subsurface exploration occurred from June 28 to July 7, 2010. During the first mobilization, a total of 19 shallow (32 feet or less) borings were completed. The second field exploration phase consisted of the boring drilled by WSDOT personnel (THT-21-10), and took place concurrently with the first PanGEO mobilization, on June 29, 2010. The third field (second PanGEO mobilization) exploration phae took place between July 27 and July 28, 2010, during which the two remaining deep borings (THT-20-10 and THT-22-10) were drilled. The deep borings were drilled to a depth of approximately 150 feet below the surface. The final boring (THT-23-10) was drilled on October 26, 2010. PanGEO personnel were on site for all field explorations except the WSDOT boring.

All shallow borings except THT-23-10 were drilled by Geologic Drill of Spokane, Washington, using a 4-inch diameter hollow stem auger drill string powered by a drill head mounted on a Bobcat tracked vehicle. THT-23-10 was drilled by Geologic Drill, but using a trailer mounted, 6 inch hollow stem auger drill. THT-21-10 was drilled by a WSDOT crew using mud rotary, CME drilling equipment. THT-20-10 and THT-22-10 were drilled using mud rotary drilling technology to avoid disturbance of the sandy soils below the water table, and to provide the best quality SPT data for foundation design. The borings were drilled by Holocene Drilling of Edgewood, Washington, using a tire mounted Mobil B-61 drill rig.

SAMPLING METHODS

Soils encountered were generally sampled using conventional SPT split spoon samplers. The shallow borings were sampled using 140-lb safety hammer activated with a rope and cathead system. The deep borings were sampled with a sampler driven by a 140-lb safety hammer activated with an auto-trip mechanism.

Soil samples were obtained from the borings generally at 5-foot intervals. Borings located in proposed stormwater infiltration facilities were continuous sampled beginning either at a depth of 10 feet or 0 feet below surface, depending on the type and anticipated depth of the facility (pond or trench). The continuous sampling extended for a distance of approximately 20 feet in all the borings so sampled.

Standard Penetration Tests (SPT) sampling was performed in general accordance with ASTM D-1586 using a 2-inch outside diameter split-spoon sampler. The samplers were driven into the soil a distance of 18 inches using a 140-pound weight falling a distance of 30 inches. The hammers for the deep borings were operated using an auto-trip hammer. The hammer for the shallow borings was operated by means of a rope and cathead mechanism. The number of blows to drive the sampler each 6 inches over an 18-inch interval was recorded and indicated on the boring logs. The number of blows to drive the sampler the final 12 inches is termed the SPT resistance, or N-value, and is used to evaluate the strength and consistency/relative density of the soil.

An engineer or engineering geologist from PanGEO or the WSDOT Drill Inspector assigned to the crew was present throughout the various phases of the field exploration program to observe the borings, assist in sampling, and to prepare descriptive logs of the explorations. Soils were described in general accordance with the guidelines shown on Figure A-1. The stratigraphic contacts shown on the summary logs represent the approximate boundaries between soil types; actual stratigraphic contacts encountered at other locations in the field may differ from the contact elevations shown on the logs, and may be gradual rather than abrupt. The soil and groundwater conditions depicted are only for the specific date and locations reported, and therefore, are not necessarily representative of other locations and times.

FIELD EXPLORATIONS – TEST PITS

To obtain additional samples for laboratory testing, three test pits were excavated on September 8, 2011, at the location of the two proposed CAVFS, and the relocated pond in the NW quadrant of the interchange. The locations of the test pits were measured in the field based on existing site features. The ground surface elevation at the location of the test pits was visually estimated based on the elevation difference between the ground surface elevation at the test pit, and adjacent test boring locations that had previously been surveyed. The test pits were excavated with a rubber-tracked mini-excavator owned and operated by Northwest Excavating & Trucking Co, Inc. to a depth of approximately 8 feet below the existing ground surface at the location of the CAVFS, and to a depth of approximately 10 feet below the existing ground surface at the location of the NW quadrant pond. An engineer from PanGEO was present during the test pit excavations to obtain representative soil samples and to describe and document the soils encountered in the explorations. The soil samples were described using the system outlined on Figure A-1. The relative in-situ density of cohesionless soils, or the relative consistency of fine-grained soils, was estimated from the excavating action of the excavator, and the stability of the test pit sidewalls. After the test pit was logged and photographed, the excavation was backfilled with the excavated soils, the surface was tamped smooth, and straw was spread over the disturbed ground surface.

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean CLAY
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes: 1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.

2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered:	Units of material distinguished by color and/or composition from material units above and below
Laminated:	Layers of soil typically 0.05 to 1mm thick, max. 1 cm
Lens:	Layer of soil that pinches out laterally
Interlayered:	Alternating layers of differing soil material
Pocket:	Erratic, discontinuous deposit of limited extent
Homogeneous:	Soil with uniform color and composition throughout
Fissured:	Breaks along defined planes
Slickensided:	Fracture planes that are polished or glossy
Blocky:	Angular soil lumps that resist breakdown
Disrupted:	Soil that is broken and mixed
Scattered:	Less than one per foot
Numerous:	More than one per foot
BCN:	Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Spilt Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

LOG KEY 10-069 116TH_INTERCHANGE.GPJ PANGEO.GDT 5/23/11

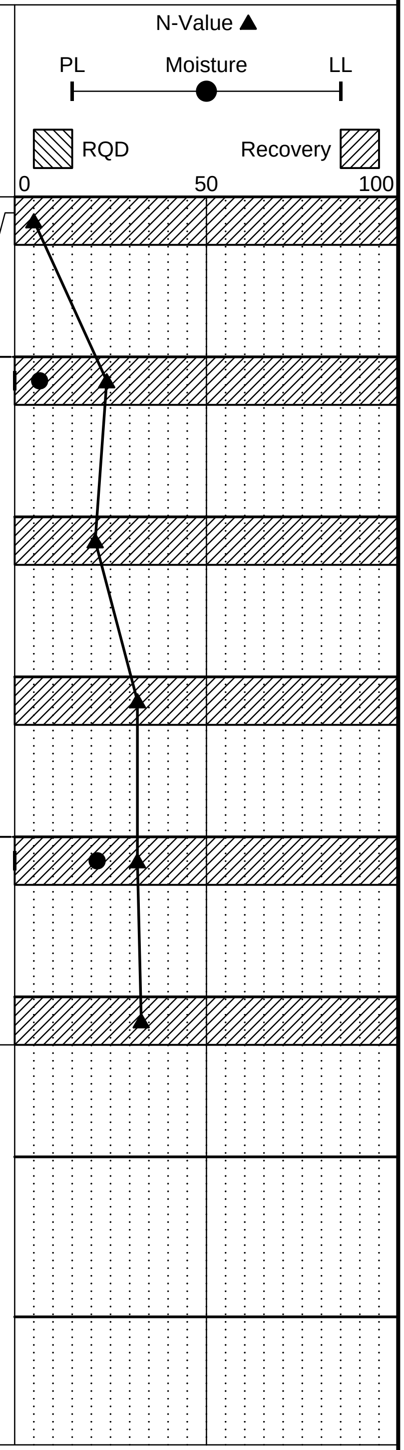
PanGEO INCORPORATED
Phone: 206.262.0370

Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	I-5 NE 116th Interchange	Surface Elevation:	71.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		2 2 3			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Loose, moist, reddish-brown, silty fine SAND **(Recessional Outwash)**.
5	S-2		7 11 13	GS		Medium dense to dense, SAND with silt (SP-SM): moist to wet, gray, poorly graded, interbedded fine to medium SAND and slighty silty SAND; trace subrounded gravel, layered iron oxide staining **(Recessional Outwash)**
10	S-3		7 10 11			-grades to fine to coarse sand.
15	S-4		9 12 20			-becomes dense, wet, moderate heave observed; driller adding bentonite drilling slurry- 16 to 25 feet.
20	S-5		11 14 18	GS		Dense, gray, silty SAND (SM): wet, trace subrounded gravel, **(Recessional Outwash)**
25	S-6		8 14 19			
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 15 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 221+15, 444' RT.

LOG OF TEST BORING THT-01-10

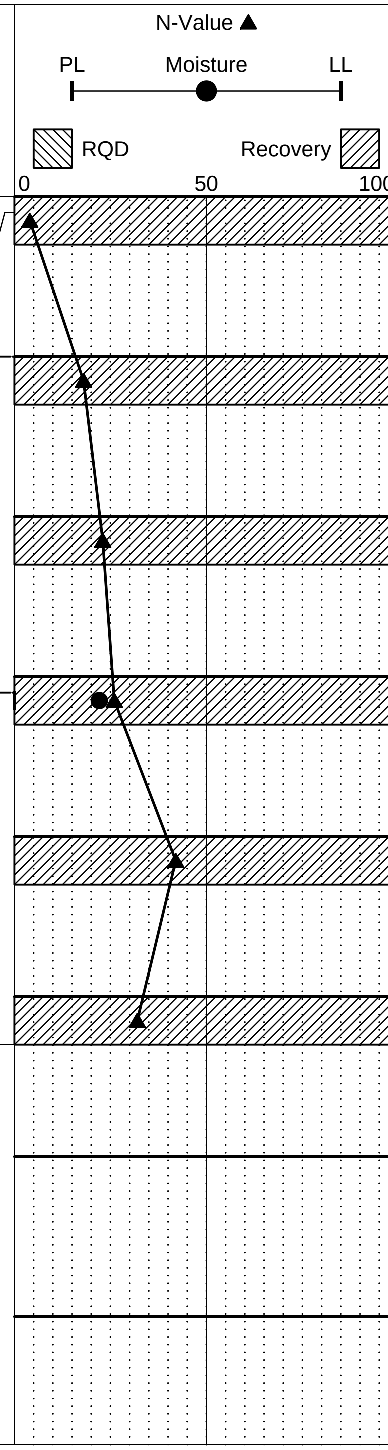
PanGEO INCORPORATED
Phone: 206.262.0370

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	69.9ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		2 2 2			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Loose to medium dense, moist, reddish-brown, silty SAND; occasional fine organics **(Recessional Outwash)**
5	S-2		5 10 8			Medium dense, moist to wet, gray to brown, interbedded fine to medium SAND and slightly silty SAND; trace subrounded gravel, layered iron oxide staining **(Recessional Outwash)**
10	S-3		9 11 12			
15	S-4		12 12 14	GS		Medium dense to dense, wet, gray, silty SAND (SM): trace subrounded gravel, moderate heave observed **(Recessional Outwash)**.
20	S-5		11 19 23			-becomes dense, decreased gravel, thin iron oxide stained layers.
25	S-6		10 16 16			-increasing SILT, rapid dilatancy.
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 15 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 218+71, 304' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

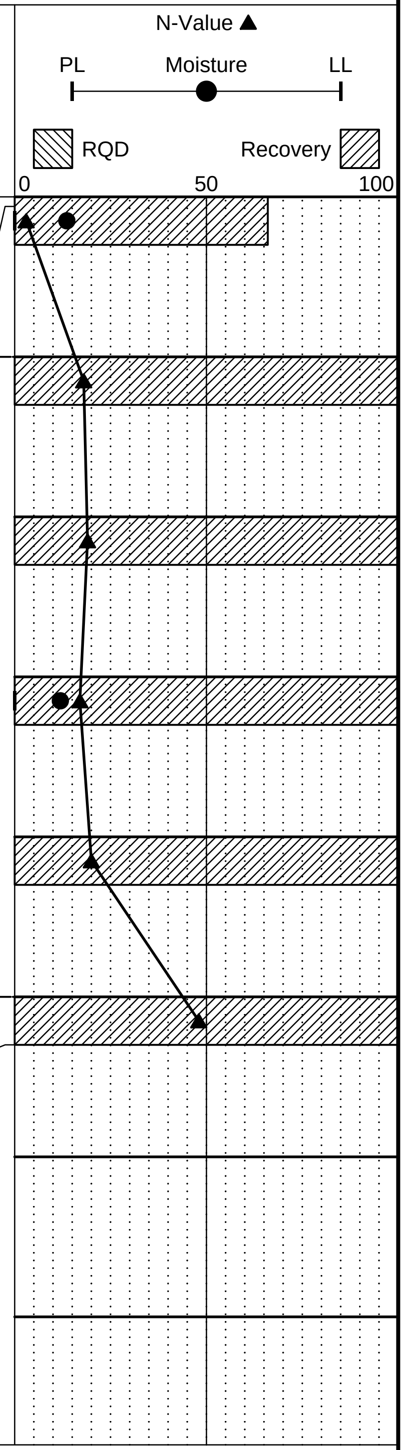
LOG OF TEST BORING THT-02-10

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.7ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		1 2 1	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Loose to medium dense, moist, reddish-brown, SAND with silt (SP-SM); poorly graded, occasional fine organics **(Recessional Outwash)**
5	S-2		5 9 9			Medium dense, moist to wet, gray to brown, silty SAND (SM); fine to medium grained, occasional subrounded gravel, lenses of silt, layered iron oxide staining **(Recessional Outwash)**
10	S-3		8 9 10			
15	S-4		5 7 10	GS		-thin interbeds of SILT and fine SAND, iron oxide stained.
20	S-5		8 12 8			
						-becomes wet.
25	S-6		20 22 26			Dense, wet, gray, slightly silty, fine to coarse SAND; trace fine gravel **(Recessional Outwash)**
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 15 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 215+63, 223' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

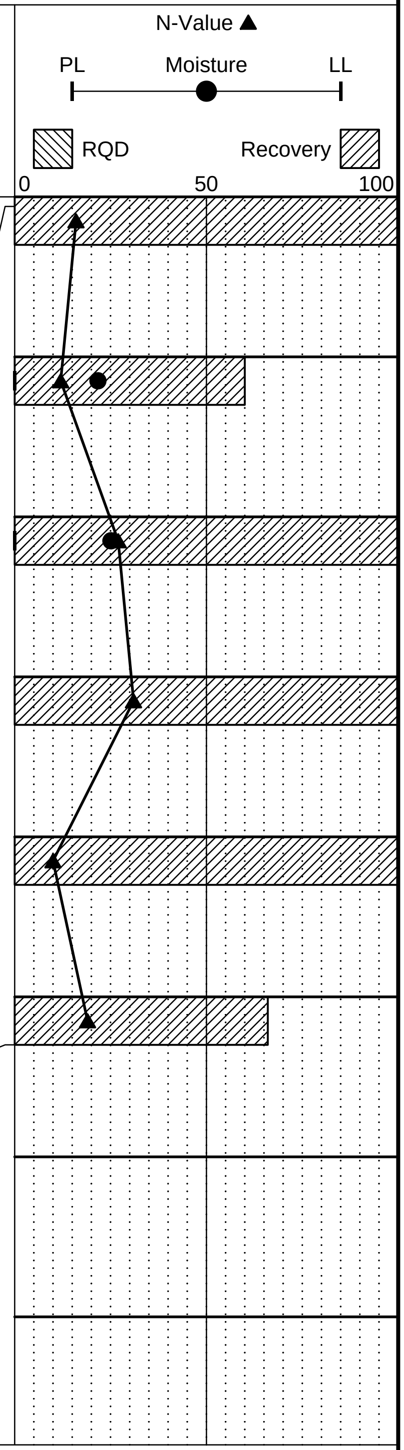
LOG OF TEST BORING THT-03-10

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	53.3ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 6 10			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist to wet, gray to brown, silty SAND (SM); fine to medium grained, interbedded finer and coarser sand, occasional subrounded gravel, lenses of silty sand and silt, layered iron oxide staining **(Recessional Outwash)**
5	S-2		3 5 7	GS		
						-becomes wet.
						-driller adding bentonite drilling slurry, 10 to 25 feet.
10	S-3		8 12 15	GS		-silty sand (SM), occasional thin beds of fine organics, mottled iron oxide staining, rapid dilatancy.
15	S-4		6 13 18			-becomes dense, decreasing SILT.
20	S-5		4 4 6			-becomes loose, brown, thin interbeds of fine to medium silty SAND and SILT; silty SAND has rapid dilatancy, iron oxide stained.
25	S-6		6 8 11			-becomes medium dense, gray, with layered iron oxide staining, occasional SILT interbeds, thinly laminated.
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 15 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 217+45, 95' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

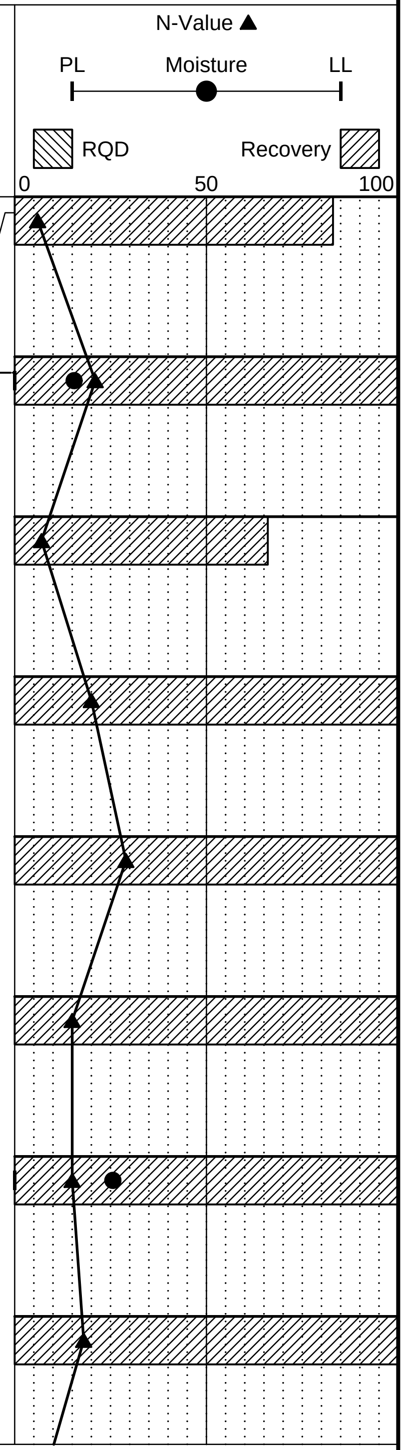
LOG OF TEST BORING THT-04-10

Figure A-5

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	61.8ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 3 3			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Loose, moist, brown, silty SAND; scattered fine organics and rootlets **(Fill)**.
5	S-2		8 10 11	GS		Medium dense to loose, moist to wet, gray-brown, silty SAND (SM); fine to medium grained, scattered organic and woody debris, **(Recessional Outwash)**
10	S-3		2 3 4			-loose, driller adding bentonite drilling slurry, 10 to 50 feet.
15	S-4		10 10 10			-becomes medium dense.
20	S-5		9 14 15			-decreased organics.
25	S-6		6 7 8			
30	S-7		3 6 9	GS		-sand with silt (SP-SM), poorly graded; interbeds of SILT, silty SAND and fine to medium SAND; scattered fine organics, rapid dilatancy.
35	S-8		3 9 9			-iron oxide staining.



Completion Depth:	51.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 220+42, 127' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

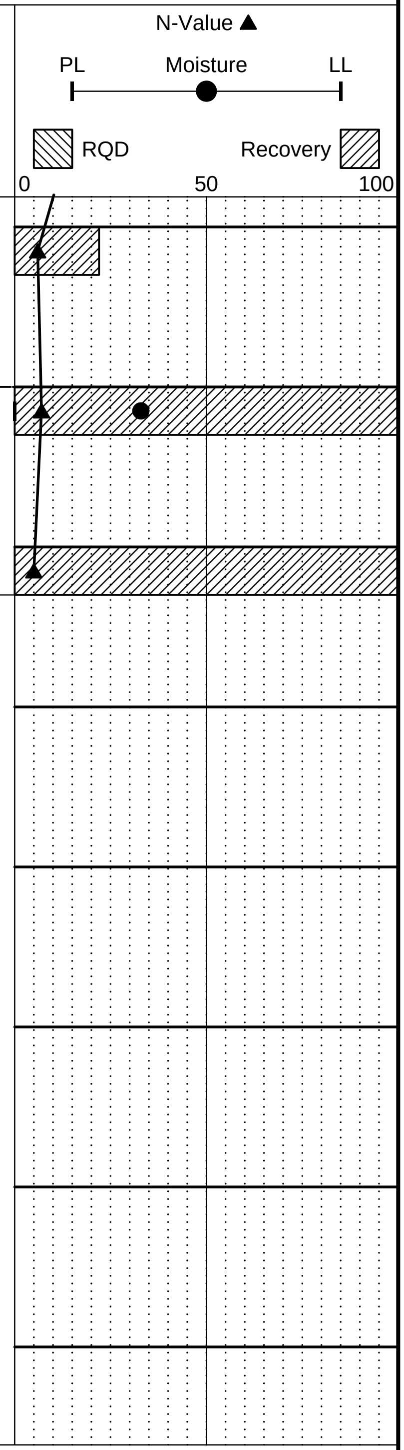
LOG OF TEST BORING THT-05-10

Figure A-6

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	61.8ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40	S-9		2 3 3			Medium dense to loose, moist to wet, gray-brown, silty SAND (SM); fine to medium grained, scattered organic and woody debris, **(Recessional Outwash)** *(Continued)* -moderate heave observed, becomes gray, loose.
45	S-10		3 2 5	GS		Medium stiff, wet, gray-brown, SILT with sand (ML); interbeds of silty fine SAND and clayey SILT, scattered organic and woody debris, SILT is massive, with medium plasticity **(Recessional Outwash)**
50	S-11		3 2 3			
						Bottom of boring at approximately 51.5 ft. Groundwater was estimated at about 10 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
55						
60						
65						
70						
75						



Completion Depth:	51.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 220+42, 127' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

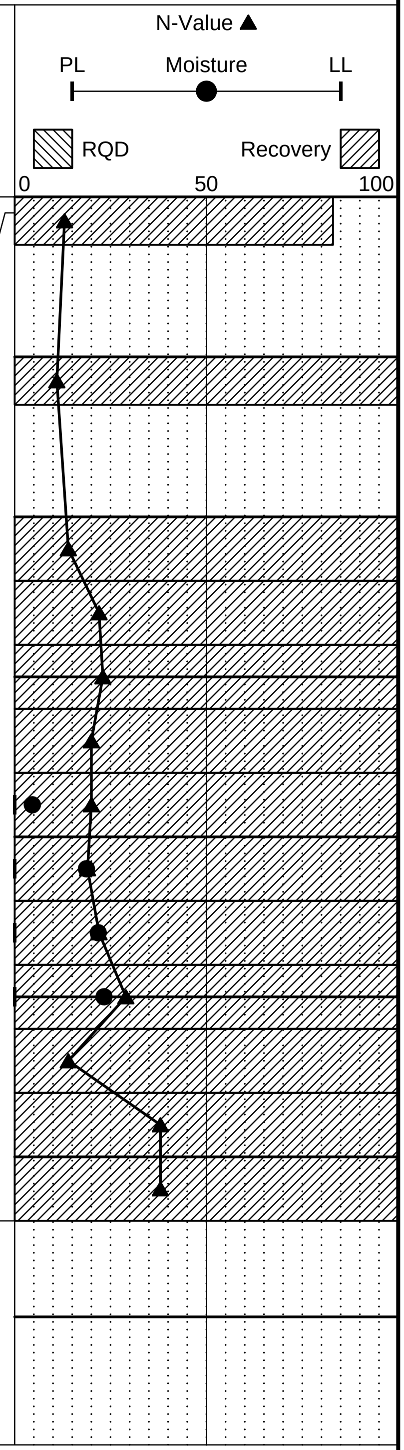
LOG OF TEST BORING THT-05-10

Figure A-6

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	78.8ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
0	S-1		5 6 7		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
					Medium dense to dense, moist to wet, brown-gray, SAND with silt (SP-SM); fine to medium grained, poorly graded, interbedded with finer and coarser beds, occasional subrounded gravel, lenses of silty sand and silt **(Recessional Outwash)**
5	S-2		5 6 5		-becomes reddish brown.
					-possible woody debris based on driller's comments.
10	S-3		6 7 7		
	S-4		3 10 12		-layered iron oxide staining, increased fine, sub-angular gravel.
15	S-5		10 11 12		
	S-6		8 9 11		
	S-7		7 10 10	GS	-poorly graded sand with silt (SP-SM).
20	S-8		6 7 12	GS	-becoming silty sand (SM).
					-becomes wet, thinly laminated silty fine SAND (SM).
	S-9		9 10 12	GS	-poorly graded sand with silt (SP-SM), driller adding bentonite drilling slurry, 22 to 30 feet.
25	S-10		6 12 17	GS	-becomes dense to medium dense, silty sand (SM).
	S-11		6 7 7		-occasional thin beds of iron oxide stained fine sandy SILT and silty SAND to bottom of hole.
30	S-12		14 18 20		
	S-13		10 15 23		
					Bottom of boring at approximately 32 ft. Groundwater was estimated at about 21.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35					Note: Samples S-3 through S-13 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	6/29/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 221+07, 312' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

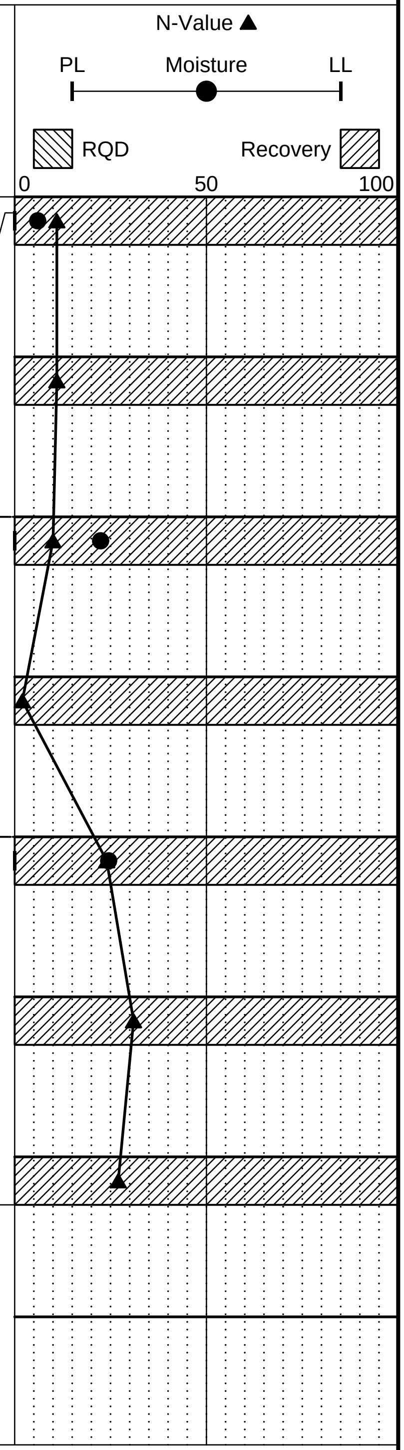
LOG OF TEST BORING THT-06-10

Figure A-7

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	62.1ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		4 5 6	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Medium dense, moist, brown, SAND with silt (SP-SM); fine to medium grained, poorly graded, occasional subrounded gravel, layered iron oxide staining **(Recessional Outwash)**
5	S-2		5 5 6			
10	S-3		5 5 5	GS	▽	Loose, wet, gray, SAND with silt (SP-SM); fine to medium grained, poorly graded, occasional fine organics, occasional iron oxide staining **(Recessional Outwash)**
15	S-4		1 1 1			-very loose, driller adding bentonite drilling slurry, 15 to 30 feet.
20	S-5		7 11 13	GS		Medium dense to dense, wet, gray to reddish-brown SAND with silt (SP-SM); poorly graded, thin beds of iron oxide staining, trace fine organics, moderate heave observed at Sample S-5 **(Recessional Outwash)**.
25	S-6		11 14 17			-occasional fine gravel, rapid dilatancy, dense at Sample S-6.
30	S-7		7 11 16			
						Bottom of boring at approximately 31.5 ft. Groundwater was estimated at about 10 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						



Completion Depth:	31.5ft
Date Borehole Started:	7/6/10
Date Borehole Completed:	7/6/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 221+20, 117' RT.

LOG OF BOREHOLE 10-069_116TH_INTERCHANGE.GPJ PANGEO.GDT 5/23/11

PanGEO INCORPORATED
Phone: 206.262.0370

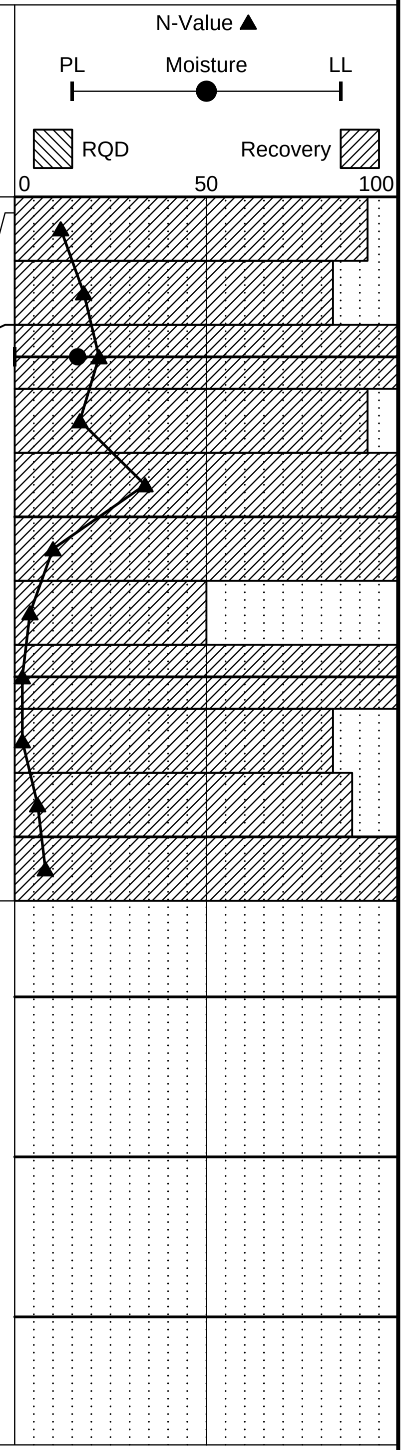
LOG OF TEST BORING THT-07-10

Figure A-8

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	54.6ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 5 7			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
	S-2		7 8 10			Medium dense, moist, gray, interbedded slightly silty to silty, fine to medium SAND; occasional fine organics, occasional iron oxide staining **(Recessional Outwash)**
5	S-3		13 13 9	GS		Medium dense to very loose, wet, brown to reddish-brown, silty SAND (SM); fine to medium grained, trace fine organics, occasional subrounded gravel, layered iron oxide staining **(Recessional Outwash)**.
	S-4		6 9 8			
	S-5		6 14 20			-becomes gray, with occasional fine organics; driller adding bentonite drilling slurry, 8 to 30 feet.
10	S-6		8 6 4			-becomes loose, with increasing organics and wood debris, occasional thin beds of clayey SILT, dense at Sample S-5.
	S-7		3 2 2			-very loose to 18'.
15	S-8		1 1 1			-becomes gray-brown.
	S-9		1 1 1			
	S-10		2 2 4			
20	S-11		3 3 5			-medium dense.
						Bottom of boring at approximately 22 ft. Groundwater was estimated at about 4 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
25						Note: Samples S-1 through S-11 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.
30						
35						



Completion Depth:	22.0ft
Date Borehole Started:	7/6/10
Date Borehole Completed:	7/6/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 218+27, 88' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

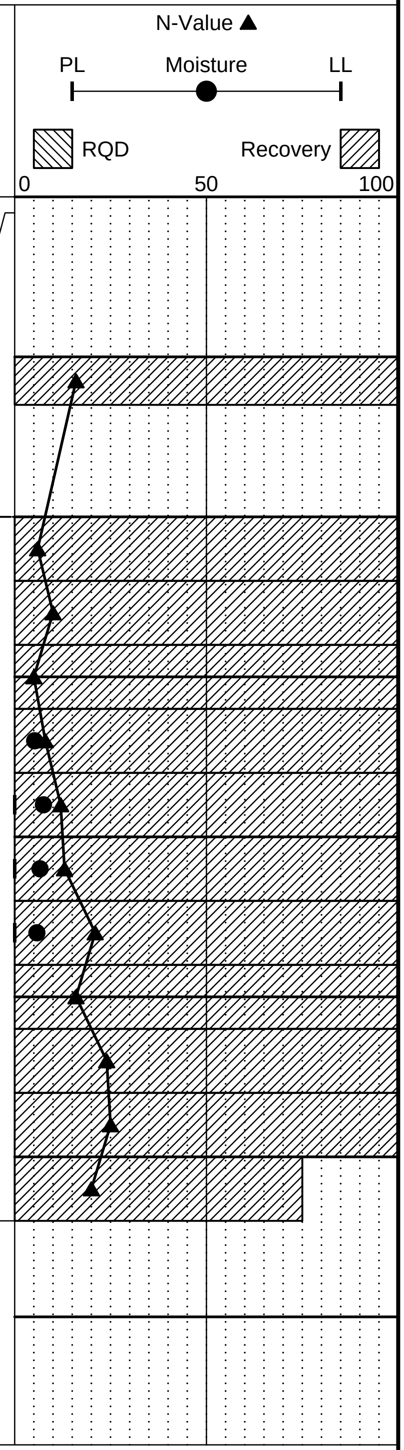
LOG OF TEST BORING THT-08-10

Figure A-9

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	79.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense to loose, moist, brownish-gray, fine to medium SAND; trace silt, fine gravel, occasional iron oxide staining **(Recessional Outwash)**
5	S-1		5 8 8			
10	S-2		3 3 3			Loose to medium dense, moist, gray, SAND; poorly graded, trace silt and fine gravel, occasional interbeds of brown slightly silty SAND **(Recessional Outwash)**
	S-3		3 5 5			
15	S-4		3 3 2			-increasing SILT, iron oxide stained at bottom of sample.
	S-5		4 4 4	GS		
	S-6		4 6 6	GS		-becomes poorly graded sand with silt (SP-SM), medium dense.
20	S-7		6 6 7	GS		-poorly graded sand with silt (SP-SM).
	S-8		7 10 11	GS		-poorly graded sand with silt (SP-SM).
25	S-9		8 9 7			-occasional thin beds of fine sandy SILT, decreased coarse SAND.
	S-10		8 9 15			
	S-11		12 12 13			-becomes wet.
30	S-12		7 9 11			
						Bottom of boring at approximately 32 ft. Groundwater was estimated at about 29 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						Note: Samples S-2 through S-12 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft
Date Borehole Started:	7/6/10
Date Borehole Completed:	7/6/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 223+97, 311' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

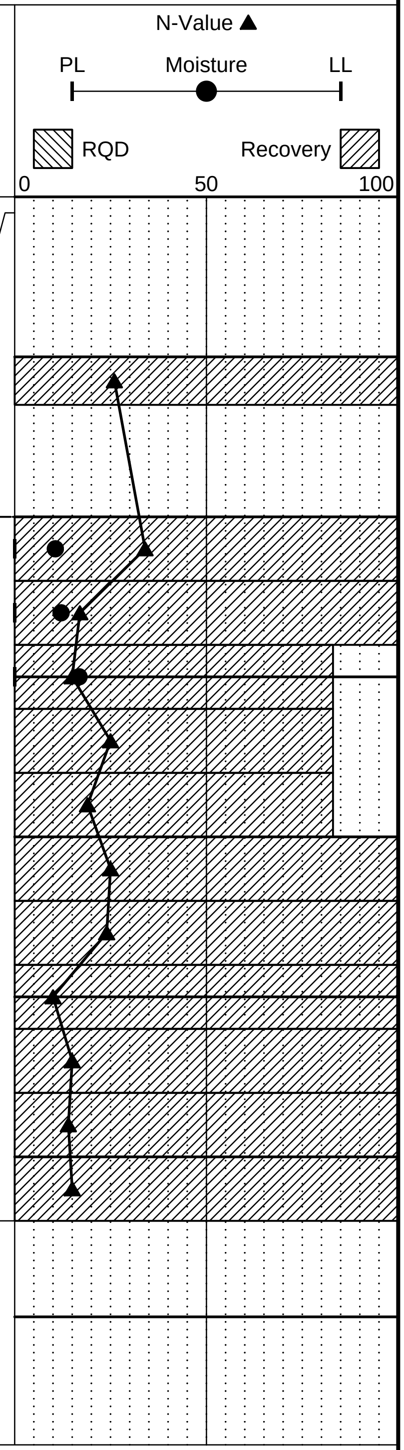
LOG OF TEST BORING THT-09-10

Figure A-10

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	70.6ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist to wet, brown to gray-brown, fine to medium SAND; trace fine silt and rounded gravel, occasional iron oxide staining **(Recessional Outwash)**
5	S-1		9 11 15			
10	S-2		13 17 17	GS		Dense to medium dense, moist to wet, gray to brownish-gray, silty SAND (SM); interbeds of fine to medium sand, trace silt, fine gravel, occasional iron oxide staining and thin organic rich beds **(Recessional Outwash)**
	S-3		10 9 8	GS		-grades to poorly graded sand with silt (SP-SM), increasing moisture, drillers adding bentonite drilling slurry, 12 to 30 feet.
15	S-4		7 8 7	GS		-grades to well graded sand with silt (SW-SM).
	S-5		10 12 13			
	S-6		9 9 10			-becomes wet.
20	S-7		7 9 16			
	S-8		13 14 10			
25	S-9		6 4 6			-numerous fine organics, increased SILT, medium to rapid dilatancy.
	S-10		5 7 8			
	S-11		4 7 7			
30	S-12		3 6 9			
						Bottom of boring at approximately 32 ft. Groundwater was estimated at about 18 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						Note: Samples S-2 through S-12 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft
Date Borehole Started:	7/2/10
Date Borehole Completed:	7/2/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 224+80, 247' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

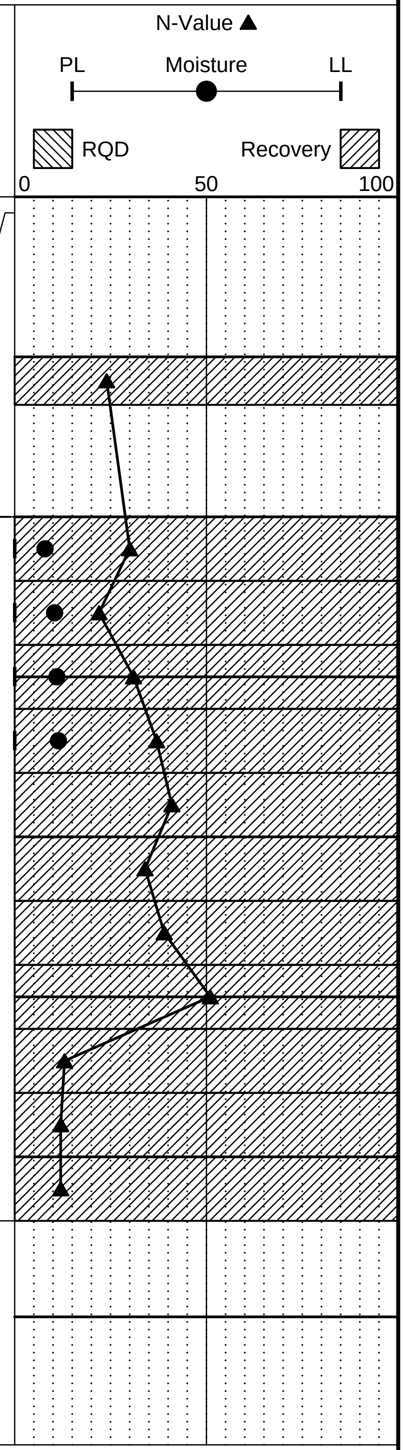
LOG OF TEST BORING THT-10-10

Figure A-11

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	73.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist, brown to gray-brown, fine to medium SAND; trace silt and fine rounded gravel, occasional iron oxide staining **(Recessional Outwash)**
5	S-1		9 11 13			
10	S-2		10 15 15	GS		Medium dense to dense, moist to wet, gray to brownish-gray, SAND with silt (SP-SM); poorly graded, interbeds of fine to medium sand, trace silt, fine gravel, layered iron oxide staining, occasional thin beds of fine oganics **(Recessional Outwash)**
	S-3		10 10 12	GS		-grading to well graded sand with silt (SW-SM). -grading to silty sand (SM).
15	S-4		12 15 16	GS		
	S-5		12 16 21	GS		-silty sand (SM).
	S-6		18 20 21			-becomes wet, drillers adding bentonite drilling slurry, 12 to 30 feet.
20	S-7		10 14 20			
	S-8		13 18 21			
25	S-9		14 24 27			
	S-10		5 7 6			-becomes medium dense, increasing SILT.
	S-11		6 5 7			
30	S-12		6 5 7			
						Bottom of boring at approximately 32 ft. Groundwater was estimated at about 18 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions. Note: Samples S-2 through S-12 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.
35						



Completion Depth:	32.0ft	Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 226+07, 197' LT.
Date Borehole Started:	7/1/10	
Date Borehole Completed:	7/1/10	
Logged By:	Nels Reese, L.G.	
Drilling Company:	Geologic Drill, Inc.	

PanGEO INCORPORATED
Phone: 206.262.0370

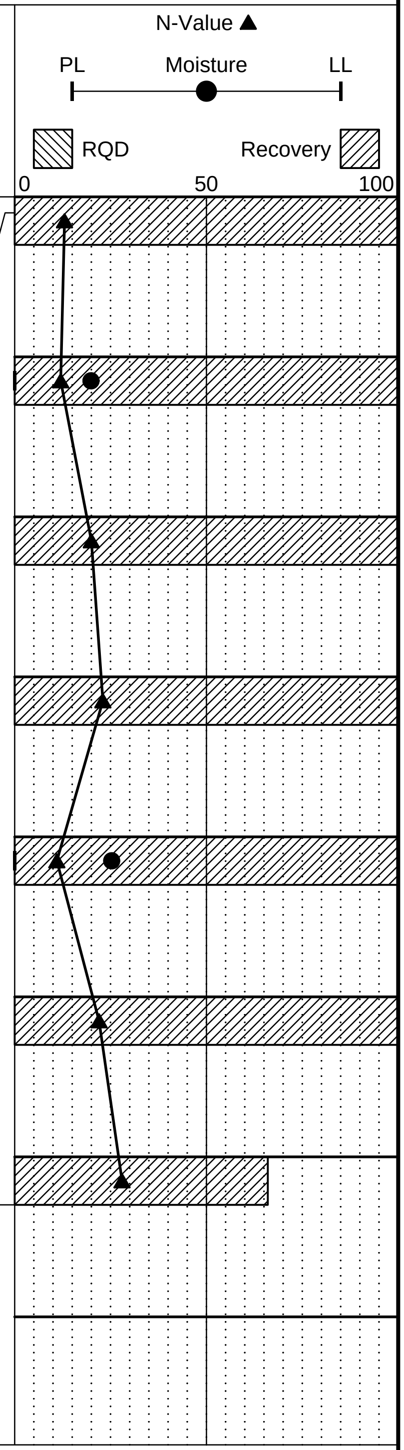
LOG OF TEST BORING THT-11-10

Figure A-12

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	70.3ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 6 7			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist, gray to brownish-gray, silty SAND (SM); fine to medium grained, trace fine gravel, interbeds of slightly silty sand **(Recessional Outwash)**
5	S-2		4 6 6	GS		-occassional fine organics and wood debris.
10	S-3		7 10 10			-occasional thin silt beds, fine oganics, and woody debris, iron oxide stained.
					▽	-becomes wet, drillers adding bentonite drilling slurry, 12.5 to 30 feet.
15	S-4		10 10 13			-rapid dilatancy, layered iron oxide staining.
20	S-5		5 5 6	GS		-silty sand (SM), grades brown, with interbeds of clayey silt.
25	S-6		8 10 12			
30	S-7		8 15 13			
						Bottom of boring at approximately 31.5 ft. Groundwater was estimated at about 12.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						



Completion Depth:	31.5ft
Date Borehole Started:	7/2/10
Date Borehole Completed:	7/2/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 226+89, 114' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

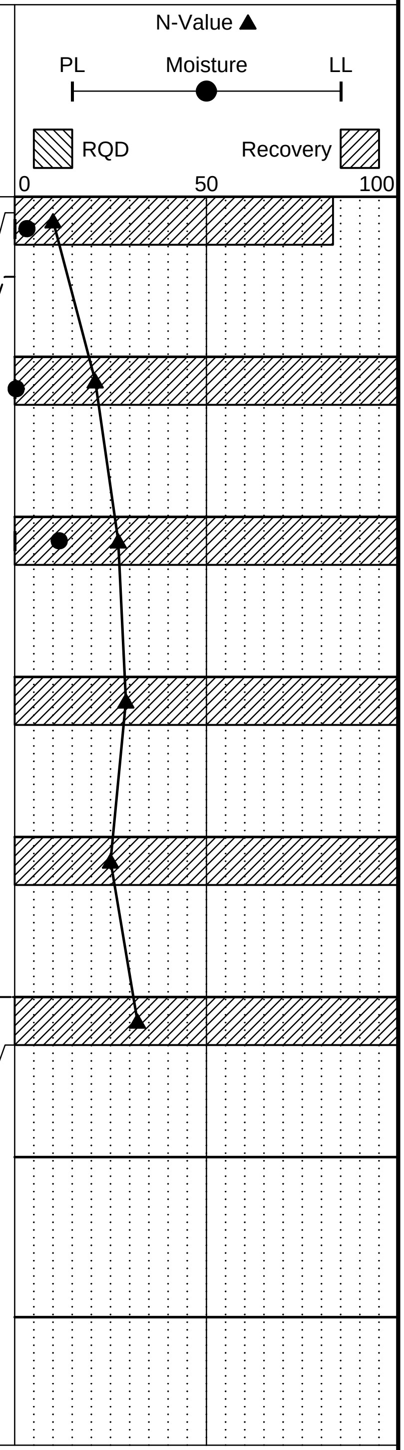
LOG OF TEST BORING THT-12-10

Figure A-13

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	73.1ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 5 5	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Loose, moist, reddish brown, silty fine to medium SAND; occasional fine organics, iron oxide stained **(Recessional Outwash)**
5	S-2		6 10 11	GS		Medium dense, moist, gray to brown, SAND with silt (SP-SM); fine to medium grained, poorly graded, trace to slightly silty, trace coarse sand, occasional subrounded gravel, layered iron oxide staining **(Recessional Outwash)**
						-driller adding bentonite drilling slurry, 7.5 to 25 feet.
10	S-3		11 13 14	GS		-becomes wet, increasing GRAVEL and coarse SAND.
15	S-4		7 13 16			
20	S-5		11 12 13			-layered iron oxide staining, increasing SILT.
25	S-6		11 16 16			Dense, wet, gray to brown, silty fine to medium SAND; trace coarse sand, occasional subrounded gravel, iron oxide stained, rapid dilatancy **(Recessional Outwash)**
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 10 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	7/1/10
Date Borehole Completed:	7/1/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 232+62, 102' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

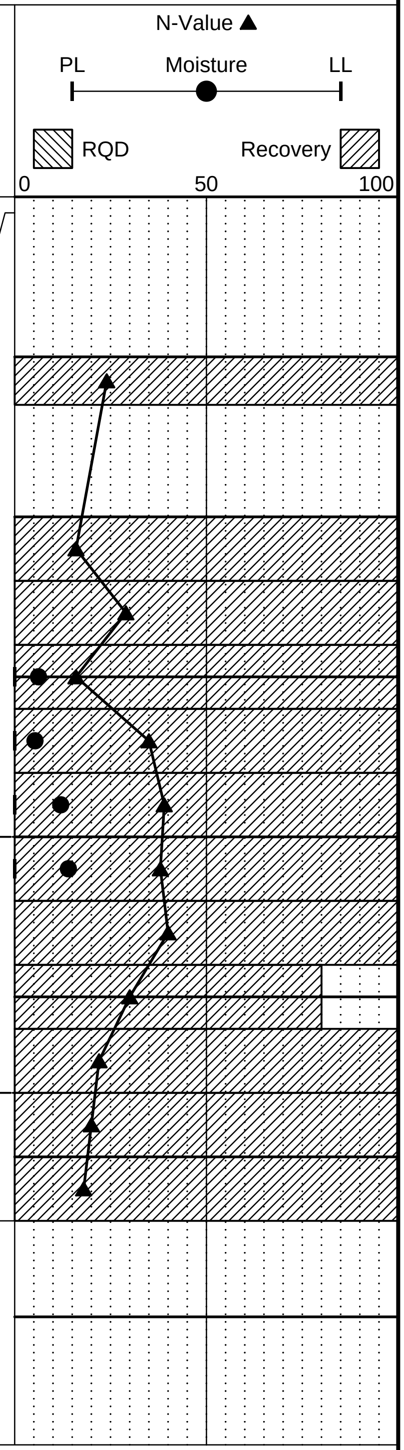
LOG OF TEST BORING THT-13-10

Figure A-14

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	78.9ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Medium dense to dense, moist to wet, gray-brown to brown, SAND with silt (SP-SM); fine to medium grained, poorly graded, trace fine rounded gravel, occasinal thin interbeds of silty SAND, iron oxide stained **(Recessional Outwash)**
5	S-1		8 9 15			-gravelly drilling from 3 to 4 feet.
10	S-2		7 7 9			
	S-3		6 14 15			-occasional interbeds of fine sandy SILT, trace fine organics.
15	S-4		3 6 10	GS		-poorly graded sand with silt (SP-SM).
	S-5		10 15 20	GS		-poorly graded sand with silt (SP-SM), becomes dense.
	S-6		18 20 19	GS		-poorly graded sand with silt (SP-SM). -becomes wet, drillers adding bentonite drilling slurry, 20 to 30 feet.
20	S-7		12 20 18	GS		Dense to medium dense, wet, gray-brown, SAND with silt (SW-SM); well graded, trace fine rounded to sub-angular gravel, occasinal thin interbeds of silty SAND, iron oxide stained **(Recessional Outwash)**
	S-8		16 20 20			
25	S-9		15 15 15			-increasing SILT, with interbeds of laminated fine sandy SILT and silty fine SAND, iron oxide stained.
	S-10		8 9 13			
	S-11		9 10 10			Medium dense, wet, brownish-gray, silty SAND; trace fine gravel, occasional clayey SILT interbeds, iron oxide stained **(Recessional Outwash)**.
30	S-12		8 10 8			
35						Bottom of boring at approximately 32 ft. Groundwater was estimated at about 18 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions. Note: Samples S-2 through S-12 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	6/29/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 225+04, 259' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

LOG OF TEST BORING THT-14-10

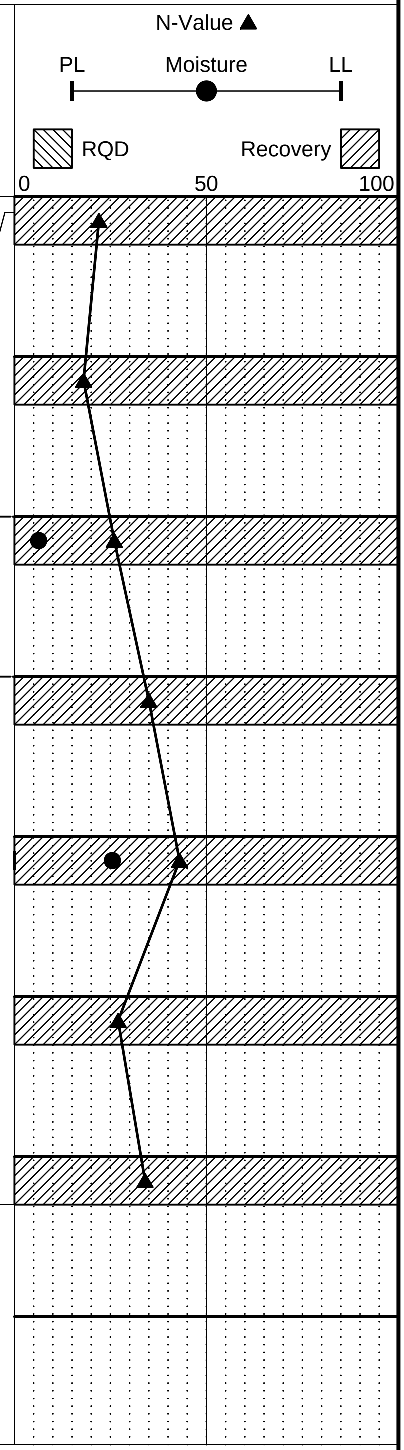
Figure A-15

The stratification lines represent approximate boundaries. The transition may be gradual.

LOG OF BOREHOLE 10-069_116TH_INTERCHANGE.GPJ PANGEO.GDT 5/23/11

Project:	I-5 NE 116th Interchange	Surface Elevation:	71.1ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		4 10 12			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist, brown to gray, slightly silty to silty fine to medium SAND; occasional subrounded gravel, iron oxide staining **(Recessional Outwash)**
5	S-2		8 10 8			
10	S-3		10 13 13	GS		Medium dense, moist to wet, gray, SAND (SP); poorly graded, fine to medium, occasional thin interbeds of brown silty SAND, iron oxide stained **(Recessional Outwash)**
						-becomes wet.
15	S-4		11 13 22			Dense to medium dense, wet, gray-brown silty SAND (SM); thin beds of iron oxide staining, occasional fine organics, rapid dilatancy **(Recessional Outwash)**
						-driller adding bentonite drilling slurry, 15 to 30 feet.
20	S-5		13 21 22	GS		
25	S-6		10 14 13			-thin interbeds of clayey, fine sandy SILT, scattered fine organics.
30	S-7		13 17 17			
						Bottom of boring at approximately 31.5 ft. Groundwater was estimated at about 13.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						



Completion Depth:	31.5ft
Date Borehole Started:	7/7/10
Date Borehole Completed:	7/7/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 226+21, 100' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

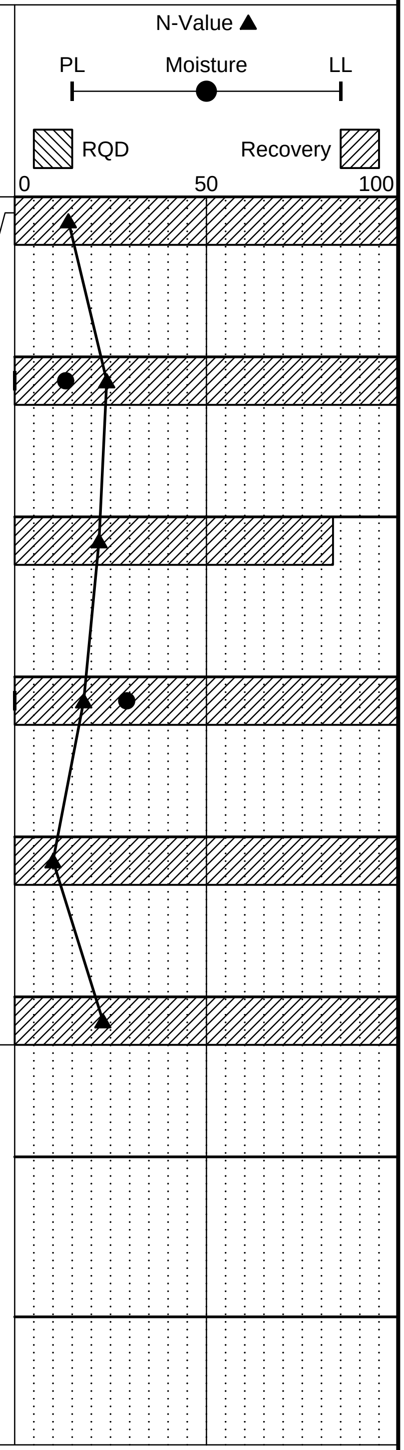
LOG OF TEST BORING THT-15-10

Figure A-16

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	71.7ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		4 5 9			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist to wet, brown-gray, silty SAND (SM); fine to medium grained, occasional fine gravel, occasional thin interbeds of brown silty SAND, iron oxide stained **(Recessional Outwash)**
5	S-2		10 11 13	GS		
						-becomes wet, driller adding bentonite drilling slurry, 7.5 to 25 feet.
10	S-3		6 8 14			
15	S-4		4 8 10	GS		-silty sand (SM), occasional interbeds of fine sandy, clayey SILT, layered iron oxide staining.
20	S-5		8 6 4			
25	S-6		6 13 10			
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 7.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



		Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 228+47, 125' RT.
Completion Depth:	26.5ft	
Date Borehole Started:	6/29/10	
Date Borehole Completed:	6/29/10	
Logged By:	Nels Reese, L.G.	
Drilling Company:	Geologic Drill, Inc.	

PanGEO INCORPORATED
Phone: 206.262.0370

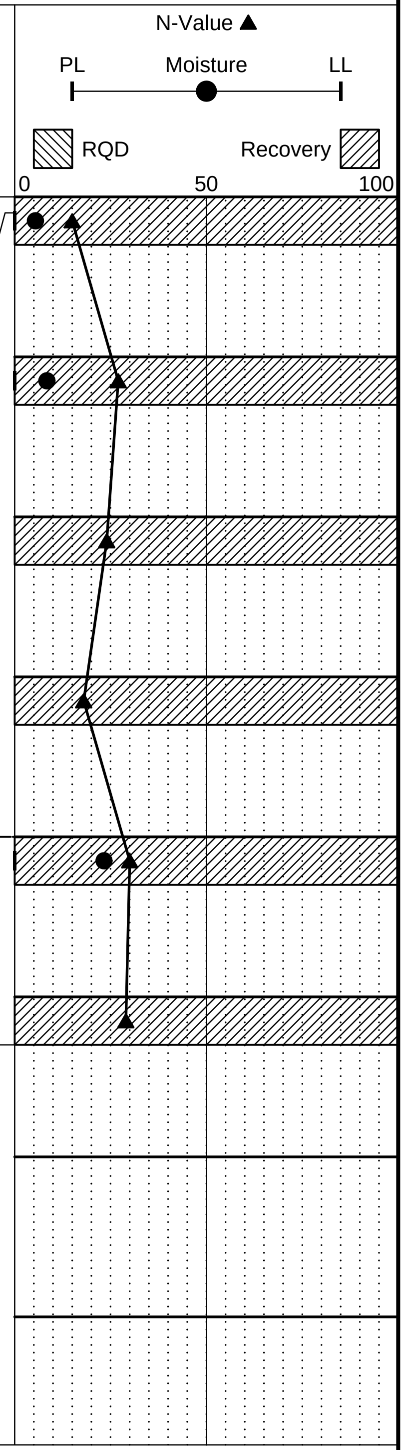
LOG OF TEST BORING THT-16-10

Figure A-17

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	73.9ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		6 7 8	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist to wet, brown-gray, SAND with silt (SP-SM); poorly graded, occasional interbeds of silty SAND and poorly graded, fine to medium SAND, layered iron oxide staining **(Recessional Outwash)**
5	S-2		8 11 16	GS		-becomes well graded sand with silt (SW-SM).
						-becomes wet, driller adding bentonite drilling slurry, 10 to 25 feet.
10	S-3		8 10 14			
15	S-4		7 9 9			
20	S-5		11 14 16	GS		Medium dense, wet, brown, SAND with silt (SP-SM); poorly graded, fine to medium grained with a trace of coarse SAND, iron oxide stained **(Recessional Outwash)**
25	S-6		9 13 16			
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 9 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft	Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 235+30, 103' RT.
Date Borehole Started:	6/29/10	
Date Borehole Completed:	6/29/10	
Logged By:	Nels Reese, L.G.	
Drilling Company:	Geologic Drill, Inc.	

PanGEO INCORPORATED
Phone: 206.262.0370

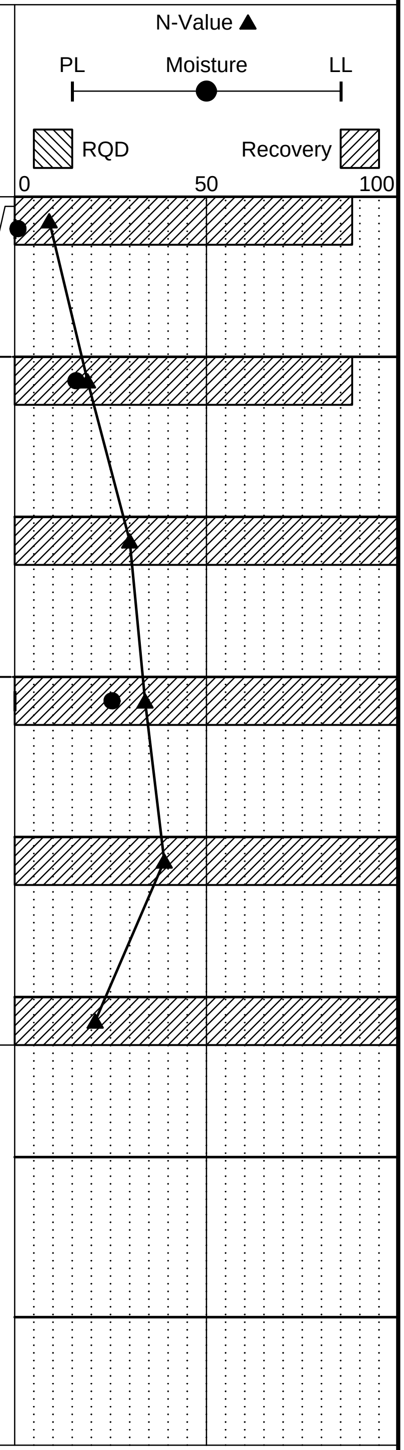
LOG OF TEST BORING THT-17-10

Figure A-18

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.4ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 4 5	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Loose to medium dense, moist to wet, brown-gray, fine to medium SAND; trace silt and fine gravel **(Recessional Outwash)**
5	S-2		4 9 10	GS		Medium dense to dense, moist to wet, gray-brown, SAND (SP); poorly graded, trace sit, occasional rounded gravel **(Recessional Outwash)**
						-becomes wet.
10	S-3		12 18 12			-becomes dense; driller adding bentonite drilling slurry, 10 to 25 feet.
15	S-4		11 16 18	GS		Dense to medium dense, wet, gray, SAND with silt (SP-SM); poorly graded, fine to medium grained, trace fine gravel **(Recessional Outwash)**
20	S-5		7 19 20			- interbeds of silty SAND, iron oxide staining.
25	S-6		5 9 12			-becomes medium dense.
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 7.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	7/1/10
Date Borehole Completed:	7/1/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 239+71, 108' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

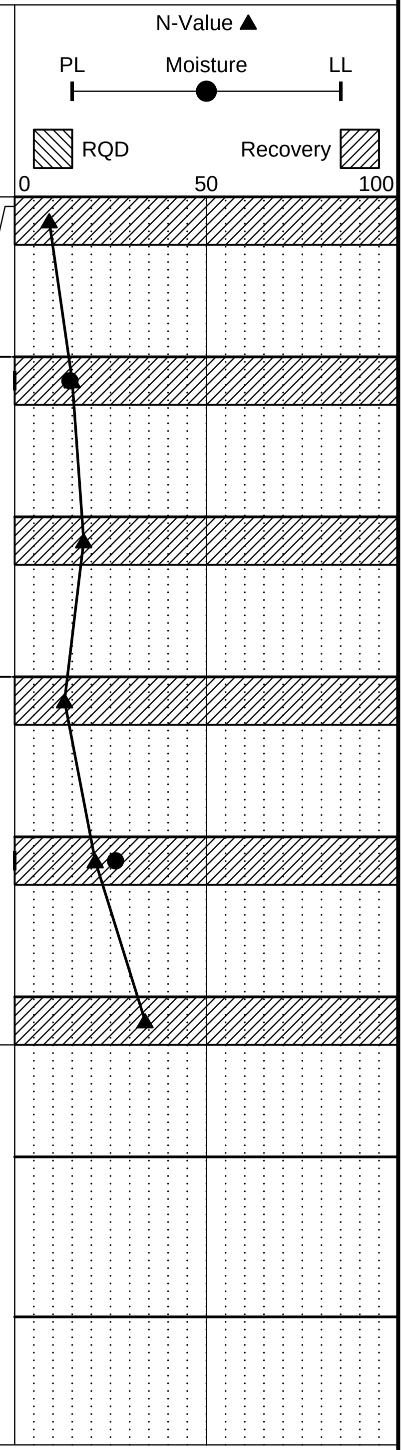
LOG OF TEST BORING THT-18-10

Figure A-19

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	73.5ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1	X	3 4 5			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Loose, moist, reddish-brown, slightly silty to silty, fine to medium SAND; occasional fine gravel, iron oxide staining **(Recessional Outwash)**.
5	S-2	X	5 7 8	GS	▽	Medium dense, wet, gray, SAND with silt (SP-SM); poorly graded, occasional fine, rounded gravel, iron oxide staining **(Recessional Outwash)**. -driller adding bentonite drilling slurry, 5 to 25 feet.
10	S-3	X	4 8 10			
15	S-4	X	6 6 7			Medium dense to dense, wet, gray, silty SAND (SM); fine to medium grained, trace fine gravel, with organic rich interbeds; silty beds have rapid dilatancy **(Recessional Outwash)**
20	S-5	X	7 10 11	GS		-interbeds of fine to medium SAND and silty fine SAND, trace fine organics.
25	S-6	X	10 19 15			-becomes dense, fine SAND; slightly silty.
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	7/1/10
Date Borehole Completed:	7/1/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 244+24, 101' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

LOG OF TEST BORING THT-19-10

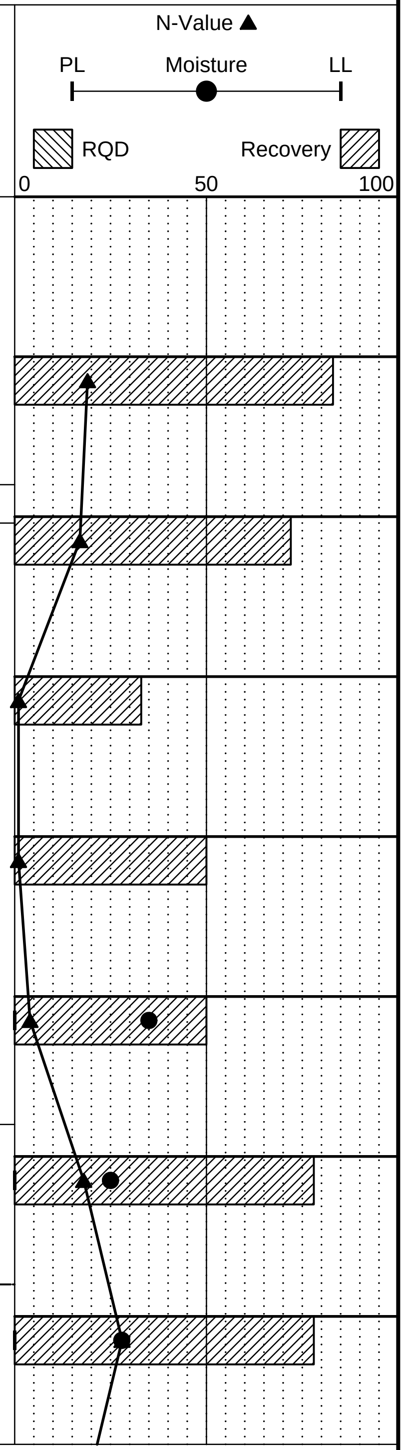
Figure A-20

LOG OF BOREHOLE 10-069_116TH_INTERCHANGE.GPJ PANGEO.GDT 5/23/11

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Medium dense, brown and gray SAND: moist, fine to coarse, layered with occasional silty organic lenses, trace weathering (Possible Fill).
5	S-1		8 9 10			
						Dark brown, organic fine SAND with silt and woody debris (Topsoil).
10	S-2		4 8 9			Loose, brown, silty SAND (SM): moist to wet, fine to medium grained, homogeneous, laminated, woody debris (Younger Alluvium - Qyal).
15	S-3		0 0 1			-very loose, dark brown, silty fine to coarse sand with woody organics.
20	S-4		0 0 1			-very loose, yellow brown, silty fine sand, trace clay, occasional woody organics, laminated.
25	S-5		1 2 2	GS		-loose, yellow and red brown, silty fine sand, wet (saturated), trace clay and coarse sand, rare gravel; red banding.
30	S-6		7 8 10	GS		Medium dense, red brown SAND with silt (SP-SM): wet, poorly graded, fine grained, homogeneous, laminated, weathered with 1/2 inch red bands (Recessional Outwash - Marysville Member - Qvrm).
35	S-7		8 12 16	GS		Medium dense, brown gray, sandy SILT (SM): wet, non-plastic, rapid dilatancy, fine grained sand, laminated with thin reddish laminae, occasional clayey silt lenses, dips to 10^{o} (Recessional Outwash - Marysville Member - Qvrm).



Completion Depth:	151.5ft
Date Borehole Started:	7/28/10
Date Borehole Completed:	7/28/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+94, 107' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

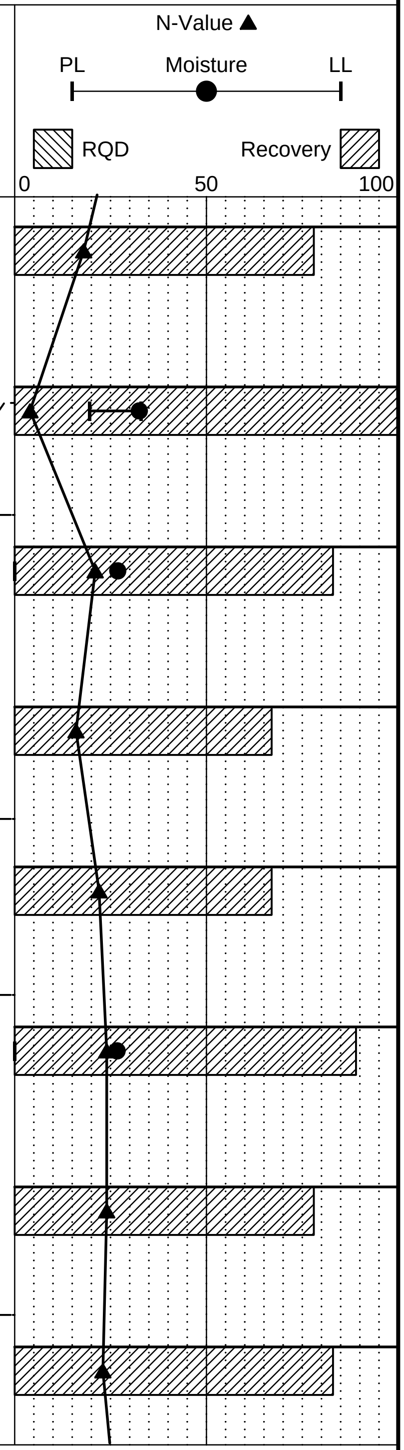
LOG OF TEST BORING THT-20-10

Figure A-21

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
40	S-8	X	7 9 9		Medium dense, brown gray, sandy SILT (SM): wet, non-plastic, rapid dilatancy, fine grained sand, laminated with thin reddish laminae, occasional clayey silt lenses, dips to 10° (Recessional Outwash - Marysville Member - Qvrm). *(Continued)* -grading to gray, fine sand and silt, occasional 1/8" clayey silt laminae, mainly non-plastic.
45	S-9	X	5 3 1	GS	-gradational contact. Soft, gray, silty CLAY (CL): moist to wet, low plasticity, slow dilatancy, laminated (Recessional Outwash).
50	S-10	X	9 10 11	GS	Medium dense, gray SAND with silt (SP-SM): wet, poorly graded, fine to medium grained, clean with trace of silt, homogenous, laminated, occasional rounded pockets of silty clay (Recessional Outwash - Marysville Member - Qvrm).
55	S-11	X	6 8 8		-rare woody organics, sand mainly greenish quartz and dark volcanic lithics.
60	S-12	X	8 11 11		Medium dense, SILT with fine sand: wet, non-plastic, rapid dilatancy, laminated with occasional silty clay lenses (Recessional Outwash - Marysville Member - Qvrm).
65	S-13	X	11 11 13	GS	Medium dense, gray SAND with silt (SP-SM): wet, poorly graded, fine grained, trace silt, homogenous, massive (Recessional Outwash - Marysville Member - Qvrm).
70	S-14	X	9 12 12		-becoming laminated.
75	S-15	X	12 12 11		Medium dense, gray, SAND with silt: wet, fine grained, homogeneous, massive with laminated layers (Recessional Outwash - Marysville Member - Qvrm).



Completion Depth:	151.5ft	Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+94, 107' LT.
Date Borehole Started:	7/28/10	
Date Borehole Completed:	7/28/10	
Logged By:	S. Evans	
Drilling Company:	Holocene Drilling	

PanGEO INCORPORATED
Phone: 206.262.0370

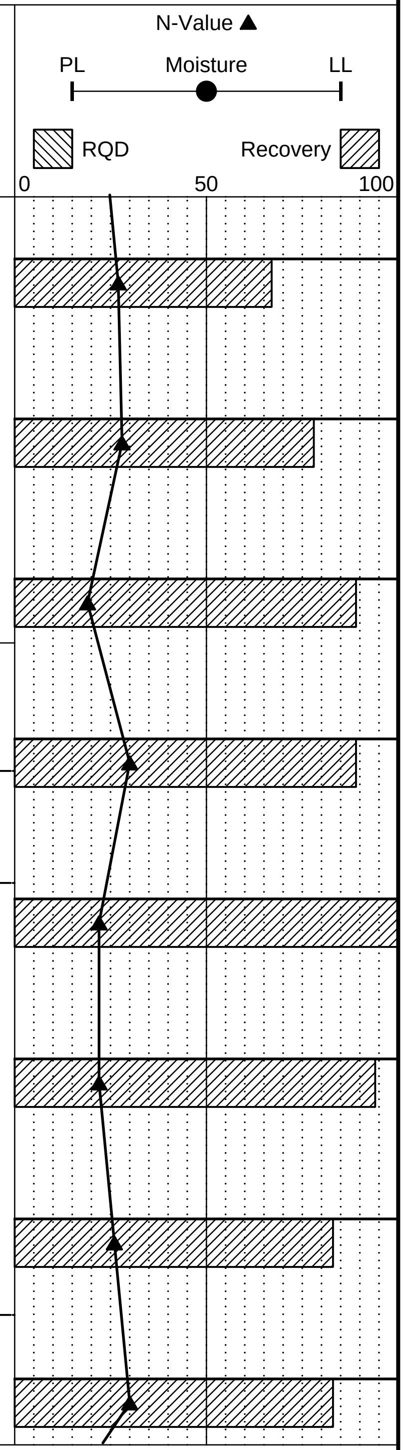
LOG OF TEST BORING THT-20-10

Figure A-21

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Medium dense, gray, SAND with silt: wet, fine grained, homogeneous, massive with laminated layers (Recessional Outwash - Marysville Member - Qvrm). *(Continued)*
80	S-16		13 12 15			
85	S-17		10 11 17			-grading to sandy silt, laminated, with 3" bed of green gray, silty clay.
90	S-18		10 9 10			-gradational contact with 2" interbeds of silty clay.
						Stiff to hard, green gray, silty CLAY: moist to wet, low plasticity, laminated (Recessional Outwash - Clay Member - Qvrc).
95	S019		11 14 16			
						Dense, gray SILT: wet, very coarse silt grading to fine sand, non-plastic, homogeneous, laminated (Recessional Outwash - Clay Member - Qvrc).
100	S-20		5 9 13			Stiff, green gray, silty CLAY: moist to wet, low plasticity, slow dilatancy, with thin (1/4") interbeds of non-plastic sandy silt (Recessional Outwash - Clay Member - Qvrc).
105	S-21		6 10 12			
110	S-22		8 14 12			-grading to interbedded silty clay and coarse silt, beds 1/2" to 1", sub-horizontal.
						Medium dense, gray, fine sandy SILT with interbeds of clayey SILT: wet (saturated), generally non-plastic, with rapid and slow dilatancy beds, beds to 6" with gradational contacts, laminated (Recessional Outwash - Clay Member - Qvrc).
115	S-23		6 12 18			



Completion Depth:	151.5ft
Date Borehole Started:	7/28/10
Date Borehole Completed:	7/28/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+94, 107' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

LOG OF TEST BORING THT-20-10

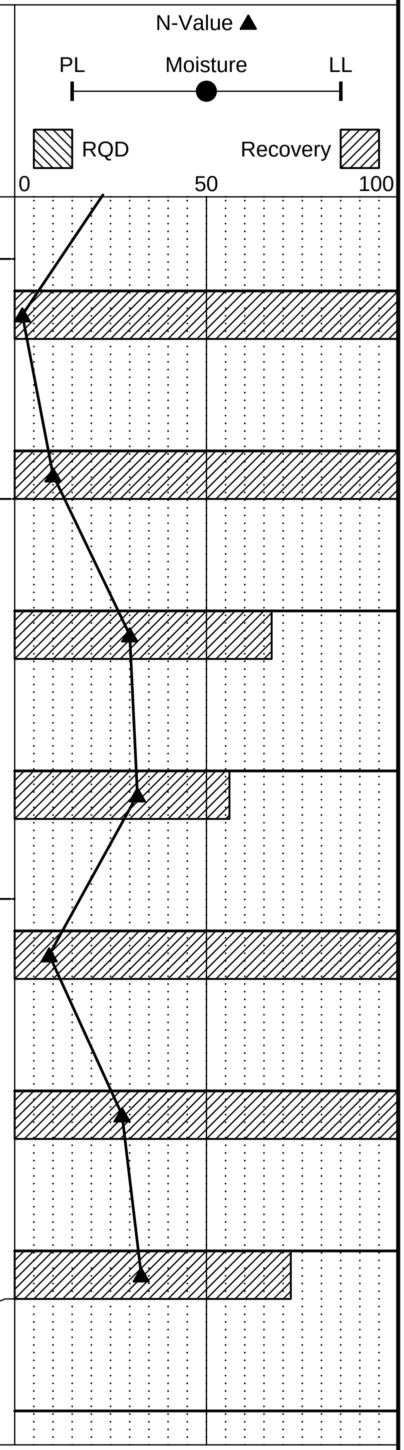
Figure A-21

The stratification lines represent approximate boundaries. The transition may be gradual.

LOG OF BOREHOLE 10-069_116TH_INTERCHANGE.GPJ PANGEO.GDT 5/23/11

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
120	S-24	X	1 1 1			Soft to stiff, green gray, silty CLAY: moist to wet, low to medium plasticity, laminated with well developed parting (Recessional Outwash - Clay Member - Qvrc).
125	S-25	X	0 3 7			
						Dense, gray SILT: wet, coarse grained grading to fine sand, homogeneous, massive (Recessional Outwash - Clay Member - Qvrc).
130	S-26	X	16 14 16			
135	S-27	X	8 14 18			-interbeds of slightly clayey silt, laminated and fine bedded (beds 1" to 3").
						Stiff to hard, green gray, silty CLAY: moist, low plasticity grading to possibly medium plasticity, slow dilatancy, laminated with occasional sandy laminae (Recessional Outwash - Clay Member - Qvrc).
140	S-28	X	0 4 5			
145	S-29	X	2 11 17			-becoming stiff, laminated with coarse silt / fine sand beds.
150	S-30	X	6 13 20			-becoming interbedded green gray silty clay and gray silt with fine sand, beds to 6", coarser downward.
						Bottom of Boring.
155						



Completion Depth:	151.5ft
Date Borehole Started:	7/28/10
Date Borehole Completed:	7/28/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+94, 107' LT.

PanGEO INCORPORATED

Phone: 206.262.0370

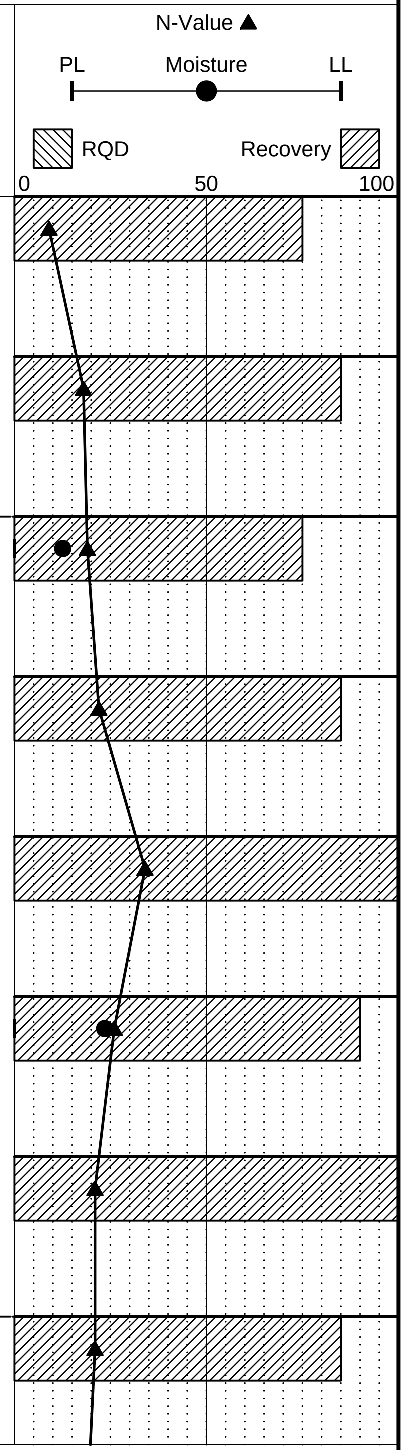
LOG OF TEST BORING THT-20-10

Figure A-21

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.6ft
Job Number:	10-069	Top of Casing Elev.:	70.0ft
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	D-1		3 5 4 4			Silty SAND with gravel, loose, brown, moist, homogeneous, HCL not tested. Length Recovered: 1.5 ft. Length Retained: 1.5 ft.
5	D-2		5 8 10 10			Well graded SAND with gravel, slightly silty, medium dense, brown, moist, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
10	D-3		5 9 10 10	GS		Poorly graded SAND with silt (SP-SM), trace gravel, medium dense, brown/gray, moist, homogeneous, HCL not tested. Length Recovered: 1.5 ft. Length Retained: 1.5 ft.
15	D-4		7 11 11 12			Poorly graded SAND, slightly silty, trace gravel, medium dense, gray, moist, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
20	D-5		8 14 20 22			Well graded SAND, slightly silty, trace gravel, dense, brown/gray, wet, homogeneous, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft.
25	D-6		6 11 15 16	GS		Silty SAND (SM), dense, brown/gray, wet, stratified, HCL not tested. Length Recovered: 1.8 ft. Length Retained: 1.8 ft. Layers of well graded sand, slightly silty.
30	D-7		8 11 10 11			Poorly graded SAND, slightly silty, medium dense, brown/gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft.
35	D-8		8 10 11 12			Silty SAND, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.



Completion Depth:	152.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	7/1/10
Logged By:	Donny Henderson
Drilling Company:	WSDOT

Remarks: Boring drilled by WSDOT crew, field log by WSDOT. STA 223+85, C/L, I-5 Median Project. 24-inch Standard Penetration Test (SPT) sampler driven with a auto-trip 140 lb. safety hammer.

PanGEO INCORPORATED
Phone: 206.262.0370

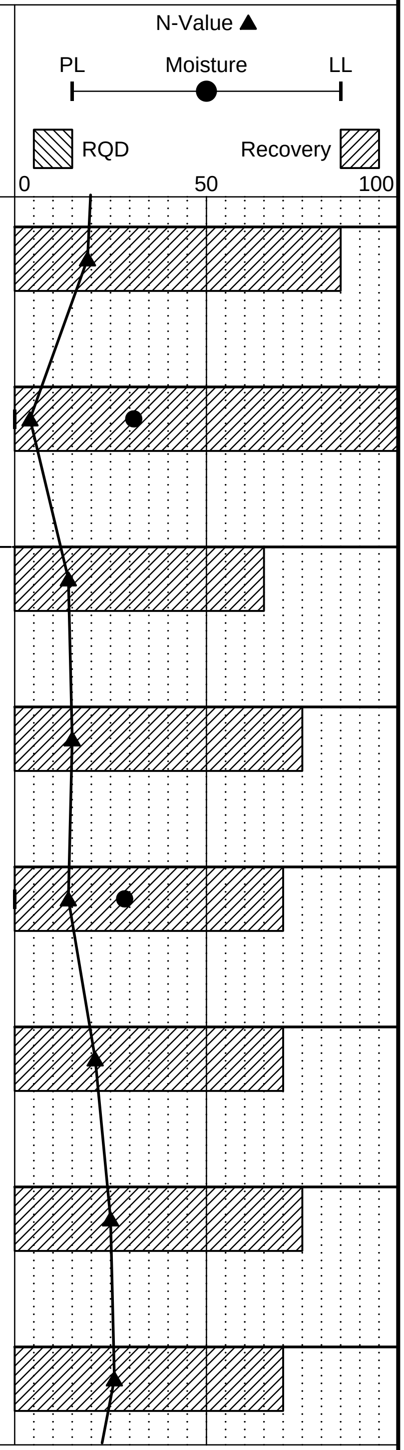
LOG OF TEST BORING THT-21-10

Figure A-22

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.6ft
Job Number:	10-069	Top of Casing Elev.:	70.0ft
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40						Silty SAND, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft. *(Continued)*
	D-9		7 7 12 16			Silty SAND, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
45	D-10		2 2 2 3	GS		Silty SAND (SM), very loose, gray, wet, stratified, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
50	D-11		4 6 8 11			Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.3 ft. Length Retained: 1.3 ft.
55	D-12		4 7 8 9			Poorly graded SAND, slightly silty, medium dense, gray, wet, stratified, HCL not tested. Length Recovered: 1.5 ft. Length Retained: 1.5 ft.
60	D-13		4 6 8 11	GS		Poorly graded, silty SAND (SM), medium dense, gray, wet, stratified, HCL not tested. Length Recovered: 1.4 ft. Length Retained: 1.4 ft.
65	D-14		6 9 12 14			Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.4 ft. Length Retained: 1.4 ft.
70	D-15		7 11 14 16			Poorly graded SAND, slightly silty, dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.5 ft. Length Retained: 1.5 ft.
75	D-16		9 13 13 12			Poorly graded SAND, slightly silty, dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.4 ft. Length Retained: 1.4 ft.



Completion Depth:	152.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	7/1/10
Logged By:	Donny Henderson
Drilling Company:	WSDOT

Remarks: Boring drilled by WSDOT crew, field log by WSDOT. STA 223+85, C/L, I-5 Median Project. 24-inch Standard Penetration Test (SPT) sampler driven with a auto-trip 140 lb. safety hammer.

PanGEO INCORPORATED

Phone: 206.262.0370

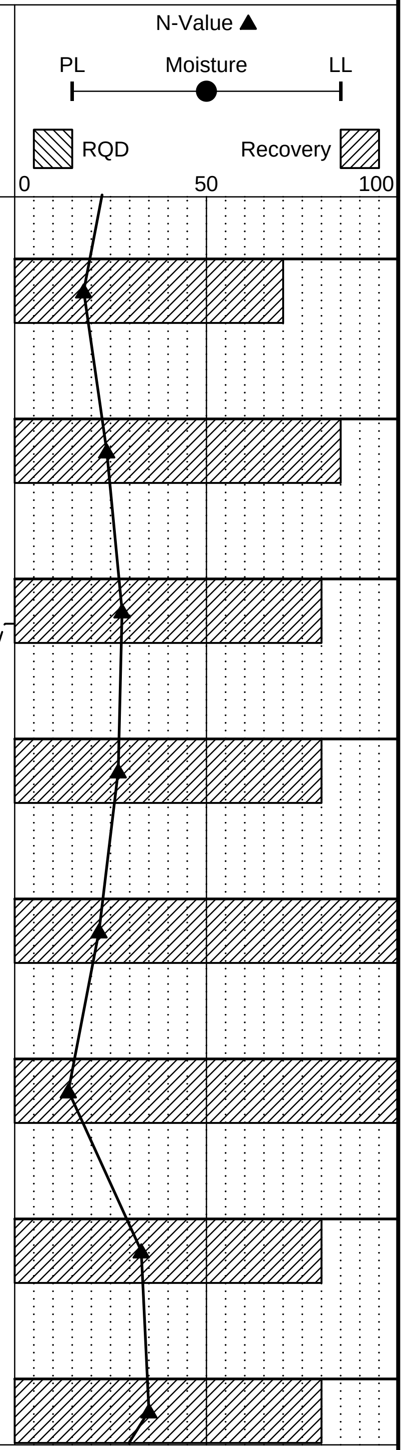
LOG OF TEST BORING THT-21-10

Figure A-22

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.6ft
Job Number:	10-069	Top of Casing Elev.:	70.0ft
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.3 ft. Length Retained: 1.3 ft. *(Continued)*
80	D-17		6 8 10 14			Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.4 ft. Length Retained: 1.4 ft.
85	D-18		9 11 13 17			Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
90	D-19		7 12 16 17			Poorly graded SAND, trace silt, dense, gray, wet, stratified, HCL not tested. Length Recovered: 1.6 ft. Length Retained: 1.6 ft. From 91.4' to 92.0' silty sand.
95	D-20		9 13 14 18			Silty SAND, dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.6 ft. Length Retained: 1.6 ft.
100	D-21		8 12 10 11			Silty SAND, medium dense, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. From 101.5' to 102.0' sandy silt, slightly elastic.
105	D-22		5 6 8 13			Silty SAND, medium dense, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of sandy silt throughout.
110	D-23		12 16 17 13			Silty SAND, dense, gray, wet, stratified, HCL not tested. Length Recovered: 1.6 ft. Length Retained: 1.6 ft. Layers of sandy silt.
115	D-24		15 20 15			Silty SAND, dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.6 ft. Length Retained: 1.6 ft.



Completion Depth:	152.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	7/1/10
Logged By:	Donny Henderson
Drilling Company:	WSDOT

Remarks: Boring drilled by WSDOT crew, field log by WSDOT. STA 223+85, C/L, I-5 Median Project. 24-inch Standard Penetration Test (SPT) sampler driven with a auto-trip 140 lb. safety hammer.

PanGEO INCORPORATED
Phone: 206.262.0370

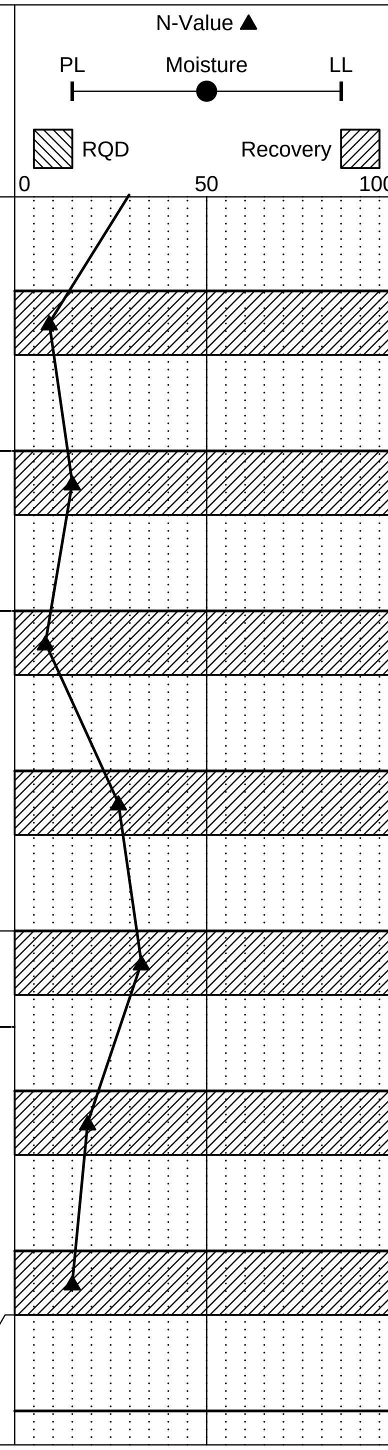
LOG OF TEST BORING THT-21-10

Figure A-22

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.6ft
Job Number:	10-069	Top of Casing Elev.:	70.0ft
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
			17			
120	D-25	X	3 4 5 10			Silty SAND, loose, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of sandy silt throughout.
125	D-26	X	4 6 9 11			Elastic SILT with sand, stiff, gray, moist, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of silty sand.
130	D-27	X	3 3 5 6			Sandy SILT, slightly elastic, loose, gray, moist, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of silty sand.
135	D-28	X	8 12 15 16			Sandy SILT, slightly elastic, dense, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. From 136.0' to 137.0' silty sand.
140	D-29	X	10 18 15 21			Silty SAND, dense, gray, moist, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft.
145	D-30	X	6 7 12 15			Elastic SILT with sand, very stiff, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of sandy silt and silty sand.
150	D-31	X	4 6 9 13			Elastic SILT with sand, stiff, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of sandy silt and silty sand.
155						End of test boring at 152 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Note: REF = SPT Refusal.



Completion Depth:	152.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	7/1/10
Logged By:	Donny Henderson
Drilling Company:	WSDOT

Remarks: Boring drilled by WSDOT crew, field log by WSDOT. STA 223+85, C/L, I-5 Median Project. 24-inch Standard Penetration Test (SPT) sampler driven with a auto-trip 140 lb. safety hammer.

PanGEO INCORPORATED

Phone: 206.262.0370

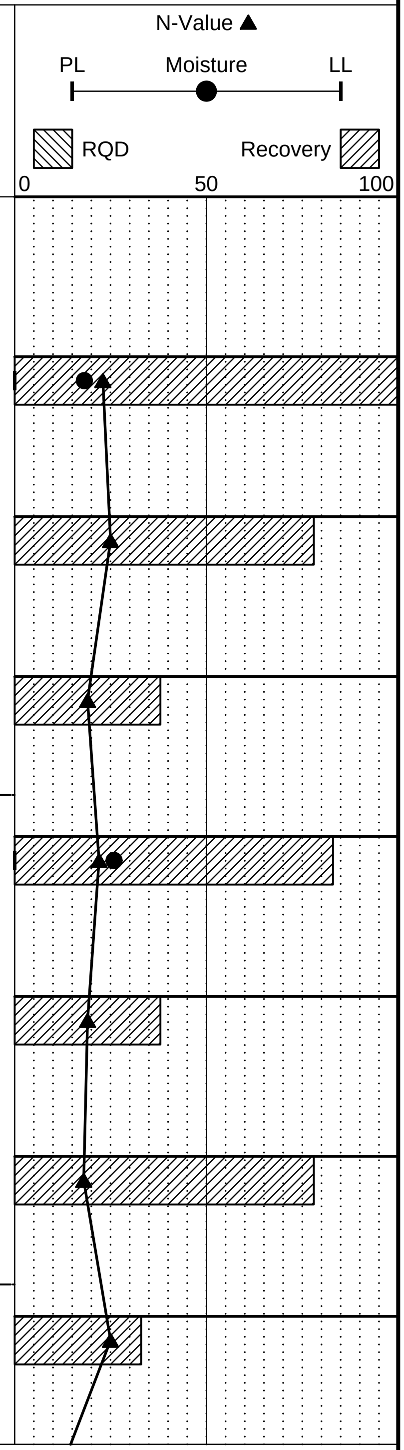
LOG OF TEST BORING THT-21-10

Figure A-22

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.0ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Medium dense, brown SAND with silt (SP-SM); moist, poorly graded, fine to medium grained, trace silt, homogeneous, subhorizontally laminated, occasional gravel (Recessional Outwash - Marysville Member - Qvrm).
5	S-1		11 11 12	GS		
10	S-2		6 11 14			-becoming red brown, weathered, with coarse sand/fine gravel interbeds; one 1/2" silt/clay bed.
15	S-3		10 11 8			-becoming wet (saturated).
						Medium dense, brown to brown gray SAND with silt SP-SM; wet, poorly graded, fine grained, homogeneous, laminated (Recessional Outwash - Marysville Member - Qvrm).
20	S-4		7 11 11	GS		
25	S-5		8 8 11			-weathered with 1/2" orange bands throughout.
30	S-6		5 8 10			-interbedded fine sand with silt and silt, beds 4 to 8 inches.
						Medium dense, gray silty SAND (SM); moist to wet, fine grained, fines non-plastic with rapid dilatancy, homogeneous, massive (Recessional Outwash - Marysville Member - Qvrm).
35	S-7		9 10 15			



Completion Depth:	151.5ft
Date Borehole Started:	7/27/10
Date Borehole Completed:	7/27/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+65, 104' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

LOG OF TEST BORING THT-22-10

Figure A-23

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.0ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

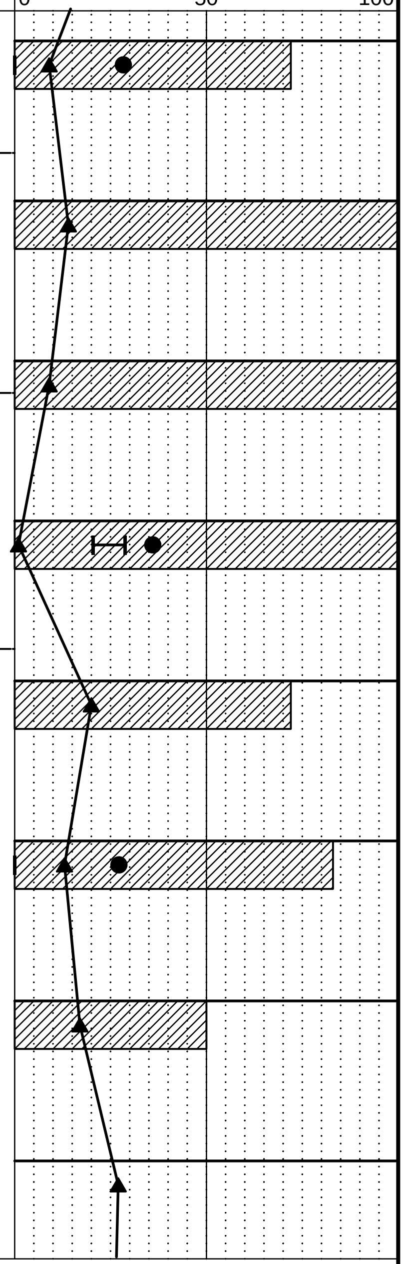
Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40	S-8		5 4 5	GS		Medium dense, gray silty SAND (SM); moist to wet, fine grained, fines non-plastic with rapid dilatancy, homogeneous, massive (Recessional Outwash - Marysville Member - Qvrm). *(Continued)* -becoming loose, saturated, with one 1 1/2" green gray silt/clay interbed.
45	S-9		4 6 8			Medium dense, gray SAND; wet (saturated), fine grained, some silt, homogeneous, laminated, one thin wood piece (Recessional Outwash - Marysville Member - Qvrm).
50	S-10		5 5 4			-becoming loose, silty fine sand.
						Medium stiff to soft, green gray, lean CLAY (CL) with silt; moist to wet, low plasticity, rapid to slow dilatancy, homogeneous, massive, with rare organics (Recessional Outwash - Marysville Member - Qvrm).
55	S-11		0 0 1	GS		-becoming soft.
60	S-12		8 10 10			Medium dense, gray SAND with silt (SP-SM); wet, poorly graded, fine to medium grained, homogeneous, massive Mainly quartz and lithic grains (Recessional Outwash - Marysville Member - Qvrm).
65	S-13		5 6 7	GS		
70	S-14		6 7 10			
75	S-15		10 12 15			

N-Value ▲

PL Moisture LL

RQD Recovery

0 50 100



Completion Depth:	151.5ft	Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+65, 104' RT.
Date Borehole Started:	7/27/10	
Date Borehole Completed:	7/27/10	
Logged By:	S. Evans	
Drilling Company:	Holocene Drilling	

PanGEO INCORPORATED

Phone: 206.262.0370

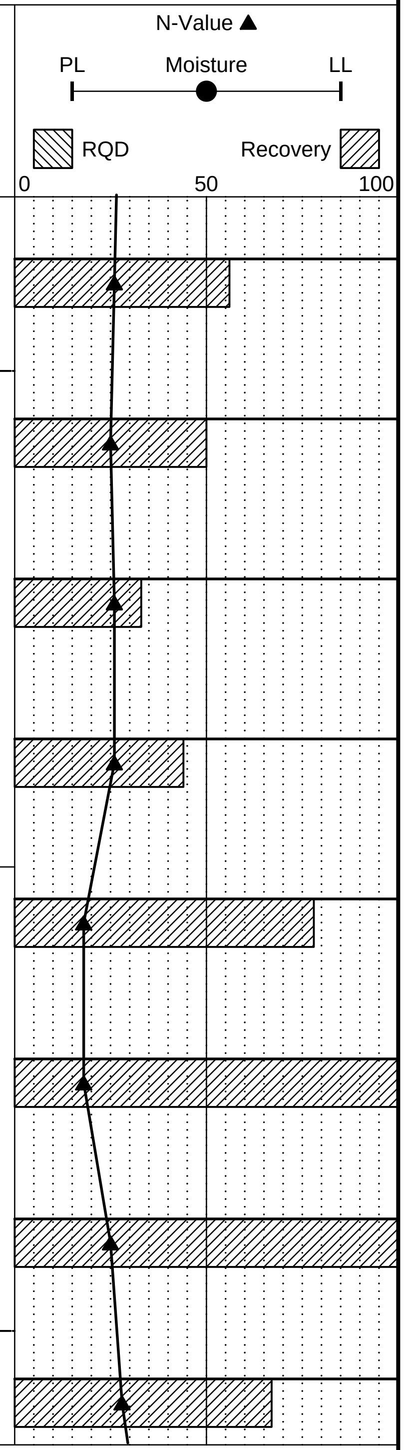
LOG OF TEST BORING THT-22-10

Figure A-23

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.0ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Medium dense, gray SAND with silt (SP-SM); wet, poorly graded, fine to medium grained, homogeneous, massive Mainly quartz and lithic grains (Recessional Outwash - Marysville Member - Qvrm). *(Continued)*
80	S-16	X	10 13 13			
						Medium dense, gray, silty SAND; wet (saturated), fine grained, mainly homogeneous, massive; silt very coarse (grading to fine sand), 1/2" clay bed it sampler tip at 85' (Recessional Outwash - Marysville Member - Qvrm).
85	S-17	X	10 13 12			
90	S-18	X	10 13 13			-grading to sandy silt, non-plastic fines, rapid dilatancy.
95	S019	X	12 12 14			-two inches silty clay bed at top of sample; silty fine sand to sandy silt.
						Stiff to very stiff, green gray, silty lean CLAY; moist and wet beds, low plasticity with non-plastic beds, laminated and thin bedded, sandy interbeds (Recessional Outwash - Clay Member - Qvrc).
100	S-20	X	7 8 10			
105	S-21	X	5 6 12			-interbedded, non-plastic, gray, wet silt and low plasticity, green gray, moist to wet, silty clay; beds 1/2" to 2".
110	S-22	X	6 11 14			-beds 1/2" to 4", increasing silt with fine sand interbeds.
						Medium dense, gray, silty SAND; wet (saturated), fine grained, grading to sandy silt in some layers, non-plastic fines, rapid dilatancy, homogeneous, laminated to 2° dip (Recessional Outwash - Clay Member - Qvrc).
115	S-23	X	10 12 16			



Completion Depth:	151.5ft
Date Borehole Started:	7/27/10
Date Borehole Completed:	7/27/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+65, 104' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

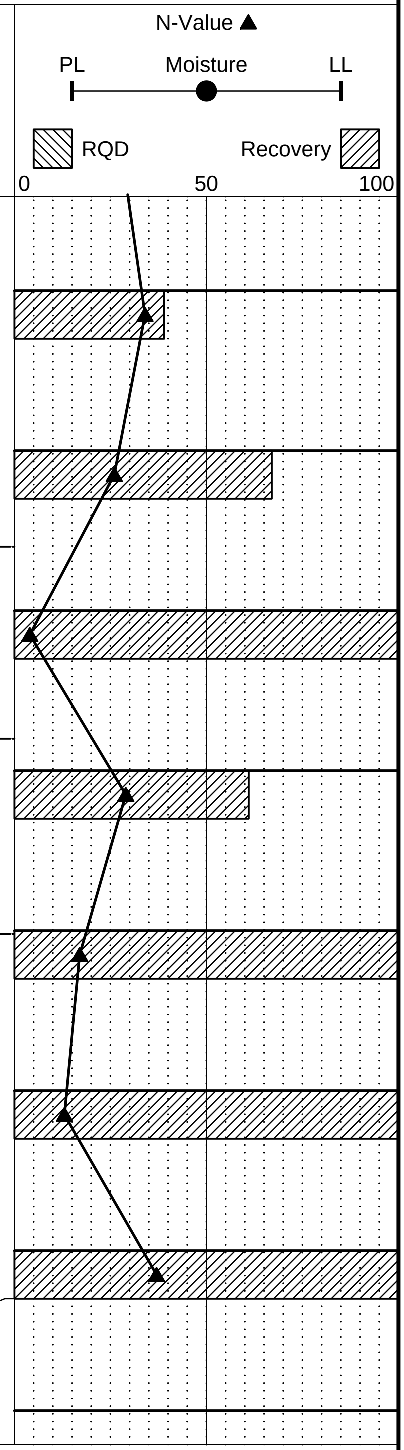
LOG OF TEST BORING THT-22-10

Figure A-23

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.0ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Medium dense, gray, silty SAND; wet (saturated), fine grained, grading to sandy silt in some layers, non-plastic fines, rapid dilatancy, homogeneous, laminated to 2° dip (Recessional Outwash - Clay Member - Qvrc). *(Continued)*
120	S-24		12 16 18			-becoming dense, with interbeds of green gray silty clay, low plasticity.
125	S-25		11 13 13			-grading to fine sand with silt, massive.
						Medium stiff, green gray, silty CLAY; wet, low plasticity, rapid dilatancy, homogeneous, massive (Recessional Outwash - Clay Member - Qvrc).
130	S-26		0 0 4			
						Medium dense, gray SAND; wet (saturated), fine grained, some silty to with silt, homogeneous, massive (Recessional Outwash - Clay Member - Qvrc).
135	S-27		10 14 15			
140	S-28		7 7 10			Stiff, green gray, CLAY with silt; moist to wet, low to medium plasticity, slow to no dilatancy, homogeneous, mainly massive (Recessional Outwash - Clay Member - Qvrc).
145	S-29		0 2 11			-stiff, interbeds of silt beds with rapid dilatancy, gradational contacts.
150	S-30		9 13 24			-hard, gray, interbedded, low plasticity silty clay and non-plastic silt with fine sand.
						Bottom of Boring.
155						



Completion Depth:	151.5ft	Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+65, 104' RT.
Date Borehole Started:	7/27/10	
Date Borehole Completed:	7/27/10	
Logged By:	S. Evans	
Drilling Company:	Holocene Drilling	

PanGEO INCORPORATED
Phone: 206.262.0370

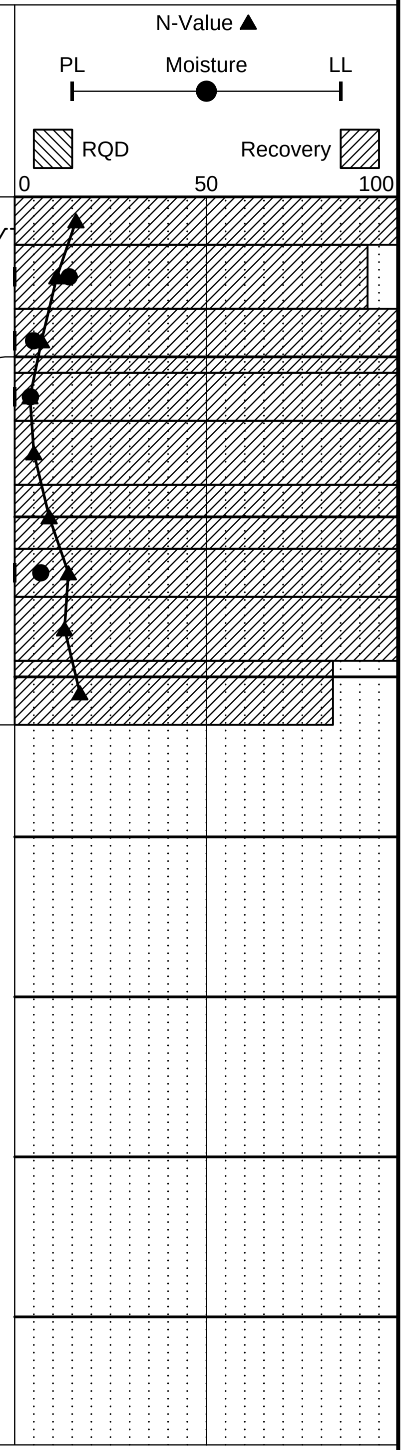
LOG OF TEST BORING THT-22-10

Figure A-23

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1	X	10 9 7			Medium dense, moist, dark brown, gravelly silty SAND; scattered fine organics **(Fill)**.
	S-2	X	5 5 6	GS		Medium dense to loose, moist, reddish-brown to light brown, silty SAND (SM); trace rounded gravel, occasional thin layers of iron oxide staining **(Recessional Outwash/Fill?)**
5	S-3	X	3 4 3	GS		-poorly graded sand (SP).
	S-4	X	3 2 2	GS		Loose to medium dense, moist, gray to brownish-gray SAND (SP); poorly graded, fine to medium grained, trace silt, coarse sand, and fine gravel, homogenous, occasional thin layers of iron oxide staining **(Recessional Outwash)**
	S-5	X	2 2 3			
10	S-6	X	3 4 5			-becomes medium dense.
	S-7	X	5 7 7	GS		-becoming poorly graded sand with silt (SP-SM).
	S-8	X	5 6 7			-thin bed of silt and silty sand near bottom of sample S-8.
15	S-9	X	7 7 10			
						Bottom of boring at approximately 16.5 ft. Groundwater not encountered during drilling. However, groundwater levels may vary depending on seasonal conditions. Note: Samples S-2, S-3, S-5, S-6, S-8, and S-9 were driven 24" each. For clarity, the blowcount for the final six inches of each sample has been omitted.
20						
25						
30						
35						



Completion Depth:	16.5ft
Date Borehole Started:	10/26/10
Date Borehole Completed:	10/26/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 221+98, 715' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

LOG OF TEST BORING THT-23-10

Figure A-24

The stratification lines represent approximate boundaries. The transition may be gradual.

Test Pit No. 1 Location: Station 226+90, 240’ LT, north of existing park and ride Approximate ground surface elevation: ~70 feet	
Depth (ft)	Material Description
0 – 1	2 to 4 inches of sod over loose, dry to moist, light brown, fine SAND with some silt, trace gravel, and prevalent organics (Topsoil/Fill)
1 – 10	Medium dense to dense, moist, light brown with some reddish brown layers, fine to medium SAND with some silt and trace gravel (Recessional Outwash)
	Test Pit terminated approximately 10 feet below ground surface. Groundwater not encountered within the depth of the exploration. No caving noted. *Samples: S-1 @ 2½ - 3 feet, moisture = 5.5%* *S-2 @ 5½ - 6 feet* *S-3 @ 9½ - 10 feet, moisture = 6.5%*

Test Pit No. 2 Location: Station 232+60, 100' RT, near bottom of existing drainage swale Approximate ground surface elevation: ~73 feet	
Depth (ft)	Material Description
0 – 1	2 to 4 inches of sod over loose, dry, light brown, silty SAND with prevalent organics (Topsoil/Fill)
1 – 8	Medium dense, dry to moist, light brown and gray, gravelly fine to medium SAND with trace silt (Recessional Outwash)
	Test Pit terminated approximately 8 feet below ground surface. Groundwater not encountered within the depth of the exploration. No caving noted. *Samples: S-1 @ 1 - 1½ feet, moisture = 2.5%* *S-2 @ 4 – 4½ feet, moisture = 3.5%* *S-3 @ 7½ - 8 feet*

Test Pit No. 3 Location: Station 235+45, 105' LT, near bottom of existing drainage swale Approximate ground surface elevation: ~73 feet	
Depth (ft)	Material Description
0 – 1	2 to 4 inches of sod over loose, dry, light brown, silty SAND with some gravel and prevalent organics (Topsoil/Fill)
1 – 8	Medium dense, dry to moist, light brown and gray, slightly gravelly to gravelly fine to coarse SAND with trace to no silt; between 5 and 6 feet reddish brown, medium to coarse sand layer (Recessional Outwash)
	Test Pit terminated approximately 8 feet below ground surface. Groundwater not encountered within the depth of the exploration. No caving noted. *Samples: S-1 @ 1 - 1½ feet, moisture = 2.5%* *S-2 @ 4 – 4½ feet, moisture = 3.5%* *S-3 @ 7 – 7½ feet*

APPENDIX B

LABORATORY TESTING AND RESULTS

APPENDIX B: LABORATORY TESTING AND RESULTS

This appendix contains descriptions of the procedures and results of physical (geotechnical) and electrochemical laboratory testing conducted on soil samples retained during the field explorations for the I-5 / 116th Street NE Interchange Improvement Project. The methodology of the soil sampling from the borings was described in Appendix A. The samples were tested to determine basic physical index properties of the soils for purposes of classifying the material types encountered and to measure or correlate parameters used in the geotechnical design. In addition, tests were conducted to determine the chemistry parameters of the on-site soils to help determine the corrosiveness of the soil.

Laboratory testing of the samples selected for testing under PanGEO's scope of work was performed by Analytical Resources, Incorporated, of Tukwila, Washington, in general accordance with the following ASTM Standard Test Methods (TM):

D 2216	TM for Laboratory Determination of Water (Moisture) Content of Soil and Rock
D 422	TM for Particle-size Analysis of Soils
D 4318	TM for Liquid Limit, Plastic Limit and Plasticity Index of Soils

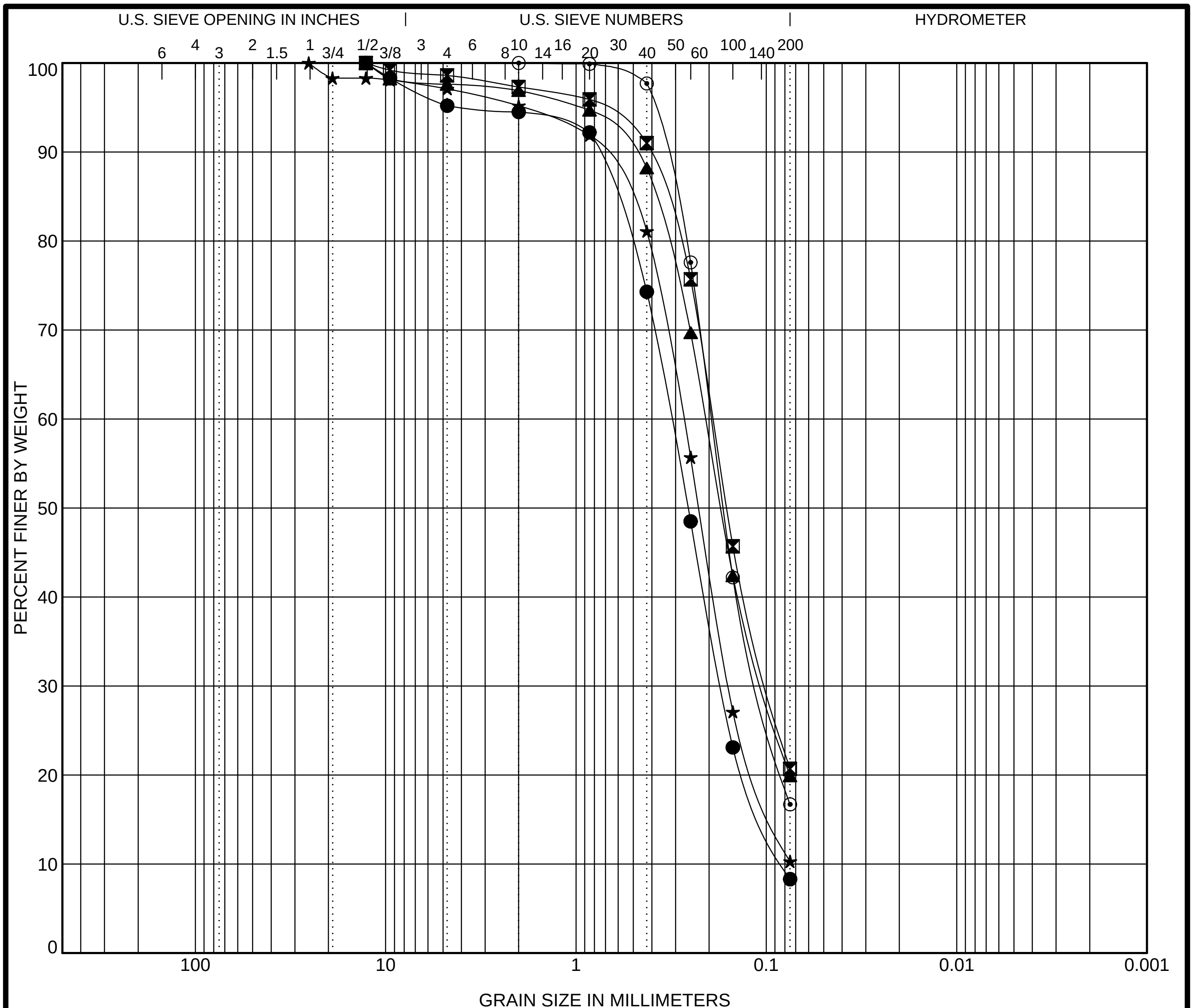
Moisture contents and liquid/plastic limits (Atterberg limits) are shown on the logs of test borings and test pits in Appendix A.

Grain size results are shown on Figures B-1 through B-15. The results of liquid/plastic limits (Atterberg limits) are presented on Figure B-16.

Electrochemical property testing of the samples selected for testing under PanGEO's scope of work was also performed by Analytical Resources, Incorporated, of Tukwila, Washington, in general accordance with the following test methods:

Minimum Resistivity Determination according to AASHTO T288
Cation Exchange capacity by Method 9080
pH by Method SW9045
Chloride by Method 325.2
Sulfate by Method MSA 10-3

The results of the cation exchange capacity test are shown in Table 2b of the report, and the electrochemical property testing results are shown in Table 16 of the report.



<table>
<tr><td rowspan="2">COBBLES</td><td colspan="2">GRAVEL</td><td colspan="3">SAND</td><td rowspan="2">SILT OR CLAY</td></tr>
<tr><td>coarse</td><td>fine</td><td>coarse</td><td>medium</td><td>fine</td></tr>
</table>

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-01-10	@ 5.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.15	3.90
⧗ THT-01-10	@ 20.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
▲ THT-02-10	@ 15.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
★ THT-03-10	@ 0.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.23	3.69
⊙ THT-03-10	@ 15.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		

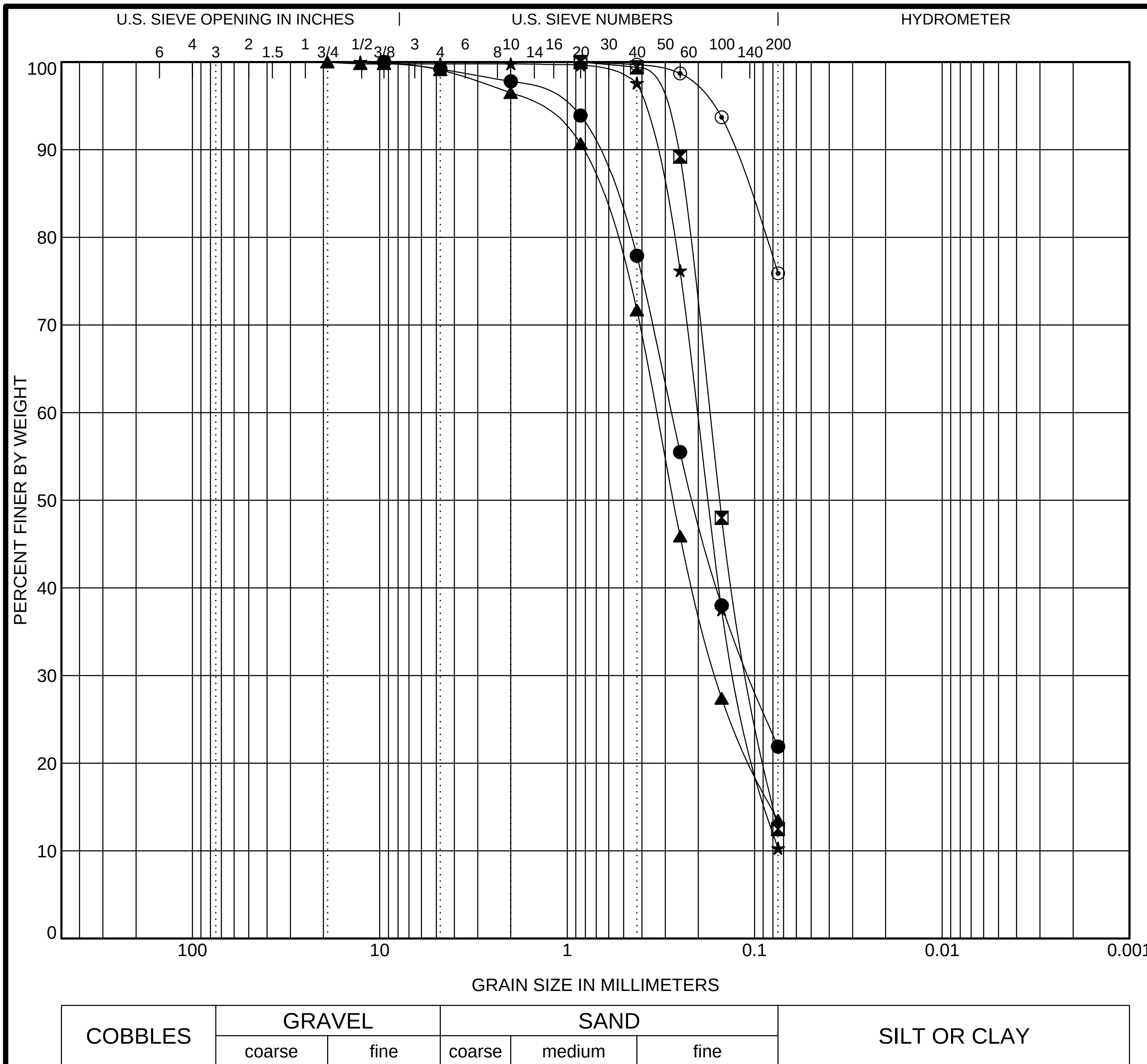
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-01-10	5.0	12.7	0.317	0.172	0.081	4.8	86.9	8.3	
⧗ THT-01-10	20.0	12.7	0.191	0.097		1.4	77.9	20.7	
▲ THT-02-10	15.0	12.7	0.209	0.102		2.4	77.7	19.9	
★ THT-03-10	0.0	25.4	0.273	0.158		2.9	86.8	10.3	
⊙ THT-03-10	15.0	2	0.194	0.108		0.0	83.3	16.7	

GRAIN SIZE DISTRIBUTION

PanGEO
INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-1



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	THT-04-10	@ 5.0 ft.	SILTY SAND(SM)	NP	NP	NP		
⧗	THT-04-10	@ 10.0 ft.	SILTY SAND(SM)	NP	NP	NP		
▲	THT-05-10	@ 5.0 ft.	SILTY SAND(SM)	NP	NP	NP		
★	THT-05-10	@ 30.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.02	2.71
⊙	THT-05-10	@ 45.0 ft.	SILT with SAND(ML)	NP	NP	NP		

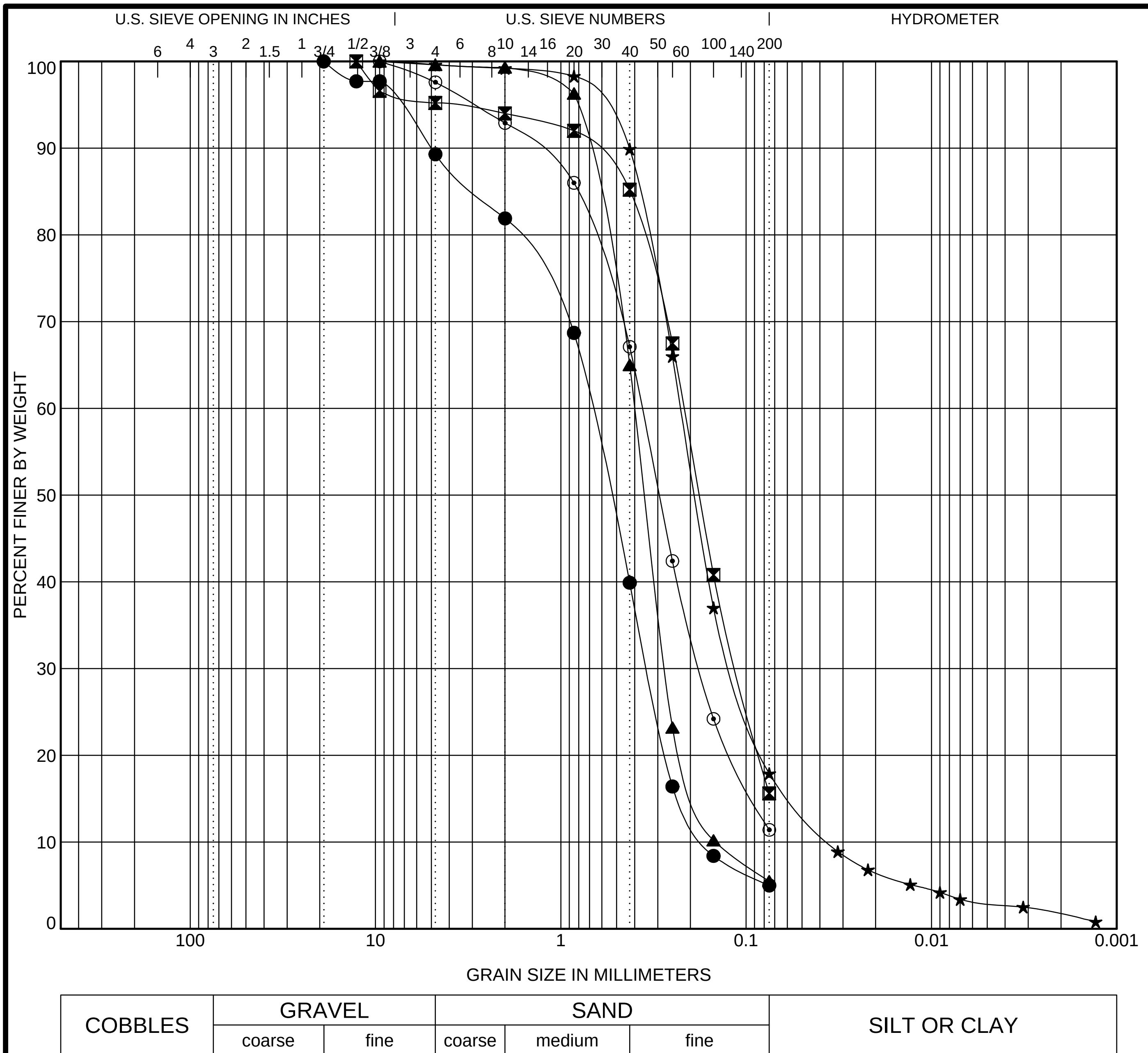
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	THT-04-10	5.0	9.5	0.278	0.106		0.8	77.3	21.9	
⧗	THT-04-10	10.0	0.85	0.174	0.106		0.0	87.5	12.5	
▲	THT-05-10	5.0	19.05	0.334	0.161		0.9	85.6	13.5	
★	THT-05-10	30.0	12.7	0.202	0.124		0.2	89.5	10.3	
⊙	THT-05-10	45.0	0.85				0.0	24.1	75.9	

PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-2



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	THT-06-10	@ 18.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.01	4.15
⧗	THT-06-10	@ 20.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
▲	THT-06-10	@ 22.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.28	2.74
★	THT-06-10	@ 24.0 ft.	**SILTY SAND(SM)**	NP	NP	NP	1.69	6.33
⊙	THT-07-10	@ 0.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.23	5.25

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	THT-06-10	18.0	19.05	0.689	0.34	0.166	10.7	84.3	5.0	
⧗	THT-06-10	20.0	12.7	0.217	0.111		4.8	79.6	15.6	
▲	THT-06-10	22.0	9.5	0.399	0.273	0.146	0.4	94.1	5.5	
★	THT-06-10	24.0	9.52	0.225	0.116	0.036	0.4	81.7	14.9	3.0
⊙	THT-07-10	0.0	9.5	0.365	0.177		2.4	86.2	11.4	

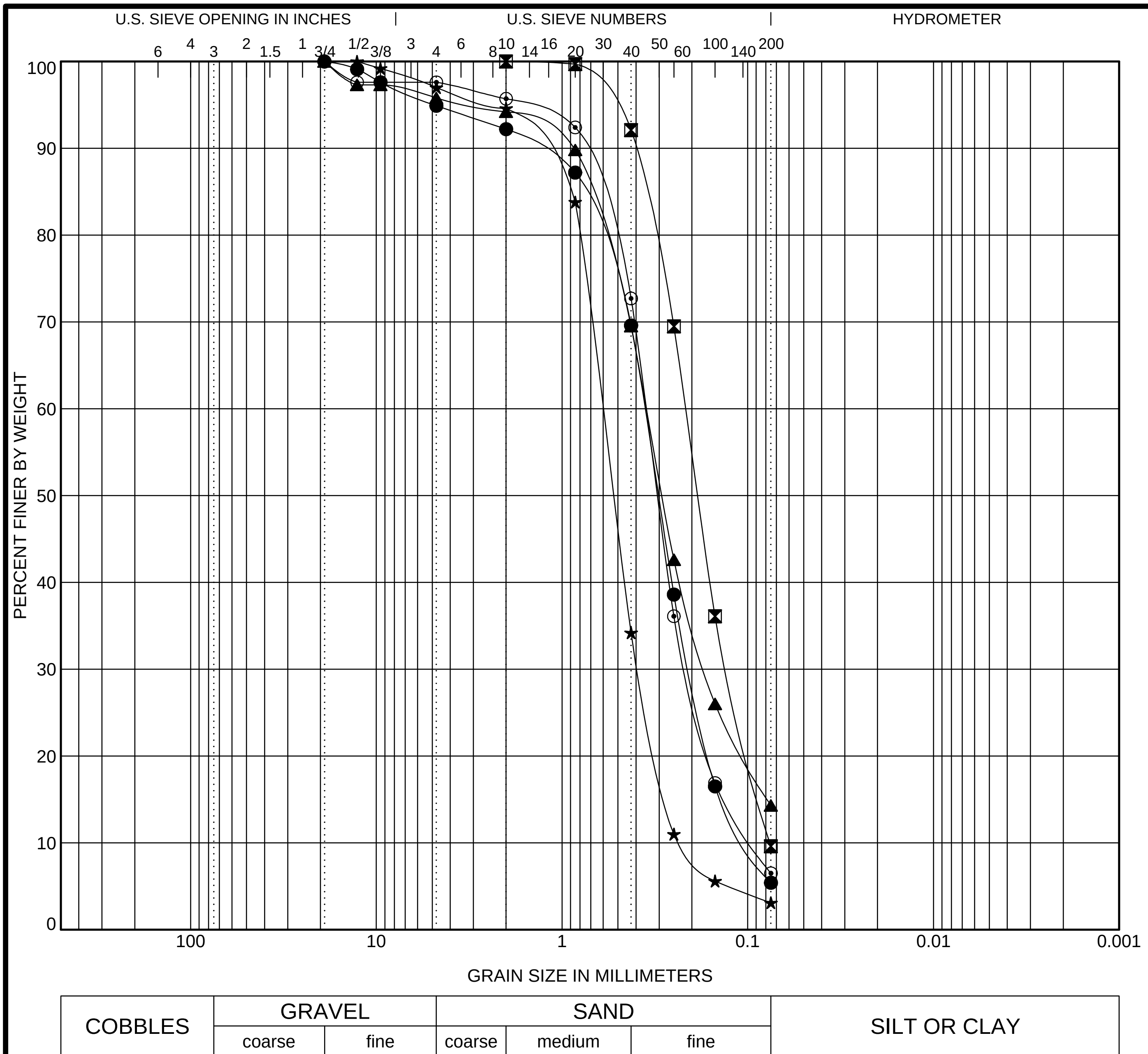
PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-3

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**THT-07-10**	**@ 10.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.17**	**3.61**
⊠	**THT-07-10**	**@ 20.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.00**	**2.85**
▲	**THT-08-10**	**@ 4.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
★	**THT-09-10**	**@ 16.0 ft.**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**1.08**	**2.68**
⊙	**THT-09-10**	**@ 18.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.35**	**3.73**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-07-10**	**10.0**	**19.05**	**0.361**	**0.205**	**0.1**	**5.1**	**89.5**	**5.4**	
⊠	**THT-07-10**	**20.0**	**2**	**0.216**	**0.128**	**0.076**	**0.0**	**90.4**	**9.6**	
▲	**THT-08-10**	**4.0**	**19.05**	**0.352**	**0.17**		**4.2**	**81.5**	**14.3**	
★	**THT-09-10**	**16.0**	**12.7**	**0.609**	**0.386**	**0.227**	**3.0**	**93.9**	**3.1**	
⊙	**THT-09-10**	**18.0**	**19.05**	**0.354**	**0.213**	**0.095**	**2.4**	**91.1**	**6.5**	

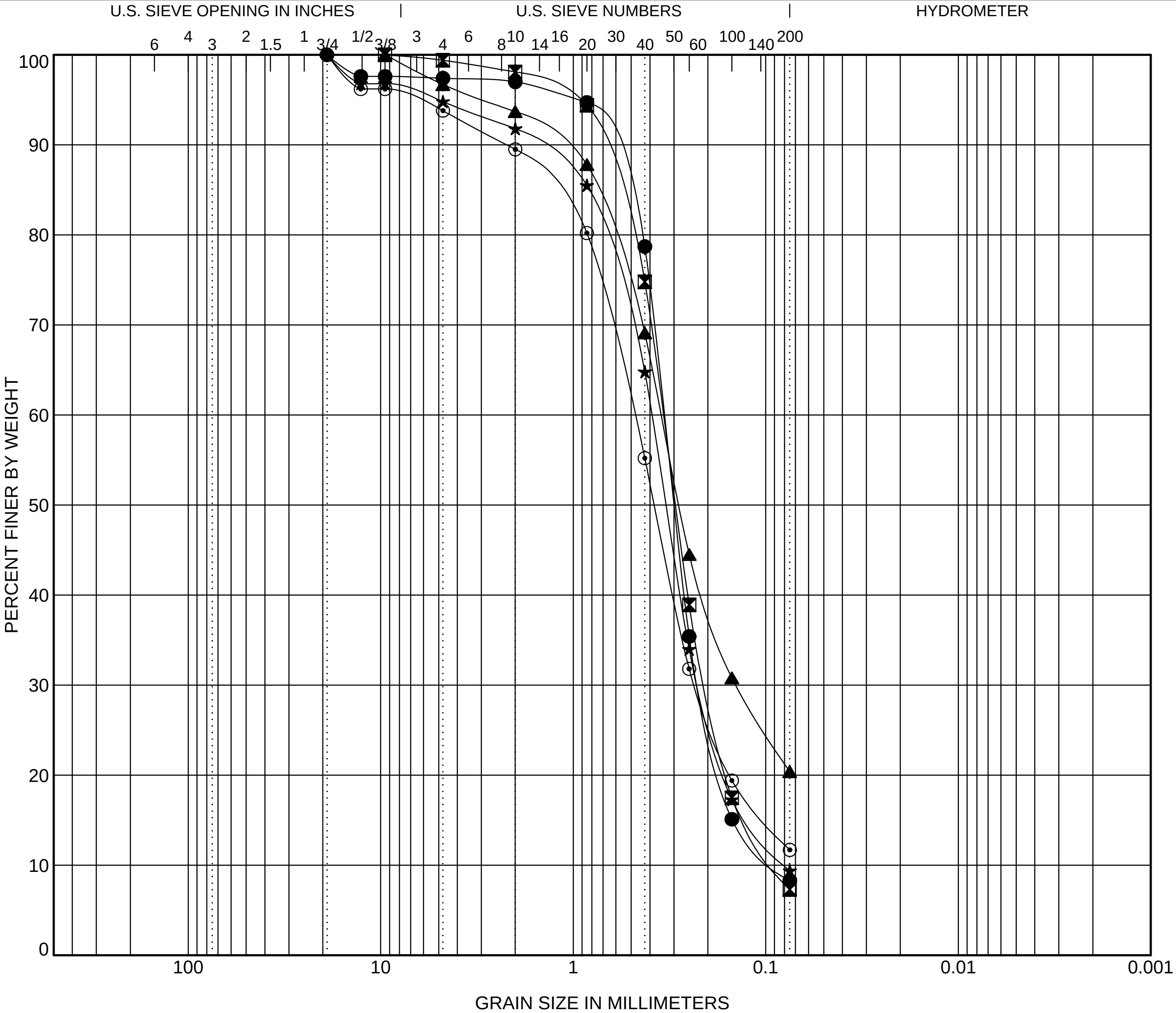
GRAIN SIZE DISTRIBUTION

PanGEO
INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-4

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**THT-09-10**	**@ 20.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.58**	**3.79**
⧖	**THT-09-10**	**@ 22.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.33**	**3.79**
▲	**THT-10-10**	**@ 10.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
★	**THT-10-10**	**@ 12.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.58**	**4.95**
⊙	**THT-10-10**	**@ 14.0 ft.**	**WELL-GRADED SAND with SILT(SW-SM)**	**NP**	**NP**	**NP**	**1.72**	**7.54**

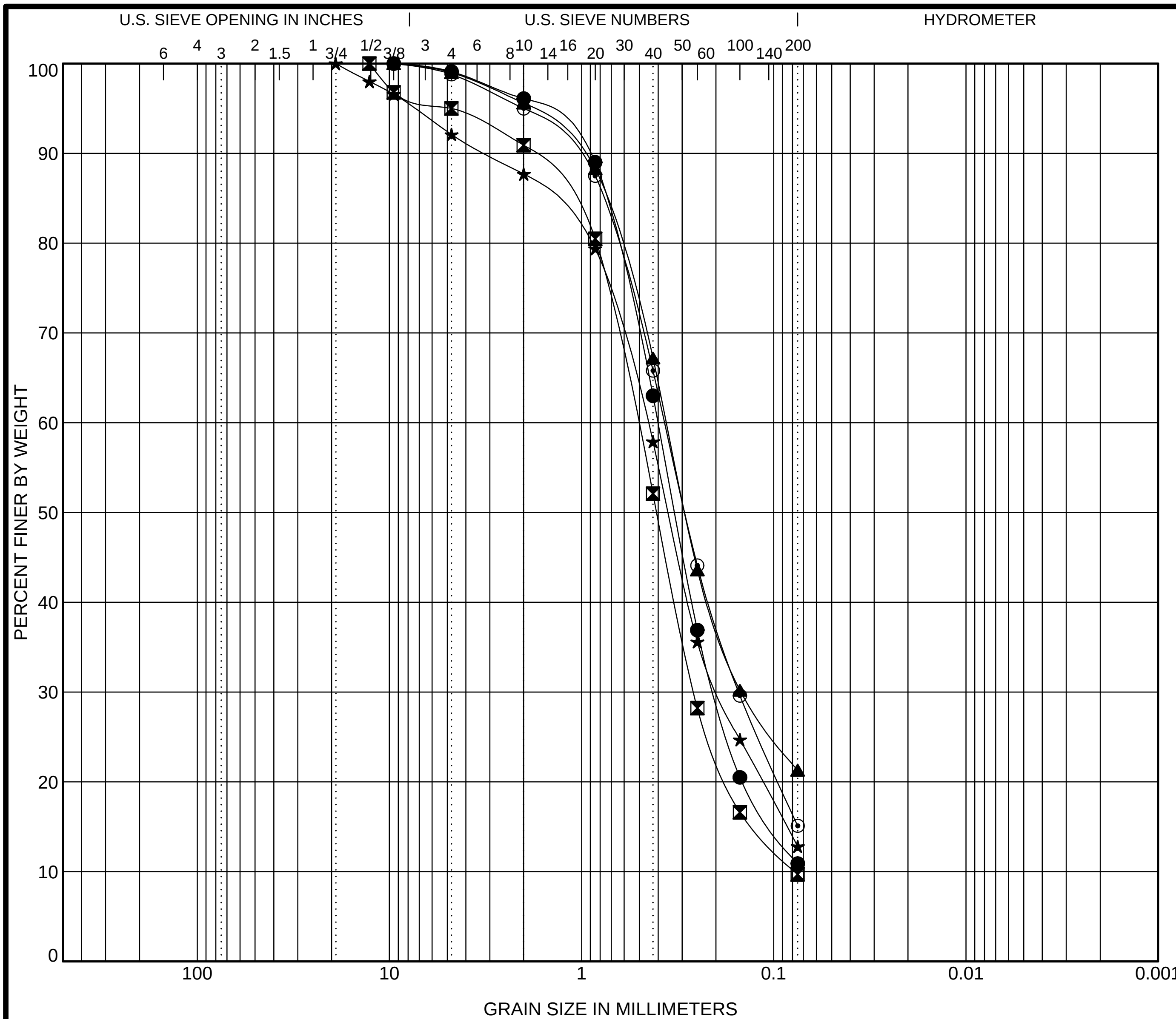
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-09-10**	**20.0**	**19.05**	**0.338**	**0.218**	**0.089**	**2.6**	**89.1**	**8.3**	
⧖	**THT-09-10**	**22.0**	**9.5**	**0.341**	**0.202**	**0.09**	**0.6**	**92.1**	**7.3**	
▲	**THT-10-10**	**10.0**	**9.5**	**0.349**	**0.142**		**3.3**	**76.3**	**20.4**	
★	**THT-10-10**	**12.0**	**19.05**	**0.391**	**0.221**	**0.079**	**5.2**	**85.4**	**9.4**	
⊙	**THT-10-10**	**14.0**	**19.05**	**0.485**	**0.232**		**6.2**	**82.1**	**11.7**	

PanGEO
INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-5



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-11-10	@ 10.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.45	5.69
⊠ THT-11-10	@ 12.0 ft.	**WELL-GRADED SAND with SILT(SW-SM)**	NP	NP	NP	1.70	6.67
▲ THT-11-10	@ 14.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
★ THT-11-10	@ 16.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
⊙ THT-12-10	@ 5.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-11-10	10.0	9.5	0.4	0.202		0.9	88.2	10.9	
⊠ THT-11-10	12.0	12.7	0.515	0.26	0.077	5.0	85.3	9.7	
▲ THT-11-10	14.0	9.5	0.361	0.148		1.0	77.7	21.3	
★ THT-11-10	16.0	19.05	0.455	0.192		7.9	79.3	12.8	
⊙ THT-12-10	5.0	9.52	0.369	0.152		1.2	83.7	15.1	

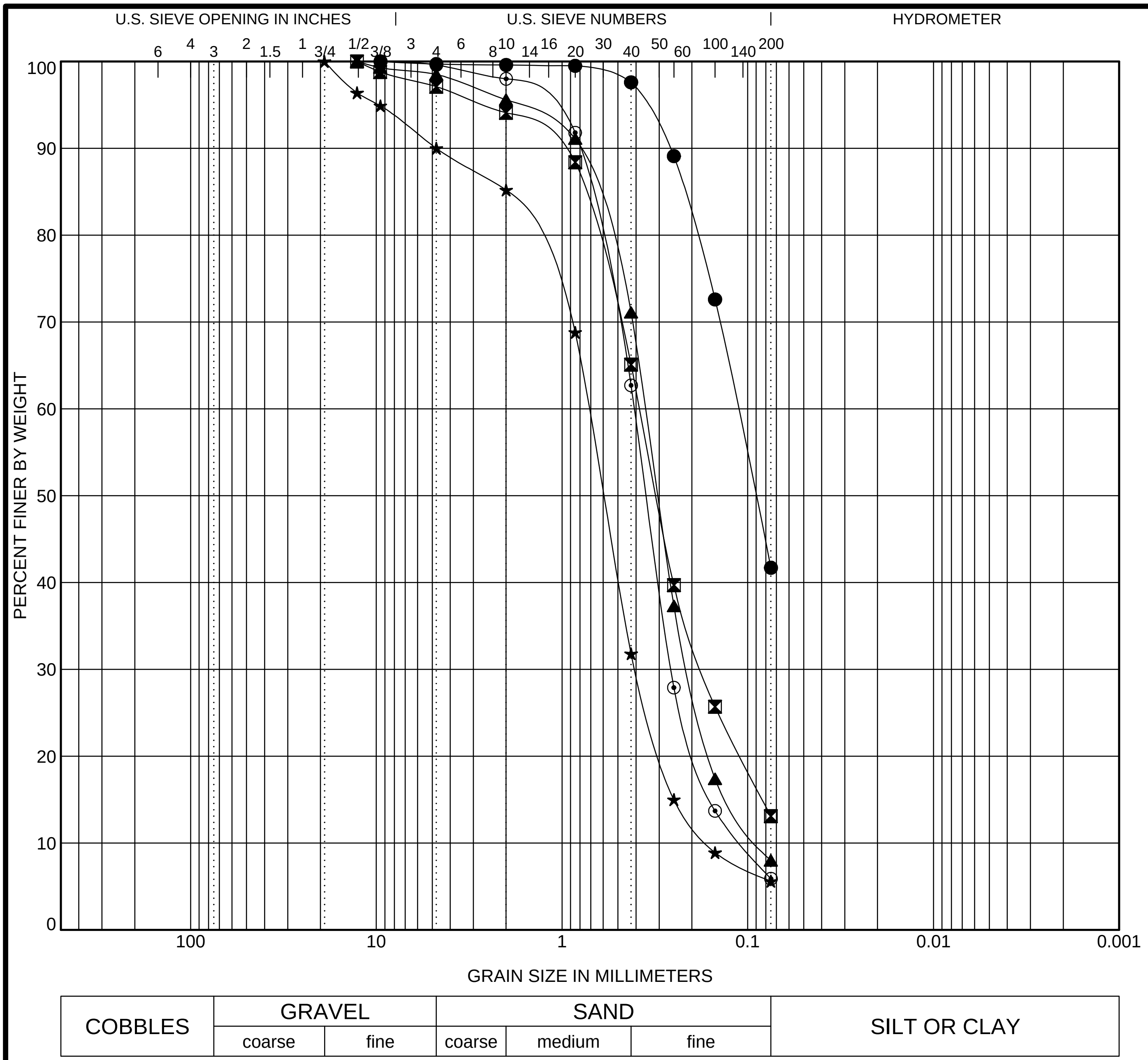
GRAIN SIZE DISTRIBUTION

PanGEO INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-6

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	THT-12-10	@ 20.0 ft.	SILTY SAND(SM)	NP	NP	NP		
⊠	THT-13-10	@ 1.0 ft.	SILTY SAND(SM)	NP	NP	NP		
▲	THT-13-10	@ 6.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.38	4.11
★	THT-13-10	@ 10.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.36	4.38
⊙	THT-14-10	@ 14.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.51	3.78

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	THT-12-10	20.0	9.5	0.113			0.3	58.0	41.7	
⊠	THT-13-10	1.0	12.7	0.382	0.175		2.9	84.0	13.1	
▲	THT-13-10	6.0	12.7	0.357	0.207	0.087	1.5	90.5	8.0	
★	THT-13-10	10.0	19.05	0.721	0.402	0.164	10.0	84.4	5.6	
⊙	THT-14-10	14.0	9.52	0.408	0.258	0.108	0.4	93.7	5.9	

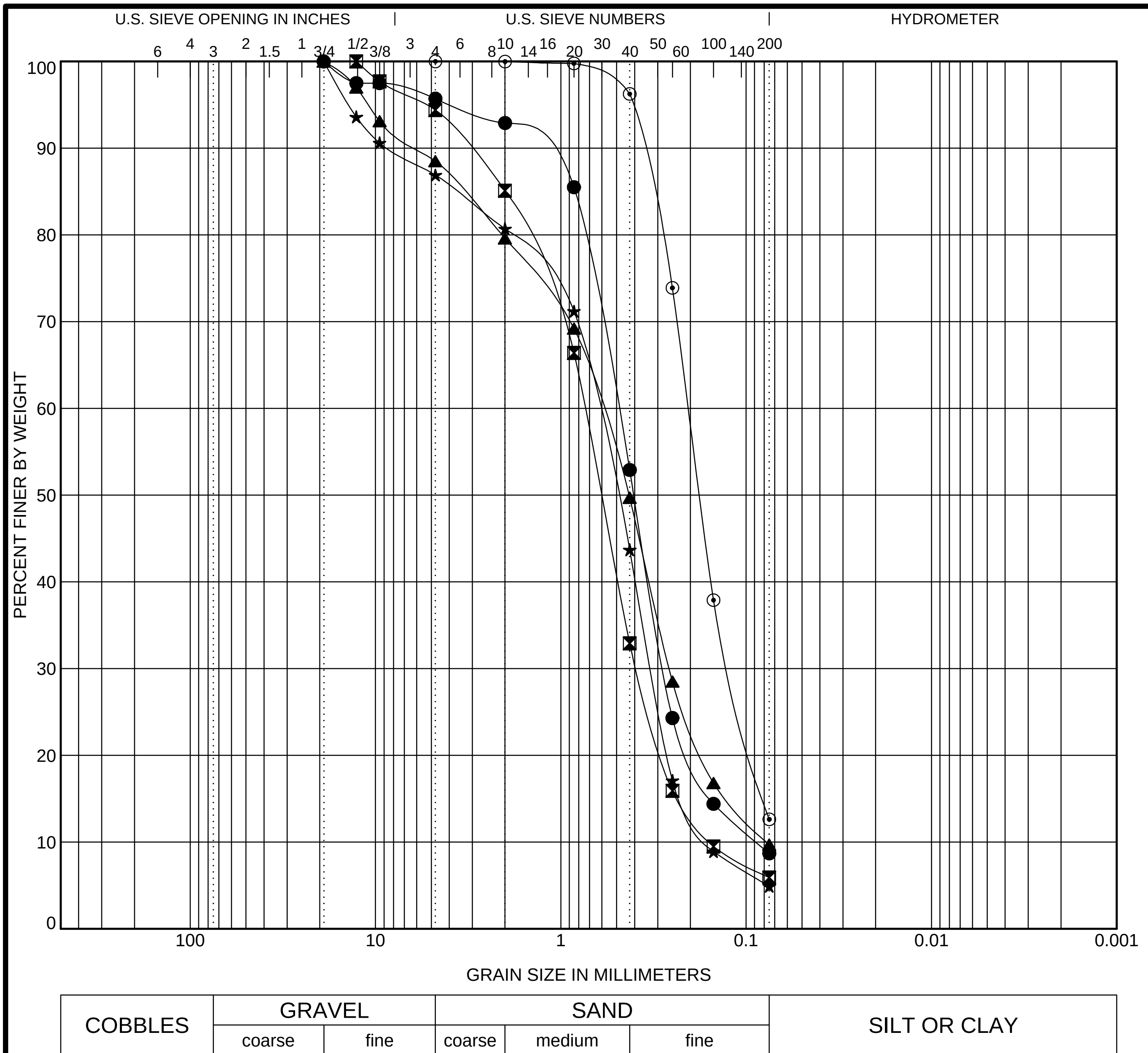
PanGEO
INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-7

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-14-10	@ 16.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.78	5.63
⊠ THT-14-10	@ 18.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.30	4.77
▲ THT-14-10	@ 20.0 ft.	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP	1.42	7.94
★ THT-15-10	@ 10.0 ft.	POORLY GRADED SAND(SP)	NP	NP	NP	1.02	3.99
⊙ THT-15-10	@ 20.0 ft.	SILTY SAND(SM)	NP	NP	NP		

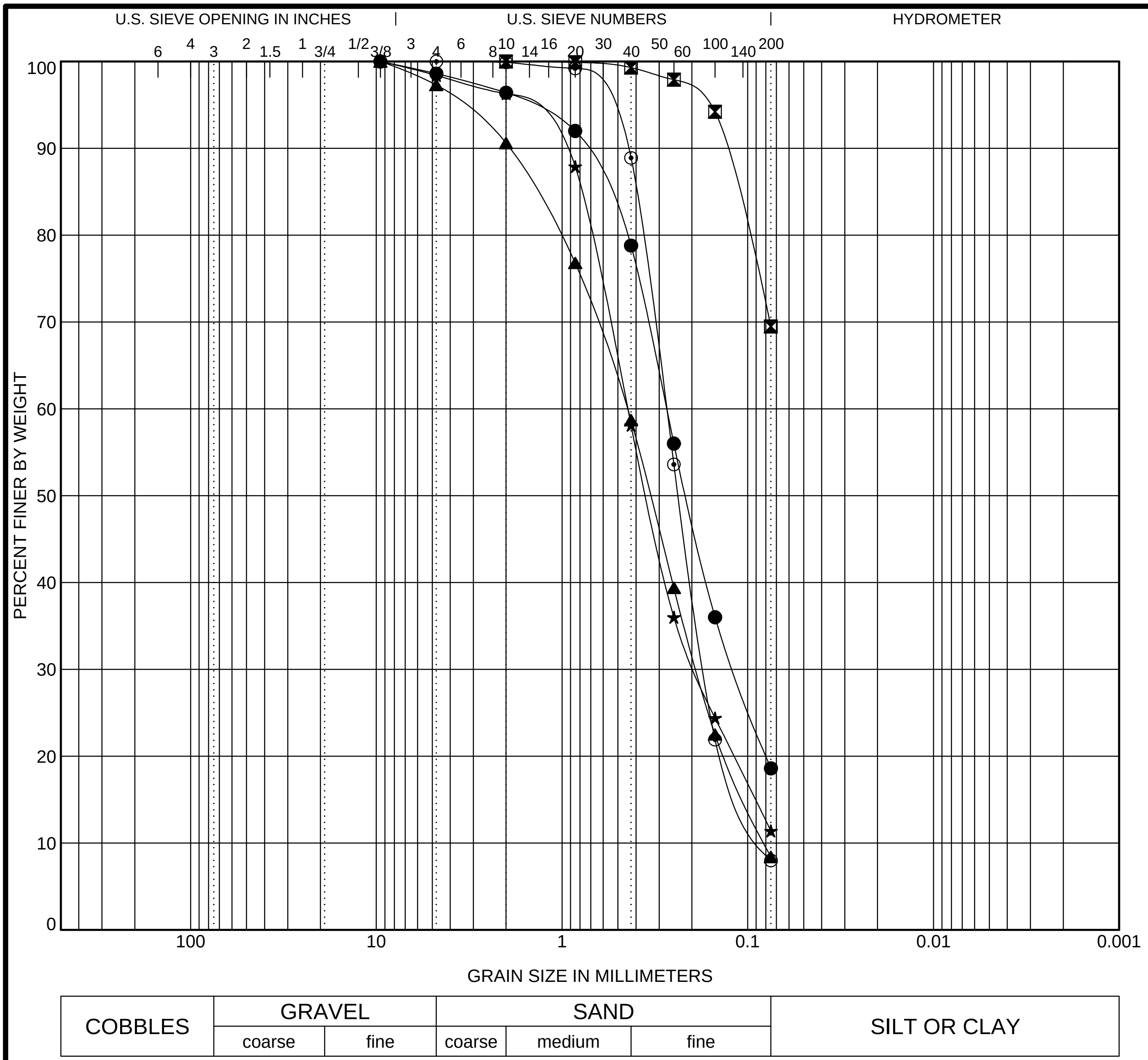
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-14-10	16.0	19.05	0.494	0.278	0.088	4.3	87.0	8.7	
⊠ THT-14-10	18.0	12.7	0.745	0.388	0.156	5.6	88.5	5.9	
▲ THT-14-10	20.0	19.05	0.613	0.26	0.077	11.5	78.8	9.7	
★ THT-15-10	10.0	19.05	0.641	0.323	0.161	13.1	82.0	4.9	
⊙ THT-15-10	20.0	4.75	0.205	0.121		0.0	87.4	12.6	

GRAIN SIZE DISTRIBUTION

PanGEO INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-8



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**THT-16-10**	**@ 5.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
⊠	**THT-16-10**	**@ 15.0 ft.**	**SANDY SILT(ML)**	**NP**	**NP**	**NP**		
▲	**THT-17-10**	**@ 0.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**0.98**	**5.51**
★	**THT-17-10**	**@ 5.0 ft.**	**WELL-GRADED SAND with SILT(SW-SM)**	**NP**	**NP**	**NP**	**1.19**	**6.38**
⊙	**THT-17-10**	**@ 20.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.28**	**3.32**

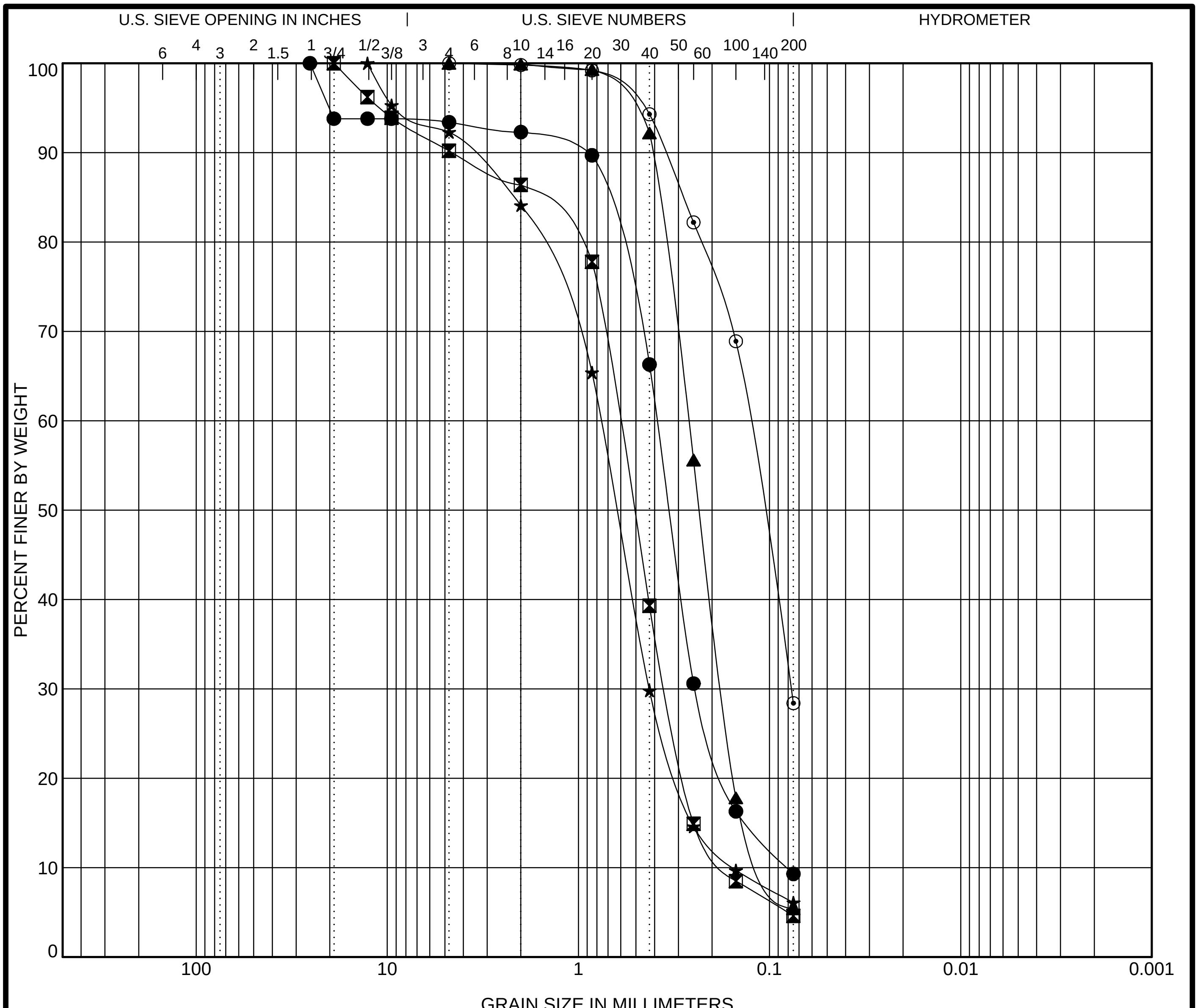
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-16-10**	**5.0**	**9.52**	**0.274**	**0.118**		**1.4**	**80.0**	**18.6**	
⊠	**THT-16-10**	**15.0**	**2**				**0.0**	**30.5**	**69.5**	
▲	**THT-17-10**	**0.0**	**9.5**	**0.447**	**0.188**	**0.081**	**2.7**	**88.9**	**8.4**	
★	**THT-17-10**	**5.0**	**9.5**	**0.444**	**0.192**		**1.6**	**87.0**	**11.4**	
⊙	**THT-17-10**	**20.0**	**4.75**	**0.275**	**0.171**	**0.083**	**0.0**	**92.0**	**8.0**	

GRAIN SIZE DISTRIBUTION

PanGEO
INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-9



<table>
<tr><td rowspan="2">COBBLES</td><td colspan="2">GRAVEL</td><td colspan="3">SAND</td><td rowspan="2">SILT OR CLAY</td></tr>
<tr><td>coarse</td><td>fine</td><td>coarse</td><td>medium</td><td>fine</td></tr>
</table>

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-18-10	@ 1.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.92	4.81
⊠ THT-18-10	@ 5.0 ft.	**POORLY GRADED SAND(SP)**	NP	NP	NP	1.16	3.65
▲ THT-18-10	@ 15.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.21	2.75
★ THT-19-10	@ 5.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.54	4.94
⊙ THT-19-10	@ 20.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		

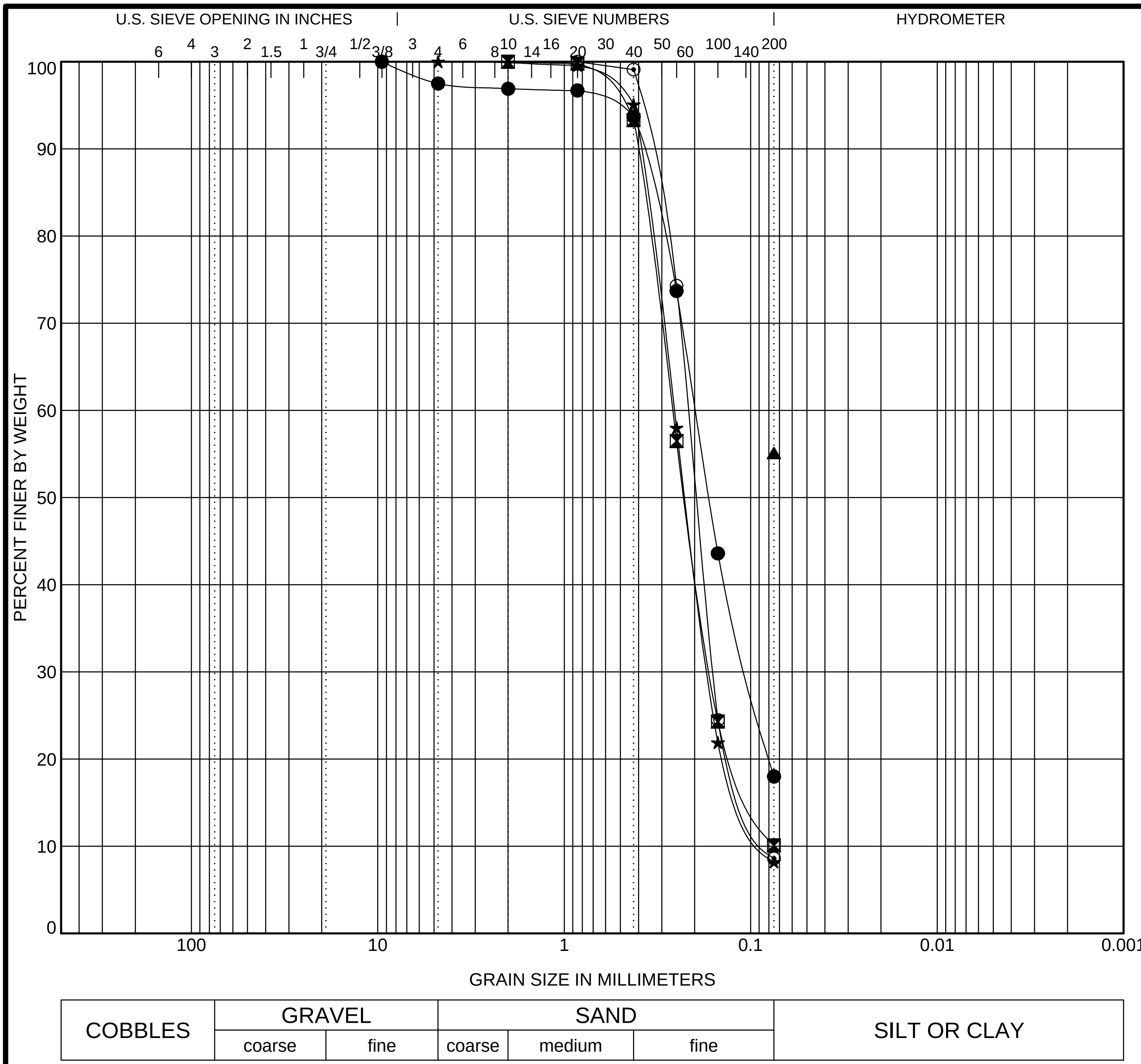
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-18-10	1.0	25.4	0.387	0.245	0.08	6.6	84.1	9.3	
⊠ THT-18-10	5.0	19.05	0.617	0.347	0.169	9.8	85.6	4.6	
▲ THT-18-10	15.0	4.75	0.266	0.177	0.097	0.0	94.6	5.4	
★ THT-19-10	5.0	12.7	0.765	0.427	0.155	7.7	86.2	6.1	
⊙ THT-19-10	20.0	4.75	0.129	0.077		0.0	71.6	28.4	

GRAIN SIZE DISTRIBUTION

PanGEO INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-10



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-20-10	@ 25.0 ft.	SILTY SAND(SM)	NP	NP	NP		
⧗ THT-20-10	@ 30.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.37	3.52
▲ THT-20-10	@ 35.0 ft.	SANDY SILT(ML)	NP	NP	NP		
★ THT-20-10	@ 50.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.34	3.13
⊙ THT-20-10	@ 65.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.46	2.71

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-20-10	25.0	9.525	0.198	0.104		2.5	79.5	18.0	
⧗ THT-20-10	30.0	2	0.263	0.164		0.0	89.9	10.1	
▲ THT-20-10	35.0	0.075				0.0	0.0	55.1	
★ THT-20-10	50.0	4.75	0.257	0.168	0.082	0.0	91.8	8.2	
⊙ THT-20-10	65.0	0.85	0.216	0.159	0.08	0.0	91.4	8.6	

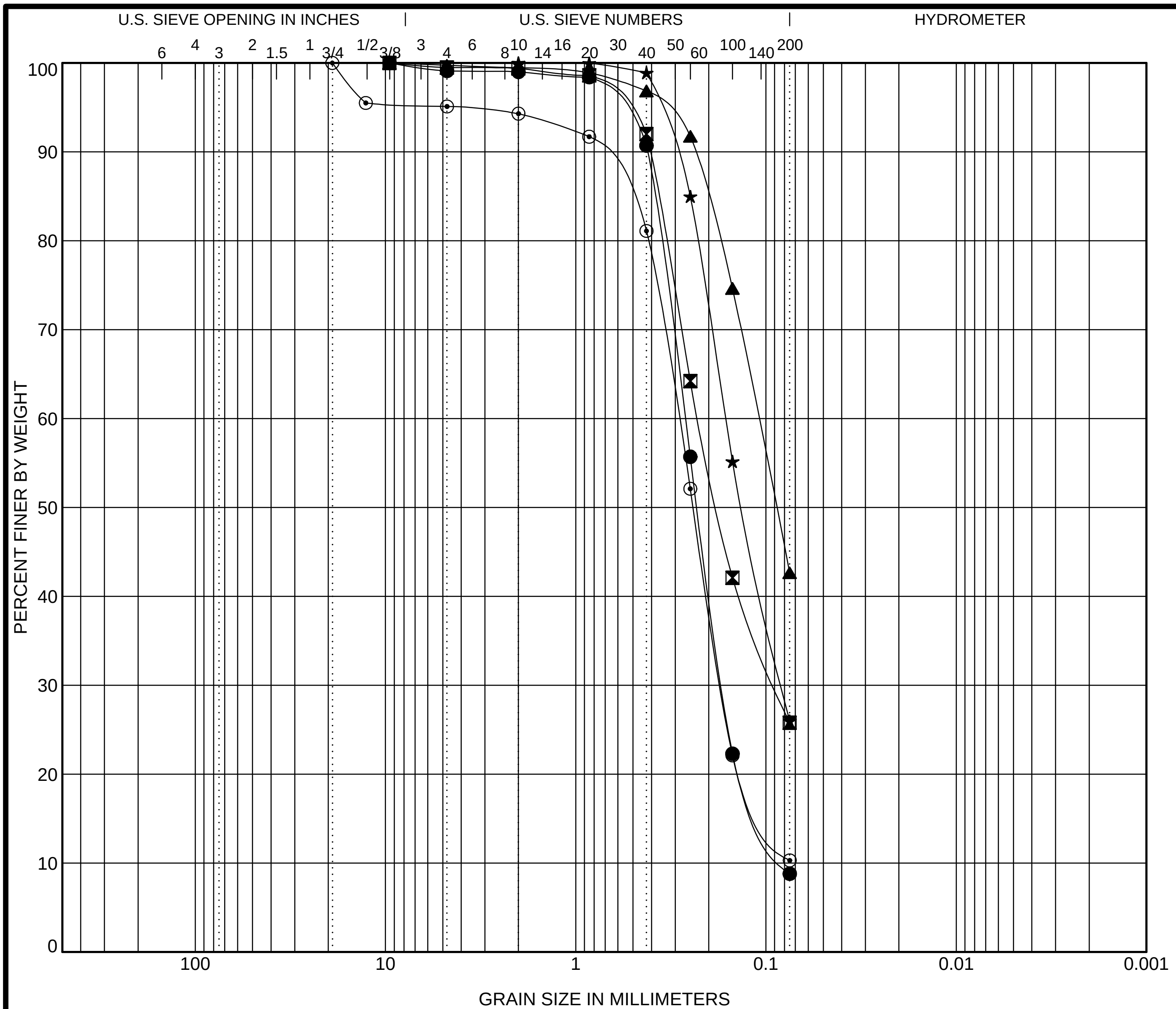
PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-11

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**THT-21-10**	**@ 11.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.34**	**3.35**
⊠	**THT-21-10**	**@ 26.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
▲	**THT-21-10**	**@ 46.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
★	**THT-21-10**	**@ 61.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
⊙	**THT-22-10**	**@ 5.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.38**	**3.92**

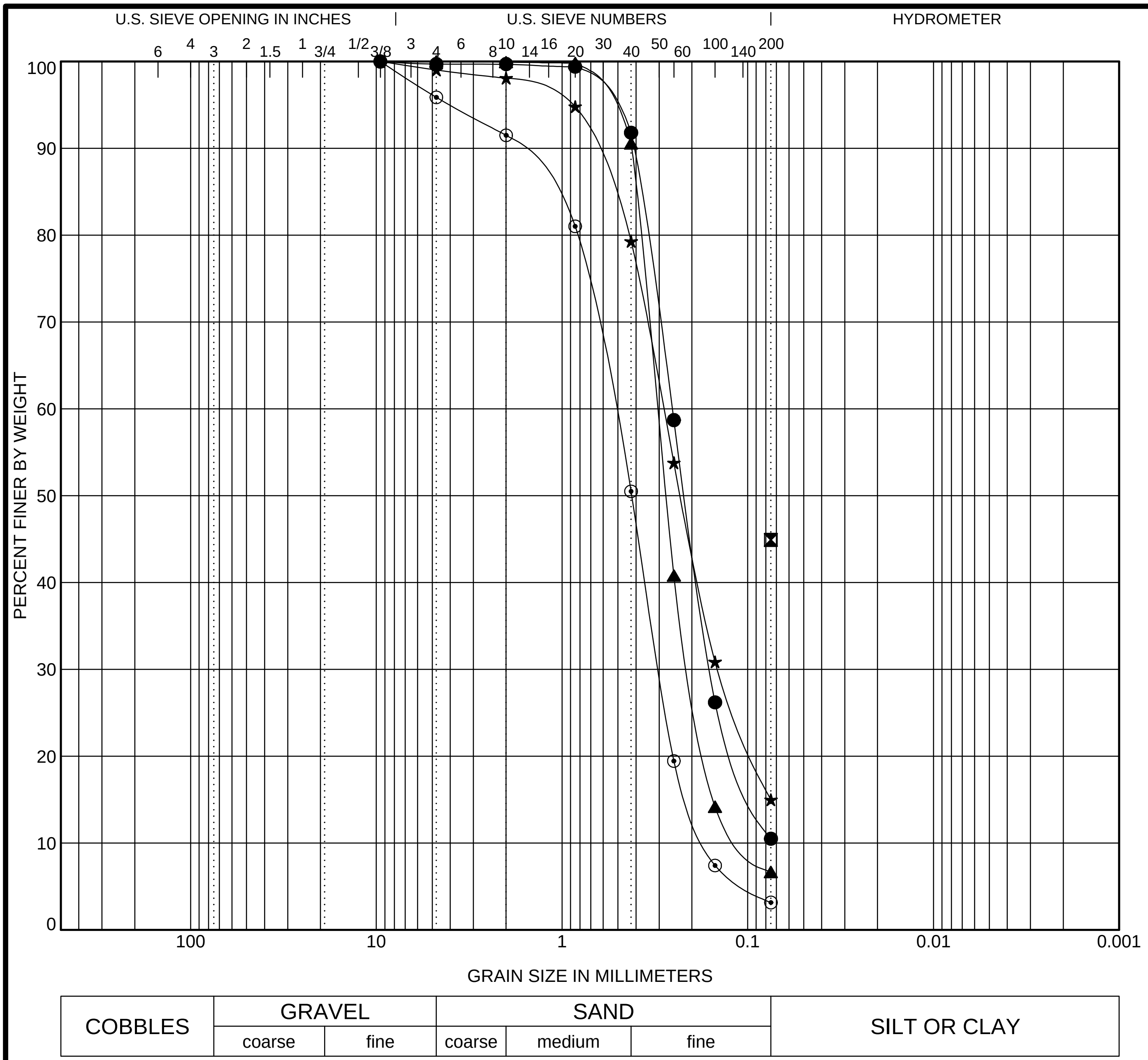
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-21-10**	**11.0**	**9.525**	**0.267**	**0.169**	**0.08**	**0.9**	**90.3**	**8.8**	
⊠	**THT-21-10**	**26.0**	**9.525**	**0.227**	**0.09**		**0.5**	**73.7**	**25.8**	
▲	**THT-21-10**	**46.0**	**9.525**	**0.109**			**0.3**	**57.1**	**42.7**	
★	**THT-21-10**	**61.0**	**2**	**0.163**	**0.082**		**0.0**	**74.0**	**26.0**	
⊙	**THT-22-10**	**5.0**	**19.05**	**0.289**	**0.172**		**4.9**	**84.8**	**10.3**	

PanGEO
INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-12



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**THT-22-10**	**@ 20.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.35**	**3.48**
⧗	**THT-22-10**	**@ 40.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
▲	**THT-22-10**	**@ 65.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.32**	**3.01**
★	**THT-23-10**	**@ 1.5 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
⊙	**THT-23-10**	**@ 3.5 ft.**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**1.02**	**3.15**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-22-10**	**20.0**	**9.525**	**0.255**	**0.159**		**0.3**	**89.2**	**10.5**	
⧗	**THT-22-10**	**40.0**	**0.075**				**0.0**	**0.0**	**44.9**	
▲	**THT-22-10**	**65.0**	**4.75**	**0.307**	**0.203**	**0.102**	**0.0**	**93.3**	**6.7**	
★	**THT-23-10**	**1.5**	**9.525**	**0.284**	**0.144**		**1.0**	**84.0**	**15.0**	
⊙	**THT-23-10**	**3.5**	**9.525**	**0.527**	**0.299**	**0.167**	**4.1**	**92.7**	**3.2**	

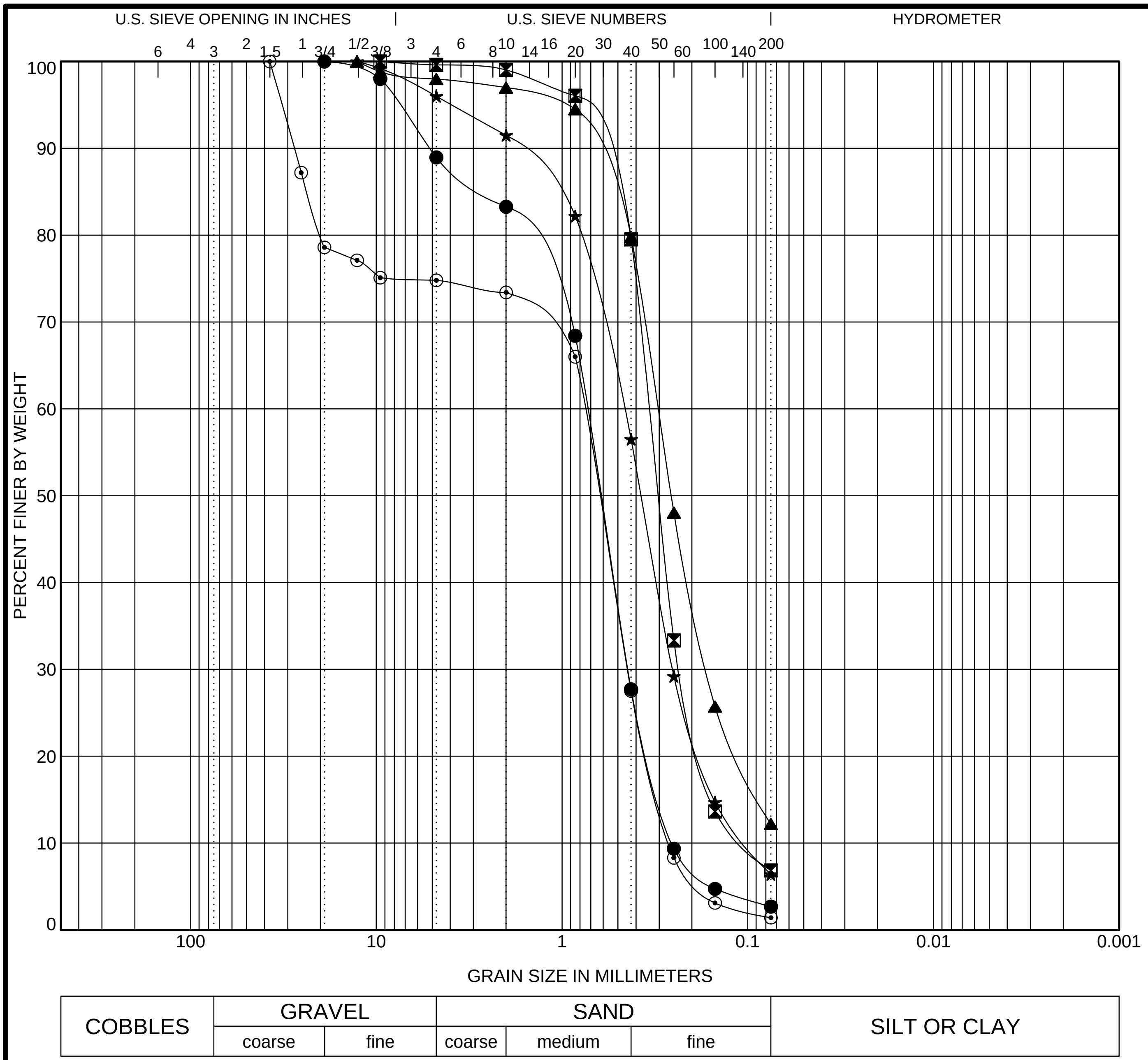
PanGEO
INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-13

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	THT-23-10	@ 5.5 ft.	POORLY GRADED SAND(SP)	NP	NP	NP	1.04	2.89
⊠	THT-23-10	@ 11.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.50	3.28
▲	TP-1	@ 2.5 ft.	SILTY SAND(SM)	NP	NP	NP	1.34	4.56
★	TP-1	@ 9.5 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.36	4.61
⊙	TP-2	@ 1.0 ft.	POORLY GRADED SAND with GRAVEL(SP)	NP	NP	NP	0.99	2.91

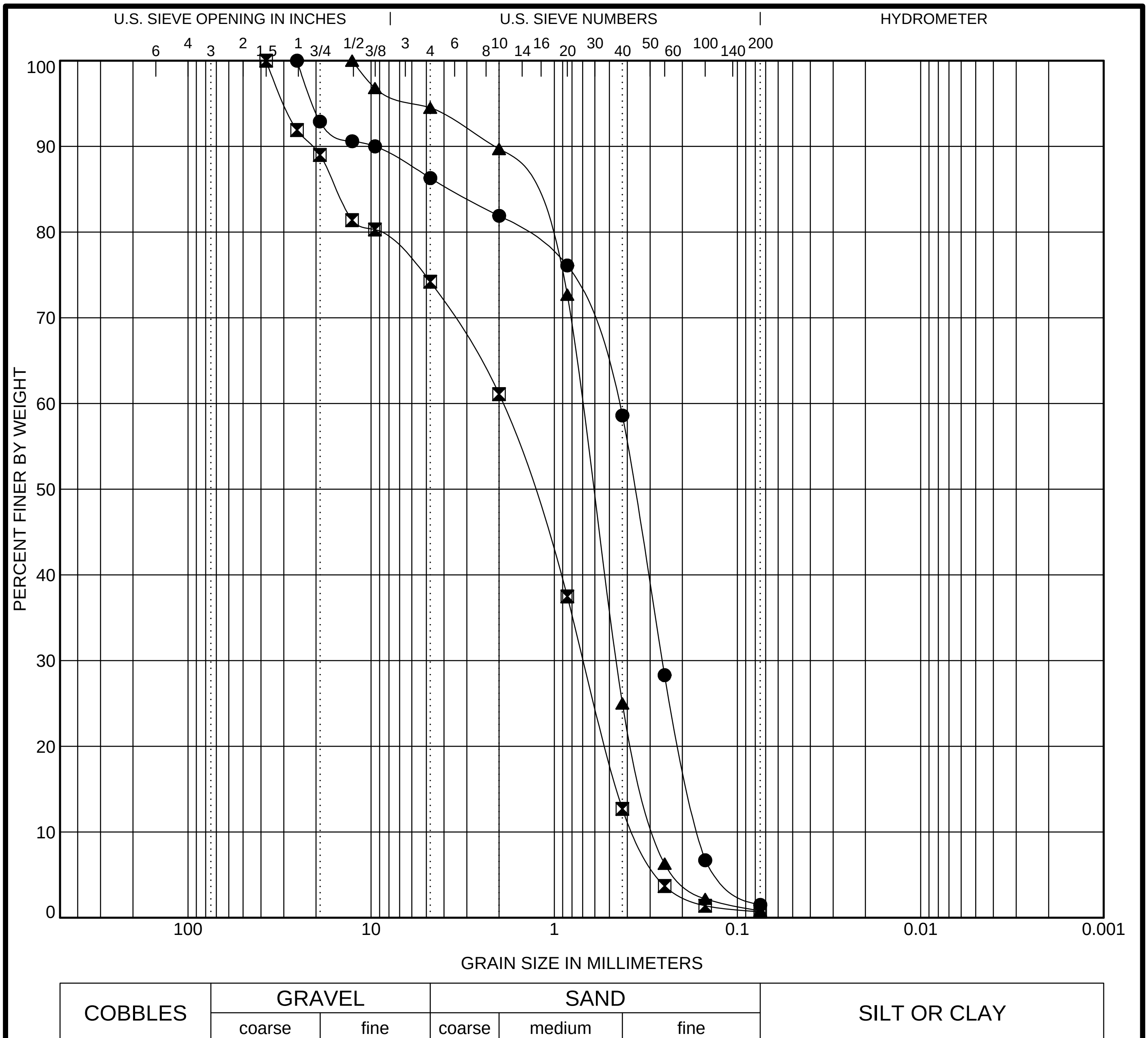
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	THT-23-10	5.5	19.05	0.737	0.442	0.255	11.1	86.3	2.7	
⊠	THT-23-10	11.0	9.525	0.34	0.229	0.103	0.4	92.8	6.8	
▲	TP-1	2.5	12.7	0.305	0.165		2.0	85.8	12.2	
★	TP-1	9.5	12.7	0.467	0.254	0.101	4.0	89.6	6.4	
⊙	TP-2	1.0	37.5	0.763	0.445	0.262	25.2	73.4	1.4	

PanGEO
INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-14



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	TP-2	@ 4.0 ft.	POORLY GRADED SAND(SP)	NP	NP	NP	0.91	2.77
⊠	TP-3	@ 1.0 ft.	POORLY GRADED SAND with GRAVEL(SP)	NP	NP	NP	0.68	5.30
▲	TP-3	@ 4.0 ft.	POORLY GRADED SAND(SP)	NP	NP	NP	1.06	2.55

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-2	4.0	25.4	0.449	0.258	0.162	13.7	84.8	1.5	
⊠	TP-3	1.0	37.5	1.922	0.689	0.362	25.8	73.5	0.7	
▲	TP-3	4.0	12.7	0.707	0.457	0.278	5.5	93.7	0.8	

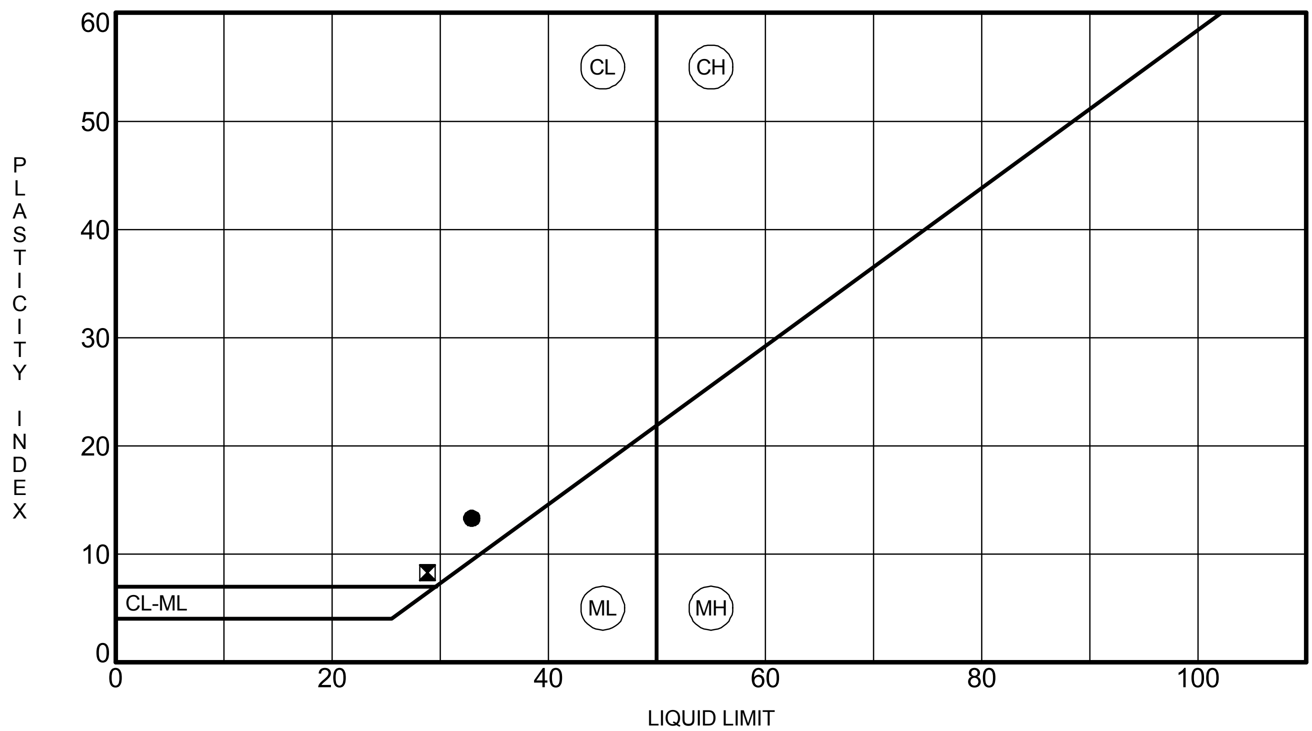
PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-15

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



	Specimen Identification		M	LL	PL	PI	Fines	Classification
●	**THT-20-10**	**45.0**	**33**	**33**	**20**	**13**	**87**	**LEAN CLAY(CL)**
⧗	**THT-22-10**	**55.0**	**36**	**29**	**21**	**9**	**98**	**LEAN CLAY(CL)**

PanGEO INCORPORATED
Phone: 206.262.0370

ATTERBERG LIMITS

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-16

APPENDIX C

LOGS OF TEST BORINGS FROM PREVIOUS FIELD EXPLORATIONS

APPENDIX C: LOGS OF TEST BORINGS FROM PREVIOUS FIELD EXPLORATIONS

This appendix contains copies of the boring logs from the previous investigation for the interchange by WSDOT, dated October, 1967. The locations of the borings are included on Figure 3, Site and Exploration Plan, Central.

Also included in this appendix are copies of boring logs from previous field explorations by Shannon & Wilson, dated December, 2005 and November, 2007. The locations of the borings, where visible within the limits of the drawing, are included on Figure 3, Site and Exploration Plan, Central.

H. F. 26.66 (Rev. 10-64)

WASHINGTON STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER C.S. 3104
P.S.H.
S.S.H. No. 1 Section GNRR U'XING: PIER #4 Job No. L-2848
Hole No. H-1 Station Ry STA. 116+73 Offset 14.5' RT ℄ Ground Elev. 59.5
Type of Boring AUGER 8C48-8 & JET Water Table 19.0 Below GROUND Casing AUGER 95.0
Inspector JOHN H. BARKHOUSE Date 5 JAN 67 To 9 JAN 67 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			B U-1	TOP SOIL - Silty Sand with bits of organic material & small amount fine gravel, dark brown, Very loose
	2		1 1 1 1 STD. PEN. 2	SLIGHTLY SILTY SAND - Very loose to Compact, brown, Very fine to medium; Occasional piece fine gravel
5			B U-3	
	10		5 5 5 4 STD. PEN. 4	
10			B U-5	
	22		11 10 12 14 STD. PEN. 6	
15	19		7 9 10 11 STD. PEN. 7	Samples moist to 17.0 FT - wet thereon
20	18		6 7 11 12 STD. PEN. 8	SLIGHTLY SILTY SAND - Very fine to fine, compact to dense, brown, with lenses & thin layers of Extremely fine to fine dark brown sand.
25	19		8 8 11 7 STD. PEN. 9	
30				

H.F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
S.S.H. No. 1 Section GNRR U'XING; PIER #4 Job No. L-2848
Hole No. H-1 Station Ry STA. 116+73 Offset 14.5 FT RT ℄ Ground Elev. 59.5
Type of Boring AUGER & JET Water Table 19.0 Below GROUND Casing AUGER 95.0
Inspector JOHN H. BARNHOUSE Date 5-JAN.'67 - 9-JAN.'67 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	33		12, 15, 18, 19 STD. PEN. 10	
35	50		12, 22, 28, 29 STD. PEN. 11	
40	24		12, 10, 14, 18 STD. PEN. 12	SAND - grey, clean & silty layered, very fine to fine compact to dense with lenses & thin layers to approximately 6" of extremely fine silty sand & sandy silt.
45	21		7, 9, 12, 12 STD. PEN. 13	
50	28		11, 11, 17, 14 STD. PEN. 14	
55	22		7, 10, 12, 18 STD. PEN. 15	
60				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
S.S.H. No. 1 Section GNRR U'XING: PIER #4 Job No. L-2848
Hole No. H-1 Station Ry 116+73 Offset 14.5 FT RT ℄ Ground Elev. 59.5
Type of Boring AUGER & JET Water Table 19.0 BELOW GROUND Casing AUGER 95.0
Inspector JOHN H. BARNHOUSE Date 5-JAN-TO 9-JAN-67 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	37		10 18 19 24 STD. PEN. 16	MATERIAL DESCRIPTION REMAINS SAME
65				
	12		4 6 6 11 STD. PEN. 17	
70				
			A B C U-18	
	37		12 16 21 26 STD. PEN. 19	
75				
	20		6 8 12 16 STD. PEN. 20	
80				
	41		11 20 21 29 STD. PEN. 21	
85				
	24		9 10 14 15 STD. PEN. 22	
90				

F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER

P.S.H.
S.S.H. No. 1 Section GN RR U'XING: PIER #4 Job No. L-2848

Hole No. H-1 Station Ry STA. 116+73 Offset 14.5 FT RT ℄ Ground Elev. 59.5

Type of Boring AUGER & JET Water Table 19.0' Below Ground AUGER Casing 95.0

Inspector JOHN H. BARNHOUSE Date 5 JAN '67 To 9 JAN '67 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	50		16 20 30 33 STD. PEN. 23	MATERIAL DESCRIPTION REMAINS SAME
95				
	70		21 36 34 39 STD. PEN. 24	
100				
	78		18 28 50 38 STD. PEN. 25	TEST BORING STOPPED at 103.0'
105				

H.-F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5
P.S.H. MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER — C.S. 3104
S.S.H. No. 1 — Section GNRR U'XING: PIER # 5 — Job No. L-2848
Hole No. H-2 — Station Ry 117+13 — Offset 15' RT ℄ — Ground Elev. 61.0
Type of Boring AUGER 8C48-8 — Water Table 21.5 Below Ground — Casing AUGER 102.0
Inspector JOHN H. BARNHOUSE — Date 10-JAN. To 11-JAN.-67 — Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				TOP SOIL - Silty sand, fine, very loose, dark brown -
			B C U-1	SLIGHTLY SILTY SAND - Slightly compact to Compact, fine to course, with occasional piece of fine to medium gravel, brown
5	11		3 5 6 12 STD. PEN. 2	
10	32		12 15 17 18 STD. PEN. 3	
15	15		5 7 8 12 STD. PEN. 4	SLIGHTLY SILTY SAND - Slightly compact, fine to course, with occasional piece of fine gravel, brown. Occasional lens extremely fine sand & silt.
20	18		6 9 9 12 STD. PEN. 5	SLIGHTLY SILTY SAND - Compact, Very fine to fine, brown
25	23		12 12 11 10 STD. PEN. 6	SAND - Fairly clean, compact to very dense, very fine to fine, brown. Samples moist to 23.0' - wet thereon.
30	28		12 14 14 17 STD. PEN. 7	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
~~S.H.~~ No. 1 Section GN RR U'XING : PIER # 5 Job No. L-2848
Hole No. H-2 Station Ry 117+13 Offset 15' RT ℄ Ground Elev. 61.0
Type of Boring AUGER Water Table 21.5 Below Ground AUGER Casing 102.0
Inspector JOHN H. BARNHOUSE Date 10-JAN-TO 11-JAN-'67 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
35	75		23 33 42 43 STD. PEN. 8	
40	50		17 23 27 29 STD. PEN. 9	SAND - Clean & silty layered, compact to dense, very fine to fine with occasional silt lens, grey.
45	24		10 10 14 16 STD. PEN. 10	
50	30		11 14 16 15 STD. PEN. 11	
55	21		8 9 12 12 STD. PEN. 12	
60	27		8 13 14 13 STD. PEN. 13	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
S.S.H. No. 1 Section GNRR U'XING: PIER #5 Job No. L-2848
Hole No. H-2 Station Ry 117+13 Offset 15' RT ℄ Ground Elev. 61.0
Type of Boring AUGER Water Table 21.5 BELOW GROUND Auger Casing 102.0
Inspector JOHN H. BARNHOUSE Date 10-JAN-TO 11-JAN-'67 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	21		7, 7, 14, 16 STD. PEN. 14	
65				
	20		7, 9, 11, 12 STD. PEN. 15	SAND & SILT - Compact extremely fine to fine silty sand with silt & clayey silt layers to approximately 6", grey.
70			U-16	
				SLIGHTLY SILTY SAND - Compact to dense, very fine to fine, grey.
	39		14, 19, 20, 21 STD. PEN. 17	
75				
	21		7, 9, 12, 12 STD. PEN. 18	
80				
	24		8, 12, 12, 15 STD. PEN. 19	
85				
	40		14, 19, 21, 25 STD. PEN. 20	
90				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER

P.S.H.

S.H. No. 1 Section GNRR U'XING: PIER #5 Job No. L-2848

Hole No. H-2 Station Ry 117+13 Offset 15' RT ℄ Ground Elev. 61.0

Type of Boring AUGER Water Table 21.5 BELOW GROUND Casing AUGER 102.0

Inspector JOHN H. BARNHOUSE Date 10-JAN-TO 11-JAN 67 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	16		7 7 9 20 STD. PEN. 21	SILTY SAND - SANDY SILT - CLAYEY SILT & SILTY CLAY - Variable layers to approximately 1', Compact, grey sand is extremely fine to fine.
95				
	18		5 7 11 13 STD. PEN. 22	
100				
			A B C 11-23	Layer approximately 1' - 102.0 - 103.0 - Sands, silts & Clays mixed.
				SILTY SAND - Dense, extremely fine to very fine, grey.
105	56		12 23 33 53 STD PEN. 24	TEST BORING STOPPED at 106' 0"
110				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5
P.S.H. MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER C.S. 3104
~~S.R.~~ No. 1 Section GNAR U'XING: PIER #3 Job No. L-2848
Hole No. H-3 Station Ry 115+71 Offset 17' RT ℄ Ground Elev. 43.5
Type of Boring AUGER 8C48-8 Water Table 4.0 Below Ground Casing AUGER 101.5
Inspector JOHN H. BARNHOUSE Date 12-JAN-TO 13-JAN.-67 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			U-1	SILTY SAND - Compact, fine to course, brown
			DE	small amount fine gravel.
	24		12 11 13 14 STD. PEN. 2	
5				
	2		1 1 1 2 STD. PEN. 3	SAND - Fairly clean, very loose to slightly compact, Very fine to medium with trace of fine gravel Bits of peat throughout, brown
10				Samples moist to 6.5 - wet thereon.
	5		2 2 3 4 STD. PEN. 4	
15				
	14		STD. PEN. 5 6 5 9 12	
20				
	17		10 7 10 17 STD PEN. 6	SAND - Fairly clean with sandy silt & clayey silt in thin Layers to approximately 6", compact to dense, very fine to fine, brown. SILT Layers are grey.
25				
	58		19 30 28 33 STD. PEN 7	SILTY SAND - Dense, very fine to fine, grey.
30				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
~~S.S.H.~~ No. 1 Section GNRR U'XING : PIER #3 Job No. L-2848
Hole No. H-3 Station Ry 115+71 Offset 17' RT ℄ Ground Elev. 43.5
Type of Boring AUGER Water Table 4.0 Below Ground AUGER Casing 101.5
Inspector JOHN H. BARNHOUSE Date 12-JAN. 67 - 13-JAN. 67 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	36		12, 17, 19, 21 STD. PEN. 8	
35				
	16		6, 9, 7, 9 STD. PEN. 9	SAND - Clean & silty layered, slightly compact to compact, very fine to fine with silt & clayey silt lenses, grey.
40				
	15		7, 6, 9, 13 STD. PEN. 10	
45				
	12 27		4, 8, 10, 17 STD. PEN. 11-A, 11-B	Approximate 1' Layer Silty clay 46.5 - 47.5 - grey.
50				
	21		8, 9, 12, 15 STD. PEN. 12	
55				
	16		6, 7, 9, 11 STD. PEN. 13	
60				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5
P.S.H. MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
~~S.S.H.~~ No. 1 Section GNRR U'XING : PIER # 3 Job No. L-2848
Hole No. H-3 Station Ry 115+71 Offset 17' RT ℄ Ground Elev. 43.5
Type of Boring AUGER Water Table 4.0 Below Ground AUGER Casing 101.5
Inspector JOHN H. BARNHOUSE Date 12-JAN - 13-JAN-67 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	19		9 9 10 11 STD. PEN. 14	
65				
	18		8 8 10 15 STD. PEN. 15	
70				
	11		6 5 6 17 STD. PEN. 16	SILTY SAND - SILT - CLAYEY SILT & SILTY CLAY — Variable lenses & Layers to approximately 2', slightly compact to compact, grey, sand is extremely fine to fine.
75				
	26		9 10 16 19 STD. PEN. 17	
80				
	29		8 12 17 19 STD. PEN. 18	SILTY SAND - Compact to dense, extremely fine to fine with occasional lens & thin layer of silty clay, grey.
85				
	35		12 12 23 25 STD. PEN. 19	
90				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
~~P~~.S.H. ~~S.S.H.~~ No. 1 Section GNRR U'XING : PIER #3 Job No. L-2848
Hole No. H-3 Station Ry 115+71 Offset 17' RT ℄ Ground Elev. 43.5
Type of Boring AUGER Water Table 4.0 Below Ground Casing Auger 101.5
Inspector JOHN H. BARNHOUSE Date 12-JAN. - TO 13-JAN '67 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	47		20, 21, 26, 30 STD. PEN. 20	
95				
	56		12, 29, 32, 25 STD. PEN. 21	Approximate 2' layer very stiff clayey silt & silty clay 96.0 - 98.0
100				
	55		13, 19, 36, 37 STD. PEN. 22	TEST BORING STOPPED at 103' 6"
105				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N.R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-4 Station Ry 114+56 Offset 13' RT. ℄ Ground Elev. 33.5
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" x 50'
Inspector E.E. DUVALL Date FEB. 7, 1967 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			A B U-1	SAND - VERY LOOSE BROWN TO GRAY, FINE TO COARSE, TRACE FINE GRAVEL, SCATTERED WOOD SATURATED
	1		1 1 1 1 STD. PEN. 2	
5			A U-3	
	8		2 4 4 6 STD. PEN. 4	
10				SAND - SLIGHTLY COMPACT, DARK BROWN TO GRAY, FINE TO COARSE, SCATTERED FINE GRAVEL, WET
	17		U-5	
			7 7 10 11 STD. PEN. 6	
15				15' ARTESIAN FLOW 1 GAL. 2 MIN.
	15		6 5 7 8 STD. PEN. 7	
				SILT - LOOSE GRAY, WET
20				SAND - SLIGHTLY COMPACT GRAY, SCATTERED SILT LENSES, SLIGHT TRACE FINE GRAVEL, SATURATED TO WET
			U-8	
	16		7 8 8 12 STD. PEN. 9	
25	19		6 6 13 20 STD. PEN. 10	
30			9	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N.R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-4 Station Ry 114 +56 Offset 13' RT. ℄ Ground Elev. 33.5
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 50'
Inspector E.E. DUVALL Date FEB. 7, 1967 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	18		9 9 15 STD. PEN. 11	SAND - SLIGHTLY COMPACT GRAY, SCATTERED SILT LENSES, SLIGHT TRACE FINE GRAVEL SATURATED TO WET
35				
	15		9 7 8 10 STD. PEN. 12	
40	28		14 13 15 20 STD. PEN. 13	
45	36		5 18 18 15 STD. PEN. 14	
50	26		13 11 15 23 STD. PEN. 15	
55				
	8 18		4 4 8 10 STD. PEN. 16	SILT - SLIGHTLY COMPACT GRAY, WITH EXTREMELY FINE SAND & LENSES FINE SAND, DAMP
60				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N. R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-4 Station Ry 114+56 Offset 13' RT. ℄ Ground Elev. 33.5
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 50'
Inspector E.E. DUVALL Date FEB. 7 1967 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			C D E U-17	
	15		6 9 STD. PEN.	SAND – COMPACT TO DENSE, GRAY, FINE,
	20		8 12 18	OCCASIONAL SILT LENS, DAMP
65				
			A U-19	
	24		9 12 12 21 STD. PEN. 20	
70				
	37		10 16 21 23 STD. PEN. 21	
75				
	31		9 14 17 19 STD. PEN. 22	
80				
	33		7 12 21 22 STD. PEN. 23	
85				
	44		15 23 21 25 STD. PEN. 24	
				SILT – COMPACT GRAY, DAMP
90				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N.R.R. U-XING

S.R. No. 5
P.S.H.
~~S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2878
Hole No. H-4 Station RY 114+56 Offset 13' RT. ℄ Ground Elev. 33.5
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 50'
Inspector E.E. DUVALL Date FEB. 7, 1967 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	24		8, 12, 12, 22 STD. PEN. 25	
95	34		7, 17, 17, 22 STD. PEN. 26	SAND - DENSE, FINE GRAY, DAMP
100				
105	57		18, 30, 27, 50 STD. PEN. 27	TEST BORING STOPPED 107'-0"
				WATER TABLE 2' BELOW GROUND WITH 50' CASING
				AFTER PULLING CASING, HAD ARTESIAN FLOW

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

G.N.R.R. U-XING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-5 Station Ry 114+12 Offset 11' RT. ℄ Ground Elev. 34
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 69'
Inspector E. E. DUVALL Date FEB. 15, 1967 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				SILT - VERY LOOSE, BROWN, ORGANIC, ROOTS & WOOD, WET
			A B U-1	
				SAND - LOOSE, FINE GRAY, SCATTERED SILT, WET
			3 3 STD. PEN.	
	7			
5			4 4 2	
			B C U-3	
	4		1 3 STD. PEN.	SILTY SAND & SAND - LOOSE BROWN, FINE TO COARSE,
	7		2 5 4	TRACE FINE GRAVEL, WET
10				
			A B U-5	
			5 5 STD. PEN.	
	10		5 7 6	
15				
			A B U-7	
	10		6 4 STD. PEN.	SILTY SAND - SLIGHTLY COMPACT, FINE GRAY, WET
	16		5 11 8	GRAVEL - WATER BEARING, FINE, SLIGHTLY COMPACT
	19		8 11 STD. PEN.	SAND - COMPACT BROWN, FINE, WITH SILT LENSES, DAMP
20	27		10 17 9	
				SAND - SLIGHTLY COMPACT, FINE GRAY, SLIGHT TRACE
				FINE GRAVEL, DAMP
			7 9 STD. PEN.	
25	17		8 13 10	
30	31		8 15 STD. PEN.	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

G.N.R.R. U-XING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-5 Station Ry 114+12 Offset 11' RT. ℄ Ground Elev. 34
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 69'
Inspector E. E. DUVALL Date FEB. 15, 1967 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	31		16 13 ↓ 11	
				SAND & SILT - SLIGHTLY COMPACT, MIXED, GRAY FINE, WET
35	10		5 5 5 6 STD. PEN. 12	
			A U-13	SAND - SLIGHTLY COMPACT, FINE GRAY, SCATTERED SILTLY SAND & SILT LENSES, WET
	10		5 6 4 8 STD. PEN. 14	
40			A V-15	
	12		6 8 4 11 STD. PEN. 16	
			A B U-17	
45	11		4 6 5 7 STD. PEN. 18	
				49' SLIGHT ARTESIAN FLOW
50	12		3 6 6 10 STD. PEN. 18	
55	11		4 5 6 9 STD. PEN 20	
				SILT & SANDY SILT - SLIGHTLY COMPACT GRAY, EXTREMELY FINE, WITH FINE SAND LENSES, DAMP
60	16		5 7 STD. PEN. 20	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N.R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-5 Station Ry 114+12 Offset 11' RT. ℄ Ground Elev. 34
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 69'
Inspector E.E. DUVALL Date FEB. 15, 1967 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	16		9, 11 ↓ 21	
65				
	11		6, 5, 6, 15 STD. PEN. 23	SAND - COMPACT, FINE GRAY, OCCASIONAL SILT LENS, DAMP
70			U-23	
	36		8, 14, 22, 29 STD. PEN. 24	
75				
	41		11, 17, 24, 32 STD. PEN. 25	
80				
	34		10, 15, 19, 24 STD. PEN. 26	
85				
	32		16, 14, 18, 26 STD. PEN. 27	SILT - SLIGHTLY COMPACT, GRAY, WITH FINE SAND LENSES, DAMP
90				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING
G.N.R.R. U-XING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-5 Station Ry 114+12 Offset 11' RT. ℄ Ground Elev. 34
Type of Boring WASH BORE Water Table SEE NOTE Casing 3"X 69'
Inspector E.E. DUVALL Date FEB. 15, 1967 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	19		6 8 11 19 STD. PEN. 28	
95	35		12 16 19 29 STD. PEN. 29	SAND - COMPACT TO DENSE GRAY, FINE, SCATTERED SILT LENSES, DAMP
100	34		17 17 17 35 STD. PEN. 30	
105	68		11 32 36 37 STD. PEN. 31	TEST BORING STOPPED AT 107'-0"
				WATER TABLE - SLIGHT ARTESIAN FLOW WITH 70'5" CASING IN GROUND 69', AFTER PULLING CASING WATER TABLE AT GROUND ELEV.

Total Depth:	16.5 ft.	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation:	~ 73 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

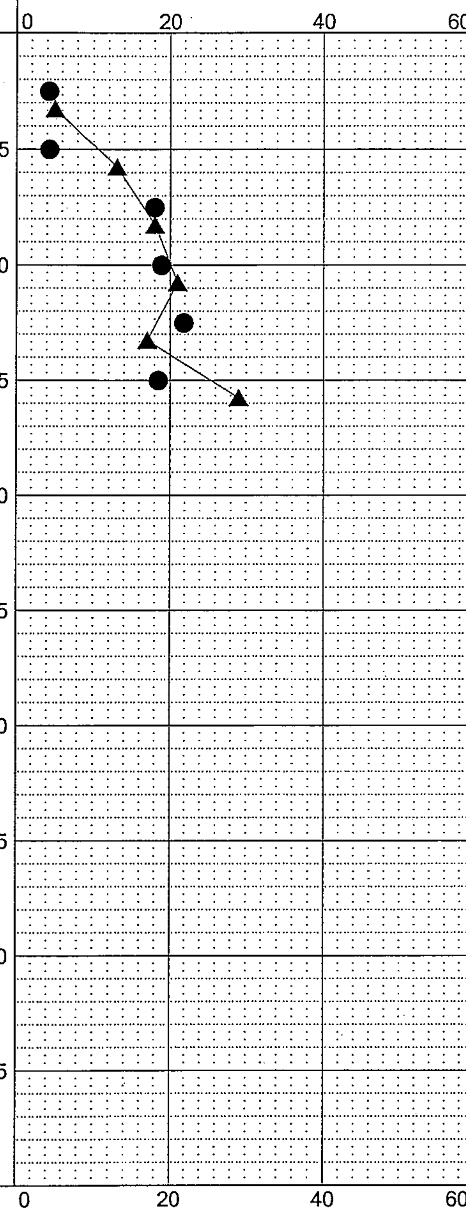
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft	PID, ppm	Samples	Ground Water
ASPHALT.	0.5			
Loose to medium dense, brown and gray, fine to medium SAND, trace of silt; moist; occasional coarse sand; SP.	7.0	0 0	1 2	
Medium dense, brown and gray SAND, trace of silt, trace of gravel after 14 feet below ground surface; moist, grading to wet; SW.	16.5	0 0 0 0	3 4 5 6	During Drilling ▽
BOTTOM OF BORING COMPLETED 5/15/2007				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered

⌶ Standard Penetration Test

▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 1

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

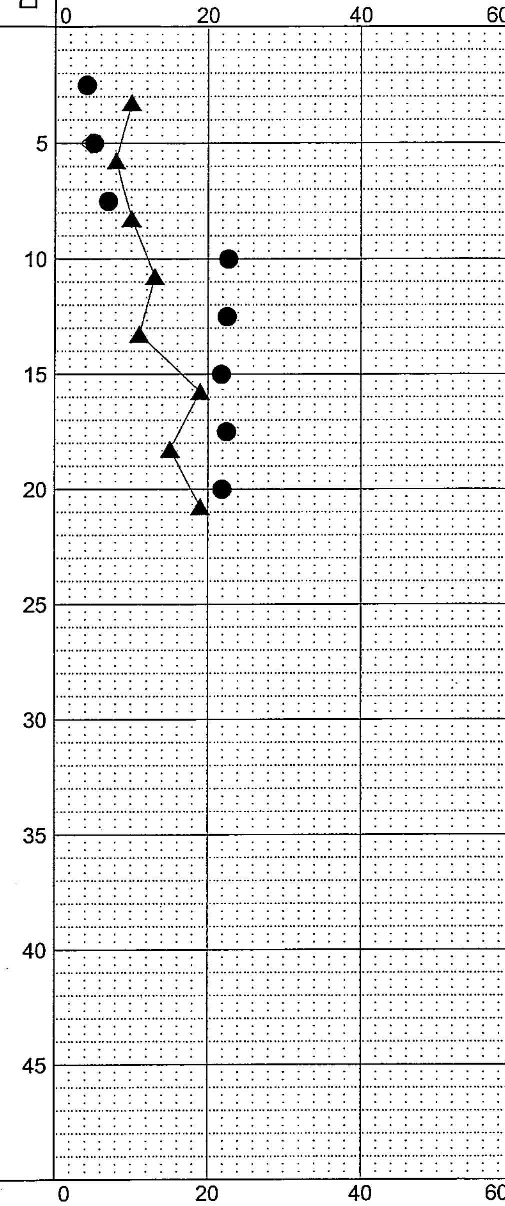
FIG. A-2

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth:	21.5 ft.	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation:	~ 71 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft	Symbol	PID, ppm	Samples	Ground Water
ASPHALT.	0.5				
Medium dense, brown-gray, trace to slightly silty, trace to slightly gravelly SAND; moist, grading to wet; abundant iron staining; SP/SP-SM.			0	1	
			0	2	
			0	3	
			0	4	During Drilling ⊻
			0	5	
			0	6	
Medium dense, gray, slightly silty to silty, fine to medium SAND; wet; SP-SM/SM.	17.0		0	7	
			0	8	
BOTTOM OF BORING COMPLETED 5/15/2007	21.5				

PENETRATION RESISTANCE (blows/foot)
▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered
⌶ Standard Penetration Test
⊻ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 2

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3

Total Depth: 16.5 ft.	Northing:	Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation: ~ 73 ft.	Easting:	Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:	Offset:	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

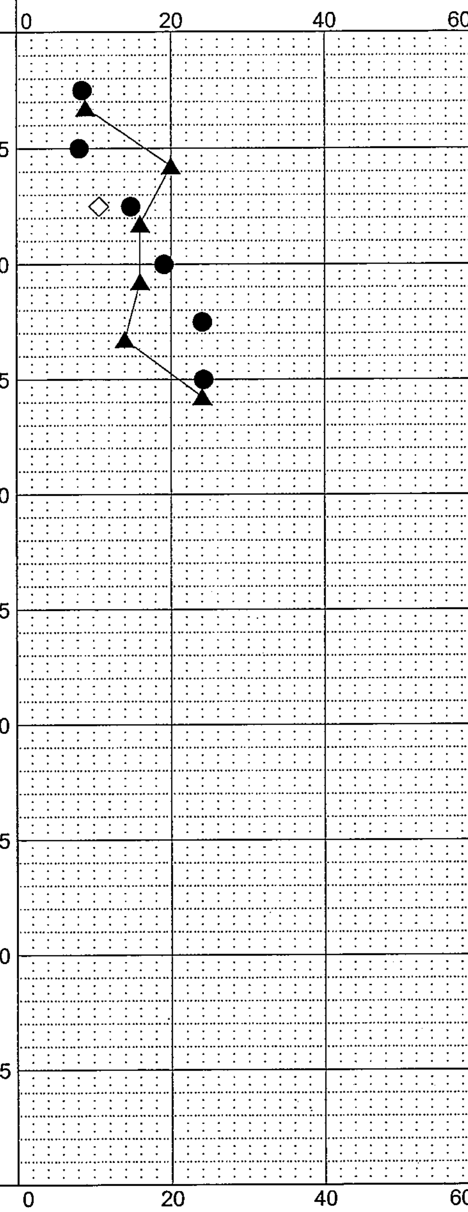
Soil Description	Depth, ft	PID, ppm	Samples
ASPHALT.	0.5		
Loose to medium dense, brown, trace to slightly silty SAND, occasionally fine gravelly; moist; iron staining; SP-SM.	10.0	0 / 0 / 0	1 / 2 / 3
Medium dense, brown-gray, slightly silty to silty, fine to medium SAND; moist; iron staining; SP-SM/SM.	12.5	0 / 0	4 / 5
Medium dense, gray, slightly silty, fine to medium SAND, trace of gravel; moist, grading to wet; iron staining; interbedded with stiff, gray SILT; wet; SP-SM/ML.	16.5	0	6

Ground Water: During Drilling ▽

BOTTOM OF BORING
COMPLETED 5/15/2007

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit |—●—| Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
Ⲓ Standard Penetration Test
▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 3

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth:	21.5 ft.	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation:	~ 75 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

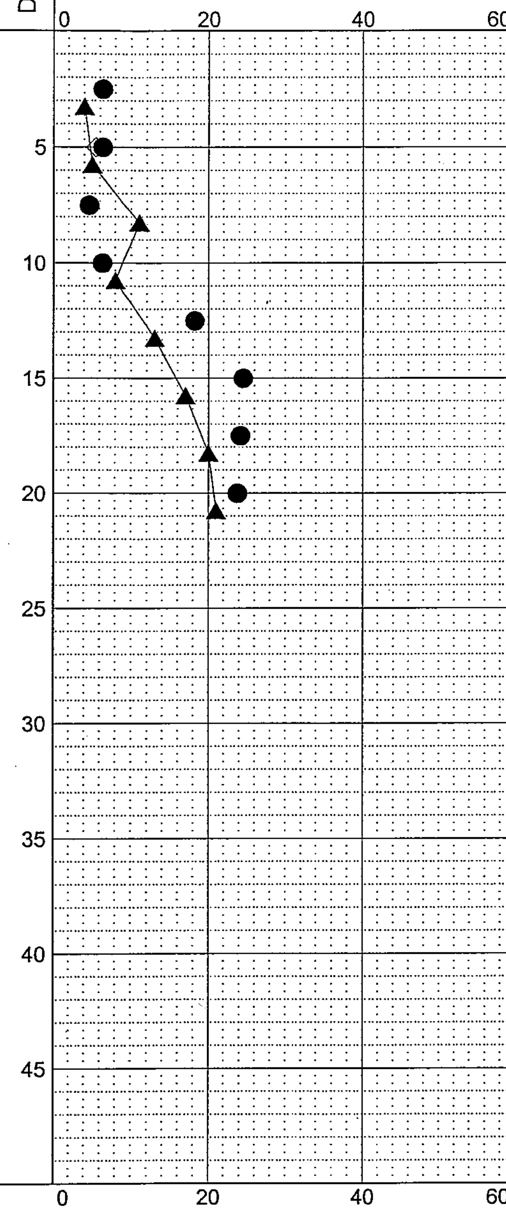
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	PID, ppm	Samples	Ground Water
Very loose to medium dense, brown to gray, slightly silty, slightly gravelly SAND; moist to wet at 14.5 feet below ground surface; iron staining; SP/SP-SM.		0, 0, 0, 0, 0, 0	1, 2, 3, 4, 5, 6	During Drilling ∇
Medium dense, brown and gray, silty, fine to medium SAND; wet; occasional fine sandy silt interbeds; iron staining; SM.	18.0	0, 0	7, 8	
BOTTOM OF BORING COMPLETED 5/15/2007	21.5			

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

Standard Penetration Test

∇ Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 4

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5

MASTER_LOG_E 21-09896-007.GPJ SHAN_WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth:	61.5 ft.	Northing:		Drilling Method:	Mud Rotary
Top Elevation:	~ 75 ft.	Easting:		Drilling Company:	Boart Longyear
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile
Horiz. Datum:		Offset:		Other Comments:	

Hole Diam.:
Rod Diam.:
Hammer Type:

SOIL DESCRIPTION

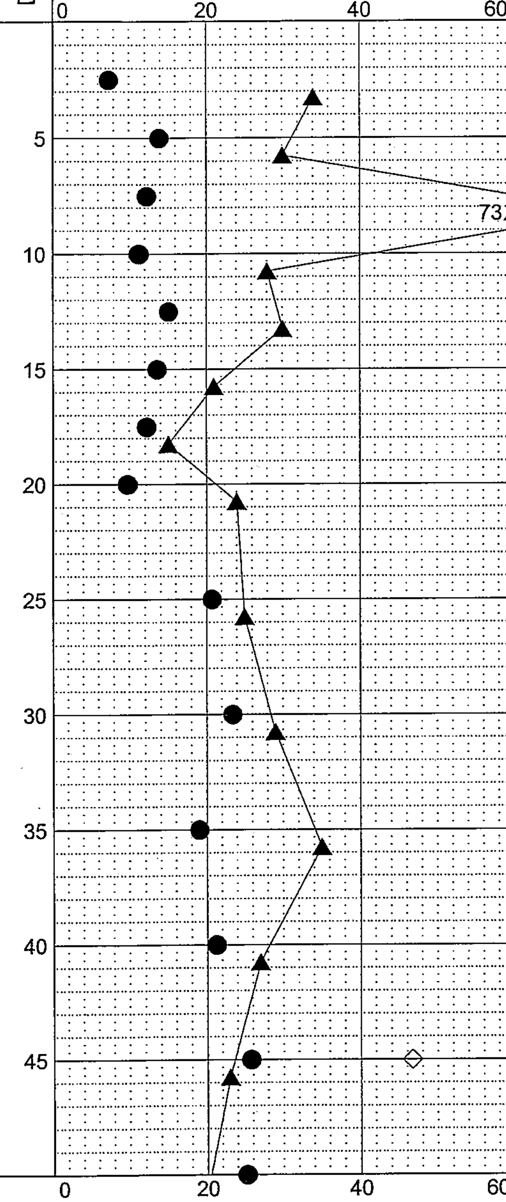
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

SOIL DESCRIPTION	Depth, ft	Symbol	PID, ppm	Samples	Ground Water
Medium dense to dense, gray, trace to slightly silty, trace to gravelly SAND; moist; iron oxidation; occasional to scattered wood fragments; (Fill) SP/SP-SM.			0 0 0 0 0	1 2 3 4 5	
Medium dense, gray-brown to orange-brown, slightly silty, slightly gravelly SAND; moist; iron oxidation; (Marine/Alluvium Deltaic) SP-SM/SM.	14.0		0 0 0 0	6 7 8 9	
Medium dense, gray, interbedded, trace to silty SAND and slightly fine sandy, silty CLAY; moist to wet; (Recessional Outwash) SP-SM/SM/CL.	26.5		0 0 0 0	10 11 12 13	During Drilling

CONTINUED NEXT SHEET

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
Ⲓ Standard Penetration Test
▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 5

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-6
Sheet 1 of 2

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: CKS Rev: CKS Typ: LKD

Total Depth:	61.5 ft.	Northing:		Drilling Method:	Mud Rotary
Top Elevation:	~ 75 ft.	Easting:		Drilling Company:	Boart Longyear
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile
Horiz. Datum:		Offset:		Other Comments:	

Hole Diam.:
Rod Diam.:
Hammer Type:

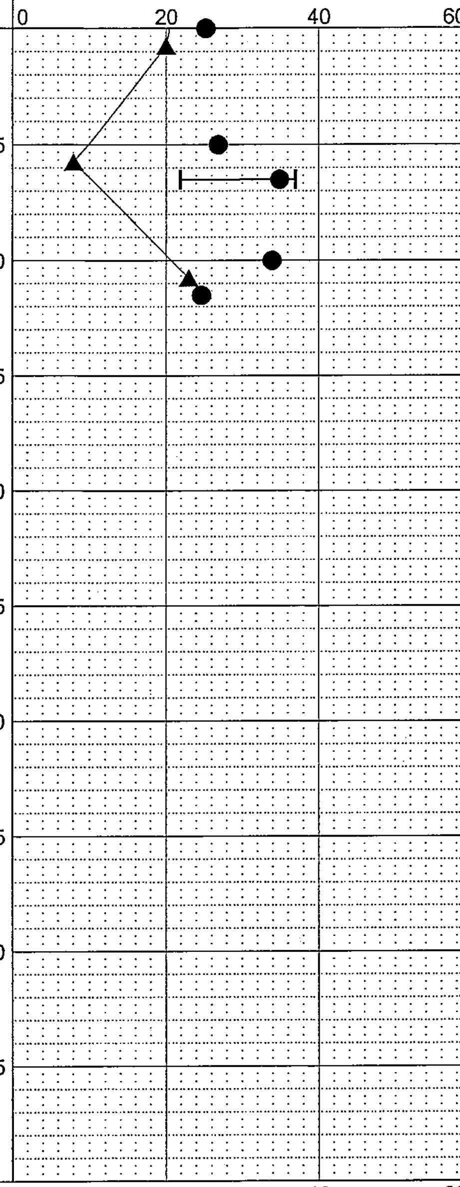
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Symbol	PID, ppm	Samples	Ground Water
Medium dense, gray, interbedded, trace to silty SAND and slightly fine sandy, silty CLAY; SP-SM/SM/CL (cont.).			0	14	
			0	15	
				16	
BOTTOM OF BORING COMPLETED 5/18/2007	61.5				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

Ground Water Level ATD

Standard Penetration Test

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 5

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

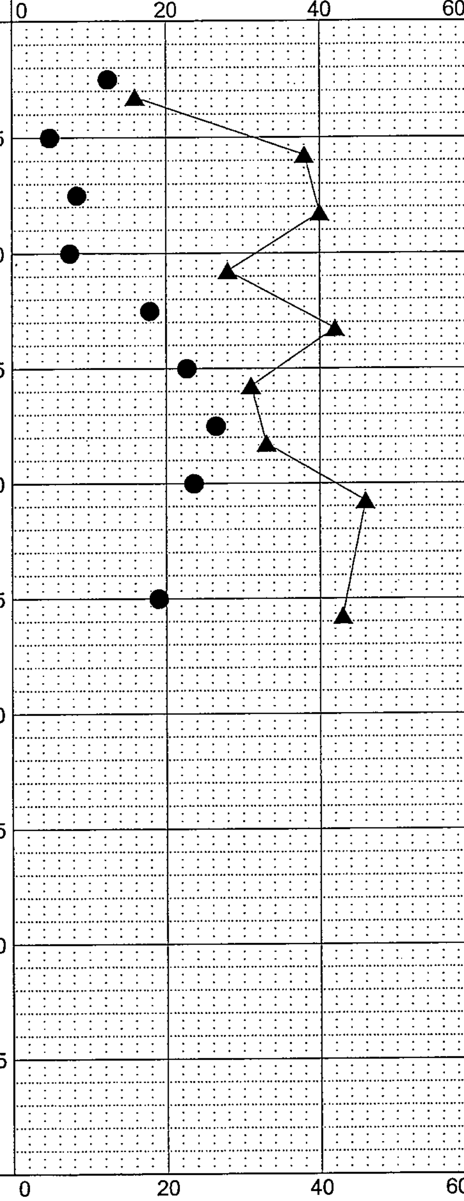
FIG. A-6
Sheet 2 of 2

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: CKS Rev: CKS Typ: LKD

Total Depth: 26.5 ft.	Northing:	Drilling Method:	Hollow Stem Auger	Hole Diam.:	4 in.
Top Elevation: ~ 65 ft.	Easting:	Drilling Company:	Boretec	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	Portable Acker	Hammer Type:	Manual
Horiz. Datum:	Offset:	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft	PID, ppm	Samples	Ground Water
Medium dense to dense, brown, gray, and orange SAND, trace of silt; moist; iron staining; SP.		0 0 0 0	1 2 3 4	
Dense, gray, slightly silty, fine SAND bedded with fine to coarse SAND, trace of fine gravel; moist; SM.	12.0	0	5	
Dense, gray, silty, fine SAND with interbeds of fine sandy SILT and slightly silty, fine to medium sand; wet; occasional organics around 15 feet below ground surface; SM.	15.0	0 0 0	6 7 8	During Drilling ▽
Dense, gray, trace to slightly silty, fine to medium SAND; wet; SP/SP-SM.	23.0	0	9	
BOTTOM OF BORING COMPLETED 5/17/2007	26.5			

PENETRATION RESISTANCE (blows/foot)
▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered
Standard Penetration Test
▽ Ground Water Level ATD

Plastic Limit ●─ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 6

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth: 71.5 ft.	Northing:	Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation: ~ 79 ft.	Easting:	Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	B-59 Mobile	Hammer Type:	
Horiz. Datum:	Offset:	Other Comments:			

SOIL DESCRIPTION

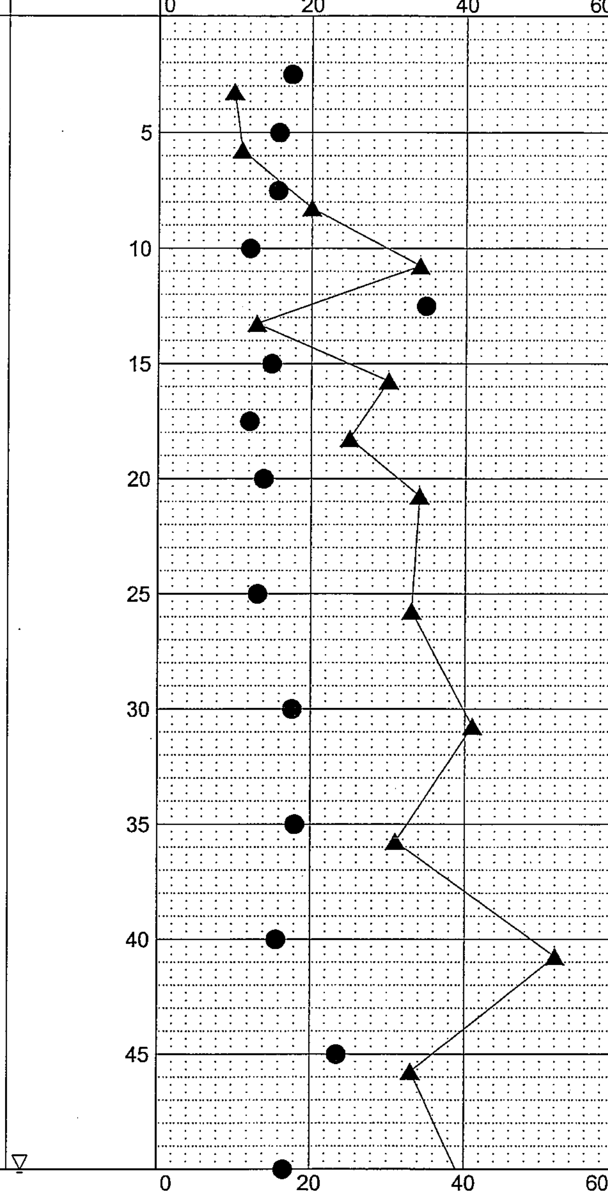
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	PID, ppm	Samples
Medium dense, brown to gray-brown, slightly gravelly, slightly silty to silty SAND; moist; slight iron oxidation; (Fill) SP-SM/SM.		0	1
		0	2
		0	3
		0	4
Medium dense, brown-gray to black, slightly silty, gravelly SAND; moist; approximately 1.5-inch-thick layer of black, silty SAND; scattered to numerous wood fragments; (Fill/Buried Organics) SP-SM.	11.5	0	5
Medium dense to dense, gray-brown, slightly silty SAND, trace of fine gravel; moist; slight iron oxidation; (Marine/Alluvium Deltaic) SP-SM.	14.0	0	6
		0	7
		0	8
		0	9
Dense, brown to gray, trace to slightly gravelly, slightly silty to silty SAND, trace of clay; moist; (Recessional Outwash) SP-SM/SM.	26.5	0	10
		0	11
		0	12
		0	13

CONTINUED NEXT SHEET

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
⌶ Standard Penetration Test
▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 7

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 1 of 2

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: CKS Rev: CKS Typ: LKD

Total Depth:	71.5 ft.	Northing:		Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation:	~ 79 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

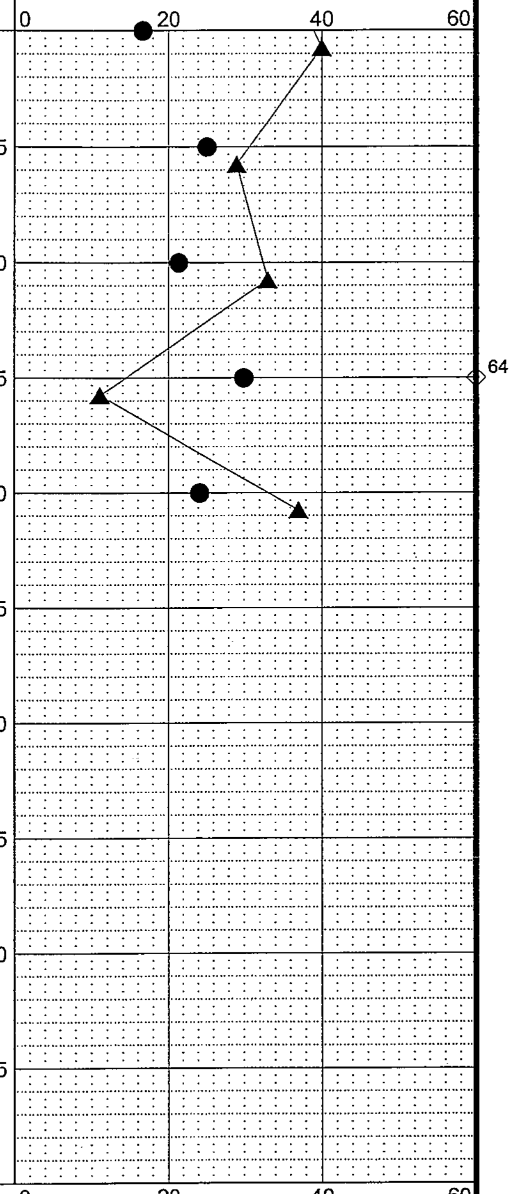
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft	PID, ppm	Samples	Ground Water
Dense, brown to gray, trace to slightly gravelly, slightly silty to silty SAND, trace of clay; (Recessional Outwash) SP-SM/SM (cont.).		0	14	During Drilling
		0	15	
Medium dense, blue-gray to gray, slightly silty, fine to medium SAND; moist to wet; with scattered seams and layers of stiff, gray, slightly fine sandy, clayey SILT; (Recessional Outwash) SP-SM/SM.	56.5	0	16	
		0	17	
		0	18	
BOTTOM OF BORING COMPLETED 5/17/2007	71.5			

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
⌶ Standard Penetration Test
▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 7

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 2 of 2

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: CKS Rev: CKS Typ: LKD

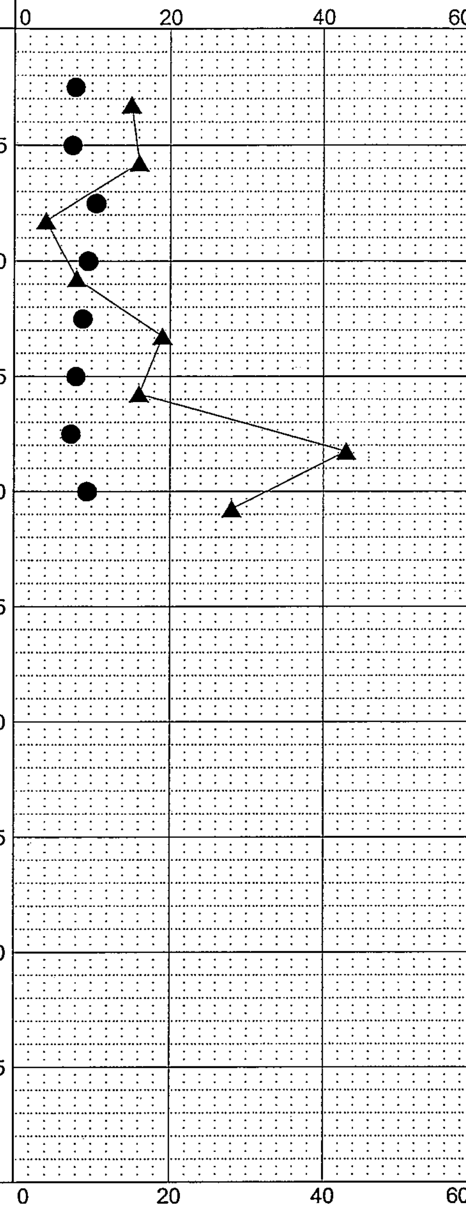
Total Depth:	21.5 ft.	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation:	~ 79 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft	PID, ppm	Samples	Ground Water
Loose to medium dense, gray and brown, trace to slightly silty, fine to medium SAND; moist; iron staining; SP/SP-SM.		0	1	None Observed During Drilling
		0	2	
		2.1	3	
		0	4	
	14.0	0	5	
Medium dense to dense, trace to slightly silty SAND; moist; iron staining; SW.		0	6	
	19.0	0	7	
Medium dense, gray-brown, trace to slightly silty, fine to medium SAND, trace of fine gravel and coarse sand; moist; SP/SP-SM.	21.5	0	8	

BOTTOM OF BORING
COMPLETED 5/16/2007

PENETRATION RESISTANCE (blows/foot)
▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND
* Sample Not Recovered
Ⲓ Standard Penetration Test

Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 8

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-9

Total Depth: 21.5 ft.	Northing:	Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation: ~ 81 ft.	Easting:	Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:	Offset:	Other Comments:			

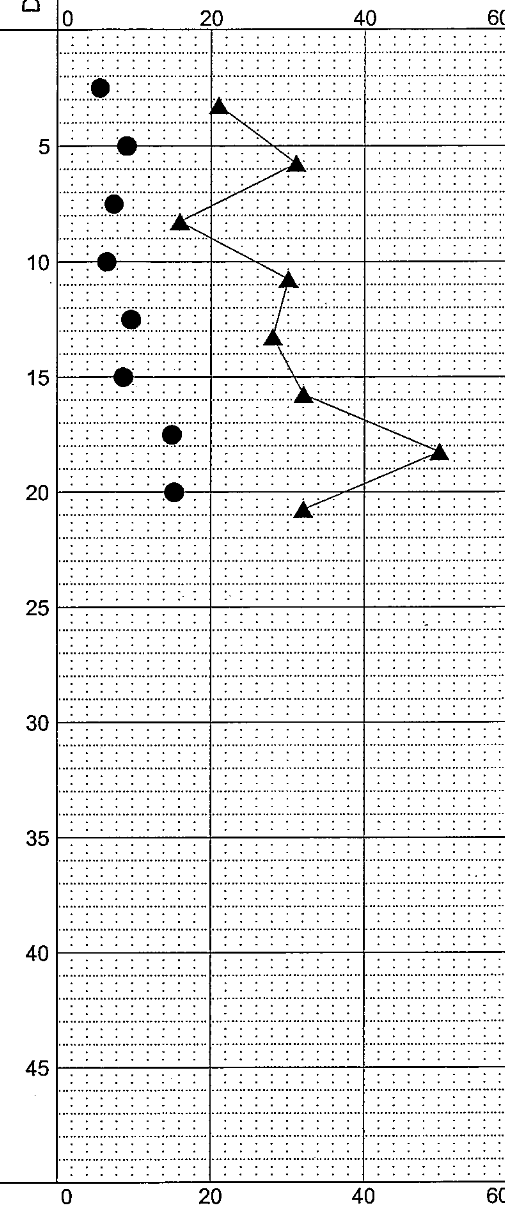
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	PID, ppm	Samples	Ground Water
Medium dense, brown, trace to slightly silty, fine to medium SAND; moist; SP/SP-SM.	4.0	0	1	None Observed During Drilling
Medium dense to dense, brown, trace to slightly silty SAND, trace of fine gravels; moist; iron staining; SW.		0	2	
		0	3	
		0	4	
		0	5	
	17.0	0	6	
Dense, gray, slightly silty to silty, fine to coarse SAND; moist; SP-SM/SM.		0	7	
	21.5	0	8	
BOTTOM OF BORING COMPLETED 5/16/2007				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

LEGEND

* Sample Not Recovered

Ⅰ Standard Penetration Test

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange Improvements Project - Phase 2

Tulalip, Washington

LOG OF BORING B- 9

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

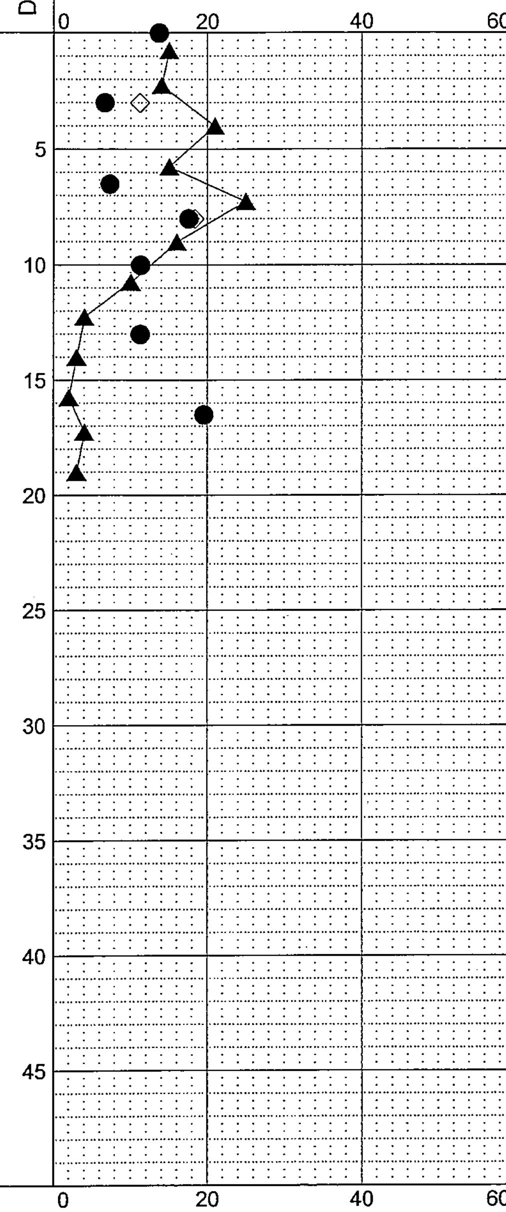
FIG. A-10

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth:	20 ft.	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation:	~ 70 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft	Symbol	PID, ppm	Samples	Ground Water
Medium dense, brown, silty, fine to medium SAND; moist; scattered roots; SM.	1.5		0	1	
Medium dense, brown, trace to slightly silty, trace to slightly gravelly SAND; moist; iron staining; SW-SM.			0	2	
			0	3	
			0	4	
	8.0		0	5	
Medium dense, dark brown, silty SAND, trace of gravel; numerous organics; SM.			0	6	
	11.0		0	7	
Very loose to loose, gray and brown, trace to slightly silty, fine to medium SAND; moist, grading to wet; frequent wood debris; SP.			0	8	
			0	9	
			0	10	▽ During Drilling
			0	11	
	20.0		0	12	
BOTTOM OF BORING COMPLETED 5/16/2007					

PENETRATION RESISTANCE (blows/foot)
▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered
Standard Penetration Test
▽ Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B-10

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-11

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth:	20 ft.	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation:	~ 70 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

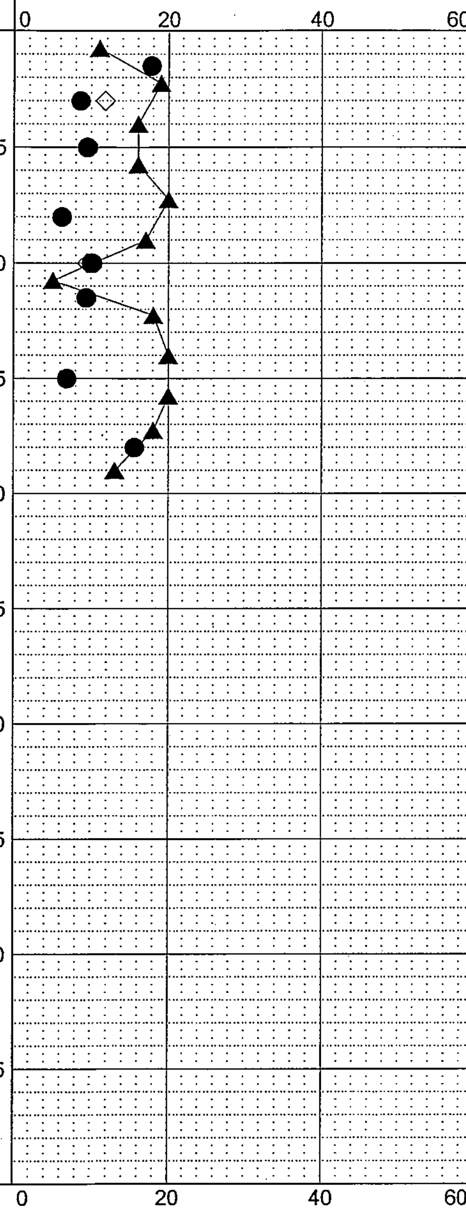
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft	PID, ppm	Samples
Medium dense, brown and gray, trace silty to silty SAND, trace of gravel; moist; scattered organics; SW-SM.		0, 0, 0, 0	1, 2, 3, 4
Medium dense, brown, slightly silty SAND; moist; SW.	6.5	0, 0	5, 6
Loose to medium dense, brown, trace to slightly silty SAND; moist; occasional iron staining; occasional fine sandy silt beds; SW-SM.	10.0	0, 0, 0	7, 8, 9
Medium dense, gray, fine SAND, trace to slightly silty; moist; SP.	15.0	0	10
Medium dense, gray and brown, trace to slightly silty, trace to slightly fine gravelly SAND; wet; SW.	16.5	0, 0	11, 12
BOTTOM OF BORING COMPLETED 5/16/2007	20.0		

Ground Water: During Drilling ∇

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

LEGEND

* Sample Not Recovered

⌶ Standard Penetration Test

∇ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B-11

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth: 131.5 ft.	Northing:	Drilling Method:		Hole Diam.:	
Top Elevation: ~ 87 ft.	Easting:	Drilling Company:		Rod Type:	
Vert. Datum:	Station:	Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:	Offset:	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

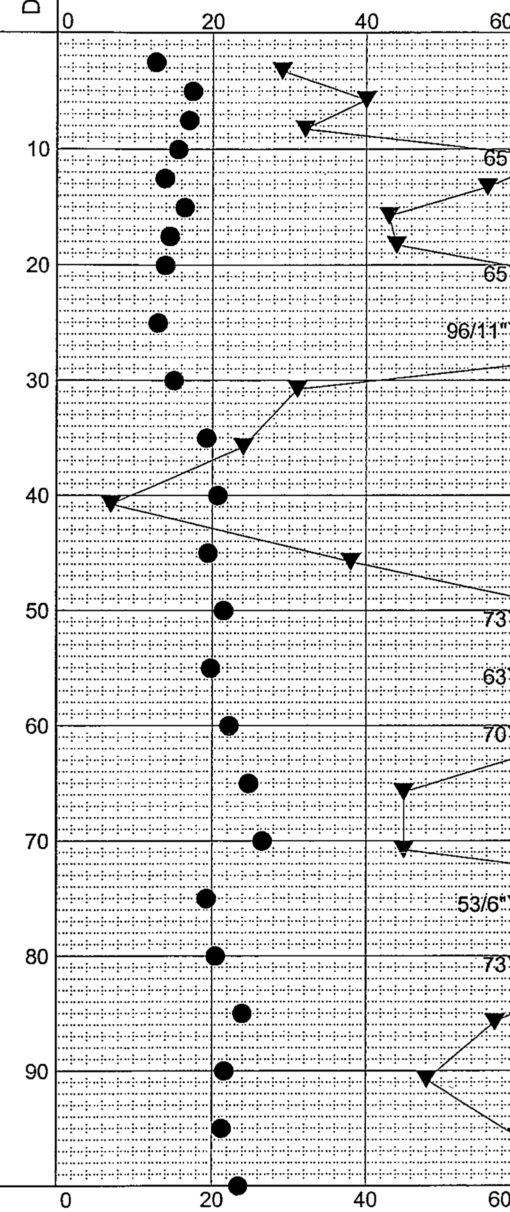
Soil Description	Depth, ft.	Samples
Medium dense to very dense, brown-tan-gray, slightly silty to silty, fine to medium SAND; moist; trace of coarse sand and gravel; scattered iron-oxide stains throughout; (Compacted Embankment Fill) SP-SM/SM.		1, 2, 3, 4, 5, 6, 7, 8, 9
Loose to dense, brown-gray, trace to slightly silty, trace to slightly gravelly SAND; moist to wet; occasional silt partings; iron-oxide stains; (Recessional Outwash) SW-SM.	28.0	10, 11, 12, 13
Very dense, olive-gray, slightly silty to silty, fine to medium SAND; moist; occasional silt partings; massive; (Recessional Outwash) SP-SM/SM.	47.0	14, 15, 16
Dense to very dense, gray, slightly silty to silty, fine SAND; moist to wet; massive; layers of gravelly, clayey sand at 89 to 92 feet; scattered organics at 75 to 77 feet; occasional clayey silt partings throughout; (Recessional Outwash) SP-SM/SM.	63.0	17, 18, 19, 20, 21, 22, 23

Ground Water: During Drilling ∇

CONTINUED NEXT SHEET

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: ____



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit |—●—| Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
⌶ Standard Penetration Test
∇ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING B-2-03

December 2005 — 21-1-09896-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1
Sheet 1 of 2

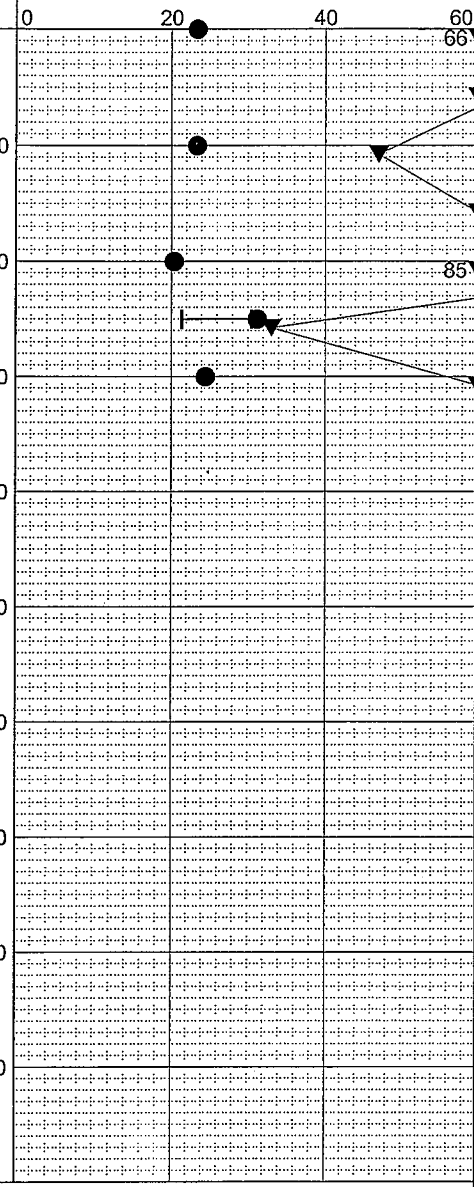
MASTER LOG E 21-09896-002.GPJ 21-20617.GPJ 6/5/07 Log: XHL Rev: SWC Typ: LKD

Total Depth:	131.5 ft.	Northing:		Drilling Method:		Hole Diam.:	
Top Elevation:	~ 87 ft.	Easting:		Drilling Company:		Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
			24		
			25		
			26		110
			27		
			28		120
Hard, gray, slightly fine sandy, silty CLAY; moist; CL.	124.0		29		
Very dense, gray, silty, fine SAND; wet; massive; (Recessional Outwash) SM.	127.0		30		130
BOTTOM OF BORING COMPLETED 5/30/2003	131.5				
					140
					150
					160
					170
					180
					190

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop:



◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

LEGEND

* Sample Not Recovered

Standard Penetration Test

Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING B-2 -03

December 2005 21-1-09896-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1
Sheet 2 of 2

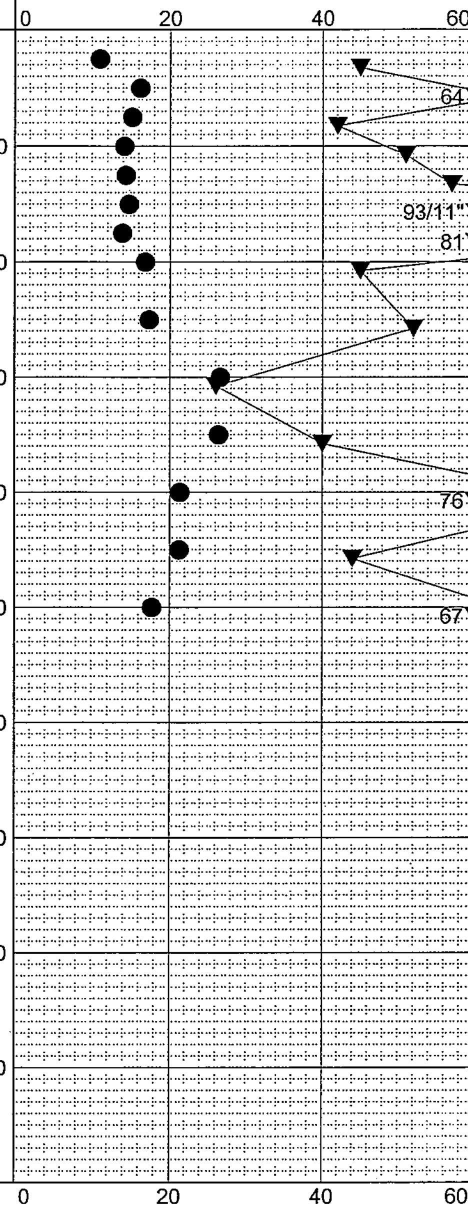
MASTER_LOG_E 21-09896-002.GPJ 21-20617.GPJ 6/5/07 Log: XHL Rev: SWC Typ: LKD

Total Depth:	*51.5 ft.*	Northing:		Drilling Method:		Hole Diam.:	
Top Elevation:	*~ 80 ft.*	Easting:		Drilling Company:		Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
Dense to very dense, light brown to brown to dark brown, slightly silty to silty, fine to medium SAND; moist; occasional organics, trace of gravel; (Compacted Embankment Fill) SP-SM/SM.			1, 2, 3, 4, 5, 6, 7, 8		10, 20
Medium dense to very dense, tan-brown, slightly silty to silty, fine to medium SAND; moist to wet; scattered iron-oxide stains; fine roots at 25 to 27 feet; massive; (Recessional Outwash) SP-SM/SM.	24.0		9, 10, 11, 12	During Drilling ▽	30, 40
Dense to very dense, gray, slightly silty, fine to medium SAND; wet; massive; (Recessional Outwash) SP-SM.	43.0		13, 14		50
BOTTOM OF BORING COMPLETED 6/2/2003	51.5				60, 70, 80, 90

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: ________



LEGEND

* Sample Not Recovered

⌶ Standard Penetration Test

▽ Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

LOG OF BORING B-4 -03

December 2005 21-1-09896-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-2

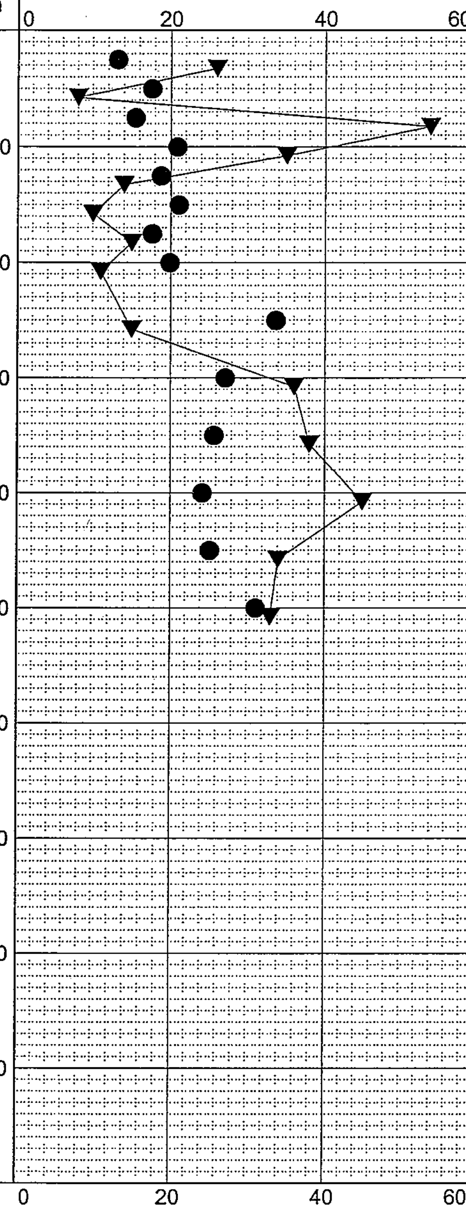
MASTER LOG E 21-09896-002.GPJ 21-20617.GPJ 6/5/07 Log: XHL Rev: SWC Typ: LKD

Total Depth:	51.5 ft.	Northing:		Drilling Method:		Hole Diam.:	
Top Elevation:	~ 63 ft.	Easting:		Drilling Company:		Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	Symbol	Samples	Ground Water
Loose to vey dense, brown, slightly gravelly, slightly silty, fine to medium SAND; moist; (Embankment Fill) SP-SM.			1, 2, 3	
Medium dense to dense, brown-gray, slightly silty to silty, gravelly, fine to medium SAND; moist to wet; scattered charcoals and organics at 12 to 14 feet; (Embankment Fill) SP-SM/SM.	10.0		4, 5, 6, 7, 8	∇ During Drilling
Medium dense, gray to dark brown, slightly silty to silty, fine to medium SAND; wet; slightly gravelly; numerous wood debris 25 to 27 feet; (Embankment Fill) SP-SM/SM.	17.0		9	
Dense, tan-olive-gray, silty, fine SAND; moist; massive; (Recessional Outwash) SM.	28.0		10, 11, 12	
Dense, gray, silty, fine SAND; moist to wet; scattered silty clay partings; (Recessional Outwash) SM.	45.0		13, 14	
BOTTOM OF BORING COMPLETED 5/30/2003	51.5			

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: ____________



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
⌶ Standard Penetration Test
∇ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING B-5 -03

December 2005 21-1-09896-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-3

SUPPLEMENTED FINAL GEOTECHNICAL REPORT
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Prepared for:

Parametrix

Project No. 10-069
July 2012

PanGEO
INCORPORATED

Geotechnical & Earthquake
Engineering Consultants

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES (follows text)

LIST OF FIGURES (continued)

July 18, 2012
Project No. 10-069

SUPPLEMENTED FINAL GEOTECHNICAL REPORT
I-5 116TH STREET NE
INTERCHANGE IMPROVEMENTS
THE TULALIP TRIBES
SNOHOMISH COUNTY, WASHINGTON

PROJECT DESCRIPTION

The Tulalip Tribe plans to replace the existing full diamond interchange at the I-5 undercrossing of 116th Street NE with a single-point urban interchange (SPUI) for improved traffic movements and to relieve congestion. The project includes a new bridge, retaining walls, stormwater management facilities, minor structures such a noise walls, luminaires, signs and new roadway construction including surfacing.

SITE DESCRIPTION

The existing interchange is located in the west central portion of Snohomish County, north of the city of Marysville. The alignment location is shown on Figure 1, Vicinity Map and Figures 2 through 4, Site and Exploration Plans.

The project site lies in a broad, relative level valley between two ridges that are elongated in the north-south direction. The project site is at an elevation of roughly 80 feet above sea level, while the ridges rise up as high as 400 feet. The topography immediately surrounding the project site is relatively level, with generally little relief except that associated with streams, drainages and the existing embankments built as part of the original interchange construction.

FIELD EXPLORATIONS

The subsurface exploration program consisted of a site reconnaissance and several subsurface exploration programs. The shallow borings for the infiltration ponds and other facilities (THT-01-10 to THT-19-10, and THT-23-10) were performed using hollow-stem auger drilling equipment. The drill used was a limited access, rubber tracked drill provided by Geologic Drill of Spokane, Washington. The deep borings for the new interchange bridge foundations (THT-20-10 and THT-22-10) were accomplished using mud rotary drilling equipment. The drill was a tire mounted, Mobil B-61 drill provided by Holocene Drilling of Edgewood, Washington. An additional boring for the central bridge pier (THT-21-10) was performed in the I-5 median by WSDOT crews using State-owned equipment. One additional boring for an alternative pond site (THT-23-10) was drilled using a trailer-mounted hollow stem auger drill provided by Geologic Drill. Finally, three test pits (TP-1 to TP-3) were excavated for proposed CAVFS and a relocated infiltration pond. The test pits were excavated with a rubber-tracked mini-excavator owned and operated by Northwest Excavating & Trucking Co., Inc. Most of the field explorations were accomplished between June 28 and July 28, 2010, with THT-23-10 drilled on October 26, 2010, and the test pits excavated on September 8, 2011.

The soils encountered in the test borings were generally sampled using conventional standard penetration test (SPT) split-spoon samplers. A standard sampling interval of 5 feet was used for most of the borings, except those intended for stormwater infiltration facility design. The borings for stormwater infiltration facility design (THT-06-10, THT-08-10 through THT-12-10, THT-14-10 and THT-23-10) were continuously sampled starting at the anticipated bottom depth for the individual facility, to the maximum depth of the boring. The continuous sampling was generally accomplished using a 24-inch split-spoon sampler. A representative of either PanGEO or WSDOT was on site during all drilling operations to supervise drilling, select sample intervals and log the test borings.

The locations of subsurface explorations are indicated on Figures 2 through 4, Site and Exploration Plans.

Appendix A contains summary logs of test borings and test pits completed during PanGEO's scope of work and describes the field exploration methodology in greater detail.

LABORATORY TESTING

Laboratory testing of soil materials included determination of moisture content, plasticity, grain size distribution, cation exchange capacity, pH, resistivity, chlorides, and sulfates. Testing was in accordance with appropriate ASTM, AASHTO and/or EPA standards. The test results and a discussion of laboratory test methodology are presented in Appendix B. Where appropriate, test results are displayed on the summary boring and test pit logs, Appendix A.

PREVIOUS GEOTECHNICAL STUDIES

A Phase 2 geotechnical study was completed by Shannon & Wilson, Inc., and is described in their report dated December 7, 2007. Copies of the borings logs are included in Appendix C, Logs of Test Borings from Previous Geotechnical Studies. The locations of these previous explorations are also indicated on Figures 2 through 4, Site and Exploration Plan.

Other previous existing information was also available from WSDOT records. This subsurface information was used to supplement recent data in support of foundation design recommendations for the bridge foundations. The logs of these previous explorations are also included in Appendix C.

REGIONAL GEOLOGY

The project site is located in the north central portion of the Western Washington Puget Lowland, an area that was occupied by the Puget Lobe of the Vashon ice sheet during the most recent ice advance. The topography was formed by the advance and retreat of the Puget Lobe ice, which carved a characteristic series of elongated, generally north-south oriented ridges with intervening valleys. The valleys became marine embayments, such as Puget Sound, and/or were filled with sediment during de-glaciation and later times. The Marysville valley appears to have been filled with outwash sediment as the glaciers retreated, leaving an expansive, relatively flat-floored valley.

The area was mapped at a 1:24,000 scale by Minard (1985). He maps the entire area around the 116th Street NE interchange as underlain by the Marysville Sand Member of a unit of recessional outwash (Qvro). Minard (1985) describes the Marysville Sand as consisting of sand with a little gravel and some interbeds of silt and/or clay. Minard (1985) also mapped a Clay Member for the recessional materials (Qvrl), which has limited surface outcrop to the east of Marysville. The recessional materials are underlain by Vashon till, which also underlies the ridges to the east and west of the project area.

SUBSURFACE CONDITIONS

SOILS

The soil borings drilled as part of the field exploration program encountered relatively consistent soil conditions throughout the project area. The predominant soil found was fine to medium grained recessional outwash. This material was found to the maximum depth drilled, approximately 150 feet. Fill material for the existing overpass approaches and the access ramps appears to have been borrowed locally, and consists of silty fine sand. At depth the borings encountered interbeds of elastic silt to lean clay within the recessional outwash sands. The soil units found at the project site are as follows:

Fill. Fill material was identified in only a few borings, specifically in THT-05-10 and THT-20-10. In THT-05-10 the fill material consisted of loose, brown, silty sand with scattered organics. This boring was located in the southeast portion of the interchange, and penetrated roughly 5½ feet of road fill before entering native material. THT-20-10 encountered up to 9 feet of medium dense, brown and gray, fine to coarse sand above a 1.2 foot thick bed of organic sand, which was interpreted as a buried topsoil layer. WSDOT borings H-5-67 and H-4-67 also reported fill materials near the ground surface.

Younger Alluvium (Qyal). In THT-20-10, the topsoil layer is underlain by up to 19 feet of very loose, brown, fine to medium sand with silt. Similar very loose material was observed in WSDOT borings H-5-67 and H-4-67, though the unit was included in the fill layer described above. The soil contains woody debris throughout, and is laminated to finely bedded. Based on the organic content, the soil structure and composition, this unit is interpreted as a recent alluvial deposit that was buried during construction of the I-5 corridor.

Recessional Outwash – (Qvro). The recessional outwash consists mainly of interbeds of silty, fine sand to fine to medium sand, with occasional fine to coarse sand beds. The material is generally poorly graded, and is mostly medium dense, though the soil can be loose or dense in some layers. Some layers also contain traces of fine gravel. Soil color ranges from brown to gray at depth, with rusty mottling in places. Occasional fine scattered organics were observed in the soil.

Recessional Lacustrine (Qvrl). Several deep borings encountered interbeds of fine grained material, including THT-20-10, THT-21-10, THT-22-10, H-5-67 and H-4-67. The shallowest such interbed was encountered in THT-20-10 at a depth of 45 feet below ground surface. In THT-21-10, the shallowest fine grained bed was found at 125 feet below surface, while the shallowest bed was at about 51 feet in THT-22-10. The fine grained beds consist of gray, lean silty clay to elastic silt material, generally non-plastic to low plastic, with rapid dilatancy. Beds range from less than 4 feet thick up to over 14 feet thick. The deposit is usually stiff, but varies in consistency from soft to very stiff.

A subsurface profile along the centerline of 116th Street NE is included as Figure 5. Subsurface profiles along the major retaining wall elements of the NE-Line, WN-Line, ES-Line, SW-Line and SE-Line are included as Figures 6 through 10, respectively.

GROUNDWATER

Free water was encountered in all the test borings. In addition, piezometers were installed in several of the previous borings. PanGEO monitored the existing piezometers, but installed no new groundwater monitoring wells. Table 1 summarizes the groundwater measurements made in the existing piezometers.

Table 1
Summary of Groundwater Measurements

Date of Reading	Well Designation (1)					
	GW-1-03 SE Quad		GW-2-03 NE Quad		GW-3-03 NW Quad	
	Depth (ft) (3)	Elev. (ft) (2)	Depth (ft)	Elev. (ft)	Depth (ft)	Elev. (ft)
Feb. 17, 2005	10.4	54.3	16.0	56.6	13.5	55.0
Mar. 16, 2005	10.6	54.0	16.3	56.3	13.7	54.8
Apr. 8, 2005	10.3	54.4	16.1	56.6	13.3	55.1
May. 18, 2005	9.8	54.9	15.4	57.2	13.1	55.4
Jul. 25, 2005	10.7	54.0	16.4	56.2	13.9	54.5
Sep. 9, 2005	11.5	53.2	17.3	55.3	14.6	53.8
Oct. 21, 2005	12.0	52.6	18.0	54.6	15.1	53.3
Nov. 30, 2005	12.0	52.7	18.0	54.6	14.9	53.6
Dec. 15, 2005	11.7	52.9	17.8	54.8	14.7	53.7
June 10, 2010	9.6	55.1	15.3	57.3	13.5	55.1
June 29, 2010	9.4	55.3	15.1	57.5	13.7	54.9
July 14, 2010	9.5	55.2	15.1	57.5	13.6	55.0
July 27, 2010	10.1	54.6	15.6	57.0	14.2	54.4
Oct. 26, 2010	11.3	53.4	17.0	55.6	15.2	53.4
May 3, 2011	7.5	57.2	12.6	60.0	11.9	56.7
May. 17, 2011	7.1	57.6	12.4	60.2	11.4	57.0

Notes:
1. Well designations taken for Shannon & Wilson Report (December 7, 2007).
2. Surveyed monument elevations 64.65 ft., 72.60 ft., and 68.64 ft. for GW-1-03, GW-2-03 and GW-3-03, respectively. (Parametrix boring location survey, 2010)
3. Measurements taken from the top of the PVC Standpipes.

SEISMIC CONSIDERATIONS

SITE SEISMICITY

The project site is located on the uplands between the Snohomish River and the Stillaguamish River deltas. This area is seismically active as the South Whidbey Island fault zone is located less than 15 miles to the south (Johnson and others, 1996, Blakely and others, 2004). Studies suggest that the Snohomish River delta has been affected by at least two and as many as five seismic events since roughly 800 AD (Bourgeois and Johnson, 2001). Evidence has been found for some three instances of liquefaction and one instance of rapid subsidence in the delta (Bourgeois and Johnson, 2001). Seismic activity on this fault is generally attributed to the intraplate seismicity within the Juan de Fuca plate. It is similar in nature to the notable Puget Lowland earthquakes, including the April 13, 1949 Olympia earthquake (Richter magnitude 7.1), the April 29, 1965 Seattle earthquake (Richter magnitude 6.5) and the February 28, 2001 Nisqually earthquake (Richter magnitude 6.8).

SEISMIC DESIGN PARAMETERS

For seismic design, an acceleration coefficient of 0.35g is recommended per the current acceleration map in AASHTO (2012). The recommended acceleration coefficient is based on expected ground motion at the project site that has a 7 percent probability of exceedance in a 75-year period for non-critical structures.

Design response spectra presented in AASHTO (2012) are considered appropriate for seismic design of the bridge. A horizontal response spectral acceleration coefficient at a period of 0.2 seconds (S_S) is 0.78 and the horizontal response spectral acceleration coefficient at a period of 1.0 seconds (S_1) is 0.27.

The soils at the site are considered Site Class D, with associated site factors F_{pga}, F_a and F_v of 1.15, 1.19 and 1.86, respectively. The site is in Seismic Performance Zone 3, bordering on Zone 4.

LIQUEFACTION POTENTIAL

The liquefaction potential of the soils at the interchange site was evaluated using the procedure originally developed by Seed and modified in the 1996 and 1998 NCEER/NSF workshops (Youd et al., 2001). The liquefaction analyses were conducted using a Magnitude 7.5 event with PGA = 0.35g, which is consistent with the WSDOT Geotechnical Design Manual (WSDOT, 2011a) design criteria. Settlement estimates were made using the procedures of Tokimatsu and Seed (1987) or Ishihara and Yoshimine (1992) as recommended in the GDM (WSDOT, 2011a).

Our analysis indicated there is high potential for liquefaction during the design earthquake at all three piers of the proposed new bridge. Factors of safety against liquefaction are plotted versus depth on Figure 11 for the borings drilled at the new abutment and pier locations. Liquefaction is expected to occur between depths of 15 to 30 feet below the ground surface at the western abutment in the Younger Alluvium deposits. Between 40 and 75 feet below the ground surface widespread liquefaction is expected to occur at all substructure locations. Although factors of safety less than 1.0 may be computed below a depth of 75 feet, the maximum considered depth of liquefaction is limited to this depth in accordance with the GDM (WSDOT, 2011a).

Liquefaction induced settlement is estimated to be on order of 10 to 12 inches at the interior pier and east abutment, while up to 20 inches of settlement could occur at the west abutment. The recommended p-y curve data have been adjusted to account for this liquefaction potential for these piers (see p-y data tables, below). Downdrag loads on deep foundations should be considered due to liquefaction-induced settlement. Estimates of downdrag forces are provided below.

CONCLUSIONS AND RECOMMENDATIONS

STORMWATER MANAGEMENT CONSIDERATIONS

This section describes the geotechnical conditions affecting the feasibility of the proposed stormwater management locations and addresses the issues affecting the potential suitability of the sites for quantity treatment of the storm water runoff. The two main geotechnical issues affecting the suitability of sites for storm water facilities are the rate at which the site soils allow infiltration, and the depth to the water table or a confining low permeability layer. The results of our assessment are summarized in Table 2a (on pages 10 through 12).

Infiltration Rates Based on ASTM Gradation Tests

Five infiltration facilities were originally planned for the project. Infiltration ponds are planned in the southeast, northeast and northwest quadrants of the interchange. In addition two potential infiltration swales were planned, one along the west side I-5 in the southwest quadrant of the interchange and one along the west side of 34th Avenue NE. Lastly, CAVFS are planned along the east side of the I-5 northbound lanes, and the west side of the I-5 southbound lanes, north of the interchange.

The subsurface soil conditions in the proposed pond area in the northwest quadrant were originally explored with borings THT-9-10, THT-10-10 and THT-11-10, with supplemental information provided by existing borings B-10-07, B-11-07 and GW-3-03 (Appendix C). Because the pond may be relocated to the northwest, test pit TP-1 was excavated to the northwest of the originally proposed pond location to obtain additional site specific subsurface information. The soil conditions beneath the pond in the northeast quadrant were explored with boring THT-14-10, with supplemental information provided by existing boring GW-2-03 (Appendix C). The soil conditions beneath the pond in the southeast quadrant were explored with boring THT-06-10, with supplemental information provided by existing boring GW-1-03 (Appendix C). The drainage swales were tested with borings THT-08-10, along I-5, and THT-23-10, along 34th Avenue NE. Lastly, TP-2 and TP-3 were excavated for the CAVFS north of the interchange, with additional information provided by borings THT-13-10, THT-17-10 and THT-18-10. To provide soil samples to test the infiltration capabilities of the soils, borings THT-06-10, THT-08-10, THT-09-10, THT-10-10, THT-11-10, THT-14-10 and THT-23-10 were continuously sampled from the approximate proposed depth of the facility to the total depth of exploration in each boring.

To evaluate the potential long-term (design) infiltration rates, we tested selected soil samples from the test borings and test pits for gradation. The samples were selected to provide data from critical depths within the pond areas. For THT-06-10 the samples tested were from 18 to 26 feet below present surface. For THT-09-10 the samples were selected from 16 to 24 feet below surface. In THT-10-10 and THT-11-10, the samples were selected from 10 to 16 feet and 10 to 18 feet below surface, respectively. One sample, from 4 feet, was tested for THT-08-10. Three samples between 1 and 10 feet were selected from THT-13-10, and four samples, from 14 to 22 feet were selected from THT-14-10. In test borings THT-17-10 and THT-18-10, two samples were tested from 1 to 5 feet below existing grade. Four samples, from 2 to 8 feet and 11 to 12½ feet, were tested from THT-23-10. Lastly, grab samples from the test pits were collected for testing at depths between 1 and 9½ feet below the ground surface. All samples were selected to best represent conditions at the planned bottom of the stormwater facilities.

The Highway Runoff Manual (HRM, WSDOT, 2008) allows for infiltration rates to be estimated based on ASTM gradation testing (page 4-63). The rates are estimated based on the D_{10} values (i.e., the particle diameter at which 10 percent, by weight, of the sample is smaller), using ASTM Test Method D422. Infiltration rates were estimated for the selected sampling and testing intervals, based on the HRM methodology. For samples that had more than 10% fines (i.e., particle sizes smaller than the U.S. Standard No. 200 sieve), no D_{10} values were calculated; however, the D_{10} value for sample from 24 feet in THT-06-10 was obtained using hydrometer testing equipment to extend the gradation curve. Using the results of the hydrometer as a control, other D_{10} values could be estimated by projecting the gradation curves to the D_{10} gridline. Table 2a summarizes the D_{10} values available and the associated estimated infiltration rates.

Most of the D_{10} values from the stormwater borings lie within a range from 0.05 to 0.1, with occasional values lying above or below this range. Based on the infiltration values from Table 4.8 of the HRM, we anticipate that the estimated long-term (design) infiltration rates will be between 0.8 to 2.0 in/hr for most of the strata within the project area. The infiltration rates from the WSDOT HRM are considered conservative for the purpose of determining the size of infiltration facilities.

SSC-4 Depth to Bedrock, Water Table, or Impermeable Layer

The Highway Runoff Manual (WSDOT, 2008) defines one of the nine Site Suitability Criteria (SSC's) as *Depth to bedrock, water table or impermeable layer* (SSC-4). The Manual specifies that the base (bottom elevation) of infiltration basins or trenches shall be at least 5 feet above the seasonal high water mark or limiting aquitard unit. The bottom of pond elevations may need to be adjusted based on this criterion, especially with regard to the higher groundwater elevations measured in May of 2011.

Mitigation measures for SSC-4 may include construction of berms around the pond or trench area and raising the facility bottom grade sufficiently to provide the required separation of 5 feet.

Dewatering Considerations

Based on the groundwater level measurements in the piezometers installed at the pond sites, excavations for pond construction are not likely to extend below the static water table. Dewatering is therefore not expected in order to construct the ponds.

SSC-7 – Soil Physical and Chemical Suitability for Treatment

The Highway Runoff Manual (WSDOT, 2008) defines one of the nine Site Suitability Criteria (SSC's) as *Soil Physical and Chemical Suitability for Treatment* (SSC-7). The Manual specifies that the cation exchange capacity (CEC) of treatment soils must be considered when determining if the soil can adequately remove the target pollutants. As such, CEC tests were performed on soil samples collected from the proposed infiltration facility areas. Table 2b on page 13 summarizes the results of the CEC tests.

Table 2a
Summary of Stormwater Infiltration Feasibility

Facility	Exploration Number	Depth (in feet)	Station	Offset	D_{10} value	Long-term Infiltration rate (in/hr)(4)	Water Table Below Facility(5)	Grading Mitigation Measures Needed to Meet SSC-4
SE Quadrant Pond	THT-06-10	18	221+10	310' RT	0.166	2.0	5'–10'	Berms
		20			~0.05 (1)	0.8	5'–10'	
		22			0.146	2.0	5'-10'	
		24			0.036 (2)	n/a	5'-10'	
NE Quadrant Pond	THT-14-10	14	225+05	260' RT	0.108	2.0	<5'	Berms, Raise Bottom Grade
		16			0.088	0.8	<5'	Berms, Raise Bottom Grade
		18			0.156	2.0	<5'	
		20			0.077	0.8	<5'	Berms
Original NW Quadrant Pond	THT-09-10	16	223+93	312' LT	0.227	3.5	5'–10'	Berms
		18			0.095	2.0	5'–10'	
		20			0.089	1.5	5'–10'	
		22			0.090	1.7	5'–10'	
	THT-10-10	10	224+76	250' LT	~0.02 (1)	n/a	<5'	Berms, Raise Bottom Grade
		12			0.079	0.8	<5'	
		14			~0.06 (1)	0.8	<5'	
	THT-11-10	10	226+05	200' LT	~0.07 (1)	0.8	<5'	Berms, Raise Bottom Grade
		12			0.077	0.8	<5'	
		14			~0.01 (1)	n/a	<5'	
		16			~0.06 (1)	0.8	<5'	

Table 2a (continued)
Summary of Stormwater Infiltration Feasibility

Facility	Borehole Number	Depth (in feet)	Station	Offset	D_{10} value	Long-term Infiltration rate (in/hr) (4)	Water Table Below Facility(5)	Grading Mitigation Measures Needed to Meet SSC-4
NW Quadrant Pond	TP-1	2.5	226+90	240' LT	~0.06 (1)	0.8	>5'	None
		9.5			0.101	2.0	>5'	
NE CAVFS	TP-2	1	232+60	100' RT	0.262	3.5	>5'	None
		4.0			0.162	2.0	>5'	
	THT-17-10	0	235+30	103'RT	0.081	1.5	>5'	None
		5			~0.06 (1)	0.8	>5'	
	THT-18-10	1	239+71	108'RT	0.08	1.5	>5'	None
		5			0.169	2.0	>5'	
NW CAVFS	THT-13-10	1	232+62	102'LT	~0.06 (1)	0.8	>5'	None
		5			0.087	1.5	>5'	
		10			0.164	2.0	>5'	
	TP-3	1	235+45	105' LT	0.362	8.0	>5'	None
		4			0.278	5.0	>5'	
I-5 Swale	THT-08-10	4	218+28	90' LT	~0.5 (1)	0.8	<5'	Berms
34th Ave NE Swale	THT-23-10	1.5			~0.5 (1)	0.8	>10'	None
		3.5			0.167	2.0		
		5.5			0.255	3.5		
		11.0			0.103	2.0		

Table 2a Notes:

(1) More than 10 percent fines; D_{10} estimated.
(2) More than 10 percent fines; D_{10} value obtained from hydrometer results.
(3) No groundwater data available.
(4) These are "design" infiltration rates based on ASTM D422 gradation D_{10} value, per 2008 WSDOT Highway Runoff Manual
(5) Depth in feet below.

Table 2b Cation Exchange Capacity

Facility	Exploration Number	Depth (in feet)	Station	Offset	Cation Exchange Capacity (meq/100g)
SE Quadrant Pond	THT-06-10[1]	18	221+10	310' RT	2.49
		20			2.92
		22			2.45
		24			2.80
NE Quadrant Pond	THT-14-10[1]	14	225+05	260’ RT	1.10
		16			1.24
		18			1.02
		20			1.85
Original NW Quadrant Pond	THT-09-10[1]	16	223+93	312’ LT	1.26
		18			2.11
		20			2.74
		22			3.69
	THT-10-10[1]	10	224+76	250’ LT	3.14
		12			2.05
		14			27.76
	THT-11-10[1]	10	226+05	200’ LT	22.65
		12			3.24
		14			4.66
		16			2.69
	B-10-07[2]	6.5	224+45	190’ LT	3.4
		8			9.1
	B-11-07[2]	6.5	223+90	220’ LT	1.6
		11.5			2.7
NW Quadrant Pond	TP-1[1]	2.5	226+90	240’ LT	1.74
		9.5			1.57
NE CAVFS	TP-2[1]	1	232+60	100’ RT	1.01
	THT-18-10[1]	1	239+71	108’ RT	2.48
NW CAVFS	THT-13-10[1]	1	232+62	102’LT	2.21
		5			0.92
	TP-3[1]	1	235+45	105’ LT	0.95

[1] Chemistry parameters were determined by Analytical Resources, Inc, of Tukwila, WA.
[2] Chemistry parameters were determined by Am Test Laboratories of Redmond, WA, as part of a previous study.

ROADWAY EMBANKMENTS

New embankments should be constructed with slopes no steeper 2H:1V for slope stability considerations. New embankment material should conform to the specification requirements for Select or Gravel Borrow (Section 9-03.14, WSDOT Standard Specifications, 2012). Embankments should be constructed in accordance with the requirements of Section 2-03 of the Standard Specifications (WSDOT, 2012b).

STRUCTURAL EARTH WALLS (SEW)

Current project plans call for seven new retaining structures, all of which are fill applications. The four largest walls (WA1, WA2, WA4, and WA6) retain the approach fills on all four ramps of the SPUI that face mainline I-5. These walls have maximum total heights ranging up to 30 feet. A wall up to 15 feet high is planned for retaining fill along the west side of the ES Line (WA3), and a wall up to 21 feet in height is planned for retaining fill between the northbound off-ramp and the SE stormwater pond (WA7). The remaining wall (WA5) will retain relatively minor fill heights up to 12 feet along the south end of the SW Line. Table 3 below summarizes the wall locations, length, and height:

Table 3
SEW Summary Table

Wall ID	Wall Alignment	Approximate Wall Length (lf)	Approximate Wall Height (ft)
WA1	**NE Line**	**460**	**4 to 26**
WA2	**WN Line**	**420**	**4 to 28**
WA3	**ES Line**	**540**	**2 to 15**
WA4	**ES Line**	**565**	**6 to 30**
WA5	**SW Line**	**110**	**4 to 12**
WA6	**SW Line**	**700**	**6 to 30**
WA7	**SE Line**	**350**	**4 to 21**

Structural earth walls (SEW) are generally recommended on the basis of relative cost and tolerance for modest settlements. Per Chapter 15 of the GDM (WSDOT, 2011a), recommendations concerning the external design of the proposed structural earth walls are presented below.

Global Stability of Retaining Walls

The overall stability of the retaining walls was analyzed in accordance with Section 11.10.4.3 of the LRFD Bridge Design Specifications (AASHTO, 2012). The stability analyses for the walls was assessed using limit equilibrium methods (Spencer's method) and the computer program SLIDE v. 6.0, developed by Roc Science. Both circular and non-circular failure surfaces were included in the analyses. The critical wall sections for the stability analyses were established based on wall height, subsurface soil and groundwater conditions, and the proposed surface grades in front of the wall. Soil strength parameters were assigned based on soil and groundwater conditions in the test borings. The analyses incorporated the design recommendations presented below. The seismic stability was analyzed using pseudo-static procedures, where the effect of earthquake ground shaking is represented by the use of a "seismic coefficient" in the stability calculations. One-half of the design peak ground acceleration was used for the seismic coefficient in our pseudo-static stability analysis. A compound stability analysis was conducted for the static and seismic condition assuming the failure surface goes through the bottom 20% to 30% of the reinforcement, per the GDM (WSDOT, 2011a) Section 15.5.3.3.

Based on our analyses, minimum static and seismic factors of safety for the critical wall sections were found to be above 1.5 and 1.1, respectively, per the GDM (WSDOT, 2011a) Section 15.4.12 for the service limit state, and Section 6.4.3.1 for the extreme event limit state.

As discussed under Seismic Considerations, above, along wall WA1 there is liquefaction potential in a zone from about 15 to 30 feet below the ground surface in this area. Considering the post-liquefaction settlement potential and the marginal post-liquefaction stability, ground improvement in this area is recommended. Ground improvement recommendations are provided below, under Bridge Foundations. The stability analyses for WA1 utilized improved foundation soil properties due to the recommended ground improvement.

Table D-1 in Appendix D provides a summary of the calculated factors of safety against global instability for critical wall sections, and selected stability analyses, which depict the wall geometry and soil properties utilized in the analyses, are presented in Figure D-1 through D-28.

Bearing Resistance

The nominal bearing resistance of the structural earth walls was calculated based on the methodology in Section 11.10.5.4 the LRFD Bridge Design Specifications (AASHTO, 2012). The nominal bearing resistance is a function of the soil properties and groundwater conditions below the wall, as well as the wall geometry. Soil strength parameters were assigned based on soil and groundwater conditions in the test borings closest to the wall section being analyzed. A summary of the estimated nominal bearing resistances is presented in Table D-2, in Appendix D. Because liquefaction is either not anticipated at shallow depths, or will be mitigated in the case of WA1, the nominal bearing resistance for the extreme event limit state is the same as the nominal bearing resistance for the strength limit state. Provided that the recommendations presented below are incorporated into the wall design, the factored resistances exceed the factored loads for the strength and extreme event limit state.

Sliding Stability and Eccentricity

The sliding stability and eccentricity were evaluated for the critical wall configurations in accordance with Section 11.10.5.1 and 11.10.5.3 of the LRFD Bridge Design Specifications (AASHTO, 2012). For the proposed SE walls, sliding and eccentricity did not control the design, and the factored resistance to sliding exceeded the factored loads for all applicable limit states.

Estimated Settlement

The settlement of the proposed walls for the service limit state was evaluated using the Hough method, in accordance with Section 10.6.2.4.2 of the LRFD Bridge Design Specifications (AASHTO, 2012). Soil strength parameters were assigned based on soil and groundwater conditions in the test borings. Maximum estimated total settlements for each of the seven walls range from about 1 to 4½ inches, and the maximum calculated differential settlements for the walls generally ranged from about 1 to 1½ inches over 100 linear feet of wall. The differential settlements were in accordance with the serviceability requirements presented in Table 15-4 of the GDM (WSDOT, 2011a) for walls with flexible facings. Table D-3 in Appendix D presents a summary of the calculated total settlements along the proposed walls in 100 foot increments, as well as the maximum calculated differential settlement over a 100 foot increment for each of the seven walls.

Special Design Provisions

In accordance with the GDM (WSDOT, 2011a), the walls are to be designed using LRFD methods, and the general special provision (GSP) fill-ins presented below are in the currently recommended LRFD format. The following recommendations should be satisfied to provide external stability of the proposed structural earth walls. Structural earth walls should be constructed in accordance with Section 6-13 of the Standard Specifications (WSDOT, 2012b), with the following information included in the general special provisions.

1. The wall may be constructed near vertical, without a specified batter.
2. The wall should be placed on a level foundation in the horizontal direction perpendicular to the wall face.
3. Wall embedment depth should be a minimum of 2 feet with a level front slope, or H/10 with 3H:1V front slope, where H is the total height of the wall.
4. A minimum 4-foot wide horizontal bench should be provided in front of the wall.
5. For all walls, the reinforcing length should not be less than 70 percent of the wall height, with a minimum reinforcing length of 8 feet. <u>For total wall heights between 22 and 26 feet for wall WA1 only, the base width of the wall should not be less than 80 percent of the wall height.</u> These recommended minimum reinforcing lengths are needed to maintain adequate external stability. Greater reinforcing lengths may be needed to provide adequate internal stability.
6. The uppermost reinforcing layer should be placed no lower than 2 feet below the top of wall. Welded wire faced systems should include a top mat at the top of the wall.

7. Since the wall will be constructed above existing grades, there is limited potential for water to reach or build up in the reinforced zone. Special drainage elements are therefore not required.

The retaining wall supporting the NE Line (WA1) will be constructed over improved ground, due to the presence of very loose recent alluvium below the wall alignment. A separate GSP fill-in is therefore recommended for this wall. Table 4 lists design parameters that should be included in the special provision for a pre-approved, proprietary structural earth wall for the NE Line ramp (WA1).

Table 4
Design Parameters for Pre-approved, Proprietary SEW for WA1

Wall Name or Number: NE Line Wall (WA1)			
Soil Properties	**Wall Backfill[1]**	**Retained Soil**	**Foundation Soil**
Unit Weight (pcf)	130	125	120
Friction Angle (deg)	38	32	34
Cohesion (psf)	0	0	0
For the Service Limit State, the wall shall be designed to accommodate a differential settlement of 2 inches per 100 feet of wall length.			
For the Extreme Event I Limit State, the wall shall be designed for a horizontal seismic acceleration coefficient K_h of 0.18g and a vertical seismic acceleration coefficient k_v of 0.0g.			

Note: [1] – Wall backfill should be good quality, free-draining, granular material such as Gravel Backfill for Walls (WSDOT, 2012b).

For wall heights greater than 22 feet in wall WA1, the minimum reinforcement lengths should be 0.8H where H is the total height of the wall.

Table 5 on the following page lists design parameters that should be included in the special provision for pre-approved, proprietary structural earth walls for proposed walls WA2 through WA7.

Table 5
Design Parameters for Pre-approved, Proprietary SEW for WA2 to WA7

Wall Name or Number: WA2, WA3, WA4, WA5, WA6, WA7			
Soil Properties	**Wall Backfill**[1]	**Retained Soil**	**Foundation Soil**
Unit Weight (pcf)	130	125	120
Friction Angle (deg)	38	32	36
Cohesion (psf)	0	0	0
For the Service Limit State, the wall shall be designed to accommodate a differential settlement of 2 inches per 100 feet of wall length.			
For the Extreme Event I Limit State, the wall shall be designed for a horizontal seismic acceleration coefficient K_h of 0.18g and a vertical seismic acceleration coefficient k_v of 0.0g.			

Note: [1] – Wall backfill should be good quality, free-draining, granular material such as Gravel Backfill for Walls (WSDOT, 2012b).

BRIDGE FOUNDATIONS

Lateral Earth Pressures on Abutment Walls

The new abutment walls should be designed for the lateral earth pressures provided in Table 6. For walls that are free to translate or rotate (i.e., flexible walls), active earth pressures should be used in the retained soil. Flexible walls are defined as being able to displace laterally at least 0.001H, where H is the height of the wall. Non-yielding walls should use at-rest earth pressure parameters.

The seismic earth pressure is computed according to the Mononobe-Okabe method described in the LRFD Bridge Design Specifications (AASHTO, 2012). The walls are assumed free to move and to develop the active earth pressure conditions during a seismic event. The seismic earth pressure is a total pressure including the active static earth pressure, and is in a uniform distribution, applied at 0.5H from the bottom of the pressure distribution.

Table 6
Abutment Wall Lateral Earth Pressures

Active (Equivalent Fluid Pressure)	31 pcf
At-Rest (Equivalent Fluid Pressure)	50 pcf
Seismic (Total Pressure, Uniform Distribution)	22 H

The recommended lateral pressures in Table 6 assume that the walls will be backfilled with a free-draining material, such as Gravel Backfill for Walls (WSDOT, 2012b) or equivalent. All backfill should be placed and compacted in accordance with Method C (Article 2-03.3(14)C, WSDOT, 2012b).

Surcharge loads, where present behind a wall, should be included in the design of the abutment walls. For uniform surcharge loads, earth pressure coefficients of 0.24 and 0.39 may be used to compute the lateral pressures on the wall face resulting from uniform vertical surcharge loads for the active and at-rest conditions, respectively. Earth pressures due to point, line, and strip loads should be computed according to Article 3.11.6 in the AASHTO LRFD Bridge Design Specifications (AASHTO, 2012).

Abutment wall drainage should be designed in accordance with Figure 7.5.10-1 of the Bridge Design Manual (WSDOT, 2012a).

Foundation Alternatives

Due to the presence of liquefiable soils in the subsurface profile beneath the bridge site, structure support should be either on deep foundations such as driven piles or drilled shafts, or on spread footings bearing on soils that have been densified by ground improvement such that the liquefaction hazard is mitigated.

Driven piles would be used in groups to support the abutments and piers for the proposed structure layout. Based on our experience, the downdrag forces that act on a group of deep foundations is considerably larger than those acting on discrete foundation elements. We therefore recommend drilled shafts over piles driven in groups for this application.

Drilled shafts with large diameters should be feasible at large enough center-to-center spacings to ignore the potential for group effects when considering axial resistance combined with downdrag forces (i.e., center-to-center spacing of 3D or more with one row of shafts per pier or abutment).

Based on our understanding of the current bridge design, a deep foundation consisting of drilled shafts will be utilized to support the structure, and recommendations regarding drilled shaft foundations are presented below.

Shaft Axial Resistance

Shaft axial compressive resistance is plotted versus shaft tip elevation for the nominal (ultimate), factored (strength), service and post-liquefaction nominal load cases on Figures 12 through 14 for 7-foot diameter shafts at Piers 1 to 3, respectively. Similar plots of axial resistance for 8- and 10-foot diameters shafts are provided on Figures 15 through 20. Note that the resistances were calculated for the nominal diameter of the smaller of the English (Imperial) and metric unit equivalent so that the resistance values provided are applicable regardless of the actual dimension of the equipment used to construct the shaft. Section 7.8.1.1 of the BDM (WSDOT, 2012a) should be followed in regards to axial resistance group reduction factors.

Downdrag

Downdrag loads are anticipated within upper 75 feet of the soil profile. Estimated downdrag loads are provided in Table 7. A load factor of 1.25 should be used for the downdrag force for design at the Strength and Extreme Limit States. At the Service Limit State, the load factor is

1.0. It should be noted that the shaft resistances presented in Figures 12 through 20 have been adjusted due to the loss of resistance in the down drag zone for the post-liquefaction load case.

Table 7
Estimated Post-liquefaction Downdrag Load

Pier Location	7-foot Diameter Shaft	8-foot Diameter Shaft	10-foot Diameter Shaft
Pier 1	1150 kips	1380 kips	1690 kips
Pier 2	1280 kips	1530 kips	1890 kips
Pier 3	1180 kips	1420 kips	1750 kips

Lateral Shaft Resistance

Recommended parameters for analysis of lateral shaft resistance using a soil-structure interaction analysis tool such as LPILE© or DFSAP are presented in Tables 8 to 10. Note that the soil layers are referenced to the general existing ground surface and do not take into consideration the depth of any foundation cap or depth to top of shaft below the existing ground surface. Also note that DFSAP should not be used for the liquefied case, but may be used for non-liquefied conditions.

The p-y curves need to be modified for group effects in accordance with AASHTO LRFD Bridge Design Specifications (AASHTO, 2012) Section 10.7.2.4 (Table 10.7.2.4-1). The table provides p-multiplier values for spacings of 3B and 5B, for row 1, row 2 and row 3+ of shafts.

Table 8 Recommended p-y Curve Parameters for Pier 1 (West Abutment)

Reference Elevation: +68 feet

Soil Layer	Bottom of Layer Elevation	Soil Type	Soil Type (KSOIL)	STATIC ANALYSIS Effective Unit Weight of Soil		Cohesion		Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction
	ft			pci	pcf	psi	psf		(deg)	pci
1	+53	Sand	4	0.072	125	0.0	0		34	110
2	+38	Sand	4	0.031	53	0.0	0		28	5
3	+23	Sand	4	0.034	58	0.0	0		34	70
4	-7	Sand	4	0.036	63	0.0	0		35	80
5	-32	Sand	4	0.036	63	0.0	0		36	95
6	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

Soil Layer	Bottom of Layer Depth	Soil Type	Soil Type (KSOIL)	POST-LIQUEFACTION ANALYSIS Effective Unit Weight of Soil		Cohesion		Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction
	ft			pci	pcf	psi	psf		(deg)	pci
1	+53	Sand	4	0.072	125	0.0	0		34	110
2	+38	liquefied	4	0.034	58	0.0	0		2	5
3	+23	part. liq.	4	0.036	63	0.0	0		10	10
4	-7	liquefied	4	0.034	58	0.0	0		2	5
5	-58	Sand	4	0.036	63	0.0	0		36	95
6	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

Table 9 Recommended p-y Curve Parameters for Pier 2 (I-5 Median)

Reference Elevation: +68 feet

Soil Layer	Bottom of Layer Elevation	Soil Type	Soil Type (KSOIL)	STATIC ANALYSIS Effective Unit Weight of Soil		Cohesion		Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction
	ft			pci	pcf	psi	psf		(deg)	pci
1	+53	Sand	4	0.072	125	0.0	0		35	135
2	+33	Sand	4	0.036	63	0.0	0		36	95
3	+23	Sand	4	0.034	58	0.0	0		34	70
4	-7	Sand	4	0.036	63	0.0	0		33	60
5	-57	Sand	4	0.036	63	0.0	0		36	95
6	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

Soil Layer	Bottom of Layer Depth	Soil Type	Soil Type (KSOIL)	POST-LIQUEFACTION ANALYSIS Effective Unit Weight of Soil		Cohesion		Axial Strain ε50	Friction Angle ϕ	Modulus of Subgrade Reaction
	ft			pci	pcf	psi	psf		(deg)	pci
1	+53	Sand	4	0.072	125	0.0	0		35	135
2	+23	part. liq.	4	0.036	63	0.0	0		10	10
3	-7	liquefied	4	0.034	58	0.0	0		2	5
4	-58	Sand	4	0.036	63	0.0	0		36	95
5	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

Table 10 Recommended p-y Curve Parameters for Pier 3 (East Abutment)

Reference Elevation: +68 feet

				STATIC ANALYSIS						
Soil Layer	**Bottom of Layer Elevation**	**Soil Type**	**Soil Type (KSOIL)**	**Effective Unit Weight of Soil**		**Cohesion**		**Axial Strain ε50**	**Friction Angle ϕ**	**Modulus of Subgrade Reaction**
	ft			**pci**	**pcf**	**psi**	**psf**		**(deg)**	**pci**
1	+53	Sand	4	0.072	125	0.0	0		36	160
2	+23	Sand	4	0.036	63	0.0	0		35	80
3	-7	Sand	4	0.034	58	0.0	0		33	60
4	-58	Sand	4	0.036	63	0.0	0		36	95
5	-82	Clay	2	0.031	53	17.36	2500	0.005		1000
				POST-LIQUEFACTION ANALYSIS						
Soil Layer	**Bottom of Layer Depth**	**Soil Type**	**Soil Type (KSOIL)**	**Effective Unit Weight of Soil**		**Cohesion**		**Axial Strain ε50**	**Friction Angle ϕ**	**Modulus of Subgrade Reaction**
	ft			**pci**	**pcf**	**psi**	**psf**		**(deg)**	**pci**
1	+53	Sand	4	0.072	125	0.0	0		36	160
2	+23	part. liq.	4	0.036	63	0.0	0		10	10
3	-7	liquefied	4	0.034	58	0.0	0		2	5
4	-58	Sand	4	0.036	63	0.0	0		36	95
5	-82	Clay	2	0.031	53	17.36	2500	0.005		1000

Ground Improvement

Soils under the bridge alignment, as well as below the NE Line wall (WA1), are likely to liquefy during a design seismic event. Ground improvement by vibro-compaction (stone columns) may be used to mitigate the liquefaction potential and allow the use of abutment and pier support on shallow spread footings. However, because we understand that the current design utilizes a deep foundation to support the new bridge, ground improvement is only anticipated below the NE Line wall (WA1).

The limits of ground improvement should provide for an area of treatment that is a minimum of 10 feet beyond the edges of spread footings or retaining walls based on the final configuration of the structures, and should extend to a minimum distance of 100 feet behind the Pier 1 (west) abutment. Plan limits of ground improvement should be established collaboratively with PanGEO as final plans are developed. Stone columns should extend to an elevation +40 feet at the Pier 1 (west) abutment.

The recommended ratios of stone column to untreated soil area (area replacement ratios) are provided in Table 11. Three different area replacement ratios are recommended to create a transition from the improved foundation conditions beneath spread footing foundations or the higher portions of the approach fills (denoted Pattern A) to lesser embankment or wall heights (Patterns B and C). This is to prevent abrupt differential settlements in the roadway surface and permanent wall supporting the approach fills. Note that the minimum Standard Penetration Test (SPT) resistance or Cone Penetrometer Test (CPT) tip resistance values recommended below as performance criteria in improvement area(s) ‘A’ need not be achieved in transitional improvement areas ‘B’ and ‘C’.

Stone columns should be installed using a method that minimizes the return of water and soil to the ground surface. Stone columns should be circular in cross-section and continuous. Stone columns should have a minimum diameter of 2 feet, be plumb, and of sufficient length to reach the minimum treatment elevations shown in the plans. The stone columns should meet the minimum requirements outlined in Table 11.

Table 11
Recommended Stone Column Minimum Requirements

			Minimum Area Replacement Ratio	
Pattern	**Minimum Diameter (ft)**	**Max. Center-to-Center Distance (ft)**	**Square Pattern**	**Equilateral Triangular Pattern**
A	2	10	0.18	0.20
B	2	12	0.09	0.10
C	2	12	0.05	0.06

The stone column diameters and spacings should be determined using the minimum area replacement ratios and the following equations:

$$R_s = 0.785(D/S)^2$$
$$R_t = 0.907(D/S)^2$$

Where: R_s = Area Replacement Ratio for a Square Pattern
R_t = Area Replacement Ratio for an Equilateral Triangular Pattern
D = Diameter of Stone Column
S = Spacing of Stone Column (center to center)

To ensure compaction of the stone column, the gravel should be vibrated. The Contractor should demonstrate that the installation procedures and methods meet the densification requirements by completing a test section and obtaining field SPT or CPT measurements of the completed installation. Production installation of stone columns should be subject to approval of the QCM and Engineer based on the performance of the test section installations.

Performance criteria presented in Table 12 should be met for acceptance of test section and production stone columns installed within improvement areas ‘A’.

Table 12
Stone Column Performance Criteria

Depth Below Existing Ground Surface (feet)	Minimum Uncorrected SPT Blowcount[1]	Minimum CPT Tip Resistance[2] (tons per square foot)
15-30	20	125
30-75	26	170

Notes: [1] – Field measured blows per foot over the last 12 inches of an 18-inch drive using an Auto-trip Safety Hammer obtained in accordance with ASTM D-1586. Wireline or cathead operated hammers should not be used.
[2] – Minimum CPT tip resistance should be calculated as the average over any consecutive 5-foot penetration.

The contractor should provide the final stone column design.

NOISE BARRIER FOUNDATIONS

New noise barrier construction is planned for the southeast quadrant of the interchange. Foundation conditions were explored with three test borings, THT-01-10, THT-02-10 and THT-03-10. Standard Plan (WSDOT, 2010) noise barrier foundations may be used based on the soils encountered in these test borings. The plans should specify soil type D1 with an associated friction angle of 32 degrees. The spread footing option for noise barrier may also be used, as the allowable bearing capacity is calculated to be above the 2,000 pounds per square foot value used for the standard plan design. The ground conditions indicated by the borings are relatively consistent between the exploration points, therefore differential settlement is expected to be less than one-half the estimated total settlement of ¾-inch.

SIGNAL, ILLUMINATION AND MINOR STRUCTURE FOUNDATIONS

In general, the new interchange construction will establish new grades with compacted granular fill materials as described above under general roadway embankments. For these conditions, the foundation of minor structures such as signals and illumination may be sized using the WSDOT Standard Plans (WSDOT, 2010) and an allowable lateral bearing pressure of 2,500 pounds per square foot. In addition, based on the results of the test borings at the site and our understanding of site conditions, the upper 10 feet of native soil generally consists of medium dense outwash. As such, we also recommend that signal and illumination foundations located outside the new fill areas within the native outwash soils may be sized using the WSDOT Standard Plans (WSDOT, 2010) and an allowable lateral bearing pressure of 2,500 pounds per square foot. Should minor structure foundation locations not be consistent with the above design assumption, PanGEO should be contacted to review the specific minor structure foundation location.

PAVEMENT DESIGN

Based on information provided by Parametrix, we understand that the design traffic loading for the new ramps is 3.1 million ESAL (18-kip equivalent single axle load) for a design life of 40 years. According to the WSDOT Pavement Policy (WSDOT, 2011b), the design life of new pavements is typically 50 years. Assuming an annual traffic growth rate of 4%, we determined the ESAL for a 50-year design life to be about 4.6 million, which was used for pavement design. It may be noted that according to our design calculations, the difference between the 40-year and 50-year traffic loading only results in a difference of about 1½ inches of crushed surfacing base course.

Because the ramp pavement will be constructed on new, properly compacted granular fill, we estimate that a resilient modulus (M_R) of 15,000 pounds per square inch (psi) is appropriate for the subgrade soils. The pavement analysis was performed using the AASHTO Guide for Design of Pavement Structures (AASHTO, 1993) and the WSDOT Pavement Policy (WSDOT, 2011b) pavement design methodology and the following parameters:

Pavement Design life	50 years
Design Traffic (18-kip ESAL)	4,600,000
Reliability	85%
Overall Standard Deviation	0.5
Design Serviceability Loss (ΔPSI)	1.5
Drainage Coefficient	1.0
Layer Coefficient: HMA	0.44
Layer Coefficient: Crushed Surfacing	0.13
Resilient Modulus	15,000 psi

Based on the design information and parameters discussed above, we recommend the flexible pavement section described in Table 13 below:

Table 13
Flexible Pavement Section

Material Description	Recommended Minimum Thickness (inches)	WSDOT Standard Specification for Aggregates
HMA	6	9-03.8
CSBC	6	9-03.9 (3)
Gravel Borrow	As needed	9-03.14 (1)

HMA: Hot Mix Asphalt, Class ½-inch PG 58-22
CSBC: Crushed Surfacing Base Course. The uppermost 2 inches of CSBC may be replaced with Crushed Surfacing Top Course (CSTC)
Gravel Borrow: Compacted to at least 95 percent of the maximum dry density, as determined by the tests described in Section 2-03.3(14)D, (WSDOT, 2012b).

It should be noted that actual pavement performance over the design period assumed in our analysis would depend on a number of factors, including the actual traffic loading conditions. The recommended pavement section will need to be revised if the traffic level (ESAL's) will be more or less than our assumed value.

Subgrade Preparation for Pavements

Pavement subgrades should be prepared in accordance with Section 2-06 of the WSDOT Standard Specifications (WSDOT, 2012b). All unsuitable soils should be removed during stripping operations and either exported from the site, or stockpiled for later re-use in landscaping areas. Following removal of the surficial unsuitable soils, the exposed subgrade should be moisture conditioned, if necessary, and compacted to a firm condition. The upper 6 inches of material should be compacted to at least 95 percent of the maximum dry density, as determined by the tests described in Section 2-03.3(14)D.

Any soft, yielding areas identified during the compaction process or proof-rolling should be over-excavated and backfilled with properly compacted CSBC, as described in Section 9-03.9(3) of the WSDOT Standard Specifications (WSDOT, 2012b), or gravel borrow as described in Section 9-03.14 (1) of the Standard Specifications.

Pond Access Roadway Surfacing

We understand that full vactor trucks, with a weight of 71,000 lbs, will utilize the pond access roads several times a year for pond maintenance and cleaning. We recommend the surfacing of the access roads consist of a minimum of 12 inches of quarry spalls, as described in Section 9-13.6 (WSDOT, 2012b), over a nonwoven Geotextile for Separation as described in Section 9-33.2(1), Table 3 (WSDOT, 2012b). The access road subgrade should be prepared in accordance with Section 2-06 of the WSDOT Standard Specifications (WSDOT, 2012b).

ELECTROCHEMICAL PROPERTY TESTING

Electrochemical property testing was conducted on representative soil samples throughout the project area to help determine the corrosiveness of the soil and to aid in pipe selection. The test results are summarized in Table 14 on the following page.

Table 14
Electrochemical Properties

Exploration Number	Depth Interval (in feet)	pH	Resistivity (ohms-cm)	Chlorides (ug/g)	Sulfates (ug/g)
THT-04-10[1]	0 - 1.5	5.1	3,700	< 8.4	47.3
THT-05-10[1]	5.0 – 6.5	4.9	not tested	<8.1	56.2
THT-08-10[1]	2.0 – 4.0	5.9	76,000	<9.8	19.8
THT-12-10[1]	10 – 11.5	6.1	22,500	56.8	398
THT-15-10[1]	5.0 – 6.5	6.0	19,000	<51.2	212
THT-20-10[1]	10.0 – 11.5	6.2	1,000	99.8	609
THT-22-10[1]	10.0 – 11.5	6.4	12,500	74.0	461
B-2-03[2]	2.5 – 4.0	5.2	40,000	<10	150
B-3-07[2]	5.0 – 6.5	5.7	82,000	<10	<11
B-4-03[2]	7.5 – 9.0	5.8	130,000	<10	<10
B-5-03[2]	35 – 36.5	5.5	14,000	<10	67
B-7-07[2]	30.0 – 31.5	6.2	25,000	<10	<12

(1) Chemistry parameters were determined by Analytical Resources, Inc, of Tukwila, WA
(2) Chemistry parameters were determined by Am Test Laboratories of Redmond, WA, as part of a previous study.

CONSTRUCTION CONSIDERATIONS

The following items should be considered during the final roadway design and development of the contract specifications and special provisions.

1. Temporary shoring and/or slopes will be required during construction of the various structures discussed above. The design and construction of temporary shoring/slopes should be the responsibility of the contractor.

2. Depending on the time of year, groundwater seepage into excavations could occur. Depending on the depth of excavation below the water, inflows may be controllable with sumps and pumps.

3. Installation of stone columns may require significant amperage rise to penetrate locally dense layers above the target layers of liquefaction mitigation.

4. Shaft construction should anticipate wet construction methods. Caving ground conditions are likely, especially in the upper portion of the soil profile. We recommend that temporary casing be used down to the elevation of the silt and clay layer, which is at about elevation -35 feet, -60 feet, and -60 feet at Piers 1, 2, and 3, respectively. We

generally recommend that the excavation should not be advanced in excess of 5 feet beyond the tip of the temporary casing.

ADDITIONAL SERVICES

PanGEO should review the final project plans and specifications to confirm that our recommendations were properly incorporated into the contract documents.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

PanGEO, Inc. (PanGEO) prepared this report for use by Parametrix, Inc, the Tulalip Tribe, and the Washington State Department of Transportation in the design and construction of the I-5 116th Street NE Interchange improvements project. The recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project.

Variations in soil conditions may exist between the locations of the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, PanGEO should be immediately notified to review the applicability of the recommendations presented herein. Additionally, PanGEO should also be notified to review the applicability of these recommendations if there are any changes in the project scope.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 36 months from its issuance. PanGEO should be notified if the project is delayed by more than 36 months from the date of this report so that the applicability of the conclusions and recommendations presented herein may be evaluated considering the time lapse.

Within the limitations of scope, schedule and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time this report and/or its contents was prepared. No warranty, express or implied, is made. The scope of PanGEO's work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water or ground water at this site. PanGEO does not practice or consult in the field of safety engineering. PanGEO does not direct the contractor's operations, and cannot be held responsible for the safety of personnel other than our own on the site; the safety of others is the responsibility of the contractor.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes shall be at the contractor's sole option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

CLOSURE

PanGEO is pleased to support Parametrix, the Tulalip Tribe, WSDOT and the design team with geotechnical engineering recommendations. If you have any questions regarding this report, please call (206) 262-0370.

Sincerely,

PanGEO, Inc.

Johnny Chen

Johnny C. Chen, P.E.
Project Geotechnical Engineer

Siew L. Tan, P.E.
Principal Geotechnical Engineer

JON C. REHKOPF
STATE OF WASHINGTON
40412
REGISTERED
PROFESSIONAL ENGINEER
7/18/2012
EXPIRES 7/4/2014

Jon C. Rehkopf, P.E.
Senior Project Geotechnical Engineer

ROBERT E. KIMMERLING
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER
7/18/12

Robert E. Kimmerling, P.E.
Principal Geotechnical Engineer

REK/SHE/JCR/rek

REFERENCES

AASHTO, 1993 Guide for Design of Pavement Structures, American Association of State Highway and Transportation Officials.

AASHTO, 2012 LRFD bridge design specifications, 6th edition, American Association of State Highway and Transportation Officials.

Blakely, R.J., Sherrod, B.L., Wells, R.E., Weaver, C.S., McCormack, D.H., Troost, K.G., and Haugerud, R.A., 2004, The Cottege Lake aeromagnetic lineament: a possible onshore extension of the Southern Whidbey Island fault, Washington. U.S.G.S. Open-file Report 2004-1204.

Bourgeois, J., and Johnson, S.Y., 2001, Geologic evidence of earthquakes at the Snohomish delta, Washington, in the past 1200 years: Geological Society of America Bulletin, v. 113, p. 482-494.

Johnson, S.Y., Potter, C.J., Armentrout, J.M., Miller, J.J., Finn, C., and Weaver, C.S., 1996, The southern Whidbey Island fault: an active structure in the Puget Lowland, Washington: Geological Society of America Bulletin, v. 108, p. 334-354.

Minard, J.P., 1985, Geologic map of the Marysville Quadrangle, Snohomish County, Washington. U.S.G.S. Miscellaneous Field Studies Map MF-1743.

WSDOT, 2008. Highway Runoff Manual, M 31-16, Washington State Department of Transportation, June 2008.

WSDOT, 2010. Standard Plans, M21-01, Washington State Department of Transportation, 2010.

WSDOT, 2011a. Geotechnical Design Manual, M 46-03.02, Washington State Department of Transportation, 2011.

WSDOT, 2011b. WSDOT Pavement Policy, Washington State Department of Transportation, June 2011.

WSDOT, 2012a. Bridge Design Manual (LRFD), M 23-50, Washington State Department of Transportation, January 2012.

WSDOT, 2012b. Standard Specifications for Road, Bridge and Municipal Construction, M41-10, Washington State Department of Transportation, 2012.

FIGURES

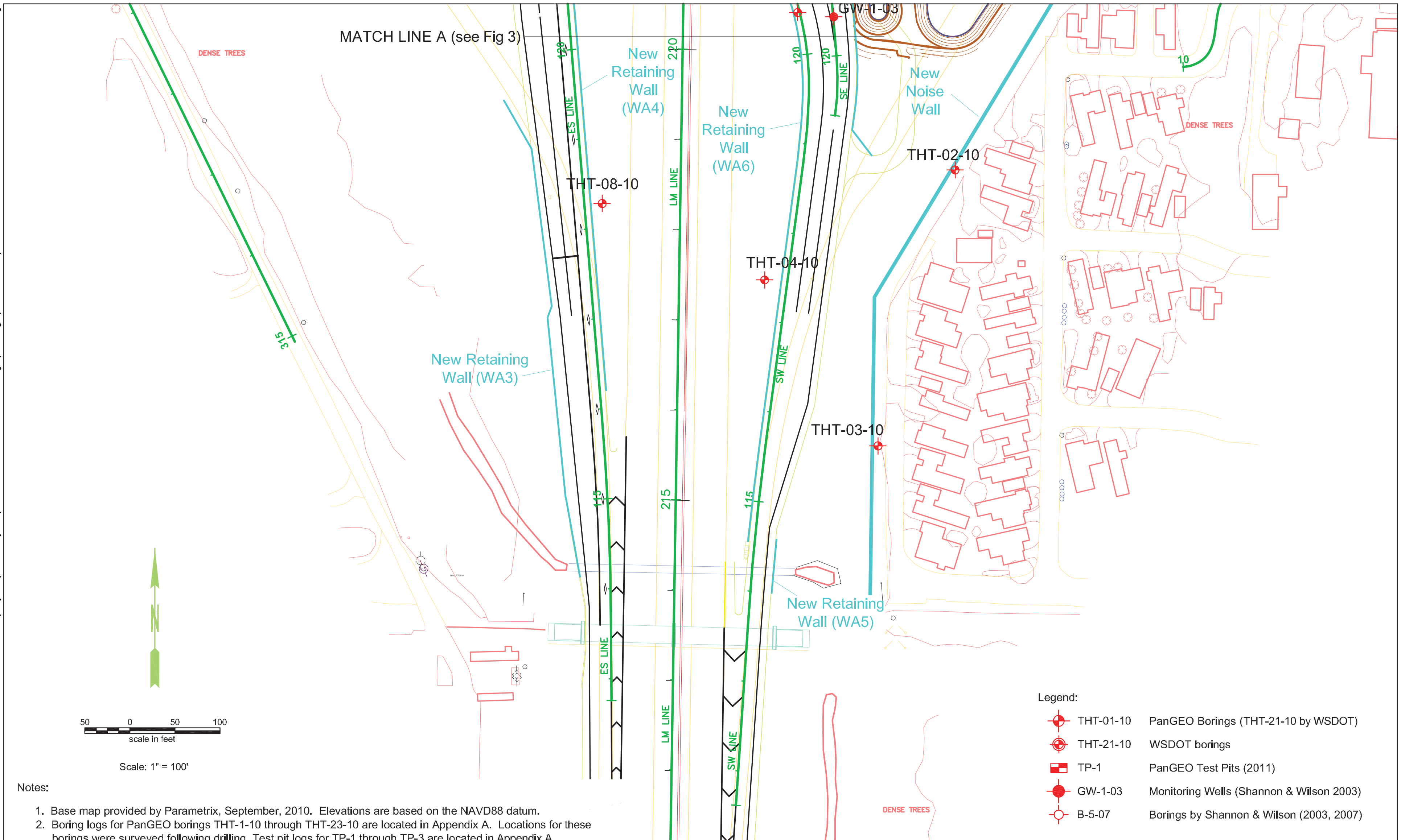
PanGEO
INCORPORATED

I-5, 116th St. NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

VICINITY MAP

Project No.	Figure No.
10-069	1

10-069_Vic_Map_Fig-1.ppt 5/17/2011(10:12 AM) SHE

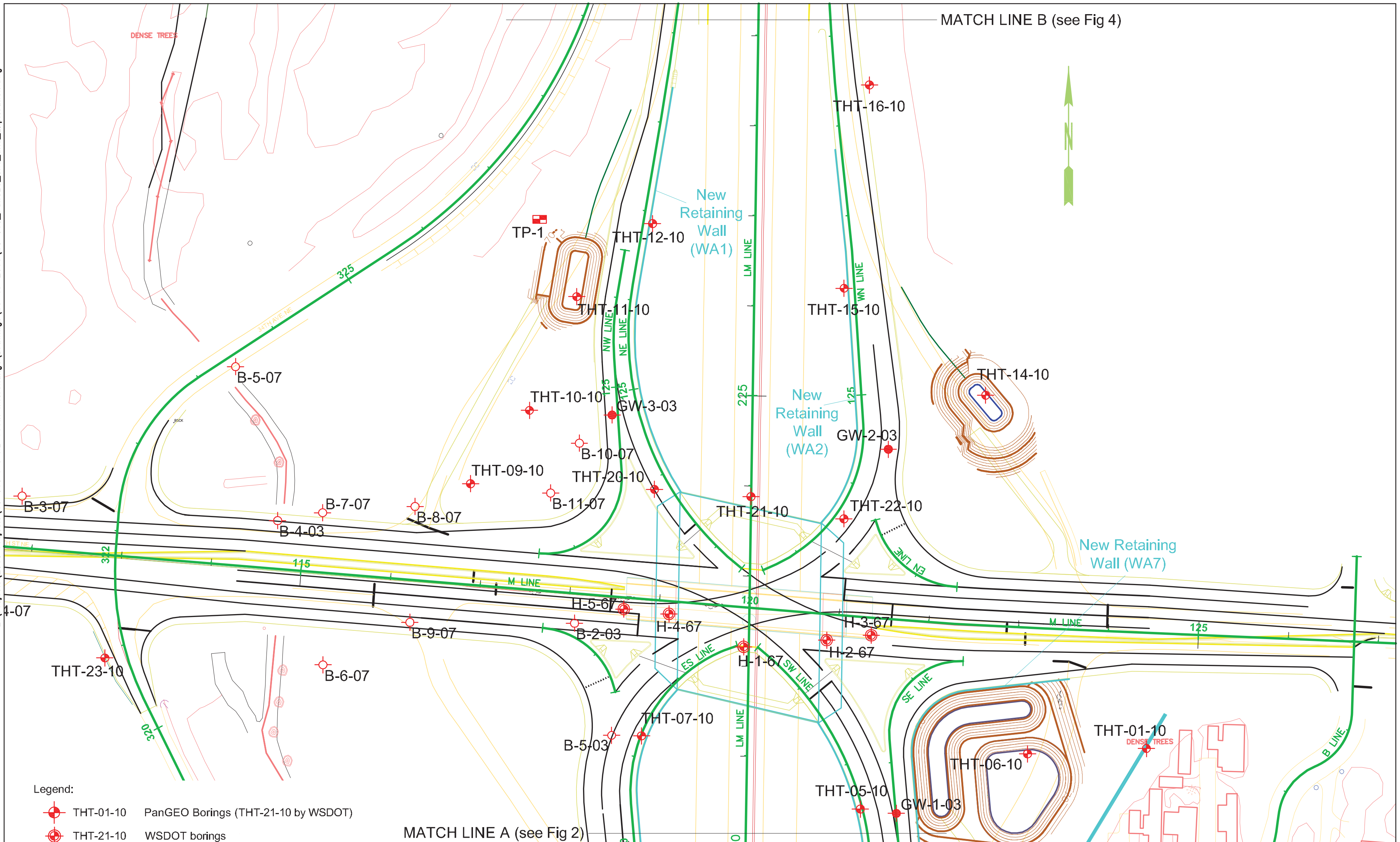


Notes:

1. Base map provided by Parametrix, September, 2010. Elevations are based on the NAVD88 datum.
2. Boring logs for PanGEO borings THT-1-10 through THT-23-10 are located in Appendix A. Locations for these borings were surveyed following drilling. Test pit logs for TP-1 through TP-3 are located in Appendix A.
3. Boring logs for historic investigations are located in Appendix C. Historic boring numbers were modified by adding the year of the investigation to the end of the boring numbers. Locations for most of these borings are approximate and based on the relative locations of the borings to known site features on report drawings. Borings where surface evidence for the location remains (such as the piezometer installations) were surveyed concurrent with the survey of the recent borings.

PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	SITE AND EXPLORATION PLAN SOUTH PROJECT NO. 10-069	FIGURE NO. 2

DRAWN BY: SHE CHECKED BY: REK DATE: 05.10.2012 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Site_and_Ex_TP_TM-Rev_5-10-12.dwg



Legend:

THT-01-10	PanGEO Borings (THT-21-10 by WSDOT)
THT-21-10	WSDOT borings
TP-1	PanGEO Test Pits (2011)
GW-1-03	Monitoring Wells (Shannon & Wilson 2003)
B-5-07	Borings by Shannon & Wilson (2003, 2007)

50 0 50 100
scale in feet

Scale: 1" = 100'

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

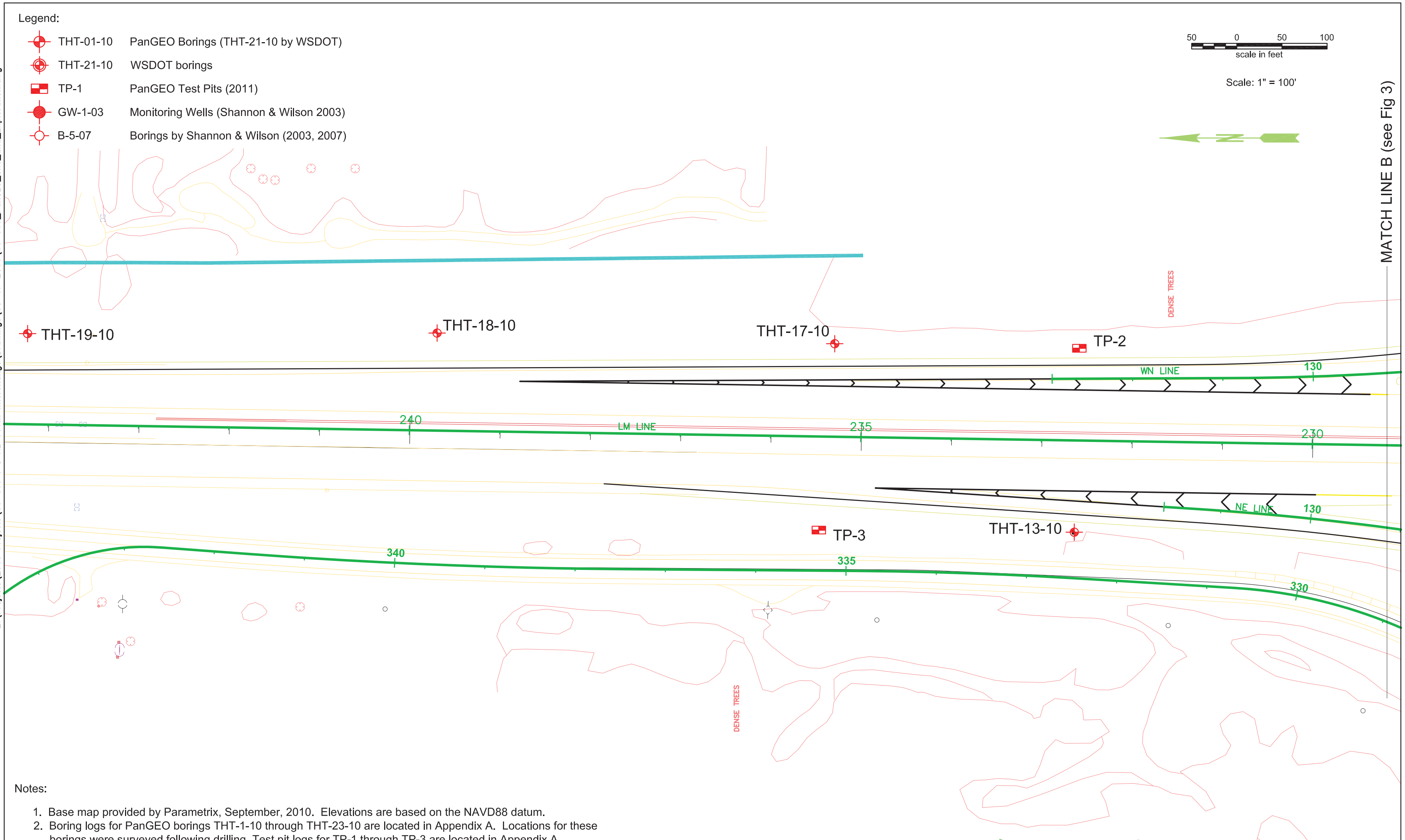
SITE AND EXPLORATION PLAN
CENTRAL

PROJECT NO. 10-069

FIGURE NO. 3

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Site_and_Exploration.dwg

DATE: 05.23.2011
CHECKED BY: REK
DRAWN BY: SHE



Notes:

1. Base map provided by Parametrix, September, 2010. Elevations are based on the NAVD88 datum.
2. Boring logs for PanGEO borings THT-1-10 through THT-23-10 are located in Appendix A. Locations for these borings were surveyed following drilling. Test pit logs for TP-1 through TP-3 are located in Appendix A.
3. Boring logs for historic investigations are located in Appendix C. Historic boring numbers were modified by adding the year of the investigation to the end of the boring numbers. Locations for most of these borings are approximate and based on the relative locations of the borings to known site features on report drawings. Borings where surface evidence for the location remains (such as the piezometer installations) were surveyed concurrent with the survey of the recent borings.

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

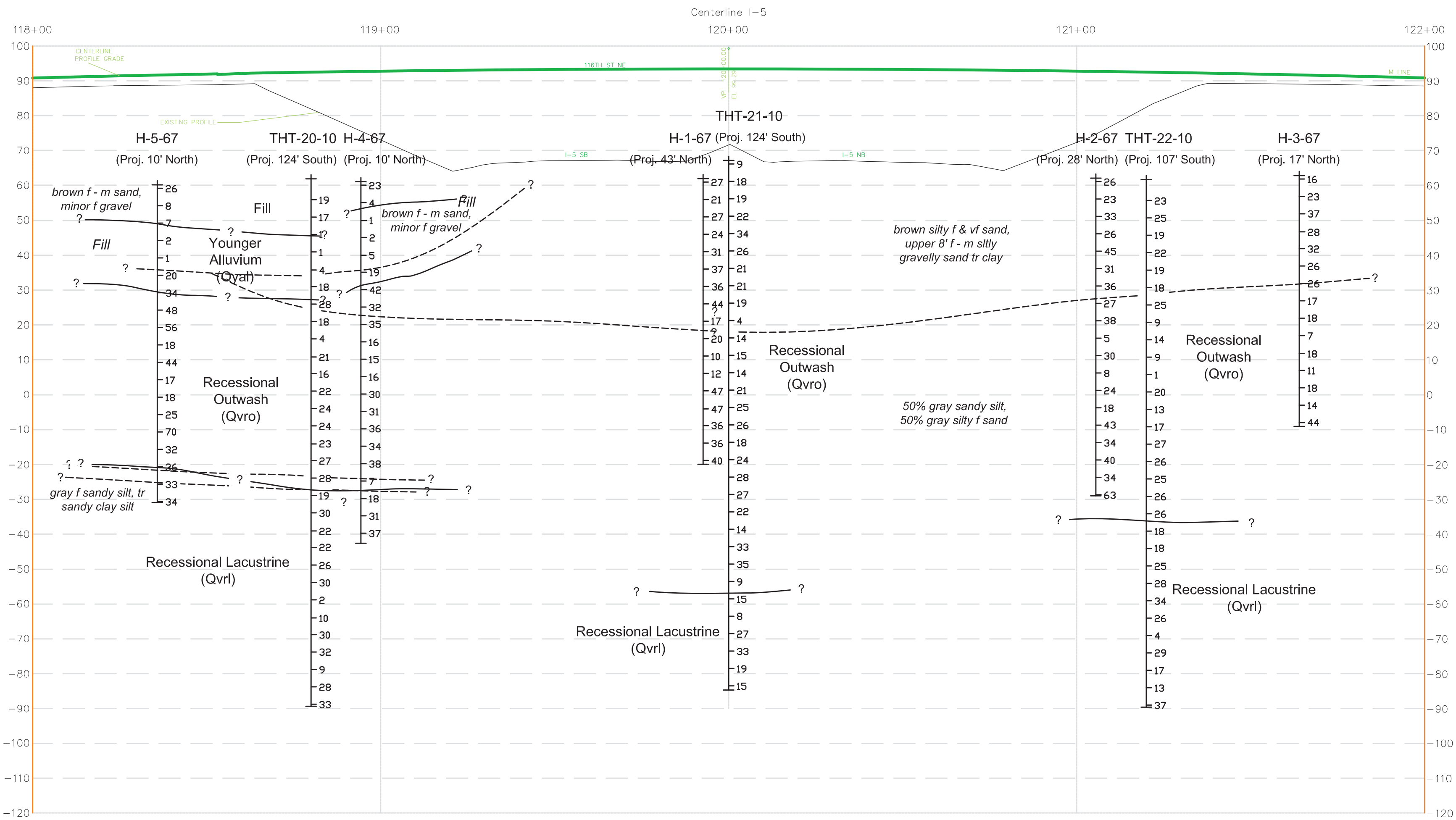
SITE AND EXPLORATION PLAN
NORTH

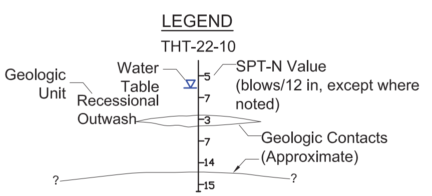
PROJECT NO. 10-069

FIGURE NO. 4

DRAWN BY: SHE CHECKED BY: REK DATE: 05.23.2011

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Site_and_Exploration.dwg





Geologic Unit Descriptions:

Fill: brown silty fine SAND and medium SAND.

Younger Alluvium (Qyal): loose, brown, silty SAND with wood debris.

Recessional Outwash - Marysville Sand Member (Qvrm): medium dense to loose, brown to gray, SAND with silt to silty SAND, occasional silt or silty clay interbeds.

Recessional Outwash - Clay Member (Qvrc): soft to stiff, green gray silty CLAY to gray SILT, occassional silty sand interbeds.

(after Minard, 1985)

15 0 15 30

scale in feet

Scale: 1" = 30'

Note: THT-20-10 and THT-22-10 drilled under direction of PanGEO personnel. All other borings donw by WSDOT. Borings with "H" designation from 1967. THT-21-10 was done in 2010.

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SUBSURFACE PROFILE
CENTERLINE 116TH STREET NE

PROJECT NO. 10-069

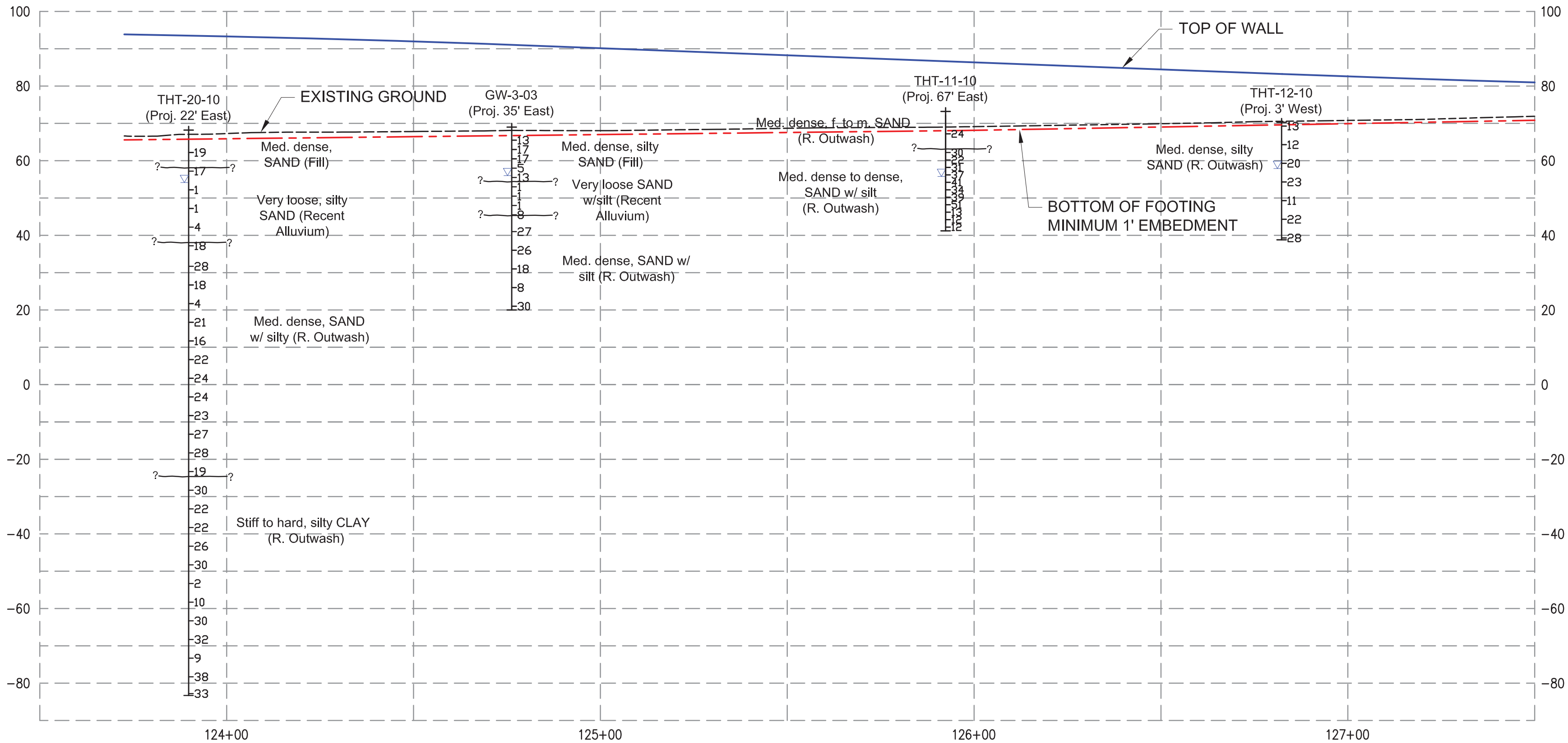
FIGURE NO. 5

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Site_and_Exploration.dwg

DATE: 07.17.2012

CHECKED BY: REK

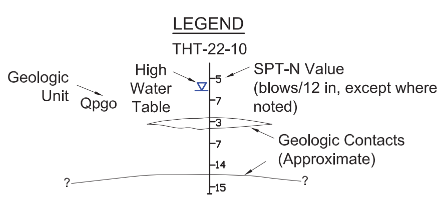
DRAWN BY: SHE



NE LINE

1" = 30'

15 0 15 30
scale in feet



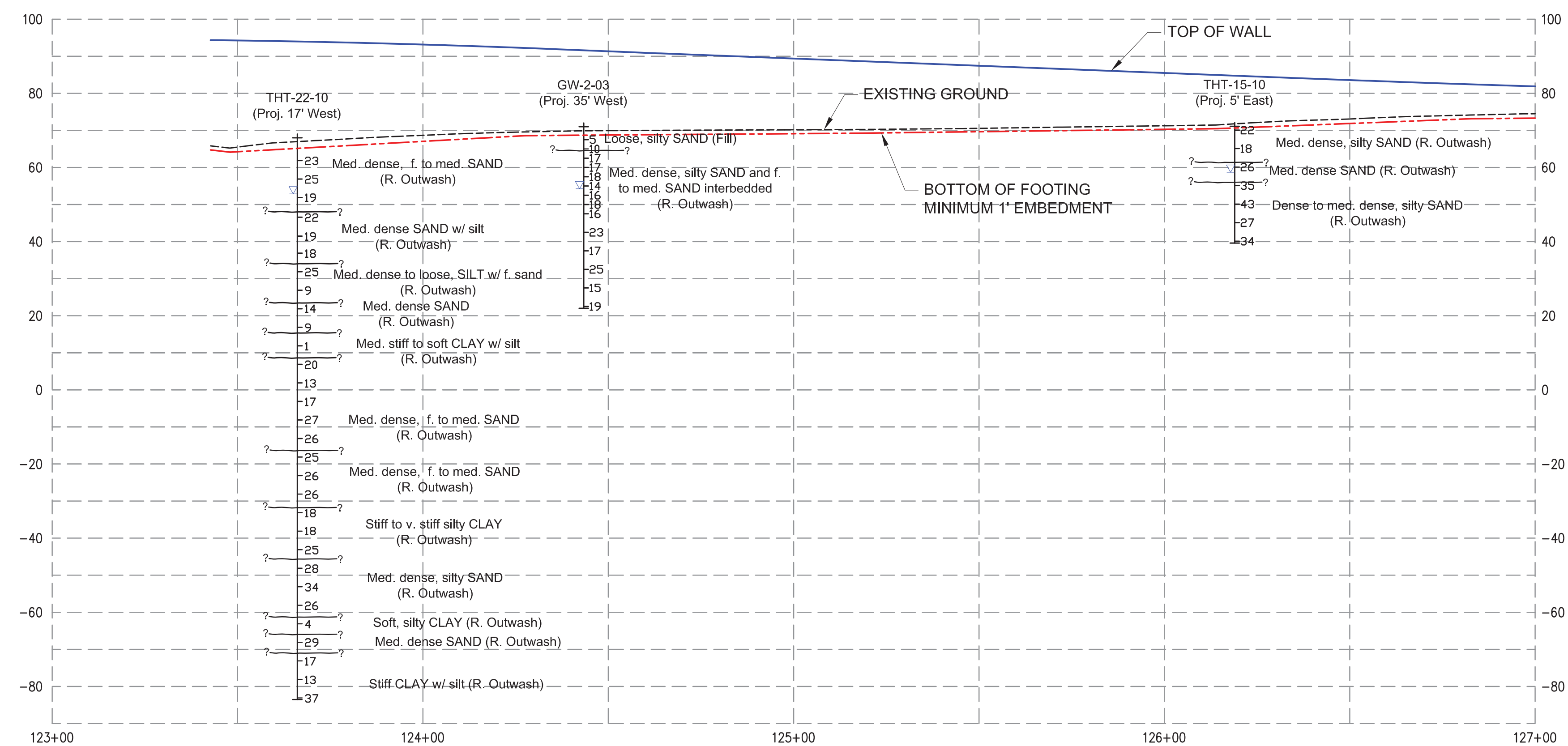
PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SUBSURFACE PROFILE
NE-LINE

PROJECT NO.	FIGURE NO.
10-069	6

DRAWN BY: NTW CHECKED BY: REK DATE: 05.23.2011 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg

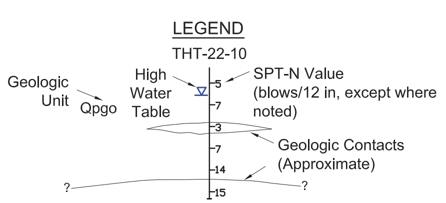


WN LINE

1" = 30'

15 0 15 30

scale in feet



PanGEO INCORPORATED

i-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

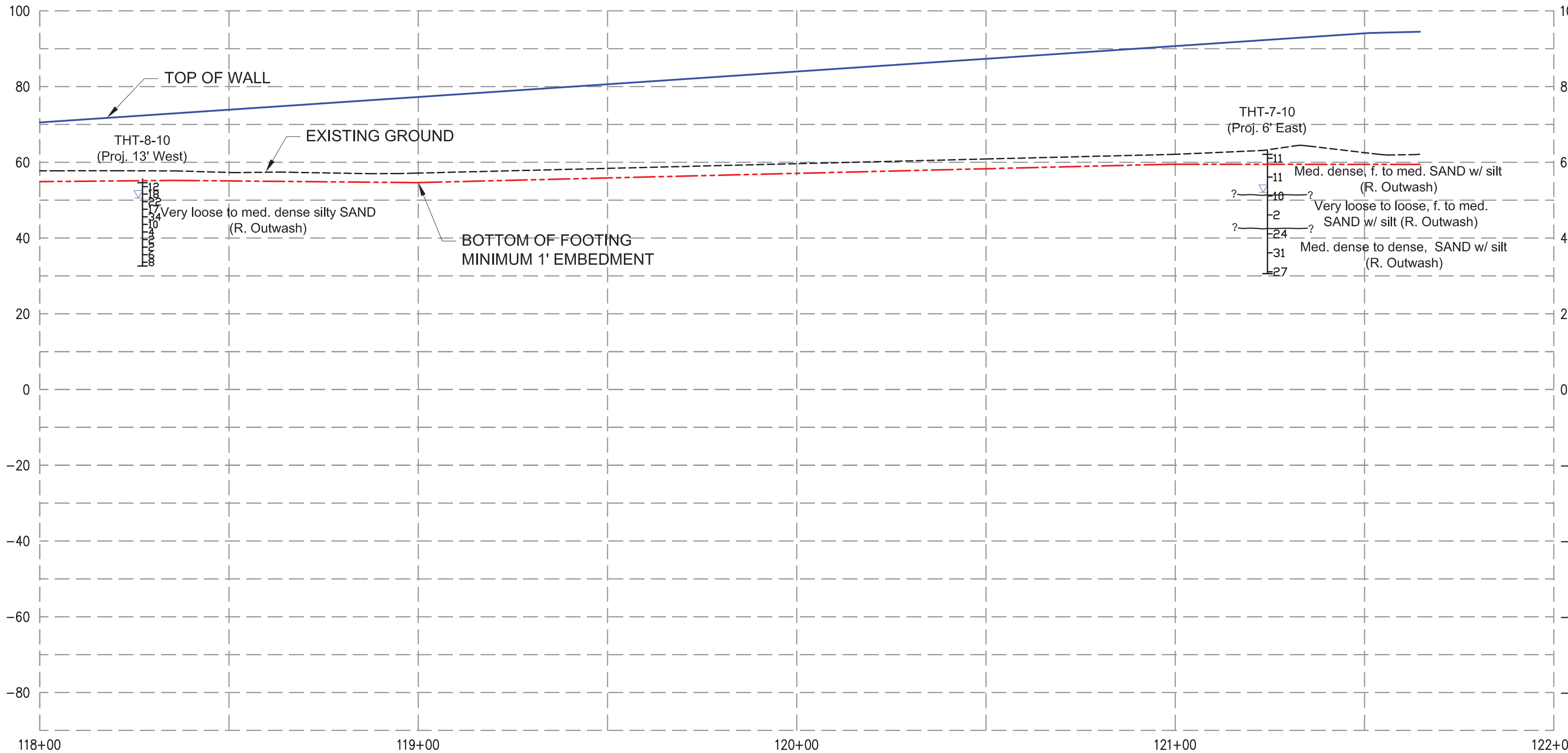
SUBSURFACE PROFILE
WN-LINE

PROJECT NO. 10-069

FIGURE NO. 7

DRAWN BY: NTW CHECKED BY: REK DATE: 05.23.2011

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg

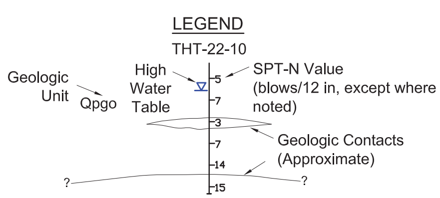


ES LINE

1" = 30'

15 0 15 30

scale in feet



PanGEO INCORPORATED

i-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

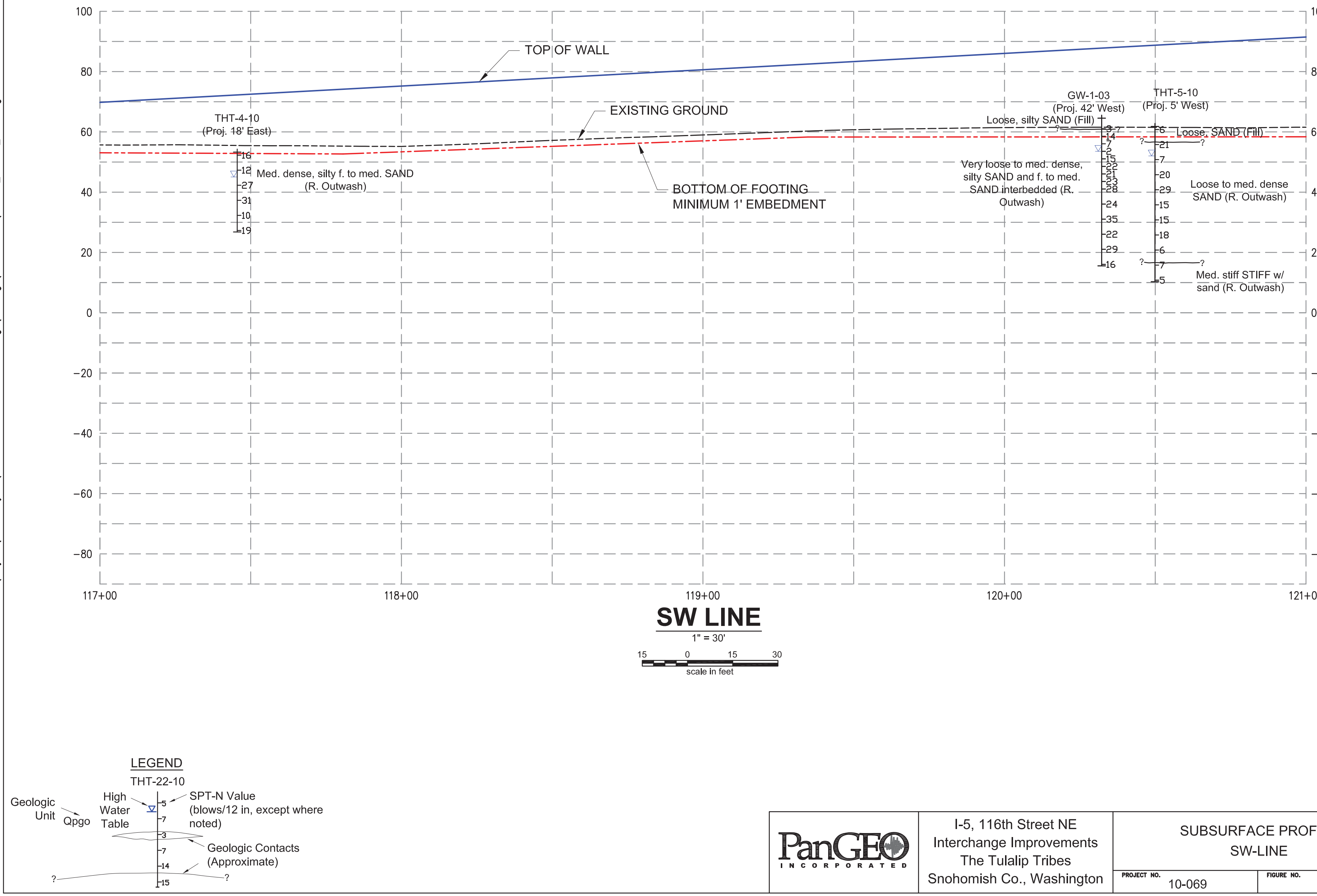
SUBSURFACE PROFILE
ES-LINE

PROJECT NO. 10-069

FIGURE NO. 8

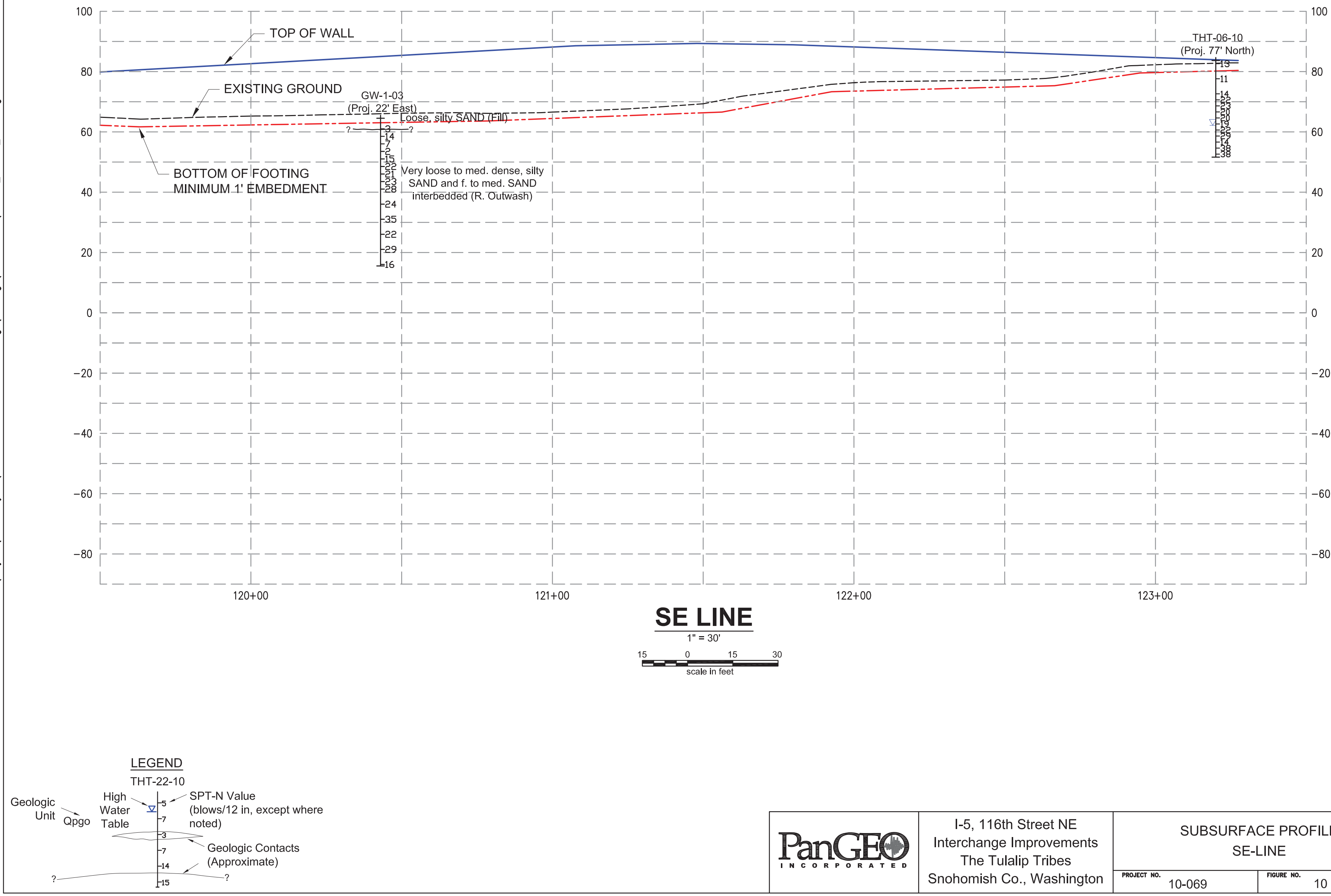
DRAWN BY: NTW CHECKED BY: REK DATE: 05.23.2011

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg



PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	SUBSURFACE PROFILE SW-LINE PROJECT NO. 10-069 FIGURE NO. 9

DRAWN BY: NTW CHECKED BY: REK DATE: 05.23.2011 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg



SE LINE

1" = 30'

scale in feet

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

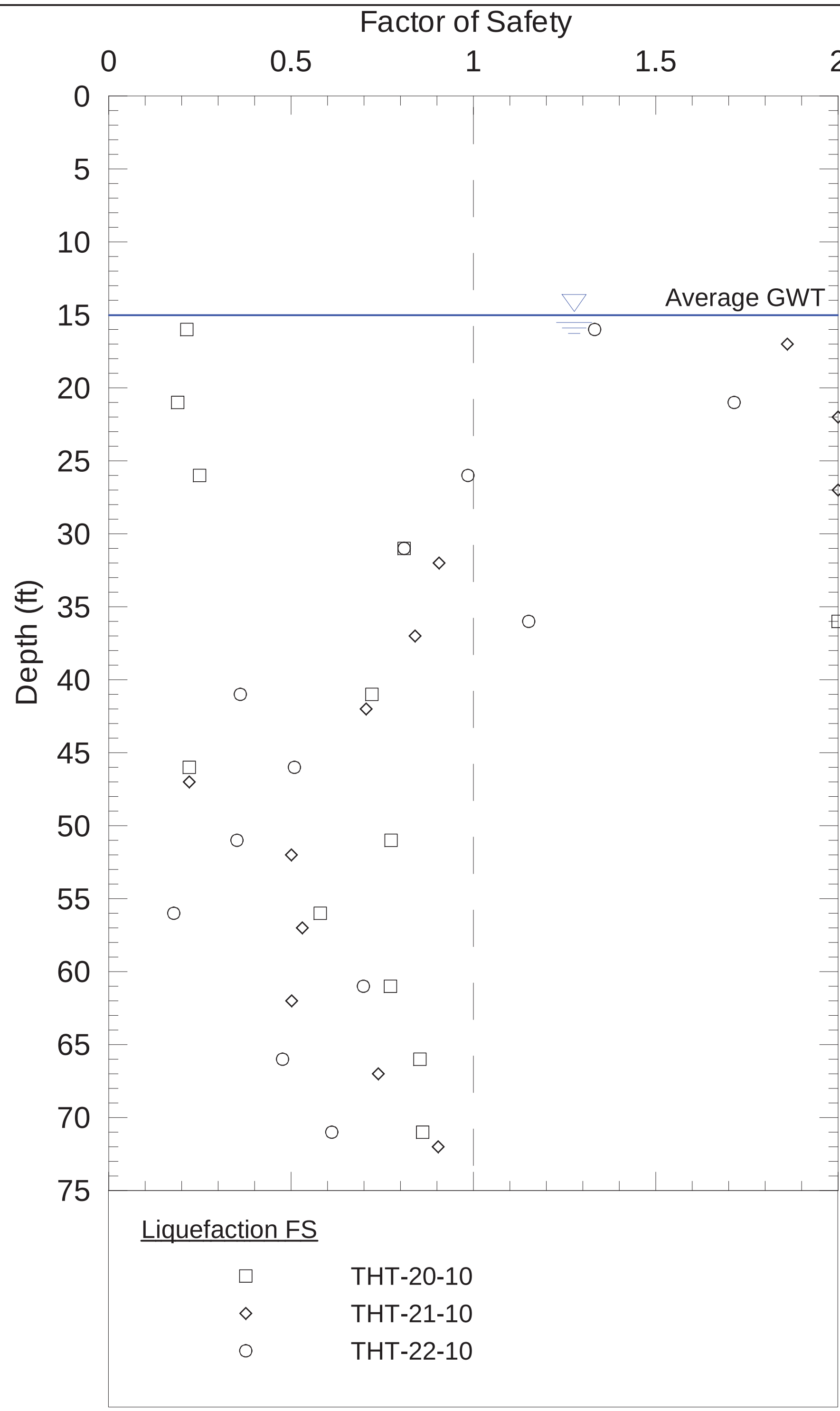
SUBSURFACE PROFILE
SE-LINE

PROJECT NO. 10-069

FIGURE NO. 10

Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Drawings\05-17-2011\10-069_PanGEO_Walls.dwg

DATE: 05.23.2011 CHECKED BY: REK DRAWN BY: NTW



Notes:
1) Design event: 7% probability in 75 years (M=7.5 event, with a PGA of 0.35g).
2) Samples with computed $(N_1)_{60cs}$ values greater than 30 or computed factors of safety greater than 2.0 were considered not liquefiable and are plotted on this chart as FS=2.

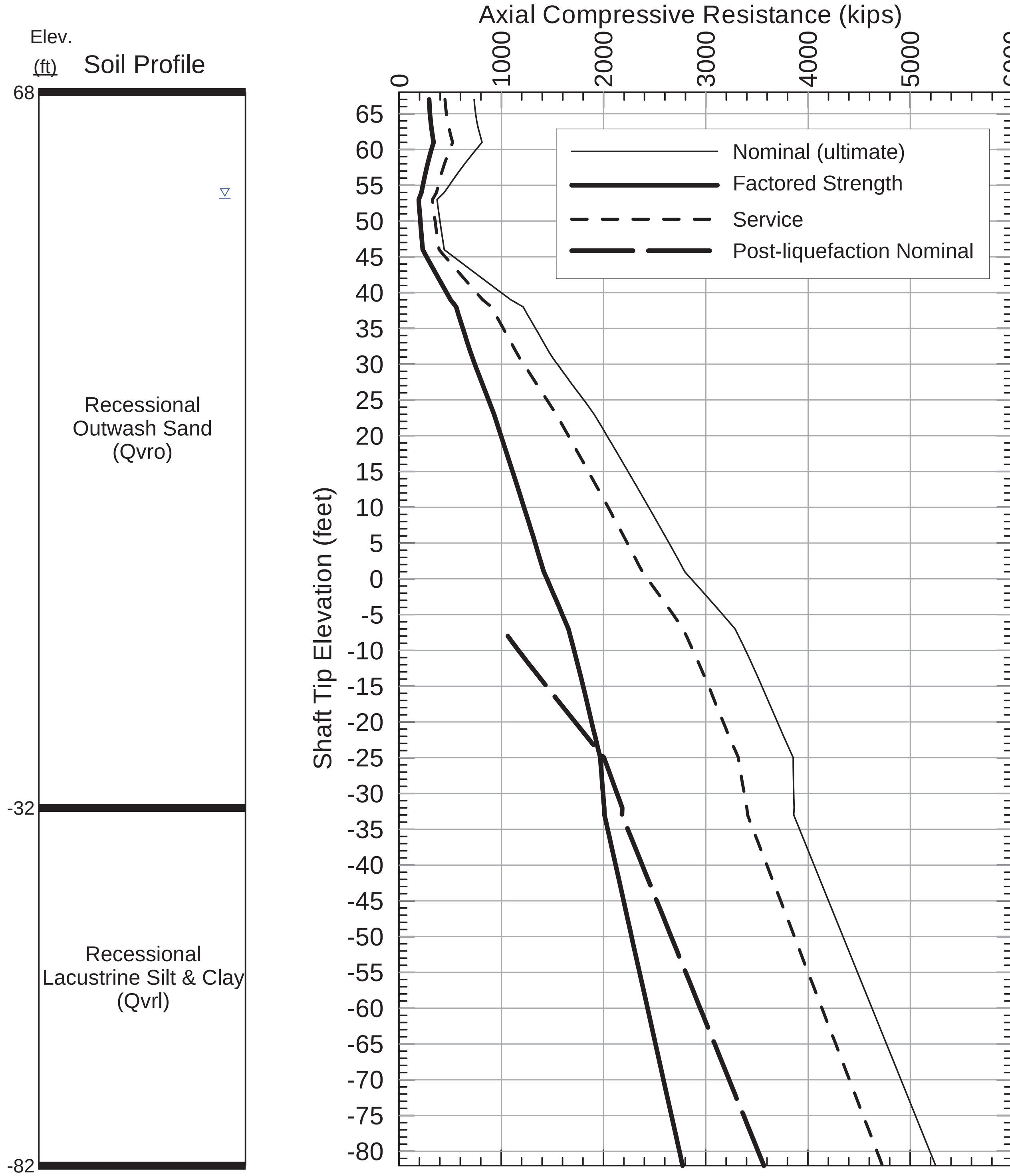
10-069 Bridge Borings Liquefaction.grf w/ 10-069 Liquefaction Bridge Borings.xls 5/17/11 (7:56) REK

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

LIQUEFACTION ASSESSMENT
TEST BORINGS THT-20-10,
THT-21-10 & THT-22-10

Project No.	Figure No.
10-069	11

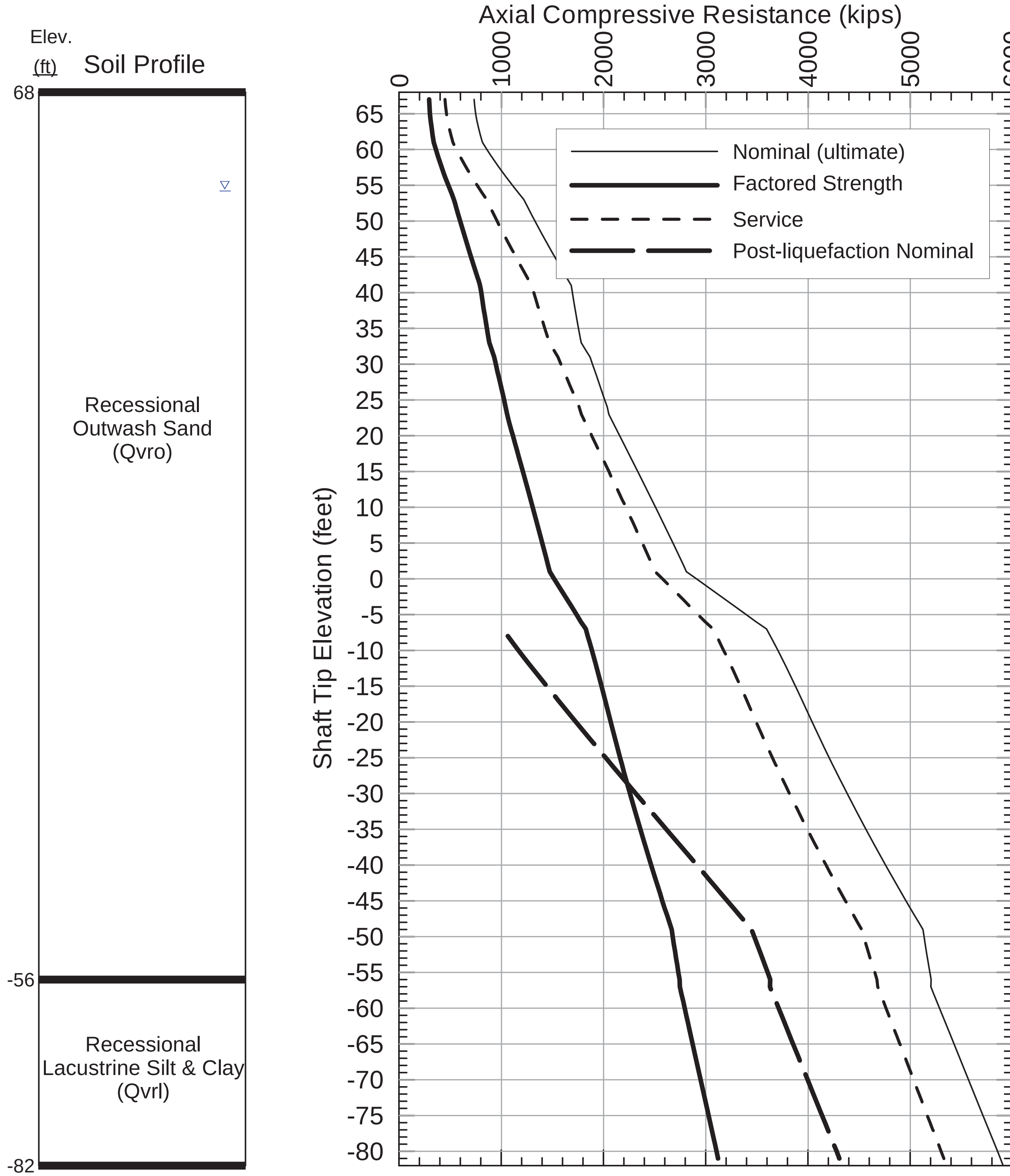


Notes:

1) Axial resistance values are for a 7-ft (or the 2.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has <u>not</u> been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes $\varphi_{side} = 0.55$ and $\varphi_{tip} = 0.40$.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

10-069 7-ft Shaft Axial Pier 1.grf w/ 10-069 7-ft Axial Shaft Resistance.xls 6/27/11 (9:26) REK

PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	AXIAL COMPRESSIVE RESISTANCE 7-FT DIAMETER SHAFT PIER 1 (WEST ABUTMENT)	
		Project No. 10-069	Figure No. 12

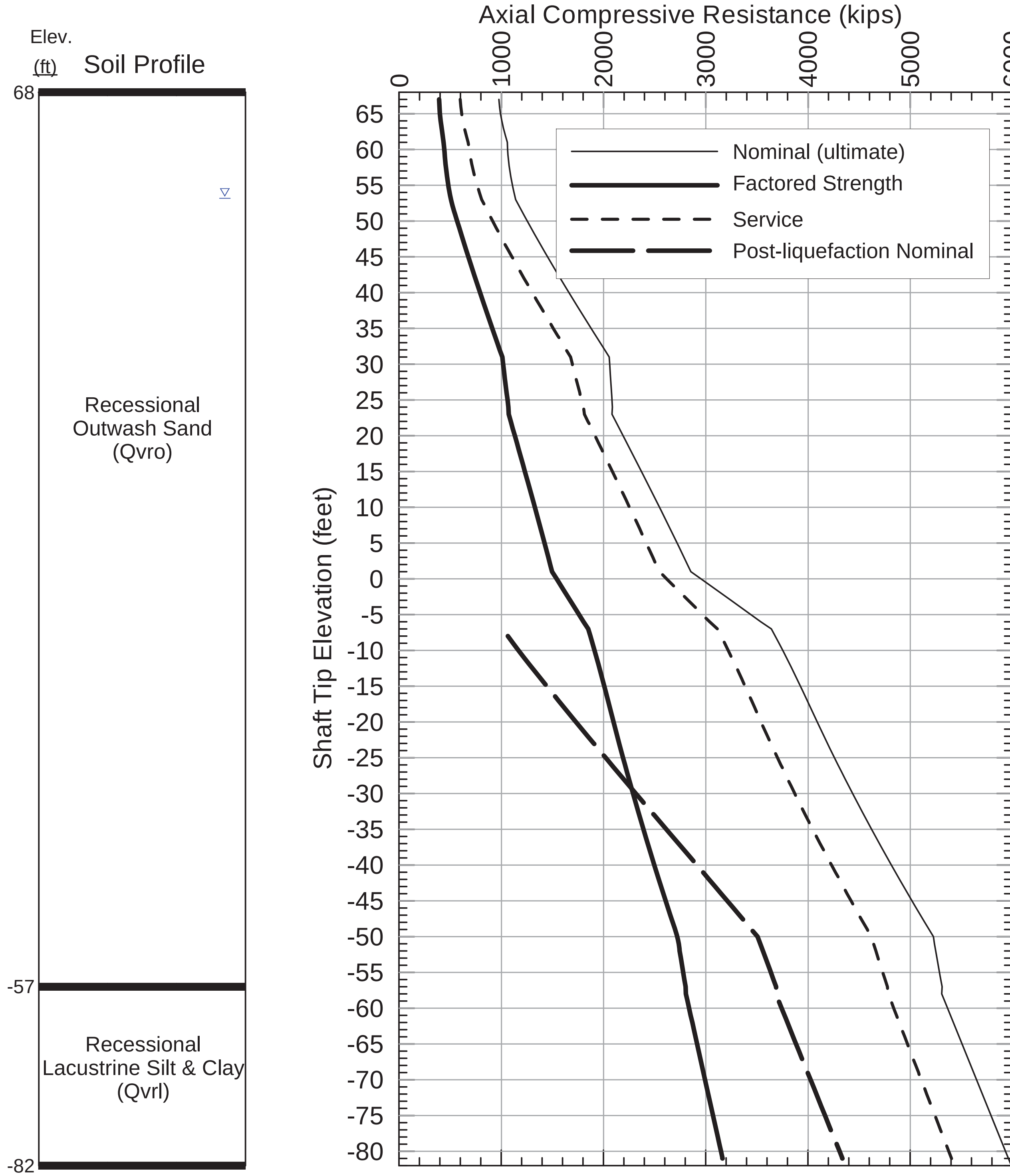


Notes:

1) Axial resistance values are for a 7-ft (or the 2.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

PanGEO INCORPORATED	**I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington**	**AXIAL COMPRESSIVE RESISTANCE 7-FT DIAMETER SHAFT PIER 2**
	Project No. **10-069**	Figure No. **13**

10-069 7-ft Shaft Axial Pier 2.grf w/ 10-069 7-ft Axial Shaft Resistance.xls 6/27/11 (9:27) REK



Notes:
1) Axial resistance values are for a 7-ft (or the 2.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has <u>not</u> been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes $\varphi_{side} = 0.55$ and $\varphi_{tip} = 0.40$.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

10-069 7-ft Shaft Axial Pier 3.grf w/ 10-069 7-ft Axial Shaft Resistance.xls 6/27/11 (9:29) REK

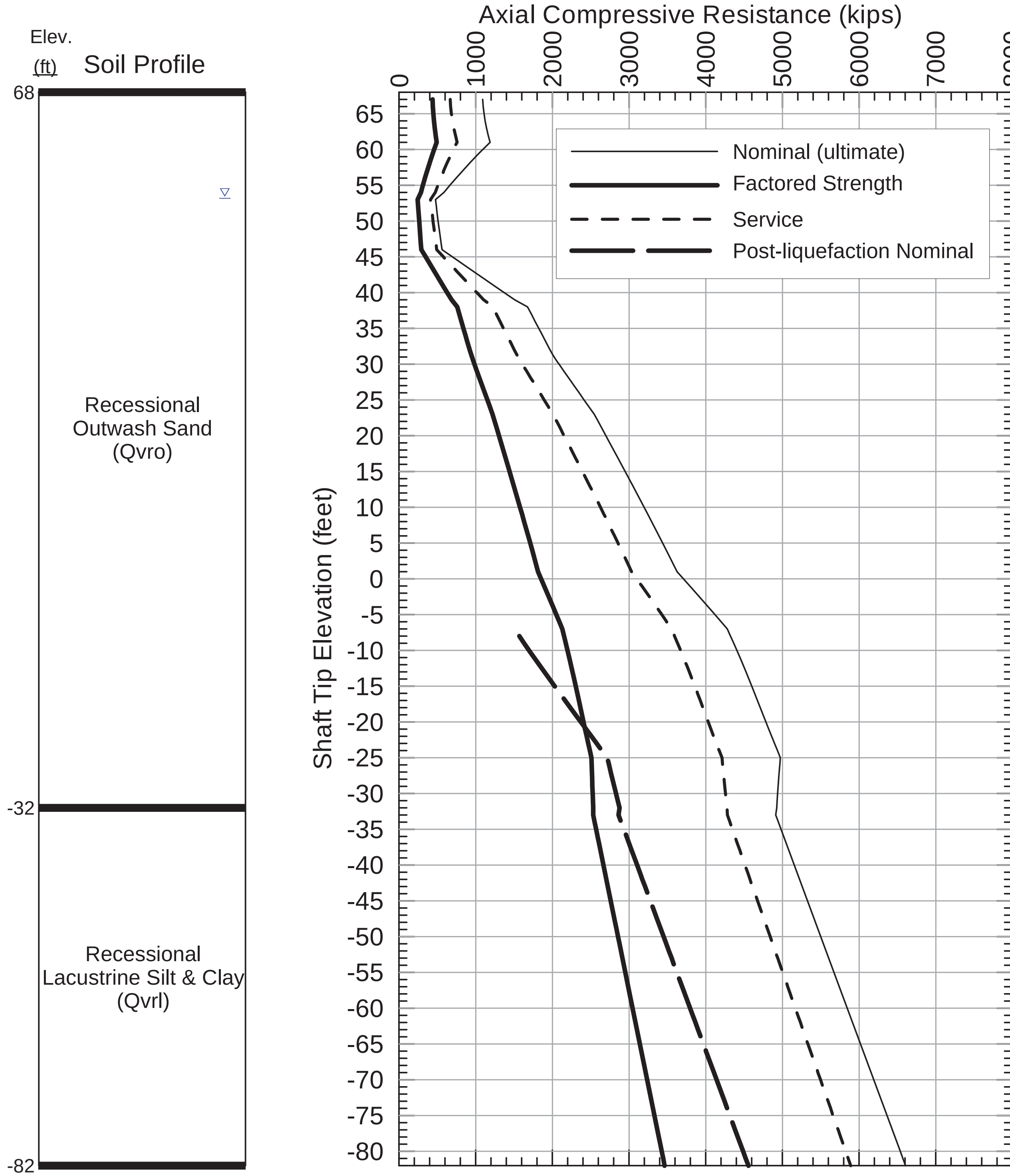
PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE
7-FT DIAMETER SHAFT
PIER 3 (EAST ABUTMENT)

Project No. **10-069**

Figure No. **14**

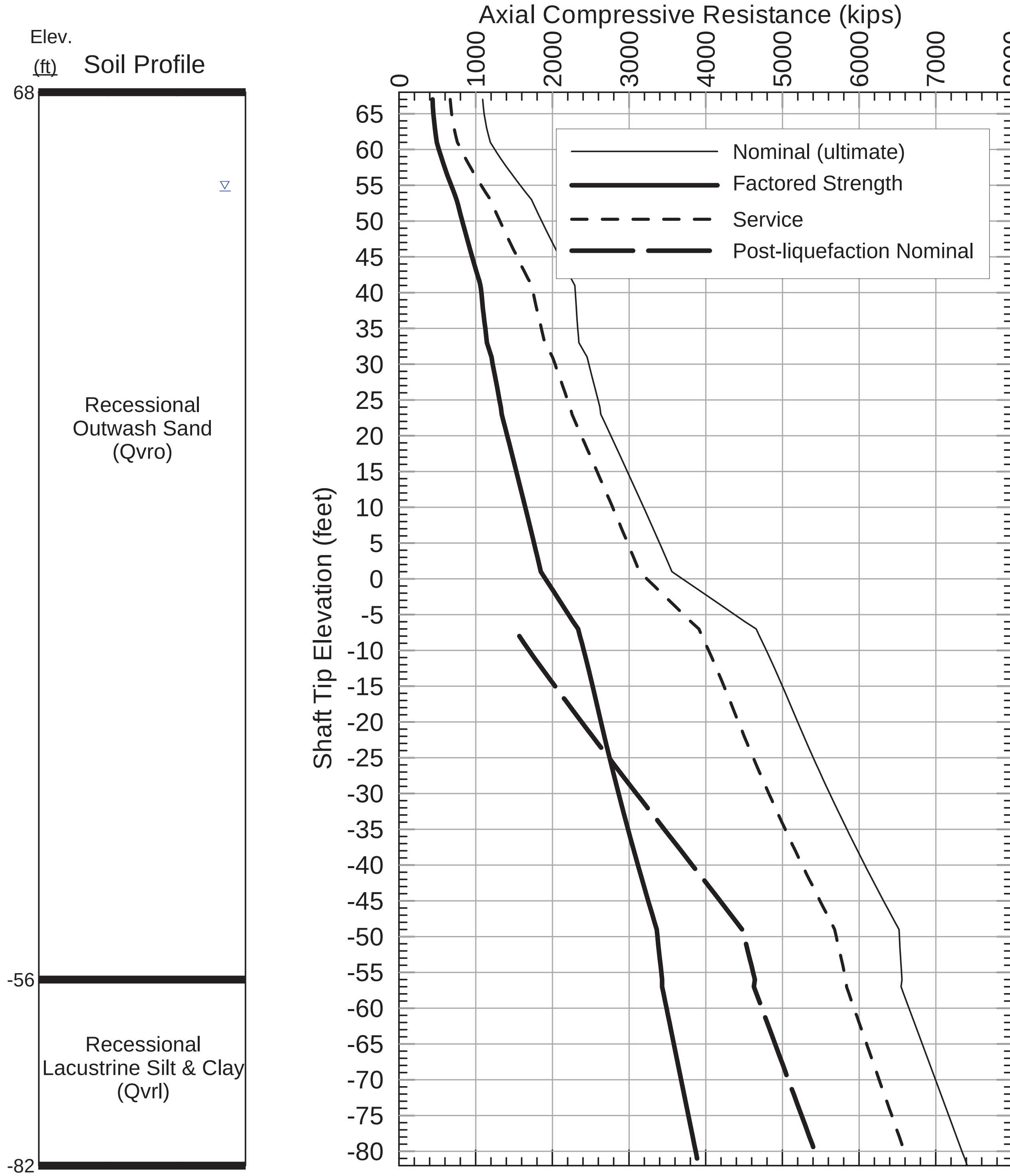


Notes:

1) Axial resistance values are for an 8-ft (or the 2.5 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

10-069 8-ft Shaft Axial Pier 1.grf w/ 10-069 8-ft Axial Shaft Resistance.xls 6/27/11 (8:57) REK

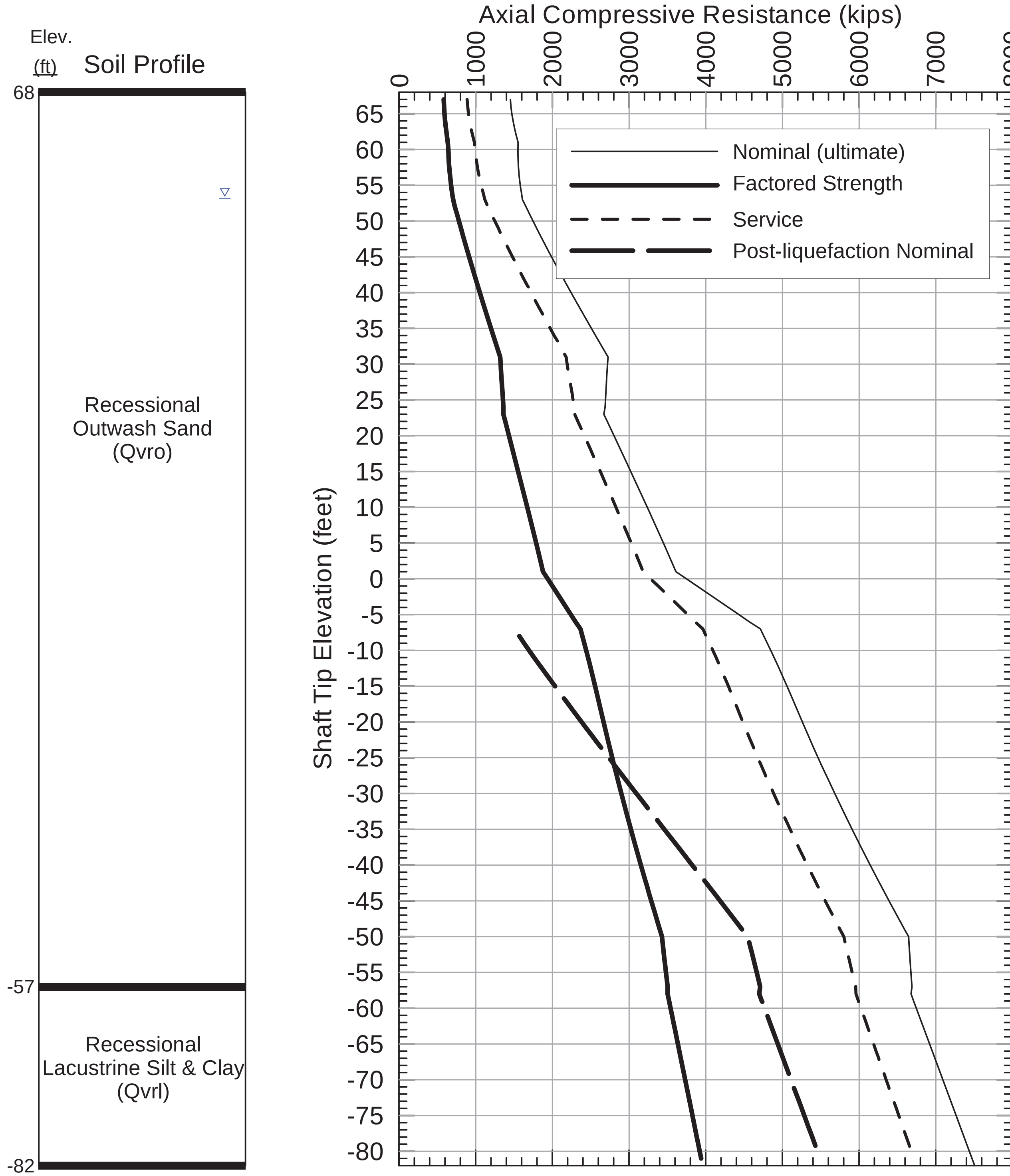
PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	AXIAL COMPRESSIVE RESISTANCE 8-FT DIAMETER SHAFT PIER 1 (WEST ABUTMENT)	
		Project No. 10-069	Figure No. 15



Notes:

1) Axial resistance values are for an 8-ft (or the 2.5 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes $\varphi_{side} = 0.55$ and $\varphi_{tip} = 0.40$.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

PanGEO INCORPORATED	**I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington**	**AXIAL COMPRESSIVE RESISTANCE 8-FT DIAMETER SHAFT PIER 2**
		Project No. **10-069** Figure No. **16**



Notes:

1) Axial resistance values are for an 8-ft (or the 2.5 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes $\varphi_{side} = 0.55$ and $\varphi_{tip} = 0.40$.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

10-069 8-ft Shaft Axial Pier 3.grf w/ 10-069 8-ft Axial Shaft Resistance.xls 6/27/11 (9:21) REK

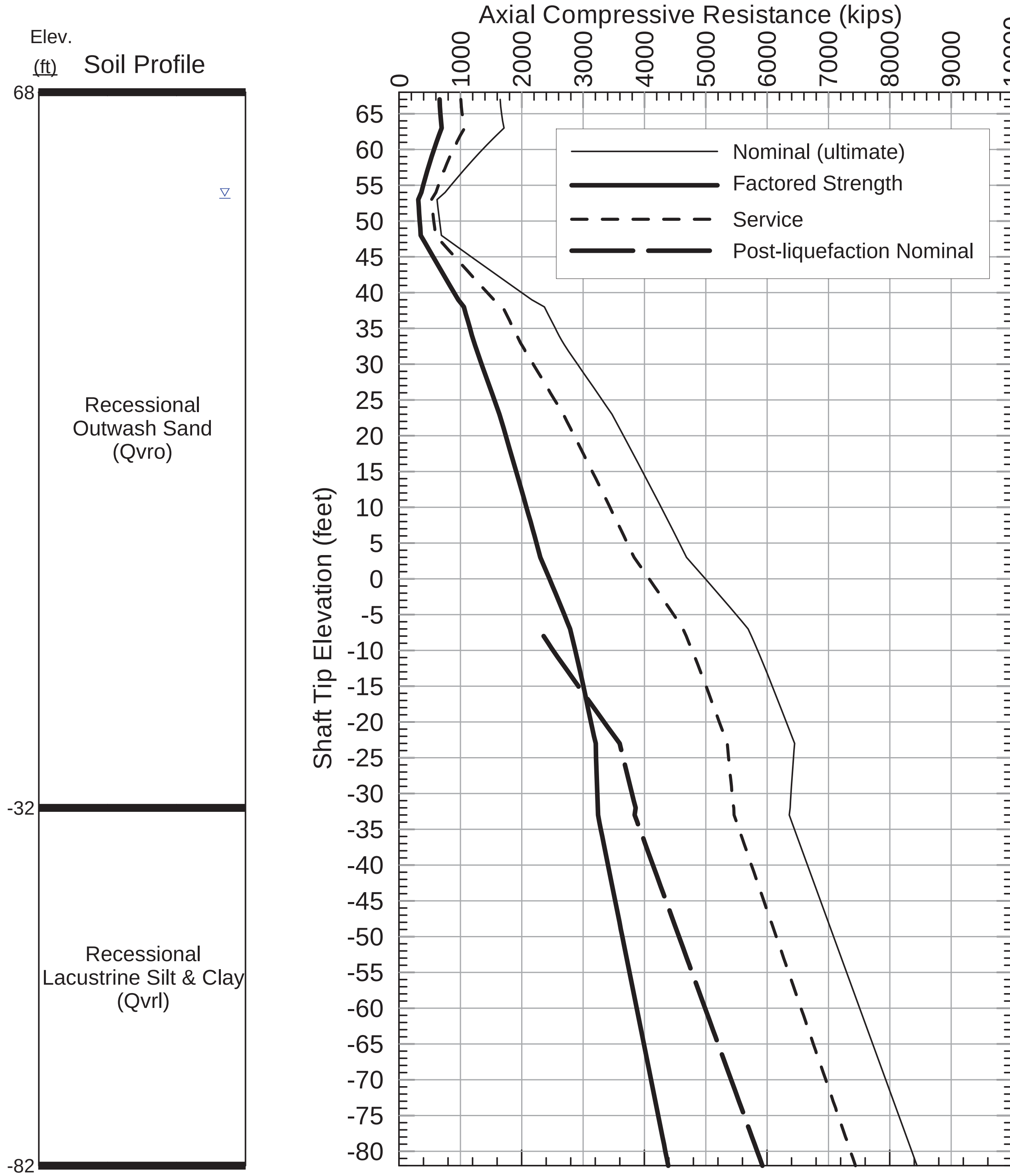
PanGEO INCORPORATED

**I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington**

**AXIAL COMPRESSIVE RESISTANCE
8-FT DIAMETER SHAFT
PIER 3 (EAST ABUTMENT)**

Project No. **10-069**

Figure No. **17**



Notes:
1) Axial resistance values are for a 10-ft (or the 3.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has <u>not</u> been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes φ_{side} = 0.55 and φ_{tip} = 0.40.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

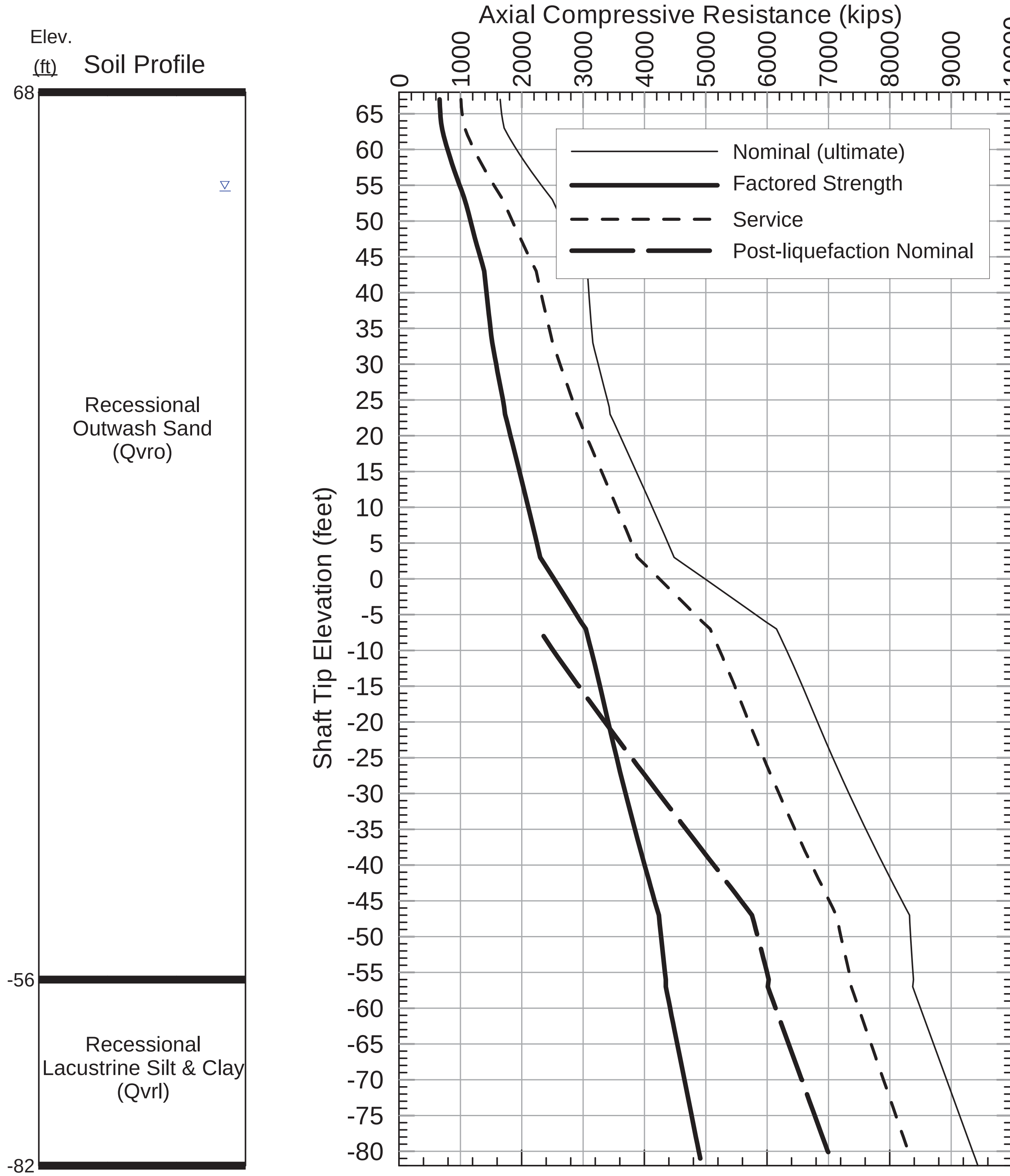
10-069 10-ft Shaft Axial Pier 1.grf w/ 10-069 10-ft Axial Shaft Resistance.xls 6/27/11 (9:35) REK

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE
10-FT DIAMETER SHAFT
PIER 1 (WEST ABUTMENT)

Project No.	Figure No.
10-069	**18**



Notes:
1) Axial resistance values are for a 10-ft (or the 3.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes $\varphi_{side} = 0.55$ and $\varphi_{tip} = 0.40$.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

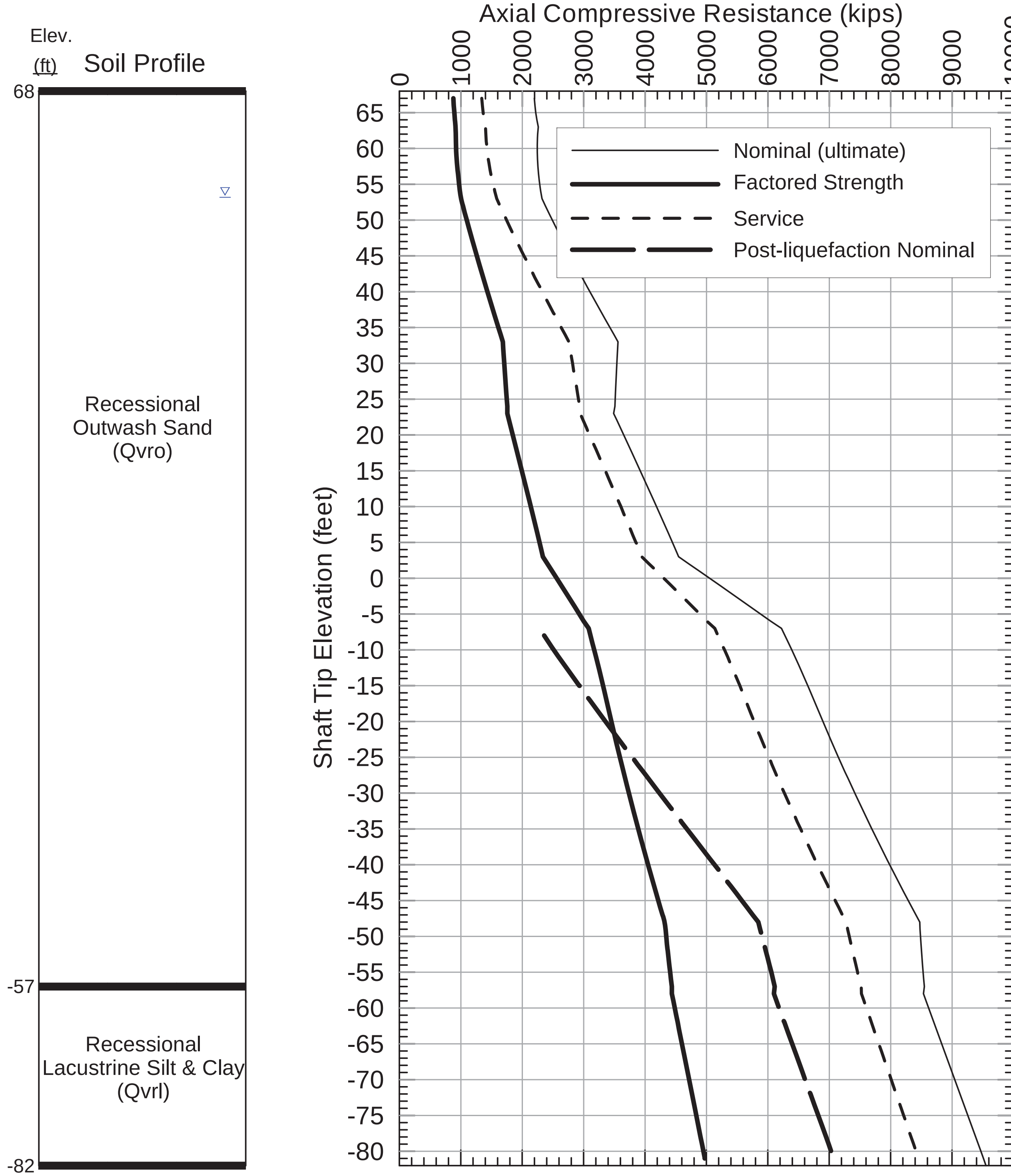
10-069 10-ft Shaft Axial Pier 2.grf w/ 10-069 10-ft Axial Shaft Resistance.xls 6/27/11 (9:37) REK

PanGEO INCORPORATED

I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington

AXIAL COMPRESSIVE RESISTANCE 10-FT DIAMETER SHAFT PIER 2

Project No.	Figure No.
10-069	19



Notes:
1) Axial resistance values are for a 10-ft (or the 3.0 m metric equivalent) diameter un-cased shaft.
2) Axial resistance values are gross values at the top of the shaft (i.e. the self-weight of the shaft has not been subtracted from the resistance values shown in these plots).
3) Factored strength limit state resistance includes $\varphi_{side} = 0.55$ and $\varphi_{tip} = 0.40$.
4) Service limit state resistance was developed to limit settlement to less than 1 inch.

10-069 10-ft Shaft Axial Pier 3.grf w/ 10-069 10-ft Axial Shaft Resistance.xls 6/27/11 (9:43) REK

PanGEO INCORPORATED	**I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington**	**AXIAL COMPRESSIVE RESISTANCE 10-FT DIAMETER SHAFT PIER 3 (EAST ABUTMENT)**
		Project No. **10-069** / Figure No. **20**

APPENDIX A

FIELD EXPLORATIONS
&
LOGS OF TEST BORINGS AND TEST PITS

APPENDIX A: FIELD EXPLORATIONS

Appendix A contains written and graphical logs of test borings and test pits presenting the factual and interpretive results of our exploration program at the subject site. The descriptions of the materials encountered in the test borings are primarily based on the soil samples extracted from the borings. The sample descriptions are augmented by observation of the drilling action and drill cuttings brought to the surface during field operations. The paragraphs below describe the field operations and sampling procedures used during the geotechnical field explorations.

FIELD EXPLORATIONS – TEST BORINGS

The 2010 subsurface exploration program consisted of twenty-three test borings, which were completed in four phases. The boring sites were marked in the field prior to drilling, based on the mapped locations of specific facilities. Following drilling, the final locations of the borings were marked with survey stakes and surveyed in. The first PanGEO subsurface exploration occurred from June 28 to July 7, 2010. During the first mobilization, a total of 19 shallow (32 feet or less) borings were completed. The second field exploration phase consisted of the boring drilled by WSDOT personnel (THT-21-10), and took place concurrently with the first PanGEO mobilization, on June 29, 2010. The third field (second PanGEO mobilization) exploration phae took place between July 27 and July 28, 2010, during which the two remaining deep borings (THT-20-10 and THT-22-10) were drilled. The deep borings were drilled to a depth of approximately 150 feet below the surface. The final boring (THT-23-10) was drilled on October 26, 2010. PanGEO personnel were on site for all field explorations except the WSDOT boring.

All shallow borings except THT-23-10 were drilled by Geologic Drill of Spokane, Washington, using a 4-inch diameter hollow stem auger drill string powered by a drill head mounted on a Bobcat tracked vehicle. THT-23-10 was drilled by Geologic Drill, but using a trailer mounted, 6 inch hollow stem auger drill. THT-21-10 was drilled by a WSDOT crew using mud rotary, CME drilling equipment. THT-20-10 and THT-22-10 were drilled using mud rotary drilling technology to avoid disturbance of the sandy soils below the water table, and to provide the best quality SPT data for foundation design. The borings were drilled by Holocene Drilling of Edgewood, Washington, using a tire mounted Mobil B-61 drill rig.

SAMPLING METHODS

Soils encountered were generally sampled using conventional SPT split spoon samplers. The shallow borings were sampled using 140-lb safety hammer activated with a rope and cathead system. The deep borings were sampled with a sampler driven by a 140-lb safety hammer activated with an auto-trip mechanism.

Soil samples were obtained from the borings generally at 5-foot intervals. Borings located in proposed stormwater infiltration facilities were continuous sampled beginning either at a depth of 10 feet or 0 feet below surface, depending on the type and anticipated depth of the facility (pond or trench). The continuous sampling extended for a distance of approximately 20 feet in all the borings so sampled.

Standard Penetration Tests (SPT) sampling was performed in general accordance with ASTM D-1586 using a 2-inch outside diameter split-spoon sampler. The samplers were driven into the soil a distance of 18 inches using a 140-pound weight falling a distance of 30 inches. The hammers for the deep borings were operated using an auto-trip hammer. The hammer for the shallow borings was operated by means of a rope and cathead mechanism. The number of blows to drive the sampler each 6 inches over an 18-inch interval was recorded and indicated on the boring logs. The number of blows to drive the sampler the final 12 inches is termed the SPT resistance, or N-value, and is used to evaluate the strength and consistency/relative density of the soil.

An engineer or engineering geologist from PanGEO or the WSDOT Drill Inspector assigned to the crew was present throughout the various phases of the field exploration program to observe the borings, assist in sampling, and to prepare descriptive logs of the explorations. Soils were described in general accordance with the guidelines shown on Figure A-1. The stratigraphic contacts shown on the summary logs represent the approximate boundaries between soil types; actual stratigraphic contacts encountered at other locations in the field may differ from the contact elevations shown on the logs, and may be gradual rather than abrupt. The soil and groundwater conditions depicted are only for the specific date and locations reported, and therefore, are not necessarily representative of other locations and times.

FIELD EXPLORATIONS – TEST PITS

To obtain additional samples for laboratory testing, three test pits were excavated on September 8, 2011, at the location of the two proposed CAVFS, and the relocated pond in the NW quadrant of the interchange. The locations of the test pits were measured in the field based on existing site features. The ground surface elevation at the location of the test pits was visually estimated based on the elevation difference between the ground surface elevation at the test pit, and adjacent test boring locations that had previously been surveyed. The test pits were excavated with a rubber-tracked mini-excavator owned and operated by Northwest Excavating & Trucking Co, Inc. to a depth of approximately 8 feet below the existing ground surface at the location of the CAVFS, and to a depth of approximately 10 feet below the existing ground surface at the location of the NW quadrant pond. An engineer from PanGEO was present during the test pit excavations to obtain representative soil samples and to describe and document the soils encountered in the explorations. The soil samples were described using the system outlined on Figure A-1. The relative in-situ density of cohesionless soils, or the relative consistency of fine-grained soils, was estimated from the excavating action of the excavator, and the stability of the test pit sidewalls. After the test pit was logged and photographed, the excavation was backfilled with the excavated soils, the surface was tamped smooth, and straw was spread over the disturbed ground surface.

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean CLAY
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes:

1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.

2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered:	Units of material distinguished by color and/or composition from material units above and below	Fissured:	Breaks along defined planes
Laminated:	Layers of soil typically 0.05 to 1mm thick, max. 1 cm	Slickensided:	Fracture planes that are polished or glossy
Lens:	Layer of soil that pinches out laterally	Blocky:	Angular soil lumps that resist breakdown
Interlayered:	Alternating layers of differing soil material	Disrupted:	Soil that is broken and mixed
Pocket:	Erratic, discontinuous deposit of limited extent	Scattered:	Less than one per foot
Homogeneous:	Soil with uniform color and composition throughout	Numerous:	More than one per foot
		BCN:	Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

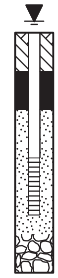
SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Spilt Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level



- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

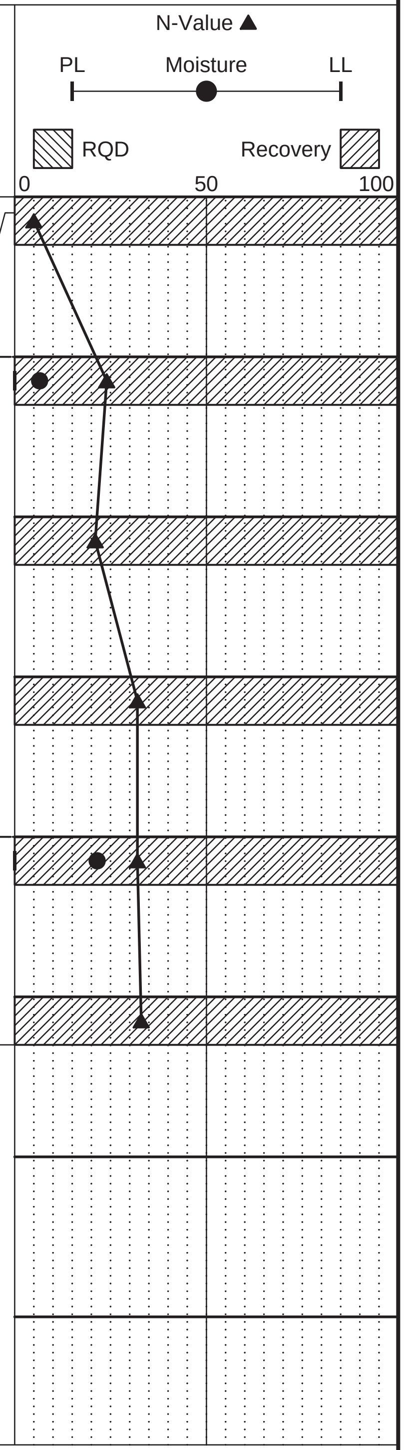
PanGEO INCORPORATED
Phone: 206.262.0370

Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	I-5 NE 116th Interchange	Surface Elevation:	71.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1	X	2 2 3			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Loose, moist, reddish-brown, silty fine SAND **(Recessional Outwash)**.
5	S-2	X	7 11 13	GS		Medium dense to dense, SAND with silt (SP-SM): moist to wet, gray, poorly graded, interbedded fine to medium SAND and slighty silty SAND; trace subrounded gravel, layered iron oxide staining **(Recessional Outwash)**
10	S-3	X	7 10 11			-grades to fine to coarse sand.
15	S-4	X	9 12 20			-becomes dense, wet, moderate heave observed; driller adding bentonite drilling slurry- 16 to 25 feet.
20	S-5	X	11 14 18	GS		Dense, gray, silty SAND (SM): wet, trace subrounded gravel, **(Recessional Outwash)**
25	S-6	X	8 14 19			
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 15 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 221+15, 444' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

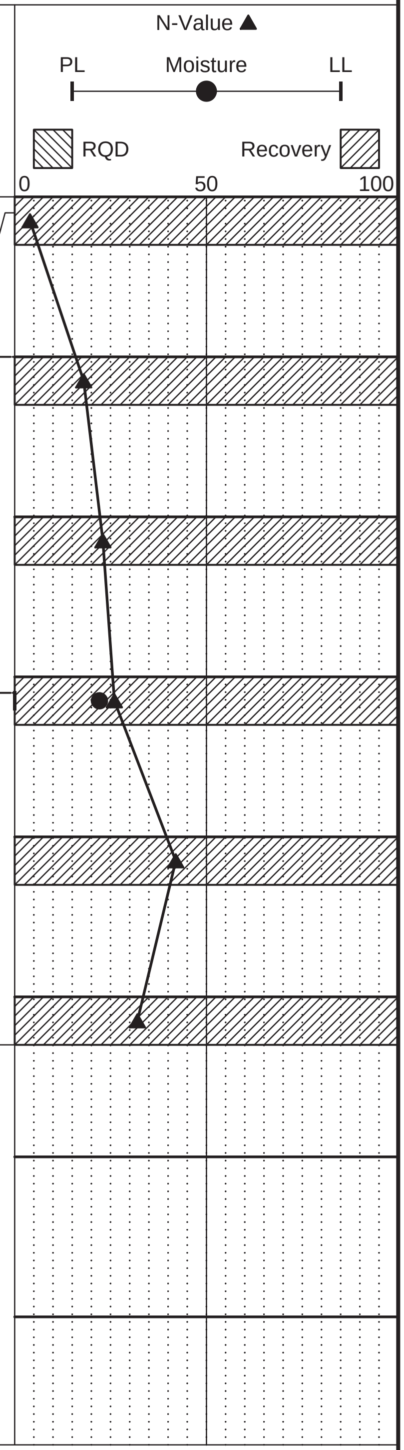
LOG OF TEST BORING THT-01-10

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	69.9ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		2 2 2			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Loose to medium dense, moist, reddish-brown, silty SAND; occasional fine organics **(Recessional Outwash)**
5	S-2		5 10 8			Medium dense, moist to wet, gray to brown, interbedded fine to medium SAND and slightly silty SAND; trace subrounded gravel, layered iron oxide staining **(Recessional Outwash)**
10	S-3		9 11 12			
15	S-4		12 12 14	GS		Medium dense to dense, wet, gray, silty SAND (SM): trace subrounded gravel, moderate heave observed **(Recessional Outwash)**
20	S-5		11 19 23			-becomes dense, decreased gravel, thin iron oxide stained layers.
25	S-6		10 16 16			-increasing SILT, rapid dilatancy.
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 15 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 218+71, 304' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

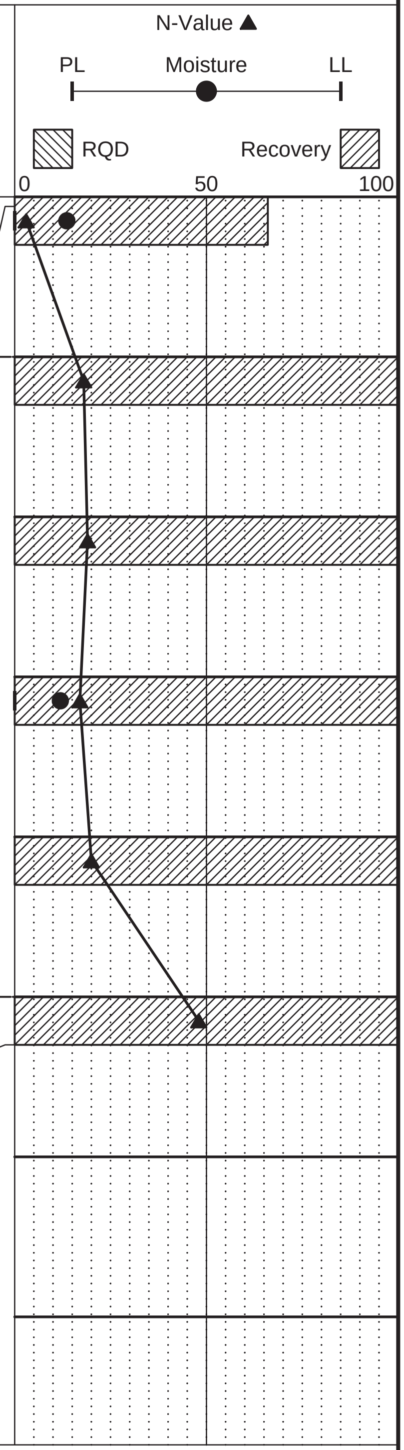
LOG OF TEST BORING THT-02-10

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.7ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1	☒	1 2 1	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Loose to medium dense, moist, reddish-brown, SAND with silt (SP-SM); poorly graded, occasional fine organics **(Recessional Outwash)**.
5	S-2	☒	5 9 9			Medium dense, moist to wet, gray to brown, silty SAND (SM); fine to medium grained, occasional subrounded gravel, lenses of silt, layered iron oxide staining **(Recessional Outwash)**
10	S-3	☒	8 9 10			
15	S-4	☒	5 7 10	GS		-thin interbeds of SILT and fine SAND, iron oxide stained.
20	S-5	☒	8 12 8			
					▽	-becomes wet.
25	S-6	☒	20 22 26			Dense, wet, gray, slightly silty, fine to coarse SAND; trace fine gravel **(Recessional Outwash)**
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 15 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 215+63, 223' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

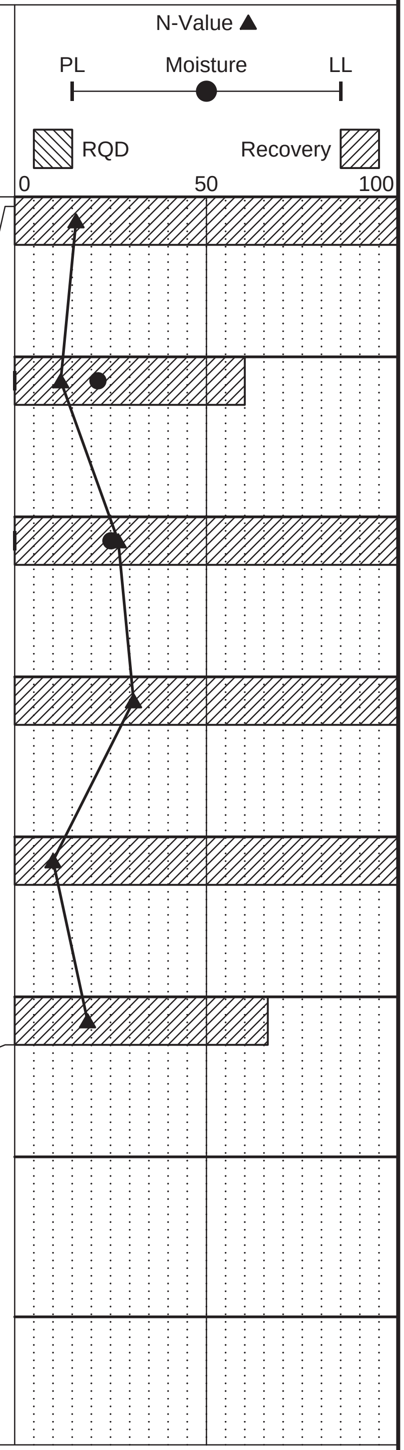
LOG OF TEST BORING THT-03-10

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	53.3ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 6 10			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist to wet, gray to brown, silty SAND (SM); fine to medium grained, interbedded finer and coarser sand, occasional subrounded gravel, lenses of silty sand and silt, layered iron oxide staining **(Recessional Outwash)**
5	S-2		3 5 7	GS		
						-becomes wet.
						-driller adding bentonite drilling slurry, 10 to 25 feet.
10	S-3		8 12 15	GS		-silty sand (SM), occasional thin beds of fine organics, mottled iron oxide staining, rapid dilatancy.
15	S-4		6 13 18			-becomes dense, decreasing SILT.
20	S-5		4 4 6			-becomes loose, brown, thin interbeds of fine to medium silty SAND and SILT; silty SAND has rapid dilatancy, iron oxide stained.
25	S-6		6 8 11			-becomes medium dense, gray, with layered iron oxide staining, occasional SILT interbeds, thinly laminated.
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 15 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 217+45, 95' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

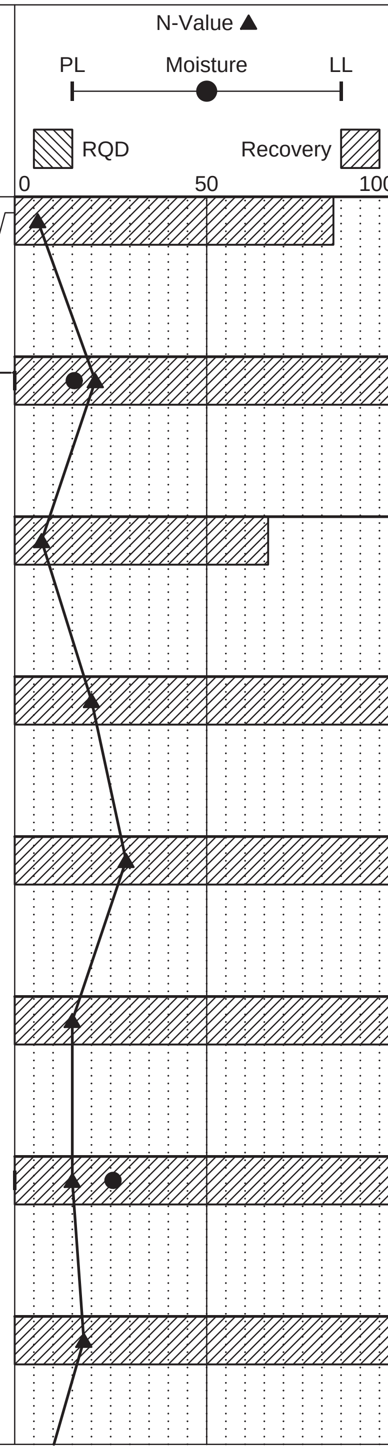
LOG OF TEST BORING THT-04-10

Figure A-5

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	61.8ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 3 3			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Loose, moist, brown, silty SAND; scattered fine organics and rootlets **(Fill)**.
5	S-2		8 10 11	GS		Medium dense to loose, moist to wet, gray-brown, silty SAND (SM); fine to medium grained, scattered organic and woody debris, **(Recessional Outwash)**
10	S-3		2 3 4			-loose, driller adding bentonite drilling slurry, 10 to 50 feet.
15	S-4		10 10 10			-becomes medium dense.
20	S-5		9 14 15			-decreased organics.
25	S-6		6 7 8			
30	S-7		3 6 9	GS		-sand with silt (SP-SM), poorly graded; interbeds of SILT, silty SAND and fine to medium SAND; scattered fine organics, rapid dilatancy.
35	S-8		3 9 9			-iron oxide staining.



Completion Depth:	51.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 220+42, 127' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

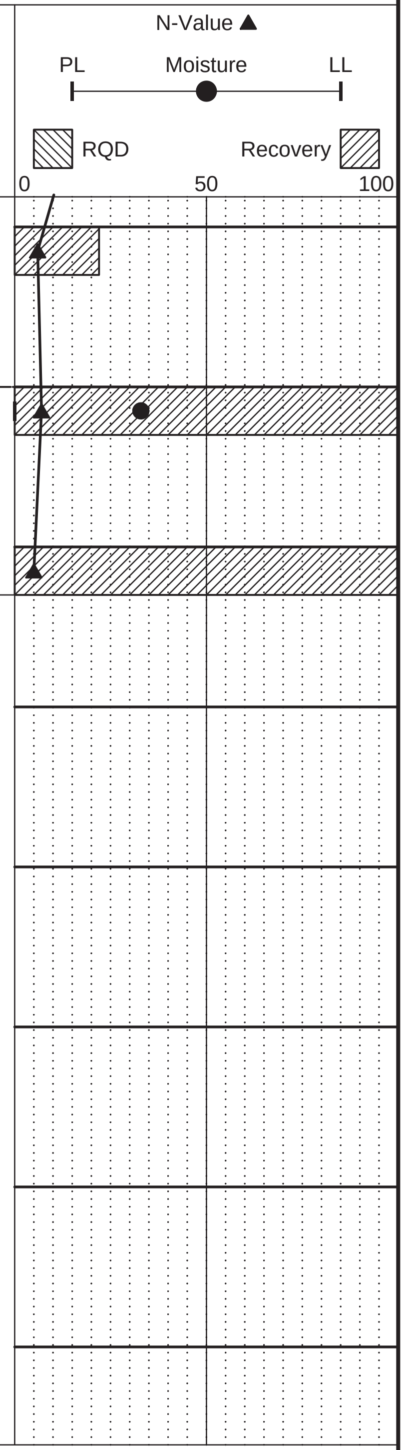
LOG OF TEST BORING THT-05-10

Figure A-6

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	61.8ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40	S-9	⊠	2 3 3			Medium dense to loose, moist to wet, gray-brown, silty SAND (SM); fine to medium grained, scattered organic and woody debris, **(Recessional Outwash)** *(Continued)* -moderate heave observed, becomes gray, loose.
45	S-10	⊠	3 2 5	GS		Medium stiff, wet, gray-brown, SILT with sand (ML); interbeds of silty fine SAND and clayey SILT, scattered organic and woody debris, SILT is massive, with medium plasticity **(Recessional Outwash)**
50	S-11	⊠	3 2 3			
						Bottom of boring at approximately 51.5 ft. Groundwater was estimated at about 10 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
55						
60						
65						
70						
75						



Completion Depth:	51.5ft
Date Borehole Started:	6/28/10
Date Borehole Completed:	6/28/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 220+42, 127' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

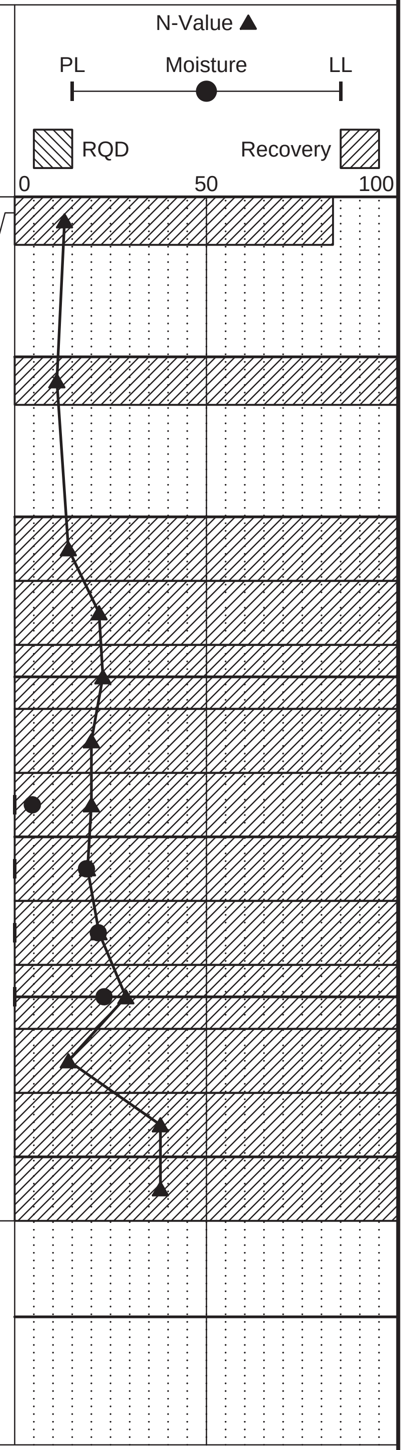
LOG OF TEST BORING THT-05-10

Figure A-6

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	78.8ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		5 6 7			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense to dense, moist to wet, brown-gray, SAND with silt (SP-SM); fine to medium grained, poorly graded, interbedded with finer and coarser beds, occasional subrounded gravel, lenses of silty sand and silt **(Recessional Outwash)**
5	S-2		5 6 5			-becomes reddish brown.
						-possible woody debris based on driller's comments.
10	S-3		6 7 7			
	S-4		3 10 12			-layered iron oxide staining, increased fine, sub-angular gravel.
15	S-5		10 11 12			
	S-6		8 9 11			
	S-7		7 10 10	GS		-poorly graded sand with silt (SP-SM).
20	S-8		6 7 12	GS		-becoming silty sand (SM).
						-becomes wet, thinly laminated silty fine SAND (SM).
	S-9		9 10 12	GS		-poorly graded sand with silt (SP-SM), driller adding bentonite drilling slurry, 22 to 30 feet.
25	S-10		6 12 17	GS		-becomes dense to medium dense, silty sand (SM).
	S-11		6 7 7			-occasional thin beds of iron oxide stained fine sandy SILT and silty SAND to bottom of hole.
	S-12		14 18 20			
30	S-13		10 15 23			
						Bottom of boring at approximately 32 ft. Groundwater was estimated at about 21.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						Note: Samples S-3 through S-13 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	6/29/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 221+07, 312' RT.

LOG OF TEST BORING THT-06-10

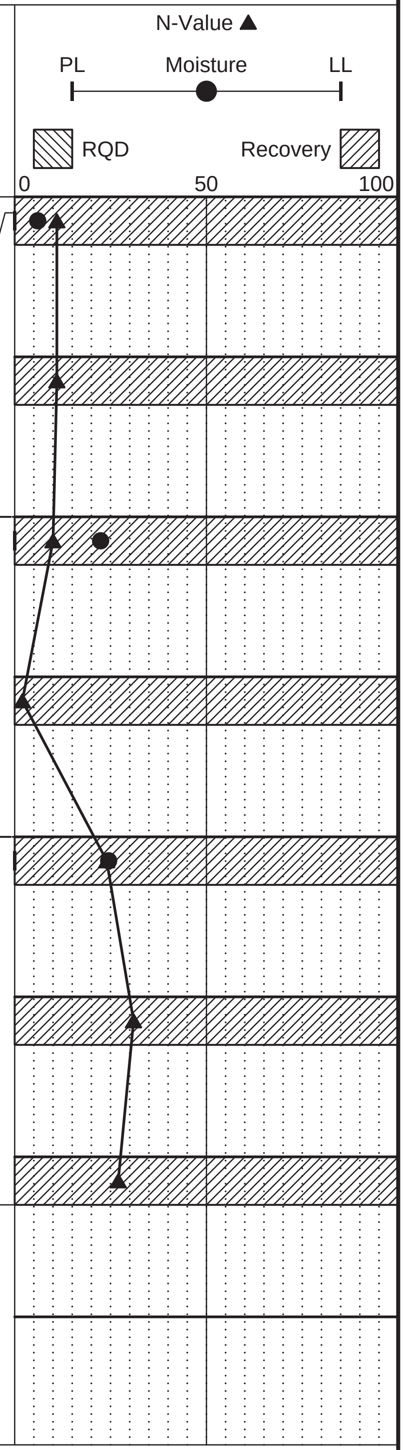
PanGEO INCORPORATED
Phone: 206.262.0370

Figure A-7

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	62.1ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
0	S-1	X	4 5 6	GS	Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
					Medium dense, moist, brown, SAND with silt (SP-SM); fine to medium grained, poorly graded, occasional subrounded gravel, layered iron oxide staining **(Recessional Outwash)**
5	S-2	X	5 5 6		
10	S-3	X	5 5 5	GS	Loose, wet, gray, SAND with silt (SP-SM); fine to medium grained, poorly graded, occasional fine organics, occasional iron oxide staining **(Recessional Outwash)**
15	S-4	X	1 1 1		-very loose, driller adding bentonite drilling slurry, 15 to 30 feet.
20	S-5	X	7 11 13	GS	Medium dense to dense, wet, gray to reddish-brown SAND with silt (SP-SM); poorly graded, thin beds of iron oxide staining, trace fine organics, moderate heave observed at Sample S-5 **(Recessional Outwash)**.
25	S-6	X	11 14 17		-occasional fine gravel, rapid dilatancy, dense at Sample S-6.
30	S-7	X	7 11 16		
					Bottom of boring at approximately 31.5 ft. Groundwater was estimated at about 10 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35					



Completion Depth:	31.5ft
Date Borehole Started:	7/6/10
Date Borehole Completed:	7/6/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 221+20, 117' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

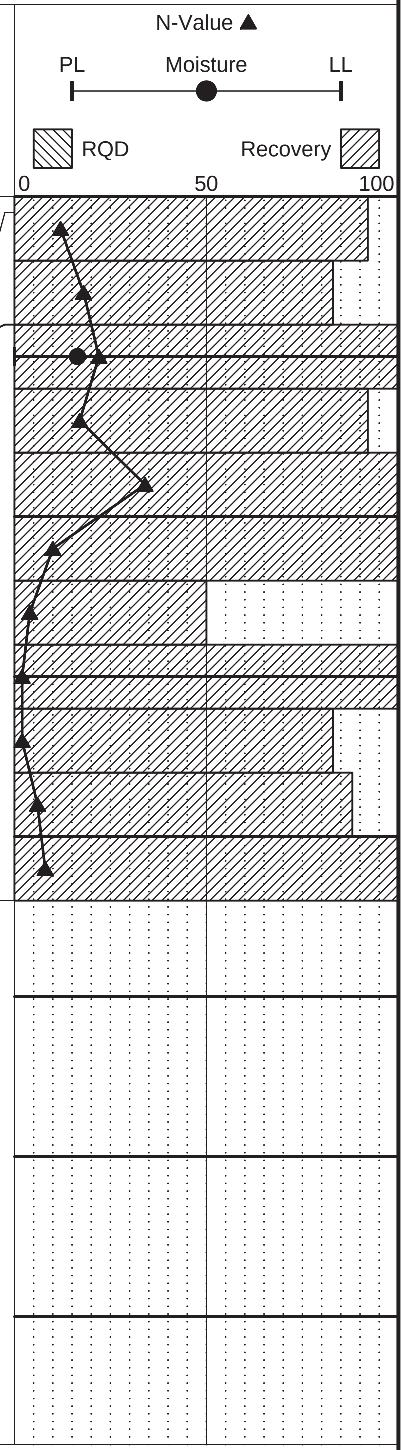
LOG OF TEST BORING THT-07-10

Figure A-8

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	54.6ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 5 7			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
	S-2		7 8 10			Medium dense, moist, gray, interbedded slightly silty to silty, fine to medium SAND; occasional fine organics, occasional iron oxide staining **(Recessional Outwash)**
5	S-3		13 13 9	GS		Medium dense to very loose, wet, brown to reddish-brown, silty SAND (SM); fine to medium grained, trace fine organics, occasional subrounded gravel, layered iron oxide staining **(Recessional Outwash)**.
	S-4		6 9 8			
	S-5		6 14 20			-becomes gray, with occasional fine organics; driller adding bentonite drilling slurry, 8 to 30 feet.
10	S-6		8 6 4			-becomes loose, with increasing organics and wood debris, occasional thin beds of clayey SILT, dense at Sample S-5.
	S-7		3 2 2			-very loose to 18'.
15	S-8		1 1 1			-becomes gray-brown.
	S-9		1 1 1			
	S-10		2 2 4			
20	S-11		3 3 5			-medium dense.
						Bottom of boring at approximately 22 ft. Groundwater was estimated at about 4 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
25						Note: Samples S-1 through S-11 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.
30						
35						



Completion Depth:	22.0ft	Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 218+27, 88' LT.
Date Borehole Started:	7/6/10	
Date Borehole Completed:	7/6/10	
Logged By:	Nels Reese, L.G.	
Drilling Company:	Geologic Drill, Inc.	

PanGEO INCORPORATED
Phone: 206.262.0370

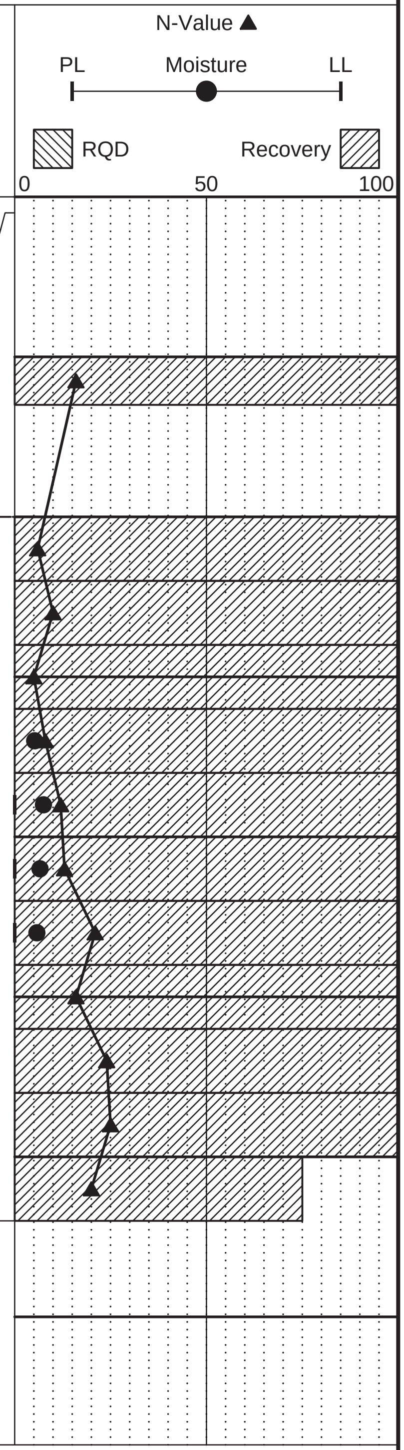
LOG OF TEST BORING THT-08-10

Figure A-9

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	79.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense to loose, moist, brownish-gray, fine to medium SAND; trace silt, fine gravel, occasional iron oxide staining **(Recessional Outwash)**
5	S-1		5 8 8			
10	S-2		3 3 3			Loose to medium dense, moist, gray, SAND; poorly graded, trace silt and fine gravel, occasional interbeds of brown slightly silty SAND **(Recessional Outwash)**
	S-3		3 5 5			
15	S-4		3 3 2			-increasing SILT, iron oxide stained at bottom of sample.
	S-5		4 4 4	GS		
	S-6		4 6 6	GS		-becomes poorly graded sand with silt (SP-SM), medium dense.
20	S-7		6 6 7	GS		-poorly graded sand with silt (SP-SM).
	S-8		7 10 11	GS		-poorly graded sand with silt (SP-SM).
25	S-9		8 9 7			-occasional thin beds of fine sandy SILT, decreased coarse SAND.
	S-10		8 9 15			
	S-11		12 12 13			-becomes wet.
30	S-12		7 9 11			
35						Bottom of boring at approximately 32 ft. Groundwater was estimated at about 29 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions. Note: Samples S-2 through S-12 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft
Date Borehole Started:	7/6/10
Date Borehole Completed:	7/6/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 223+97, 311' LT.

LOG OF TEST BORING THT-09-10

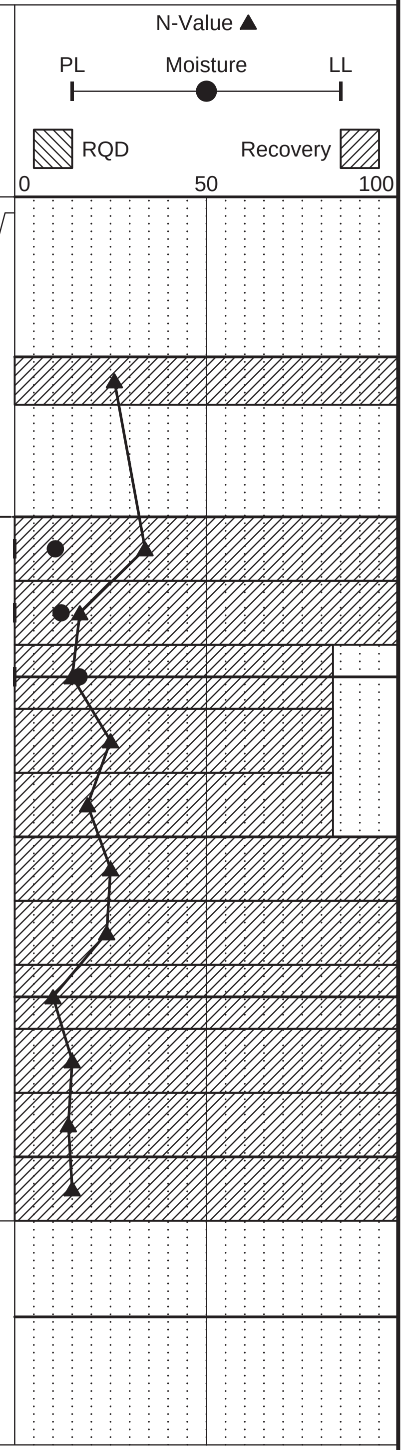
PanGEO INCORPORATED
Phone: 206.262.0370

Figure A-10

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	70.6ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist to wet, brown to gray-brown, fine to medium SAND; trace fine silt and rounded gravel, occasional iron oxide staining **(Recessional Outwash)**
5	S-1		9 11 15			
10	S-2		13 17 17	GS		Dense to medium dense, moist to wet, gray to brownish-gray, silty SAND (SM); interbeds of fine to medium sand, trace silt, fine gravel, occasional iron oxide staining and thin organic rich beds **(Recessional Outwash)**
	S-3		10 9 8	GS		-grades to poorly graded sand with silt (SP-SM), increasing moisture, drillers adding bentonite drilling slurry, 12 to 30 feet.
15	S-4		7 8 7	GS		-grades to well graded sand with silt (SW-SM).
	S-5		10 12 13			
	S-6		9 9 10			-becomes wet.
20	S-7		7 9 16			
	S-8		13 14 10			
25	S-9		6 4 6			-numerous fine organics, increased SILT, medium to rapid dilatancy.
	S-10		5 7 8			
	S-11		4 7 7			
30	S-12		3 6 9			
35						Bottom of boring at approximately 32 ft. Groundwater was estimated at about 18 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
						Note: Samples S-2 through S-12 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft
Date Borehole Started:	7/2/10
Date Borehole Completed:	7/2/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 224+80, 247' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

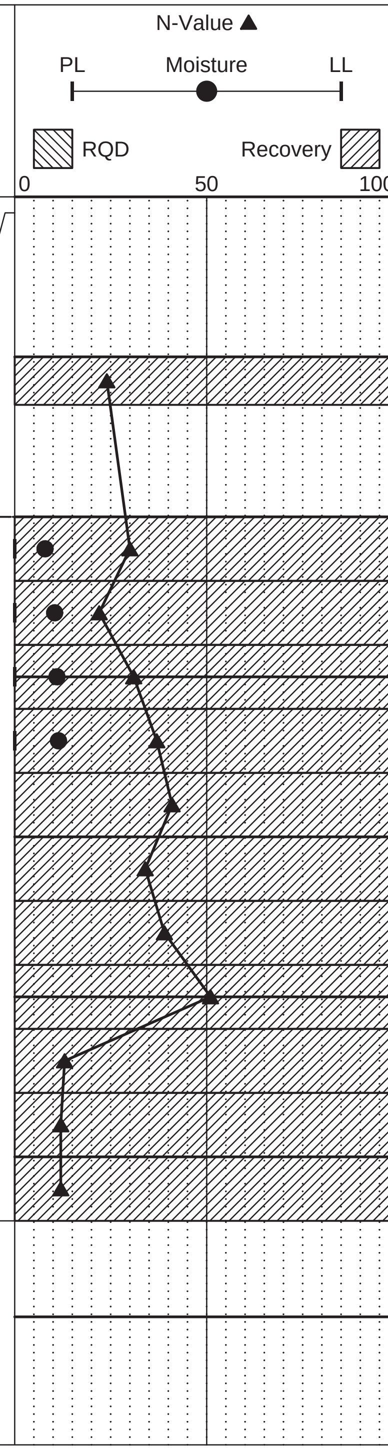
LOG OF TEST BORING THT-10-10

Figure A-11

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	73.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist, brown to gray-brown, fine to medium SAND; trace silt and fine rounded gravel, occasional iron oxide staining **(Recessional Outwash)**
5	S-1		9 11 13			
10	S-2		10 15 15	GS		Medium dense to dense, moist to wet, gray to brownish-gray, SAND with silt (SP-SM); poorly graded, interbeds of fine to medium sand, trace silt, fine gravel, layered iron oxide staining, occasional thin beds of fine oganics **(Recessional Outwash)**
	S-3		10 10 12	GS		-grading to well graded sand with silt (SW-SM).
15	S-4		12 15 16	GS		-grading to silty sand (SM).
	S-5		12 16 21	GS		-silty sand (SM).
	S-6		18 20 21			-becomes wet, drillers adding bentonite drilling slurry, 12 to 30 feet.
20	S-7		10 14 20			
	S-8		13 18 21			
25	S-9		14 24 27			
	S-10		5 7 6			-becomes medium dense, increasing SILT.
	S-11		6 5 7			
30	S-12		6 5 7			
						Bottom of boring at approximately 32 ft. Groundwater was estimated at about 18 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						Note: Samples S-2 through S-12 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft	Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 226+07, 197' LT.
Date Borehole Started:	7/1/10	
Date Borehole Completed:	7/1/10	
Logged By:	Nels Reese, L.G.	
Drilling Company:	Geologic Drill, Inc.	

PanGEO INCORPORATED
Phone: 206.262.0370

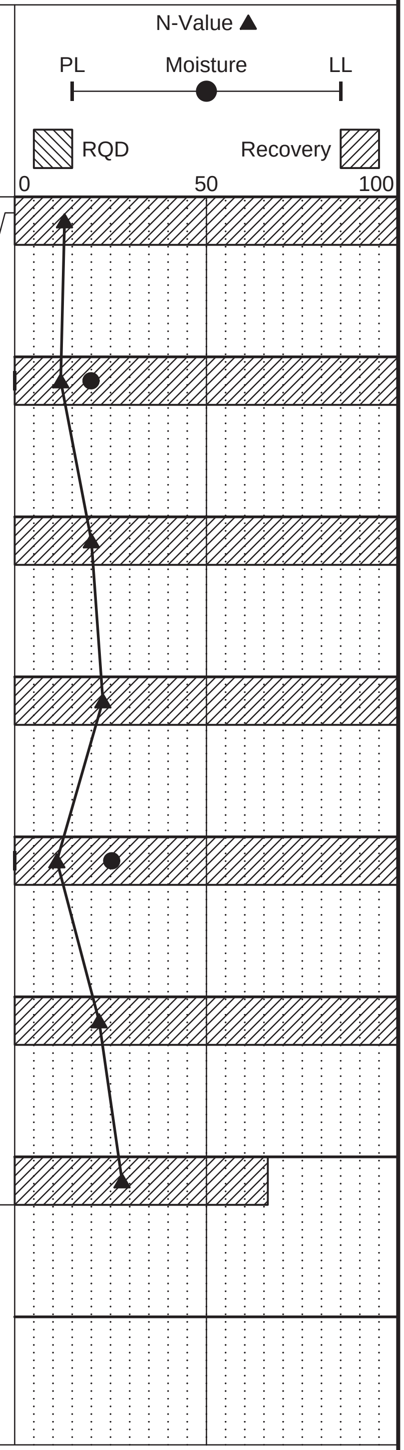
LOG OF TEST BORING THT-11-10

Figure A-12

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	70.3ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 6 7			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Medium dense, moist, gray to brownish-gray, silty SAND (SM); fine to medium grained, trace fine gravel, interbeds of slightly silty sand **(Recessional Outwash)**
5	S-2		4 6 6	GS		-occassional fine organics and wood debris.
10	S-3		7 10 10			-occassional thin silt beds, fine oganics, and woody debris, iron oxide stained.
						-becomes wet, drillers adding bentonite drilling slurry, 12.5 to 30 feet.
15	S-4		10 10 13			-rapid dilatancy, layered iron oxide staining.
20	S-5		5 5 6	GS		-silty sand (SM), grades brown, with interbeds of clayey silt.
25	S-6		8 10 12			
30	S-7		8 15 13			
						Bottom of boring at approximately 31.5 ft. Groundwater was estimated at about 12.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						



Completion Depth:	31.5ft
Date Borehole Started:	7/2/10
Date Borehole Completed:	7/2/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 226+89, 114' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

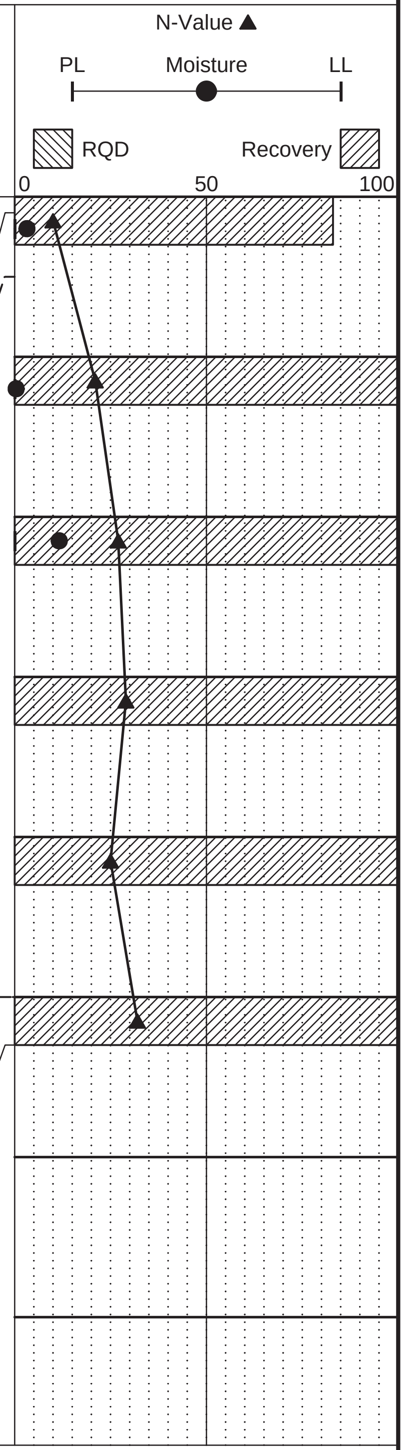
LOG OF TEST BORING THT-12-10

Figure A-13

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	73.1ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 5 5	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Loose, moist, reddish brown, silty fine to medium SAND; occasional fine organics, iron oxide stained **(Recessional Outwash)**
						Medium dense, moist, gray to brown, SAND with silt (SP-SM); fine to medium grained, poorly graded, trace to slightly silty, trace coarse sand, occasional subrounded gravel, layered iron oxide staining **(Recessional Outwash)**
5	S-2		6 10 11	GS		
						-driller adding bentonite drilling slurry, 7.5 to 25 feet.
10	S-3		11 13 14	GS		-becomes wet, increasing GRAVEL and coarse SAND.
15	S-4		7 13 16			
20	S-5		11 12 13			-layered iron oxide staining, increasing SILT.
25	S-6		11 16 16			Dense, wet, gray to brown, silty fine to medium SAND; trace coarse sand, occasional subrounded gravel, iron oxide stained, rapid dilatancy **(Recessional Outwash)**
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 10 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	7/1/10
Date Borehole Completed:	7/1/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 232+62, 102' LT.

PanGEO INCORPORATED

Phone: 206.262.0370

LOG OF TEST BORING THT-13-10

Figure A-14

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	78.9ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests
5	S-1	SPT	8, 9, 15	
10	S-2	SPT	7, 7, 9	
	S-3	SPT	6, 14, 15	
15	S-4	SPT	3, 6, 10	GS
	S-5	SPT	10, 15, 20	GS
	S-6	SPT	18, 20, 19	GS
20	S-7	SPT	12, 20, 18	GS
	S-8	SPT	16, 20, 20	
25	S-9	SPT	15, 15, 15	
	S-10	SPT	8, 9, 13	
	S-11	SPT	9, 10, 10	
30	S-12	SPT	8, 10, 8	

MATERIAL DESCRIPTION

Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.

Medium dense to dense, moist to wet, gray-brown to brown, SAND with silt (SP-SM); fine to medium grained, poorly graded, trace fine rounded gravel, occasinal thin interbeds of silty SAND, iron oxide stained **(Recessional Outwash)**

-gravelly drilling from 3 to 4 feet.

-occasional interbeds of fine sandy SILT, trace fine organics.

-poorly graded sand with silt (SP-SM).

-poorly graded sand with silt (SP-SM), becomes dense.

-poorly graded sand with silt (SP-SM).

-becomes wet, drillers adding bentonite drilling slurry, 20 to 30 feet.

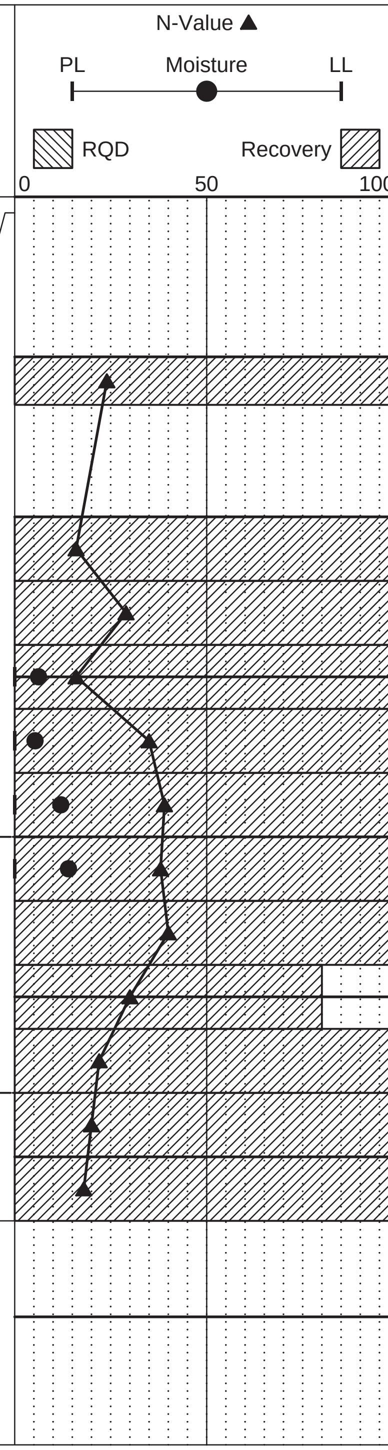
Dense to medium dense, wet, gray-brown, SAND with silt (SW-SM); well graded, trace fine rounded to sub-angular gravel, occasinal thin interbeds of silty SAND, iron oxide stained **(Recessional Outwash)**

-increasing SILT, with interbeds of laminated fine sandy SILT and silty fine SAND, iron oxide stained.

Medium dense, wet, brownish-gray, silty SAND; trace fine gravel, occasional clayey SILT interbeds, iron oxide stained **(Recessional Outwash)**.

Bottom of boring at approximately 32 ft. Groundwater was estimated at about 18 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.

Note: Samples S-2 through S-12 were driven 24 inches. Blowcounts reported are for the top 18" of the sample.



Completion Depth:	32.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	6/29/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 225+04, 259' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

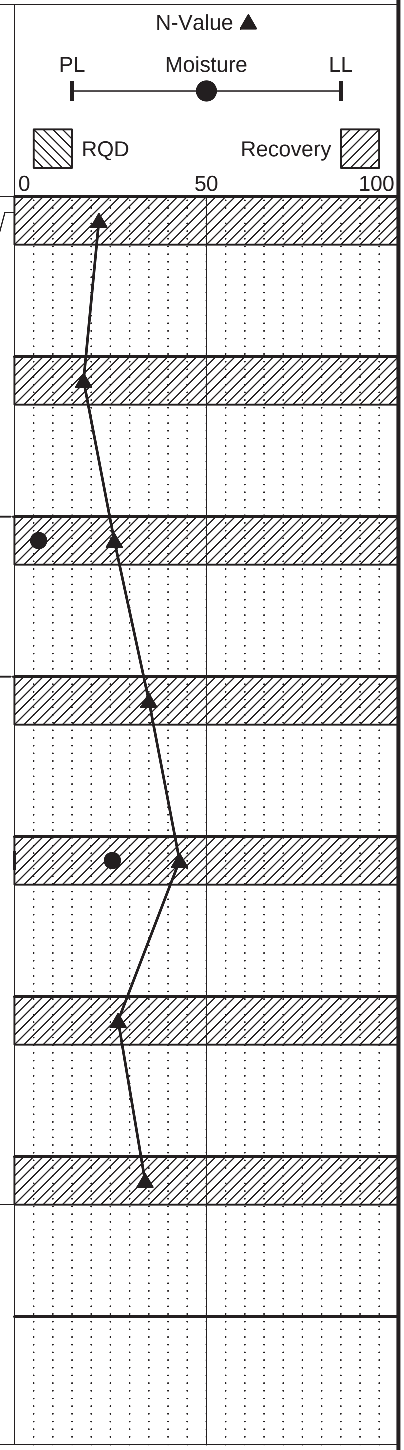
LOG OF TEST BORING THT-14-10

Figure A-15

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	71.1ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		4 10 12			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist, brown to gray, slightly silty to silty fine to medium SAND; occasional subrounded gravel, iron oxide staining **(Recessional Outwash)**
5	S-2		8 10 8			
10	S-3		10 13 13	GS		Medium dense, moist to wet, gray, SAND (SP); poorly graded, fine to medium, occasional thin interbeds of brown silty SAND, iron oxide stained **(Recessional Outwash)**
						-becomes wet.
15	S-4		11 13 22			Dense to medium dense, wet, gray-brown silty SAND (SM); thin beds of iron oxide staining, occasional fine organics, rapid dilatancy **(Recessional Outwash)**
						-driller adding bentonite drilling slurry, 15 to 30 feet.
20	S-5		13 21 22	GS		
25	S-6		10 14 13			-thin interbeds of clayey, fine sandy SILT, scattered fine organics.
30	S-7		13 17 17			
						Bottom of boring at approximately 31.5 ft. Groundwater was estimated at about 13.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
35						



Completion Depth:	31.5ft
Date Borehole Started:	7/7/10
Date Borehole Completed:	7/7/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 226+21, 100' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

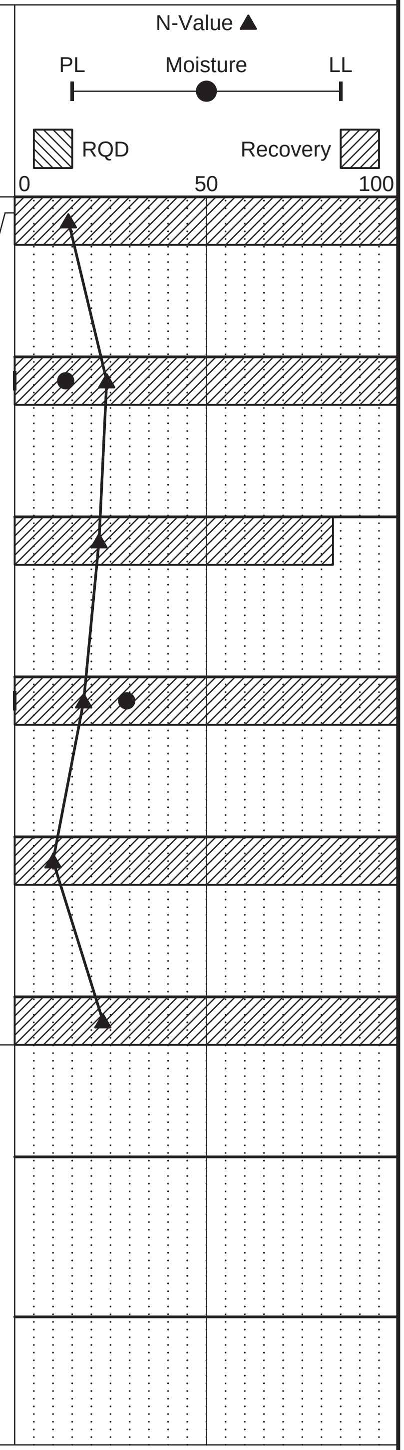
LOG OF TEST BORING THT-15-10

Figure A-16

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	71.7ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
0	S-1	4 5 9		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
				Medium dense, moist to wet, brown-gray, silty SAND (SM); fine to medium grained, occasional fine gravel, occasional thin interbeds of brown silty SAND, iron oxide stained **(Recessional Outwash)**
5	S-2	10 11 13	GS	
				-becomes wet, driller adding bentonite drilling slurry, 7.5 to 25 feet.
10	S-3	6 8 14		
15	S-4	4 8 10	GS	-silty sand (SM), occasional interbeds of fine sandy, clayey SILT, layered iron oxide staining.
20	S-5	8 6 4		
25	S-6	6 13 10		
				Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 7.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30				
35				



Completion Depth:	26.5ft	Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 228+47, 125' RT.
Date Borehole Started:	6/29/10	
Date Borehole Completed:	6/29/10	
Logged By:	Nels Reese, L.G.	
Drilling Company:	Geologic Drill, Inc.	

PanGEO INCORPORATED
Phone: 206.262.0370

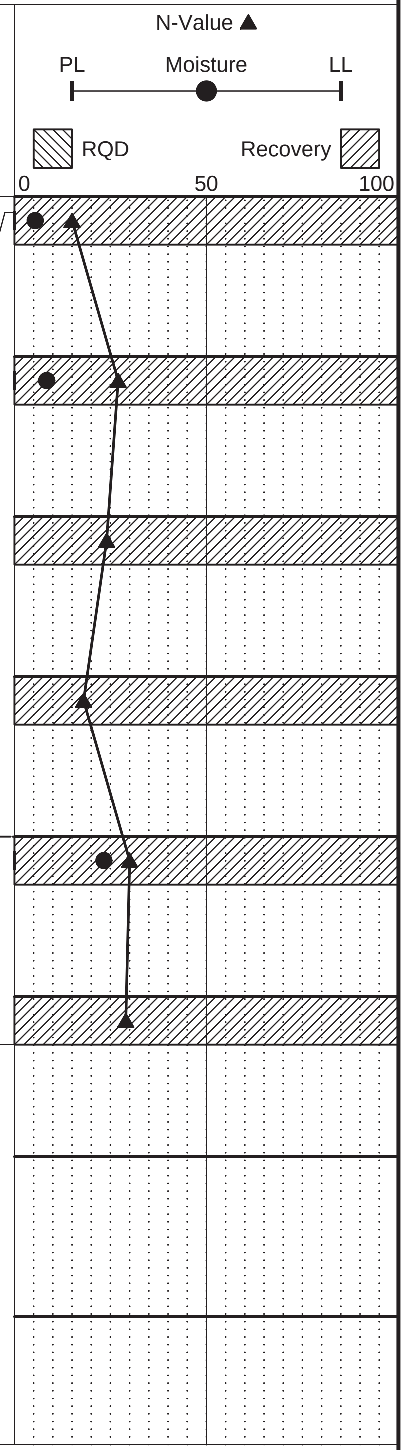
LOG OF TEST BORING THT-16-10

Figure A-17

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	73.9ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		6 7 8	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Medium dense, moist to wet, brown-gray, SAND with silt (SP-SM); poorly graded, occasional interbeds of silty SAND and poorly graded, fine to medium SAND, layered iron oxide staining **(Recessional Outwash)**
5	S-2		8 11 16	GS		-becomes well graded sand with silt (SW-SM).
						-becomes wet, driller adding bentonite drilling slurry, 10 to 25 feet.
10	S-3		8 10 14			
15	S-4		7 9 9			
20	S-5		11 14 16	GS		Medium dense, wet, brown, SAND with silt (SP-SM); poorly graded, fine to medium grained with a trace of coarse SAND, iron oxide stained **(Recessional Outwash)**
25	S-6		9 13 16			
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 9 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	6/29/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 235+30, 103' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

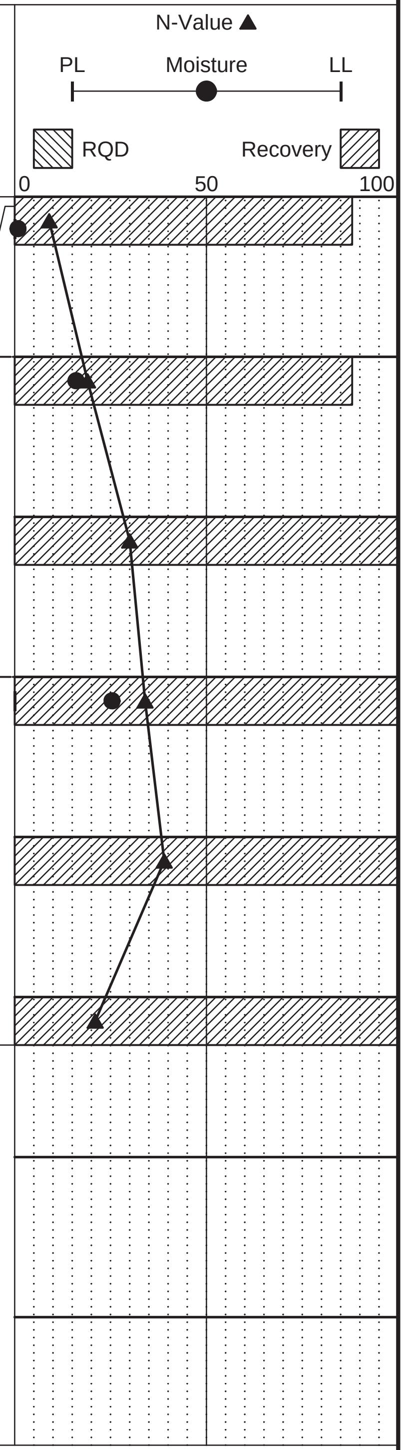
LOG OF TEST BORING THT-17-10

Figure A-18

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.4ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 4 5	GS		Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**
						Loose to medium dense, moist to wet, brown-gray, fine to medium SAND; trace silt and fine gravel **(Recessional Outwash)**
5	S-2		4 9 10	GS		Medium dense to dense, moist to wet, gray-brown, SAND (SP); poorly graded, trace sit, occasional rounded gravel **(Recessional Outwash)**
						-becomes wet.
10	S-3		12 18 12			-becomes dense; driller adding bentonite drilling slurry, 10 to 25 feet.
15	S-4		11 16 18	GS		Dense to medium dense, wet, gray, SAND with silt (SP-SM); poorly graded, fine to medium grained, trace fine gravel **(Recessional Outwash)**
20	S-5		7 19 20			- interbeds of silty SAND, iron oxide staining.
25	S-6		5 9 12			-becomes medium dense.
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 7.5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	7/1/10
Date Borehole Completed:	7/1/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 239+71, 108' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

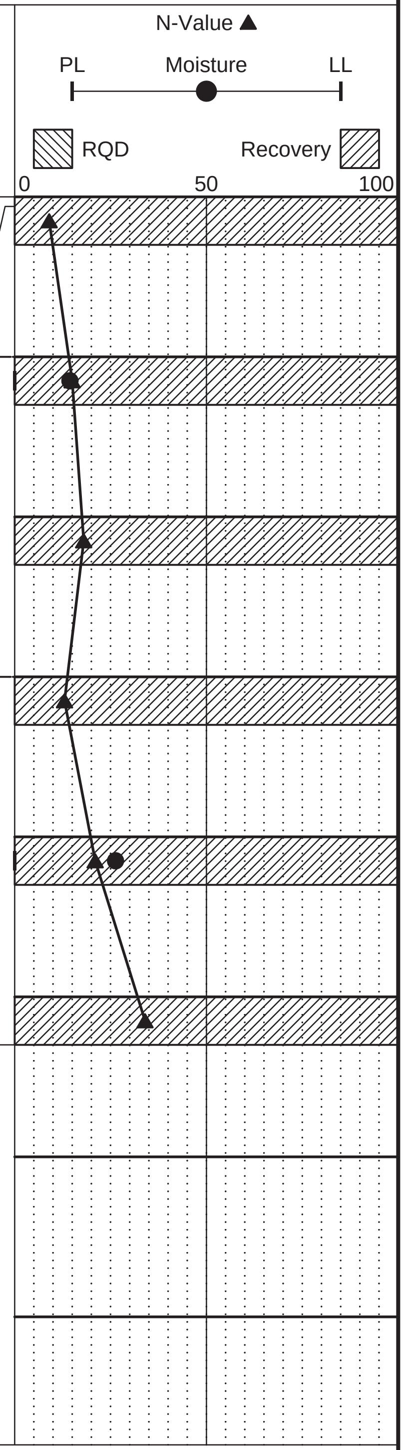
LOG OF TEST BORING THT-18-10

Figure A-19

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	73.5ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3 4 5			Loose, moist, dark brown, silty SAND; numerous fine organics **(Topsoil)**.
						Loose, moist, reddish-brown, slightly silty to silty, fine to medium SAND; occasional fine gravel, iron oxide staining **(Recessional Outwash)**.
5	S-2		5 7 8	GS		Medium dense, wet, gray, SAND with silt (SP-SM); poorly graded, occasional fine, rounded gravel, iron oxide staining **(Recessional Outwash)**. -driller adding bentonite drilling slurry, 5 to 25 feet.
10	S-3		4 8 10			
15	S-4		6 6 7			Medium dense to dense, wet, gray, silty SAND (SM); fine to medium grained, trace fine gravel, with organic rich interbeds; silty beds have rapid dilatancy **(Recessional Outwash)**
20	S-5		7 10 11	GS		-interbeds of fine to medium SAND and silty fine SAND, trace fine organics.
25	S-6		10 19 15			-becomes dense, fine SAND; slightly silty.
						Bottom of boring at approximately 26.5 ft. Groundwater was estimated at about 5 feet based on the soil sample moisture content during drilling. Groundwater level may vary depending on seasonal conditions.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	7/1/10
Date Borehole Completed:	7/1/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 244+24, 101' RT.

PanGEO INCORPORATED
Phone: 206.262.0370

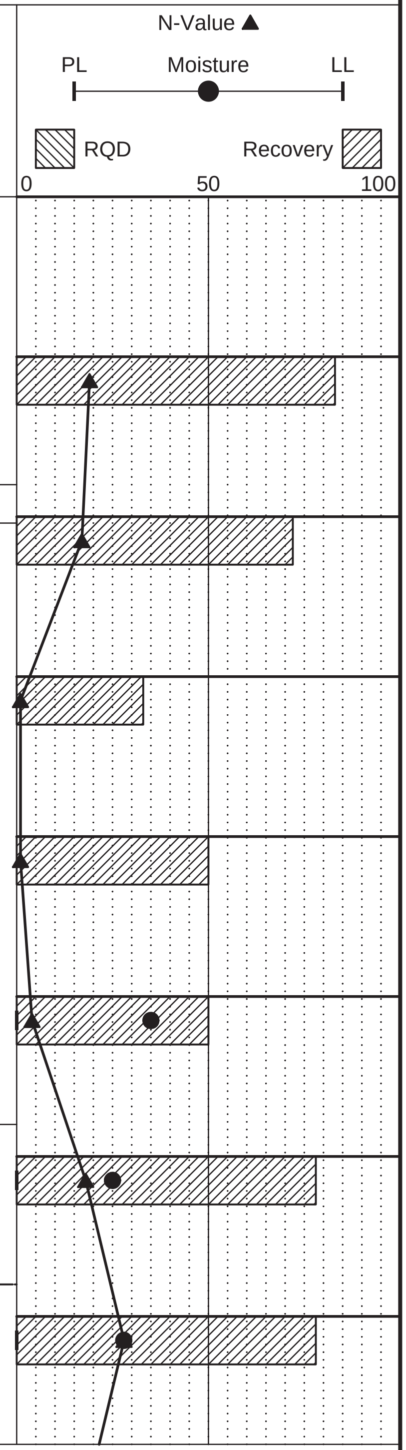
LOG OF TEST BORING THT-19-10

Figure A-20

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Medium dense, brown and gray SAND: moist, fine to coarse, layered with occasional silty organic lenses, trace weathering (Possible Fill).
5	S-1		8 9 10			
						Dark brown, organic fine SAND with silt and woody debris (Topsoil).
10	S-2		4 8 9			Loose, brown, silty SAND (SM): moist to wet, fine to medium grained, homogeneous, laminated, woody debris (Younger Alluvium - Qyal).
15	S-3		0 0 1			-very loose, dark brown, silty fine to coarse sand with woody organics.
20	S-4		0 0 1			-very loose, yellow brown, silty fine sand, trace clay, occasional woody organics, laminated.
25	S-5		1 2 2	GS		-loose, yellow and red brown, silty fine sand, wet (saturated), trace clay and coarse sand, rare gravel; red banding.
30	S-6		7 8 10	GS		Medium dense, red brown SAND with silt (SP-SM): wet, poorly graded, fine grained, homogeneous, laminated, weathered with 1/2 inch red bands (Recessional Outwash).
35	S-7		8 12 16	GS		Medium dense, brown gray, sandy SILT (SM): wet, non-plastic, rapid dilatancy, fine grained sand, laminated with thin reddish laminae, occasional clayey silt lenses, dips to 10^o (Recessional Outwash).



Completion Depth:	151.5ft
Date Borehole Started:	7/28/10
Date Borehole Completed:	7/28/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+94, 107' LT.

PanGEO INCORPORATED

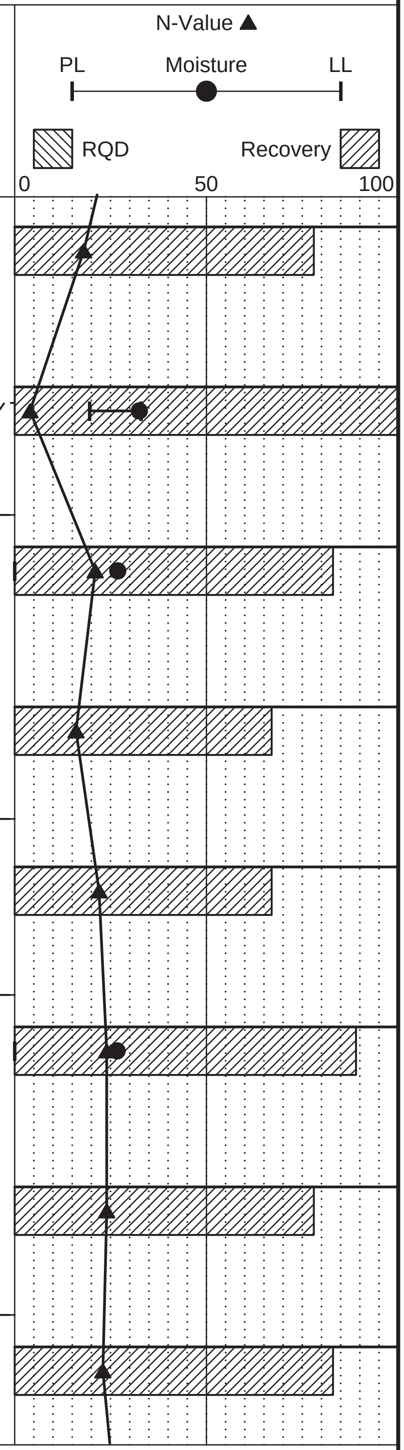
LOG OF TEST BORING THT-20-10

Figure A-21

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40	S-8	X	7 9 9			Medium dense, brown gray, sandy SILT (SM): wet, non-plastic, rapid dilatancy, fine grained sand, laminated with thin reddish laminae, occasional clayey silt lenses, dips to 10° (Recessional Outwash). *(Continued)*
						-grading to gray, fine sand and silt, occasional 1/8" clayey silt laminae, mainly non-plastic.
45	S-9	X	5 3 1	GS		-gradational contact.
						Soft, gray, silty CLAY (CL): moist to wet, low plasticity, slow dilatancy, laminated (Recessional Outwash).
50	S-10	X	9 10 11	GS		Medium dense, gray SAND with silt (SP-SM): wet, poorly graded, fine to medium grained, clean with trace of silt, homogenous, laminated, occasional rounded pockets of silty clay (Recessional Outwash).
55	S-11	X	6 8 8			-rare woody organics, sand mainly greenish quartz and dark volcanic lithics.
						Medium dense, SILT with fine sand: wet, non-plastic, rapid dilatancy, laminated with occasional silty clay lenses (Recessional Outwash).
60	S-12	X	8 11 11			
65	S-13	X	11 11 13	GS		Medium dense, gray SAND with silt (SP-SM): wet, poorly graded, fine grained, trace silt, homogenous, massive (Recessional Outwash).
70	S-14	X	9 12 12			-becoming laminated.
75	S-15	X	12 12 11			Medium dense, gray, SAND with silt: wet, fine grained, homogeneous, massive with laminated layers (Recessional Outwash).



Completion Depth:	151.5ft
Date Borehole Started:	7/28/10
Date Borehole Completed:	7/28/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+94, 107' LT.

PanGEO INCORPORATED

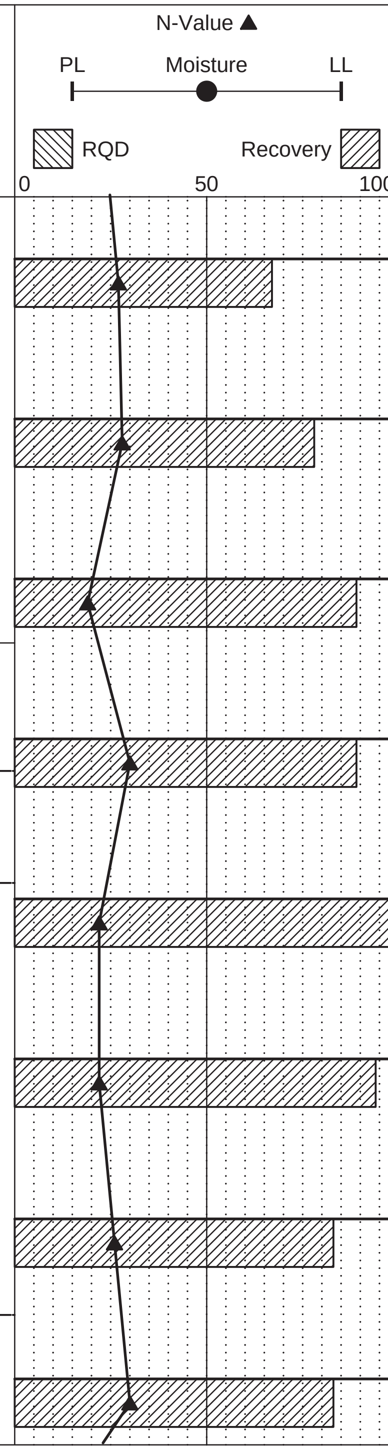
LOG OF TEST BORING THT-20-10

Figure A-21

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Medium dense, gray, SAND with silt: wet, fine grained, homogeneous, massive with laminated layers (Recessional Outwash). *(Continued)*
80	S-16		13 12 15			
85	S-17		10 11 17			-grading to sandy silt, laminated, with 3" bed of green gray, silty clay.
90	S-18		10 9 10			-gradational contact with 2" interbeds of silty clay.
						Stiff to hard, green gray, silty CLAY: moist to wet, low plasticity, laminated (Recessional Lacustrine).
95	S019		11 14 16			
						Dense, gray SILT: wet, very coarse silt grading to fine sand, non-plastic, homogeneous, laminated (Recessional Lacustrine).
100	S-20		5 9 13			Stiff, green gray, silty CLAY: moist to wet, low plasticity, slow dilatancy, with thin (1/4") interbeds of non-plastic sandy silt (Recessional Lacustrine).
105	S-21		6 10 12			
110	S-22		8 14 12			-grading to interbedded silty clay and coarse silt, beds 1/2" to 1", sub-horizontal.
						Medium dense, gray, fine sandy SILT with interbeds of clayey SILT: wet (saturated), generally non-plastic, with rapid and slow dilatancy beds, beds to 6" with gradational contacts, laminated (Recessional Lacustrine).
115	S-23		6 12 18			



Completion Depth:	151.5ft
Date Borehole Started:	7/28/10
Date Borehole Completed:	7/28/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+94, 107' LT.

PanGEO INCORPORATED

LOG OF TEST BORING THT-20-10

Figure A-21

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.2ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

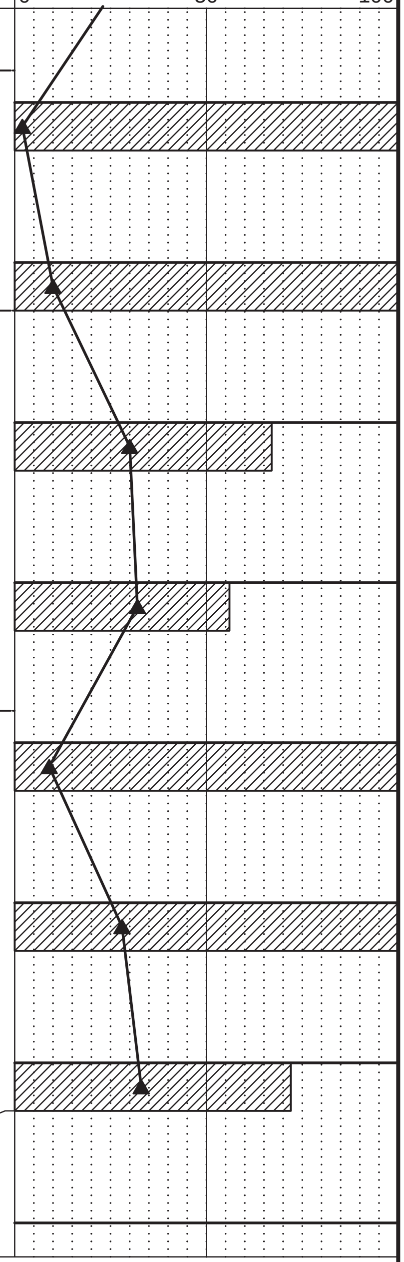
Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Soft to stiff, green gray, silty CLAY: moist to wet, low to medium plasticity, laminated with well developed parting (Recessional Lacustrine).
120	S-24		1 1 1			
125	S-25		0 3 7			
						Dense, gray SILT: wet, coarse grained grading to fine sand, homogeneous, massive (Recessional Lacustrine).
130	S-26		16 14 16			
135	S-27		8 14 18			-interbeds of slightly clayey silt, laminated and fine bedded (beds 1" to 3").
						Stiff to hard, green gray, silty CLAY: moist, low plasticity grading to possibly medium plasticity, slow dilatancy, laminated with occasional sandy laminae (Recessional Lacustrine).
140	S-28		0 4 5			
145	S-29		2 11 17			-becoming stiff, laminated with coarse silt / fine sand beds.
150	S-30		6 13 20			-becoming interbedded green gray silty clay and gray silt with fine sand, beds to 6", coarser downward.
						Bottom of Boring.
155						

N-Value ▲

PL Moisture LL

RQD Recovery

0 50 100



Completion Depth:	151.5ft
Date Borehole Started:	7/28/10
Date Borehole Completed:	7/28/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+94, 107' LT.

PanGEO INCORPORATED

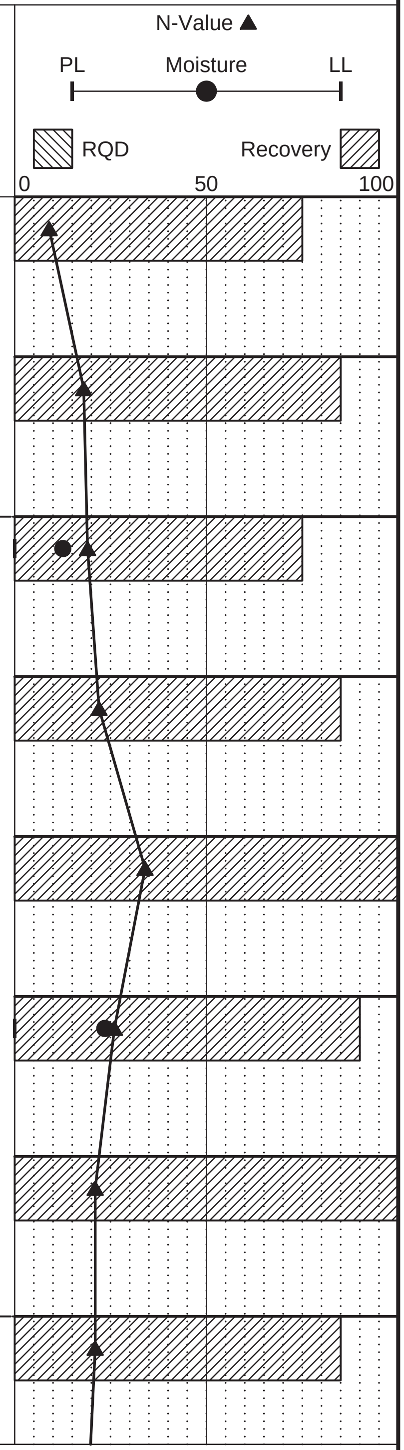
LOG OF TEST BORING THT-20-10

Figure A-21

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.6ft
Job Number:	10-069	Top of Casing Elev.:	70.0ft
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	D-1		3 5 4 4			Silty SAND with gravel, loose, brown, moist, homogeneous, HCL not tested. Length Recovered: 1.5 ft. Length Retained: 1.5 ft.
5	D-2		5 8 10 10			Well graded SAND with gravel, slightly silty, medium dense, brown, moist, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
10	D-3		5 9 10 10	GS		Poorly graded SAND with silt (SP-SM), trace gravel, medium dense, brown/gray, moist, homogeneous, HCL not tested. Length Recovered: 1.5 ft. Length Retained: 1.5 ft.
15	D-4		7 11 11 12			Poorly graded SAND, slightly silty, trace gravel, medium dense, gray, moist, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
20	D-5		8 14 20 22			Well graded SAND, slightly silty, trace gravel, dense, brown/gray, wet, homogeneous, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft.
25	D-6		6 11 15 16	GS		Silty SAND (SM), dense, brown/gray, wet, stratified, HCL not tested. Length Recovered: 1.8 ft. Length Retained: 1.8 ft. Layers of well graded sand, slightly silty.
30	D-7		8 11 10 11			Poorly graded SAND, slightly silty, medium dense, brown/gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft.
35	D-8		8 10 11 12			Silty SAND, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.



Completion Depth:	152.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	7/1/10
Logged By:	Donny Henderson
Drilling Company:	WSDOT

Remarks: Boring drilled by WSDOT crew, field log by WSDOT. STA 223+85, C/L, I-5 Median Project. 24-inch Standard Penetration Test (SPT) sampler driven with a auto-trip 140 lb. safety hammer.

PanGEO INCORPORATED

Phone: 206.262.0370

LOG OF TEST BORING THT-21-10

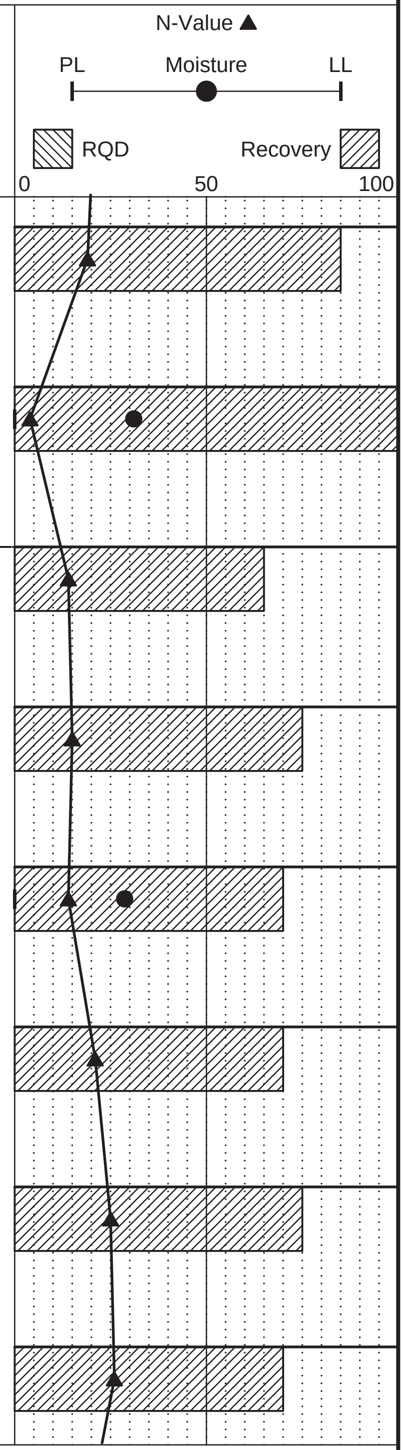
Figure A-22

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	
Job Number:	10-069	
Location:	Marysville, Washington	
Coordinates:	Northing: , Easting:	

Surface Elevation:	72.6ft
Top of Casing Elev.:	70.0ft
Drilling Method:	Wet Rotary
Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Silty SAND, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft. *(Continued)*
40	D-9		7 7 12 16			Silty SAND, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
45	D-10		2 2 2 3	GS		Silty SAND (SM), very loose, gray, wet, stratified, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
50	D-11		4 6 8 11			Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.3 ft. Length Retained: 1.3 ft.
55	D-12		4 7 8 9			Poorly graded SAND, slightly silty, medium dense, gray, wet, stratified, HCL not tested. Length Recovered: 1.5 ft. Length Retained: 1.5 ft.
60	D-13		4 6 8 11	GS		Poorly graded, silty SAND (SM), medium dense, gray, wet, stratified, HCL not tested. Length Recovered: 1.4 ft. Length Retained: 1.4 ft.
65	D-14		6 9 12 14			Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.4 ft. Length Retained: 1.4 ft.
70	D-15		7 11 14 16			Poorly graded SAND, slightly silty, dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.5 ft. Length Retained: 1.5 ft.
75	D-16		9 13 13 12			Poorly graded SAND, slightly silty, dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.4 ft. Length Retained: 1.4 ft.



Completion Depth:	152.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	7/1/10
Logged By:	Donny Henderson
Drilling Company:	WSDOT

Remarks: Boring drilled by WSDOT crew, field log by WSDOT. STA 223+85, C/L, I-5 Median Project. 24-inch Standard Penetration Test (SPT) sampler driven with a auto-trip 140 lb. safety hammer.

PanGEO INCORPORATED
Phone: 206.262.0370

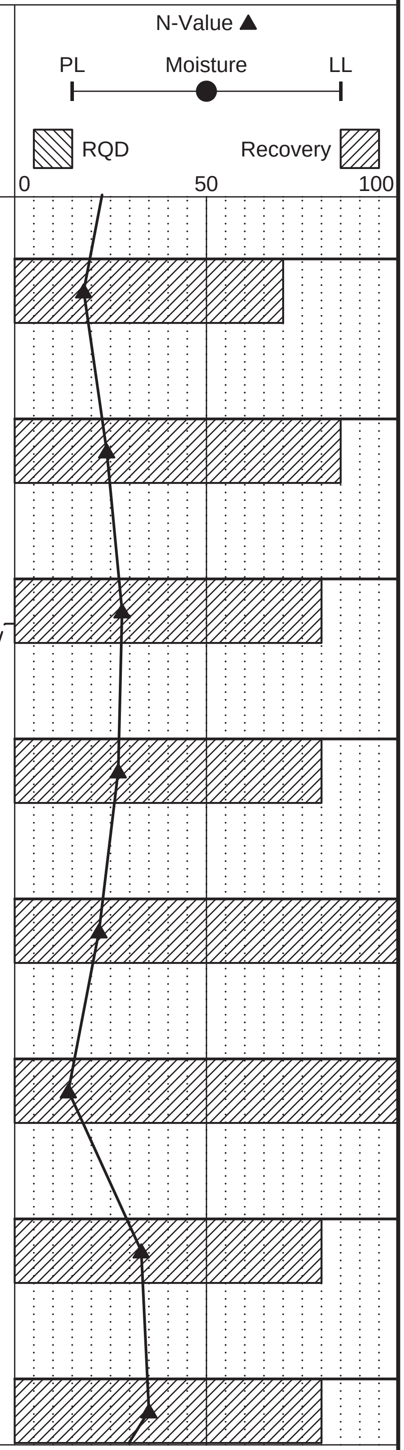
LOG OF TEST BORING THT-21-10

Figure A-22

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.6ft
Job Number:	10-069	Top of Casing Elev.:	70.0ft
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.3 ft. Length Retained: 1.3 ft. *(Continued)*
80	D-17		6 8 10 14			Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.4 ft. Length Retained: 1.4 ft.
85	D-18		9 11 13 17			Poorly graded SAND, slightly silty, medium dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.7 ft. Length Retained: 1.7 ft.
90	D-19		7 12 16 17			Poorly graded SAND, trace silt, dense, gray, wet, stratified, HCL not tested. Length Recovered: 1.6 ft. Length Retained: 1.6 ft. From 91.4' to 92.0' silty sand.
95	D-20		9 13 14 18			Silty SAND, dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.6 ft. Length Retained: 1.6 ft.
100	D-21		8 12 10 11			Silty SAND, medium dense, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. From 101.5' to 102.0' sandy silt, slightly elastic.
105	D-22		5 6 8 13			Silty SAND, medium dense, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of sandy silt throughout.
110	D-23		12 16 17 13			Silty SAND, dense, gray, wet, stratified, HCL not tested. Length Recovered: 1.6 ft. Length Retained: 1.6 ft. Layers of sandy silt.
115	D-24		15 20 15			Silty SAND, dense, gray, wet, homogeneous, HCL not tested. Length Recovered: 1.6 ft. Length Retained: 1.6 ft.



Completion Depth:	152.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	7/1/10
Logged By:	Donny Henderson
Drilling Company:	WSDOT

Remarks: Boring drilled by WSDOT crew, field log by WSDOT. STA 223+85, C/L, I-5 Median Project. 24-inch Standard Penetration Test (SPT) sampler driven with a auto-trip 140 lb. safety hammer.

PanGEO INCORPORATED

Phone: 206.262.0370

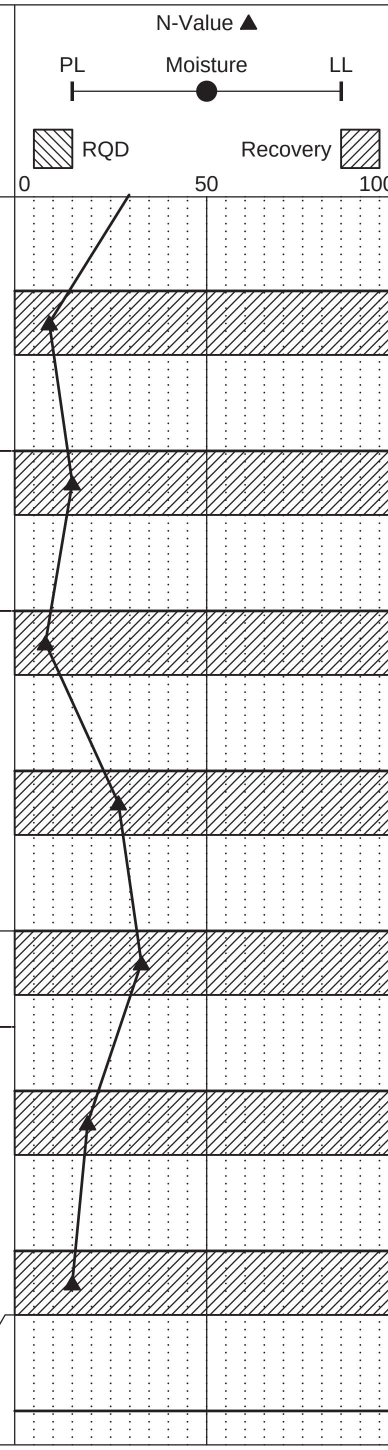
LOG OF TEST BORING THT-21-10

Figure A-22

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	72.6ft
Job Number:	10-069	Top of Casing Elev.:	70.0ft
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
			17			
120	D-25	X	3 4 5 10			Silty SAND, loose, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of sandy silt throughout.
125	D-26	X	4 6 9 11			Elastic SILT with sand, stiff, gray, moist, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of silty sand.
130	D-27	X	3 3 5 6			Sandy SILT, slightly elastic, loose, gray, moist, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of silty sand.
135	D-28	X	8 12 15 16			Sandy SILT, slightly elastic, dense, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. From 136.0' to 137.0' silty sand.
140	D-29	X	10 18 15 21			Silty SAND, dense, gray, moist, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft.
145	D-30	X	6 7 12 15			Elastic SILT with sand, very stiff, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of sandy silt and silty sand.
150	D-31	X	4 6 9 13			Elastic SILT with sand, stiff, gray, wet, stratified, HCL not tested. Length Recovered: 2 ft. Length Retained: 2 ft. Layers of sandy silt and silty sand. End of test boring at 152 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Note: REF = SPT Refusal.
155						



Completion Depth:	152.0ft
Date Borehole Started:	6/29/10
Date Borehole Completed:	7/1/10
Logged By:	Donny Henderson
Drilling Company:	WSDOT

Remarks: Boring drilled by WSDOT crew, field log by WSDOT. STA 223+85, C/L, I-5 Median Project. 24-inch Standard Penetration Test (SPT) sampler driven with a auto-trip 140 lb. safety hammer.

PanGEO INCORPORATED
Phone: 206.262.0370

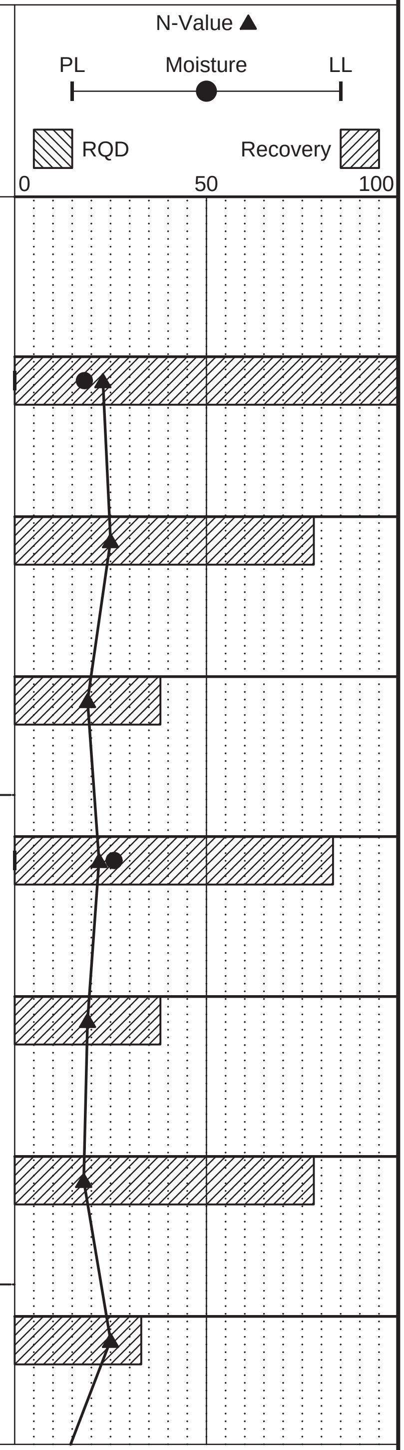
LOG OF TEST BORING THT-21-10

Figure A-22

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange
Job Number:	10-069
Location:	Marysville, Washington
Coordinates:	Northing: , Easting:
Surface Elevation:	68.0ft
Top of Casing Elev.:	N/A
Drilling Method:	Wet Rotary
Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Medium dense, brown SAND with silt (SP-SM); moist, poorly graded, fine to medium grained, trace silt, homogeneous, subhorizontally laminated, occasional gravel (Recessional Outwash).
5	S-1		11 11 12	GS		
10	S-2		6 11 14			-becoming red brown, weathered, with coarse sand/fine gravel interbeds; one 1/2" silt/clay bed.
15	S-3		10 11 8			-becoming wet (saturated).
20	S-4		7 11 11	GS		Medium dense, brown to brown gray SAND with silt SP-SM; wet, poorly graded, fine grained, homogeneous, laminated (Recessional Outwash).
25	S-5		8 8 11			-weathered with 1/2" orange bands throughout.
30	S-6		5 8 10			-interbedded fine sand with silt and silt, beds 4 to 8 inches.
35	S-7		9 10 15			Medium dense, gray silty SAND (SM); moist to wet, fine grained, fines non-plastic with rapid dilatancy, homogeneous, massive (Recessional Outwash).



Completion Depth:	151.5ft
Date Borehole Started:	7/27/10
Date Borehole Completed:	7/27/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+65, 104' RT.

PanGEO INCORPORATED

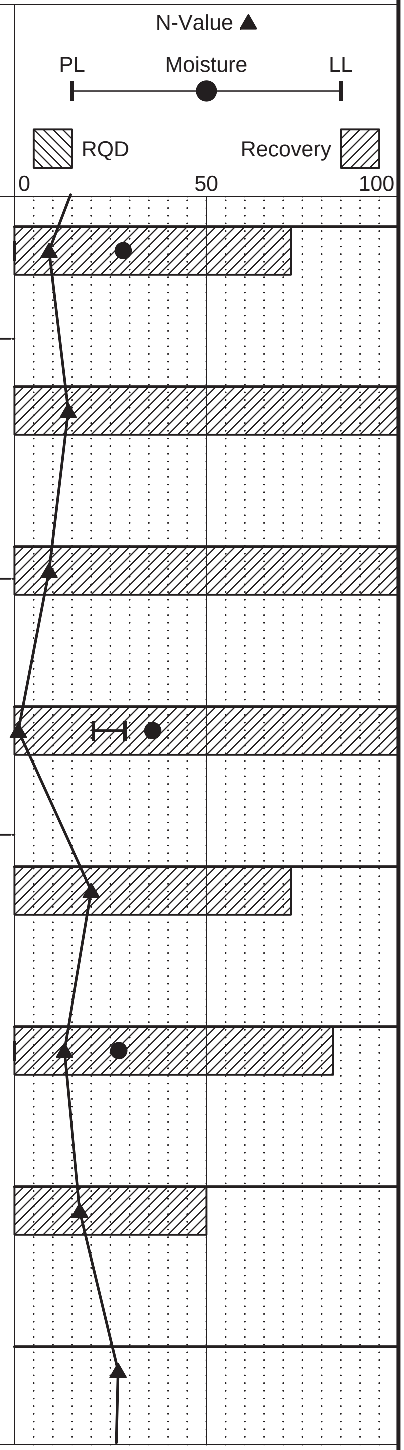
LOG OF TEST BORING THT-22-10

Figure A-23

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.0ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40	S-8		5 4 5	GS		Medium dense, gray silty SAND (SM); moist to wet, fine grained, fines non-plastic with rapid dilatancy, homogeneous, massive (Recessional Outwash). *(Continued)* -becoming loose, saturated, with one 1 1/2" green gray silt/clay interbed.
45	S-9		4 6 8			Medium dense, gray SAND; wet (saturated), fine grained, some silt, homogeneous, laminated, one thin wood piece (Recessional Outwash).
50	S-10		5 5 4			-becoming loose, silty fine sand.
						Medium stiff to soft, green gray, lean CLAY (CL) with silt; moist to wet, low plasticity, rapid to slow dilatancy, homogeneous, massive, with rare organics (Recessional Lacustrine).
55	S-11		0 0 1	GS		-becoming soft.
60	S-12		8 10 10			Medium dense, gray SAND with silt (SP-SM); wet, poorly graded, fine to medium grained, homogeneous, massive Mainly quartz and lithic grains (Recessional Outwash).
65	S-13		5 6 7	GS		
70	S-14		6 7 10			
75	S-15		10 12 15			



Completion Depth:	151.5ft
Date Borehole Started:	7/27/10
Date Borehole Completed:	7/27/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+65, 104' RT.

PanGEO INCORPORATED

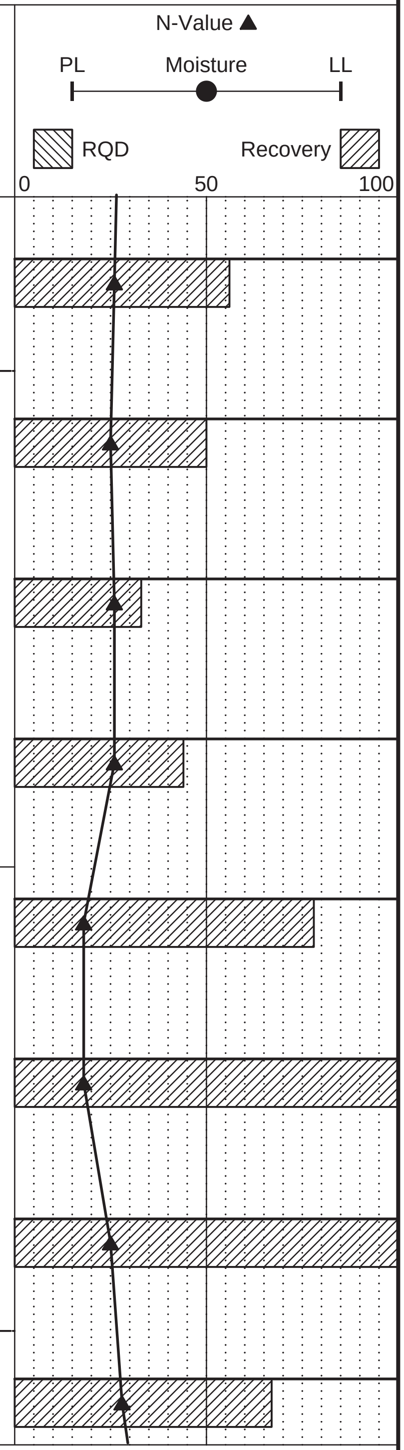
LOG OF TEST BORING THT-22-10

Figure A-23

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.0ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Medium dense, gray SAND with silt (SP-SM); wet, poorly graded, fine to medium grained, homogeneous, massive Mainly quartz and lithic grains (Recessional Outwash). *(Continued)*
80	S-16		10 13 13			
						Medium dense, gray, silty SAND; wet (saturated), fine grained, mainly homogeneous, massive; silt very coarse (grading to fine sand), 1/2" clay bed it sampler tip at 85' (Recessional Outwash).
85	S-17		10 13 12			
90	S-18		10 13 13			-grading to sandy silt, non-plastic fines, rapid dilatancy.
95	S019		12 12 14			-two inches silty clay bed at top of sample; silty fine sand to sandy silt.
						Stiff to very stiff, green gray, silty lean CLAY; moist and wet beds, low plasticity with non-plastic beds, laminated and thin bedded, sandy interbeds (Recessional Lacustrine).
100	S-20		7 8 10			
105	S-21		5 6 12			-interbedded, non-plastic, gray, wet silt and low plasticity, green gray, moist to wet, silty clay; beds 1/2" to 2".
110	S-22		6 11 14			-beds 1/2" to 4", increasing silt with fine sand interbeds.
						Medium dense, gray, silty SAND; wet (saturated), fine grained, grading to sandy silt in some layers, non-plastic fines, rapid dilatancy, homogeneous, laminated to 2^{o} dip (Recessional Lacustrine).
115	S-23		10 12 16			



Completion Depth:	151.5ft
Date Borehole Started:	7/27/10
Date Borehole Completed:	7/27/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+65, 104' RT.

PanGEO INCORPORATED

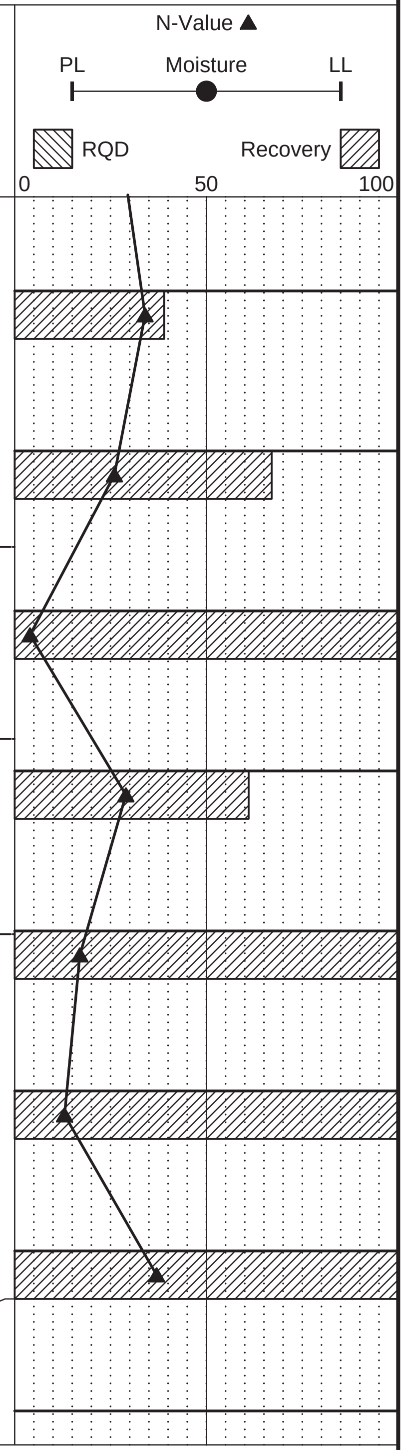
LOG OF TEST BORING THT-22-10

Figure A-23

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	68.0ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Wet Rotary
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Medium dense, gray, silty SAND; wet (saturated), fine grained, grading to sandy silt in some layers, non-plastic fines, rapid dilatancy, homogeneous, laminated to 2° dip (Recessional Lacustrine). *(Continued)*
120	S-24		12 16 18			-becoming dense, with interbeds of green gray silty clay, low plasticity.
125	S-25		11 13 13			-grading to fine sand with silt, massive.
						Medium stiff, green gray, silty CLAY; wet, low plasticity, rapid dilatancy, homogeneous, massive (Recessional Lacustrine).
130	S-26		0 0 4			
						Medium dense, gray SAND; wet (saturated), fine grained, some silty to with silt, homogeneous, massive (Recessional Outwash).
135	S-27		10 14 15			
140	S-28		7 7 10			Stiff, green gray, CLAY with silt; moist to wet, low to medium plasticity, slow to no dilatancy, homogeneous, mainly massive (Recessional Lacustrine).
145	S-29		0 2 11			-stiff, interbeds of silt beds with rapid dilatancy, gradational contacts.
150	S-30		9 13 24			-hard, gray, interbedded, low plasticity silty clay and non-plastic silt with fine sand.
						Bottom of Boring.
155						



Completion Depth:	151.5ft
Date Borehole Started:	7/27/10
Date Borehole Completed:	7/27/10
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an auto-trip mechanism. LM Line Station 223+65, 104' RT.

PanGEO INCORPORATED

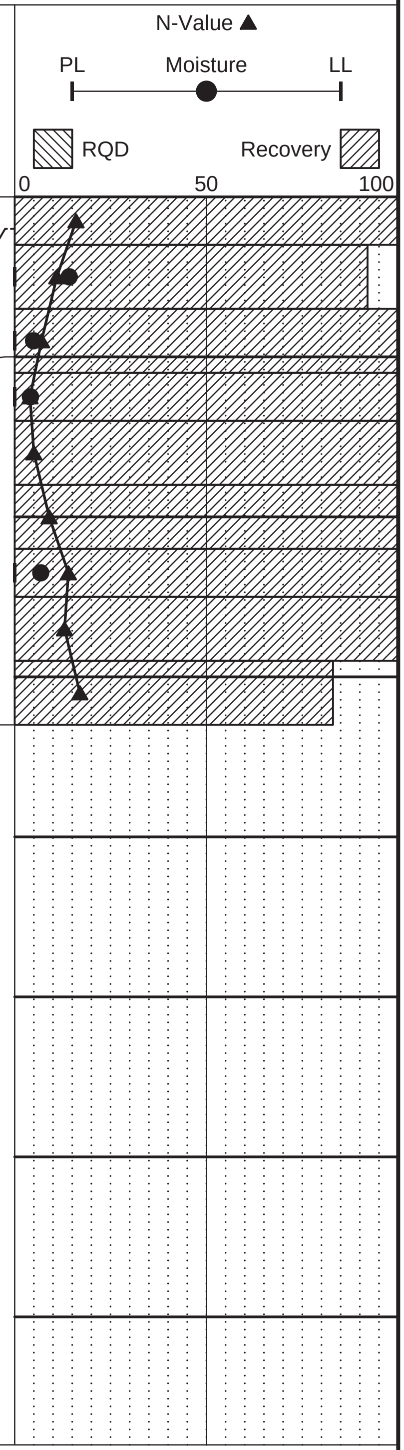
LOG OF TEST BORING THT-22-10

Figure A-23

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange	Surface Elevation:	
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		10 9 7			Medium dense, moist, dark brown, gravelly silty SAND; scattered fine organics **(Fill)**.
	S-2		5 5 6	GS		Medium dense to loose, moist, reddish-brown to light brown, silty SAND (SM); trace rounded gravel, occasional thin layers of iron oxide staining **(Recessional Outwash/Fill?)**
5	S-3		3 4 3	GS		-poorly graded sand (SP).
	S-4		3 2 2	GS		Loose to medium dense, moist, gray to brownish-gray SAND (SP); poorly graded, fine to medium grained, trace silt, coarse sand, and fine gravel, homogenous, occasional thin layers of iron oxide staining **(Recessional Outwash)**
	S-5		2 2 3			
10	S-6		3 4 5			-becomes medium dense.
	S-7		5 7 7	GS		-becoming poorly graded sand with silt (SP-SM).
	S-8		5 6 7			-thin bed of silt and silty sand near bottom of sample S-8.
15	S-9		7 7 10			
20						Bottom of boring at approximately 16.5 ft. Groundwater not encountered during drilling. However, groundwater levels may vary depending on seasonal conditions. Note: Samples S-2, S-3, S-5, S-6, S-8, and S-9 were driven 24" each. For clarity, the blowcount for the final six inches of each sample has been omitted.
25						
30						
35						



Completion Depth:	16.5ft
Date Borehole Started:	10/26/10
Date Borehole Completed:	10/26/10
Logged By:	Nels Reese, L.G.
Drilling Company:	Geologic Drill, Inc.

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with an rope and cathead mechanism. LM Line Station 221+98, 715' LT.

PanGEO INCORPORATED
Phone: 206.262.0370

LOG OF TEST BORING THT-23-10

Figure A-24

The stratification lines represent approximate boundaries. The transition may be gradual.

Test Pit No. 1 Location: Station 226+90, 240' LT, north of existing park and ride Approximate ground surface elevation: ~70 feet	
Depth (ft)	Material Description
0 – 1	2 to 4 inches of sod over loose, dry to moist, light brown, fine SAND with some silt, trace gravel, and prevalent organics (Topsoil/Fill)
1 – 10	Medium dense to dense, moist, light brown with some reddish brown layers, fine to medium SAND with some silt and trace gravel (Recessional Outwash)
	Test Pit terminated approximately 10 feet below ground surface. Groundwater not encountered within the depth of the exploration. No caving noted. *Samples: S-1 @ 2½ - 3 feet, moisture = 5.5%* *S-2 @ 5½ - 6 feet* *S-3 @ 9½ - 10 feet, moisture = 6.5%*

Test Pit No. 2

Location: Station 232+60, 100' RT, near bottom of existing drainage swale
Approximate ground surface elevation: ~73 feet

Depth (ft)	Material Description
0 – 1	2 to 4 inches of sod over loose, dry, light brown, silty SAND with prevalent organics (Topsoil/Fill)
1 – 8	Medium dense, dry to moist, light brown and gray, gravelly fine to medium SAND with trace silt (Recessional Outwash)
	Test Pit terminated approximately 8 feet below ground surface. Groundwater not encountered within the depth of the exploration. No caving noted. *Samples: S-1 @ 1 - 1½ feet, moisture = 2.5%* *S-2 @ 4 – 4½ feet, moisture = 3.5%* *S-3 @ 7½ - 8 feet*

Test Pit No. 3 Location: Station 235+45, 105' LT, near bottom of existing drainage swale Approximate ground surface elevation: ~73 feet	
Depth (ft)	Material Description
0 – 1	2 to 4 inches of sod over loose, dry, light brown, silty SAND with some gravel and prevalent organics (Topsoil/Fill)
1 – 8	Medium dense, dry to moist, light brown and gray, slightly gravelly to gravelly fine to coarse SAND with trace to no silt; between 5 and 6 feet reddish brown, medium to coarse sand layer (Recessional Outwash)
	Test Pit terminated approximately 8 feet below ground surface. Groundwater not encountered within the depth of the exploration. No caving noted. *Samples: S-1 @ 1 - 1½ feet, moisture = 2.5%* *S-2 @ 4 – 4½ feet, moisture = 3.5%* *S-3 @ 7 – 7½ feet*

APPENDIX B

LABORATORY TESTING AND RESULTS

APPENDIX B: LABORATORY TESTING AND RESULTS

This appendix contains descriptions of the procedures and results of physical (geotechnical) and electrochemical laboratory testing conducted on soil samples retained during the field explorations for the I-5 / 116th Street NE Interchange Improvement Project. The methodology of the soil sampling from the borings was described in Appendix A. The samples were tested to determine basic physical index properties of the soils for purposes of classifying the material types encountered and to measure or correlate parameters used in the geotechnical design. In addition, tests were conducted to determine the chemistry parameters of the on-site soils to help determine the corrosiveness of the soil.

Laboratory testing of the samples selected for testing under PanGEO's scope of work was performed by Analytical Resources, Incorporated, of Tukwila, Washington, in general accordance with the following ASTM Standard Test Methods (TM):

D 2216	TM for Laboratory Determination of Water (Moisture) Content of Soil and Rock
D 422	TM for Particle-size Analysis of Soils
D 4318	TM for Liquid Limit, Plastic Limit and Plasticity Index of Soils

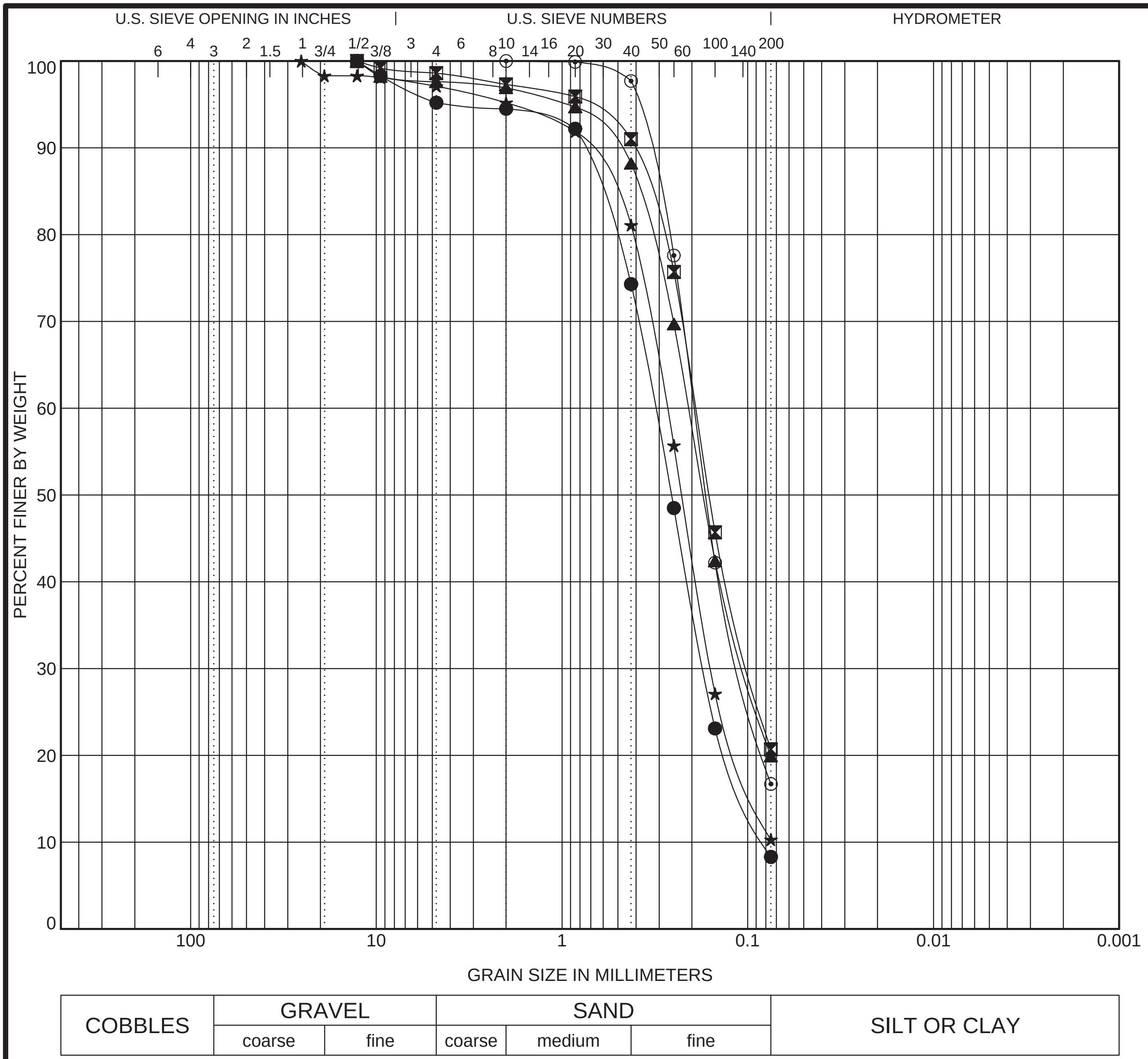
Moisture contents and liquid/plastic limits (Atterberg limits) are shown on the logs of test borings and test pits in Appendix A.

Grain size results are shown on Figures B-1 through B-15. The results of liquid/plastic limits (Atterberg limits) are presented on Figure B-16.

Electrochemical property testing of the samples selected for testing under PanGEO's scope of work was also performed by Analytical Resources, Incorporated, of Tukwila, Washington, in general accordance with the following test methods:

Minimum Resistivity Determination according to AASHTO T288
Cation Exchange capacity by Method 9080
pH by Method SW9045
Chloride by Method 325.2
Sulfate by Method MSA 10-3

The results of the cation exchange capacity test are shown in Table 2b of the report, and the electrochemical property testing results are shown in Table 14 of the report. The raw laboratory test results for electrochemical property testing are included at the end of this Appendix.



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**THT-01-10**	**@ 5.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.15**	**3.90**
⧗	**THT-01-10**	**@ 20.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
▲	**THT-02-10**	**@ 15.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
★	**THT-03-10**	**@ 0.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.23**	**3.69**
⊙	**THT-03-10**	**@ 15.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-01-10**	**5.0**	**12.7**	**0.317**	**0.172**	**0.081**	**4.8**	**86.9**	**8.3**	
⧗	**THT-01-10**	**20.0**	**12.7**	**0.191**	**0.097**		**1.4**	**77.9**	**20.7**	
▲	**THT-02-10**	**15.0**	**12.7**	**0.209**	**0.102**		**2.4**	**77.7**	**19.9**	
★	**THT-03-10**	**0.0**	**25.4**	**0.273**	**0.158**		**2.9**	**86.8**	**10.3**	
⊙	**THT-03-10**	**15.0**	**2**	**0.194**	**0.108**		**0.0**	**83.3**	**16.7**	

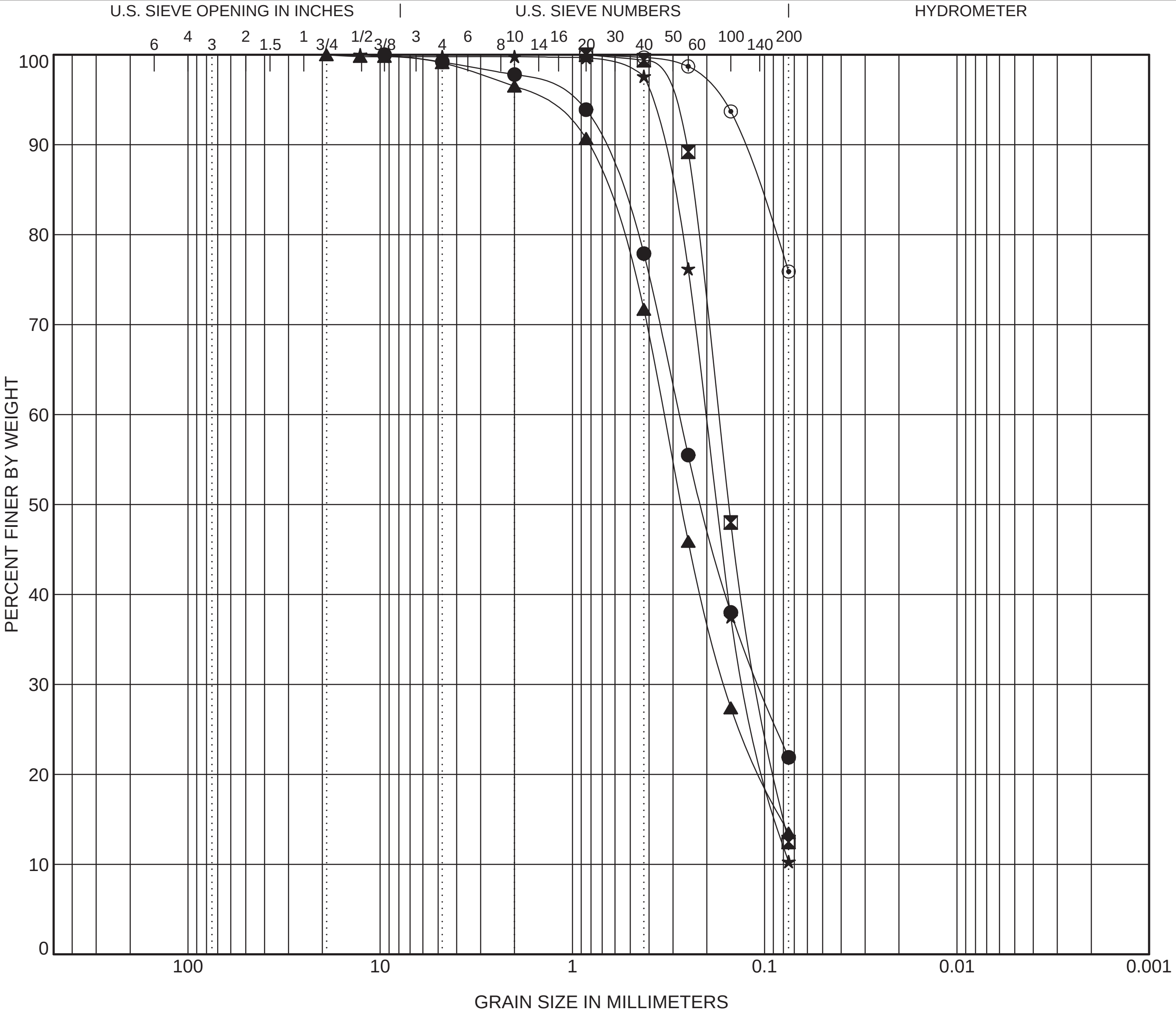
PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-1

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**THT-04-10**	**@ 5.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
☒	**THT-04-10**	**@ 10.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
▲	**THT-05-10**	**@ 5.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
★	**THT-05-10**	**@ 30.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.02**	**2.71**
⊙	**THT-05-10**	**@ 45.0 ft.**	**SILT with SAND(ML)**	**NP**	**NP**	**NP**		

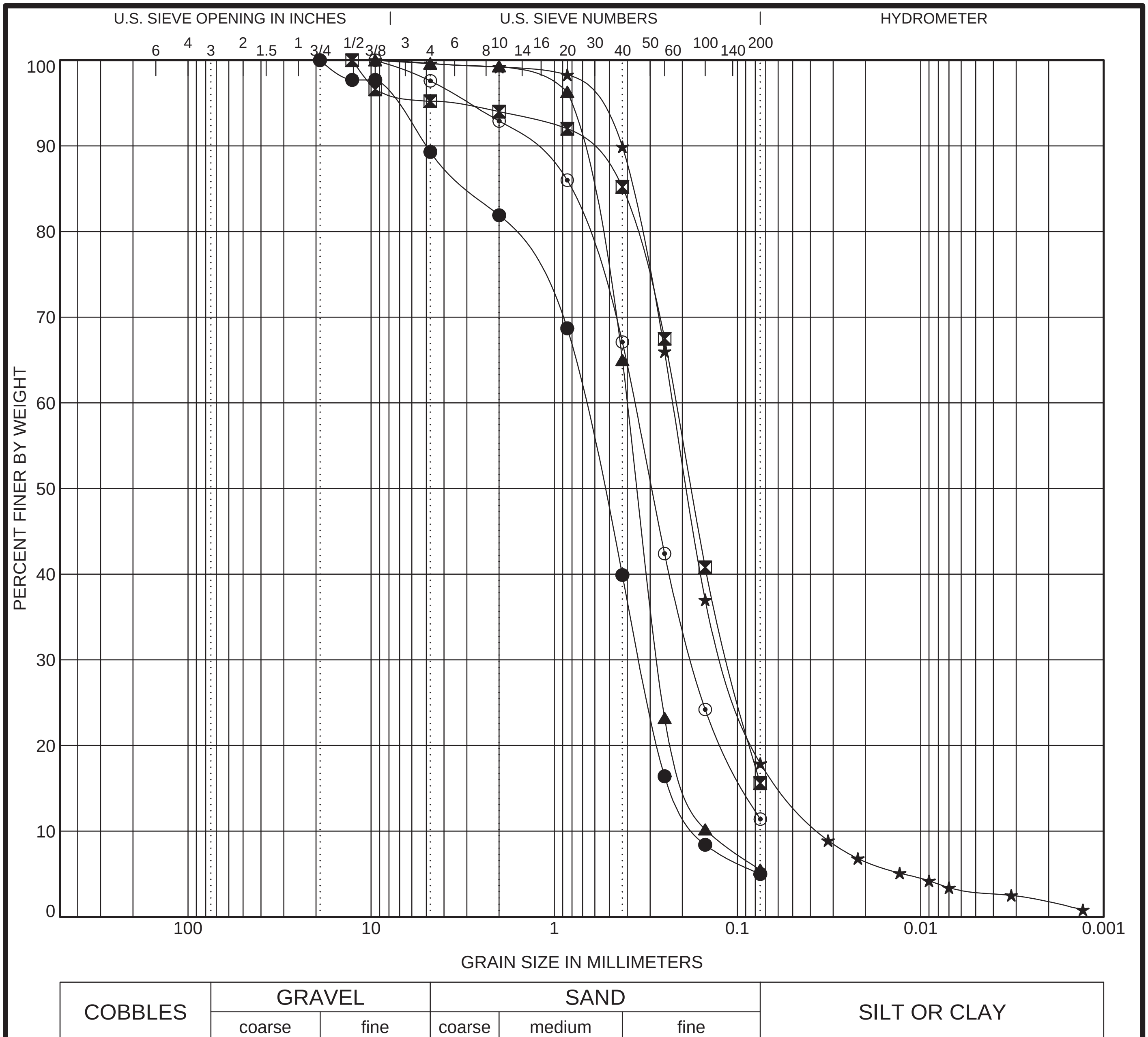
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-04-10**	**5.0**	**9.5**	**0.278**	**0.106**		**0.8**	**77.3**	**21.9**	
☒	**THT-04-10**	**10.0**	**0.85**	**0.174**	**0.106**		**0.0**	**87.5**	**12.5**	
▲	**THT-05-10**	**5.0**	**19.05**	**0.334**	**0.161**		**0.9**	**85.6**	**13.5**	
★	**THT-05-10**	**30.0**	**12.7**	**0.202**	**0.124**		**0.2**	**89.5**	**10.3**	
⊙	**THT-05-10**	**45.0**	**0.85**				**0.0**	**24.1**	**75.9**	

PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-2



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**THT-06-10**	**@ 18.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.01**	**4.15**
⧗	**THT-06-10**	**@ 20.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
▲	**THT-06-10**	**@ 22.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.28**	**2.74**
★	**THT-06-10**	**@ 24.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**	**1.69**	**6.33**
⊙	**THT-07-10**	**@ 0.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.23**	**5.25**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-06-10**	**18.0**	**19.05**	**0.689**	**0.34**	**0.166**	**10.7**	**84.3**	**5.0**	
⧗	**THT-06-10**	**20.0**	**12.7**	**0.217**	**0.111**		**4.8**	**79.6**	**15.6**	
▲	**THT-06-10**	**22.0**	**9.5**	**0.399**	**0.273**	**0.146**	**0.4**	**94.1**	**5.5**	
★	**THT-06-10**	**24.0**	**9.52**	**0.225**	**0.116**	**0.036**	**0.4**	**81.7**	**14.9**	**3.0**
⊙	**THT-07-10**	**0.0**	**9.5**	**0.365**	**0.177**		**2.4**	**86.2**	**11.4**	

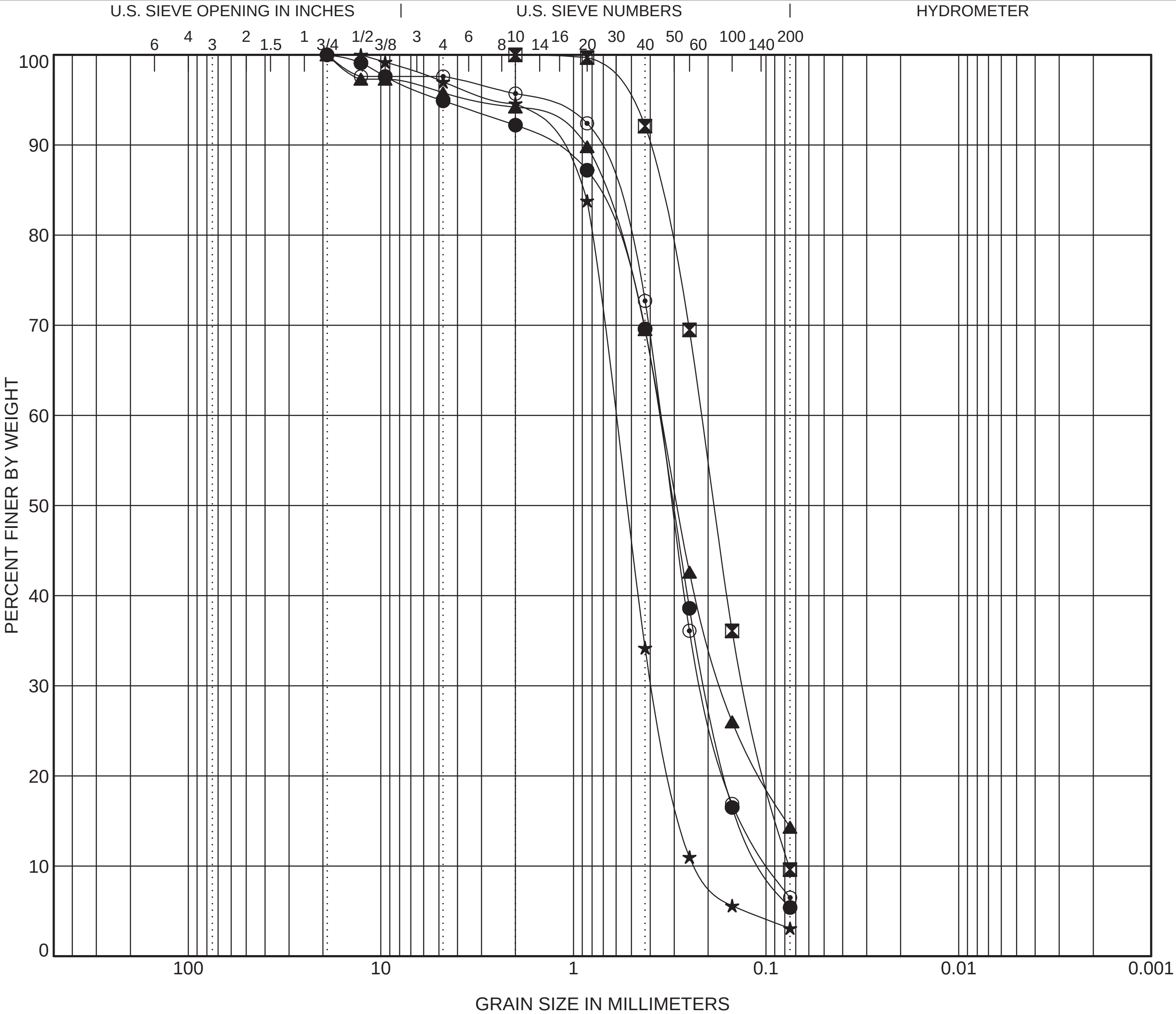
GRAIN SIZE DISTRIBUTION

PanGEO INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-3

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	THT-07-10	@ 10.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.17	3.61
⊠	THT-07-10	@ 20.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.00	2.85
▲	THT-08-10	@ 4.0 ft.	SILTY SAND(SM)	NP	NP	NP		
★	THT-09-10	@ 16.0 ft.	POORLY GRADED SAND(SP)	NP	NP	NP	1.08	2.68
⊙	THT-09-10	@ 18.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.35	3.73

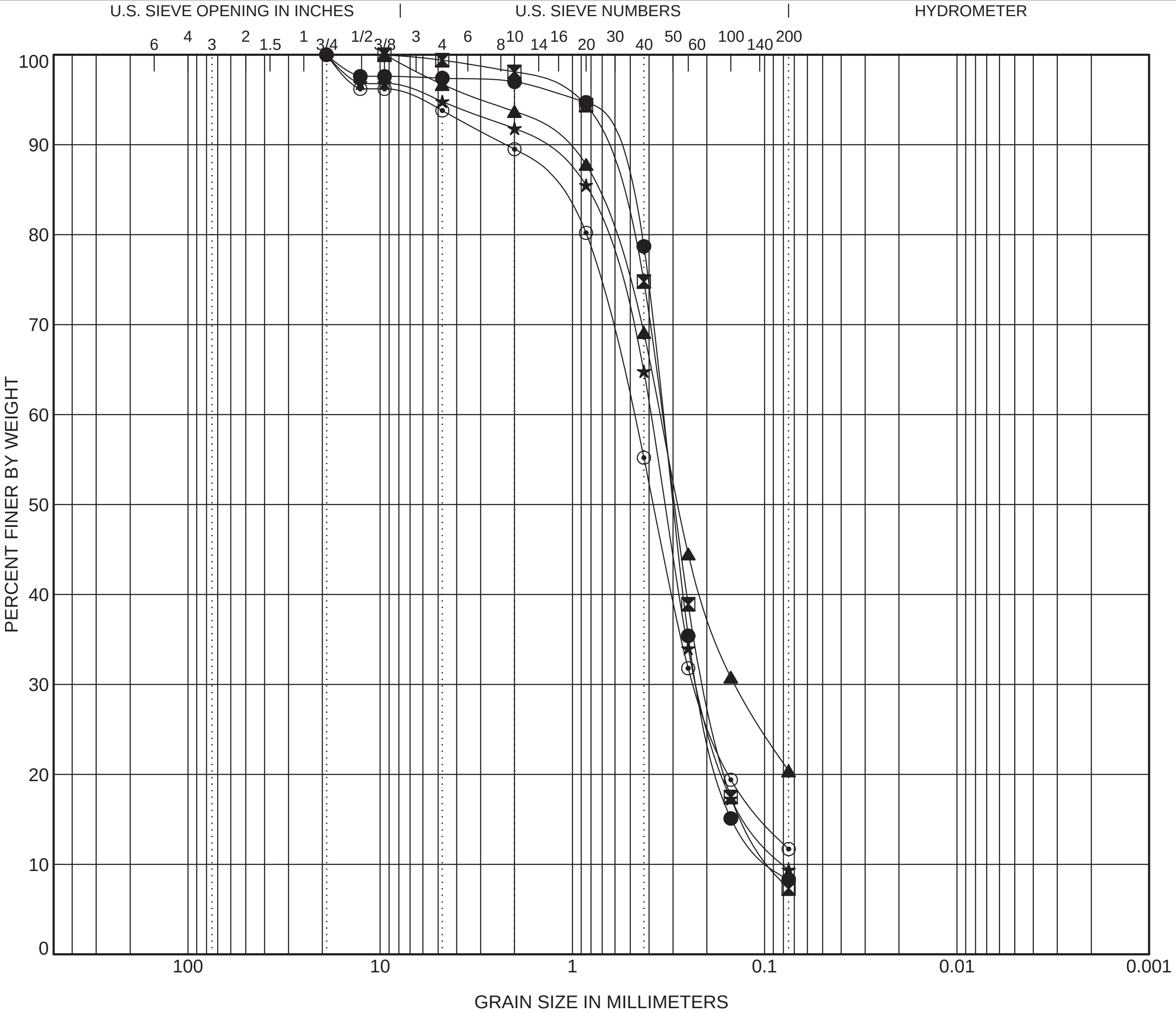
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	THT-07-10	10.0	19.05	0.361	0.205	0.1	5.1	89.5	5.4	
⊠	THT-07-10	20.0	2	0.216	0.128	0.076	0.0	90.4	9.6	
▲	THT-08-10	4.0	19.05	0.352	0.17		4.2	81.5	14.3	
★	THT-09-10	16.0	12.7	0.609	0.386	0.227	3.0	93.9	3.1	
⊙	THT-09-10	18.0	19.05	0.354	0.213	0.095	2.4	91.1	6.5	

GRAIN SIZE DISTRIBUTION

PanGEO INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-09-10	@ 20.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.58	3.79
⊠ THT-09-10	@ 22.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.33	3.79
▲ THT-10-10	@ 10.0 ft.	SILTY SAND(SM)	NP	NP	NP		
★ THT-10-10	@ 12.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.58	4.95
⊙ THT-10-10	@ 14.0 ft.	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP	1.72	7.54

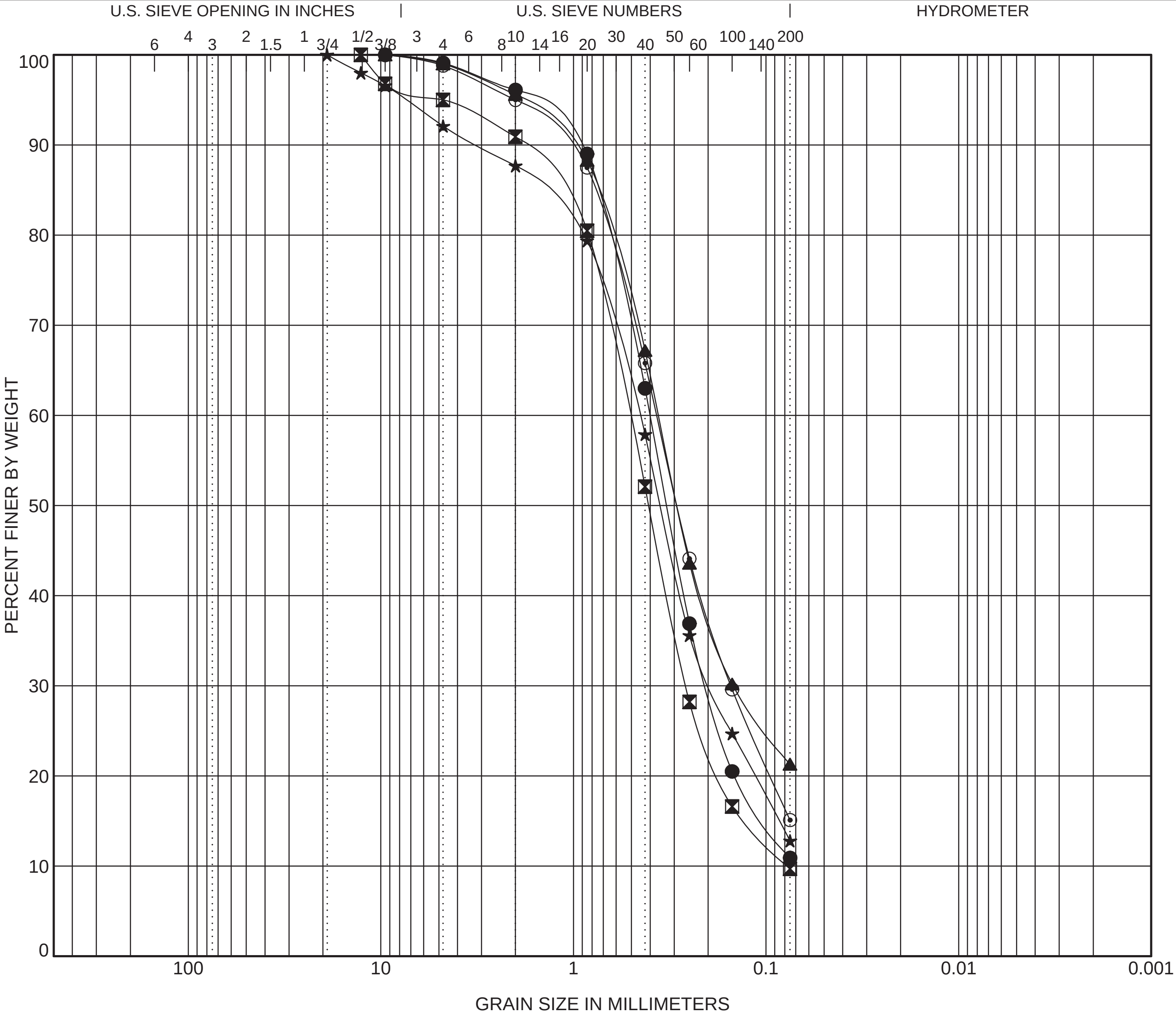
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-09-10	20.0	19.05	0.338	0.218	0.089	2.6	89.1	8.3	
⊠ THT-09-10	22.0	9.5	0.341	0.202	0.09	0.6	92.1	7.3	
▲ THT-10-10	10.0	9.5	0.349	0.142		3.3	76.3	20.4	
★ THT-10-10	12.0	19.05	0.391	0.221	0.079	5.2	85.4	9.4	
⊙ THT-10-10	14.0	19.05	0.485	0.232		6.2	82.1	11.7	

PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-5



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-11-10	@ 10.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.45	5.69
⊠ THT-11-10	@ 12.0 ft.	**WELL-GRADED SAND with SILT(SW-SM)**	NP	NP	NP	1.70	6.67
▲ THT-11-10	@ 14.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
★ THT-11-10	@ 16.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
⊙ THT-12-10	@ 5.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		

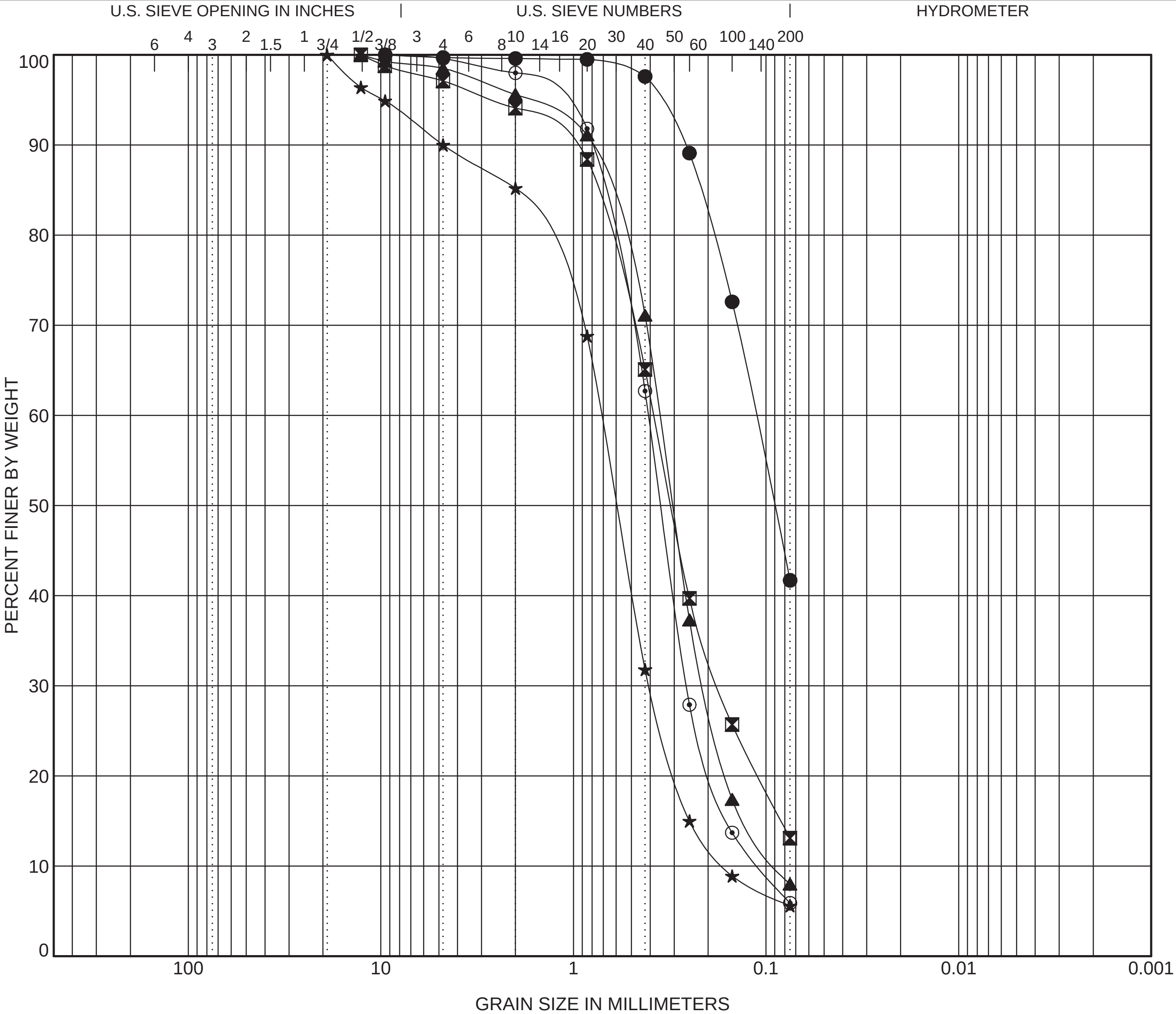
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
● THT-11-10	10.0	9.5	0.4	0.202		0.9	88.2	10.9
⊠ THT-11-10	12.0	12.7	0.515	0.26	0.077	5.0	85.3	9.7
▲ THT-11-10	14.0	9.5	0.361	0.148		1.0	77.7	21.3
★ THT-11-10	16.0	19.05	0.455	0.192		7.9	79.3	12.8
⊙ THT-12-10	5.0	9.52	0.369	0.152		1.2	83.7	15.1

PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-6



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-12-10	@ 20.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
⊠ THT-13-10	@ 1.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
▲ THT-13-10	@ 6.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.38	4.11
★ THT-13-10	@ 10.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.36	4.38
⊙ THT-14-10	@ 14.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.51	3.78

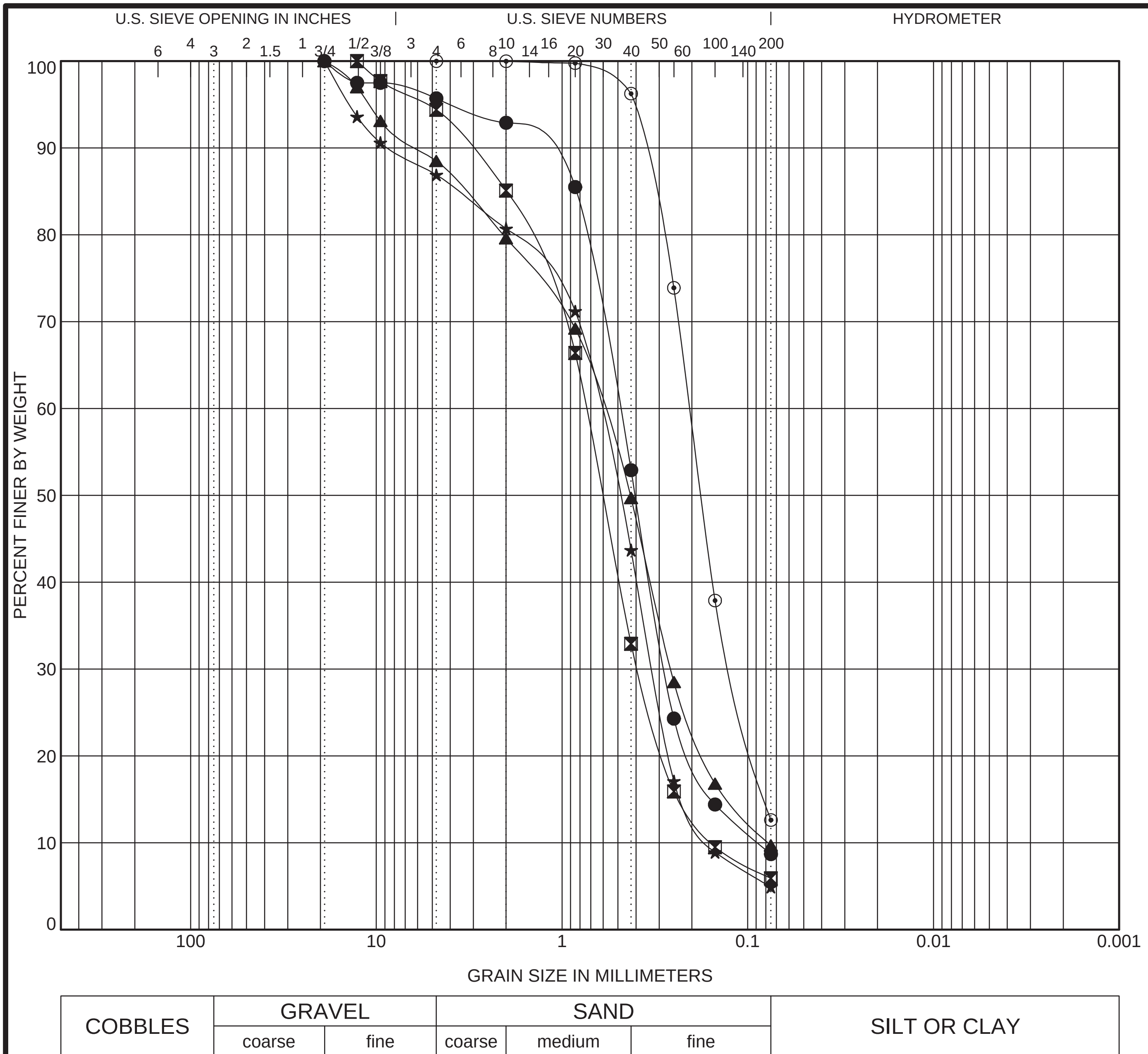
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-12-10	20.0	9.5	0.113			0.3	58.0	41.7	
⊠ THT-13-10	1.0	12.7	0.382	0.175		2.9	84.0	13.1	
▲ THT-13-10	6.0	12.7	0.357	0.207	0.087	1.5	90.5	8.0	
★ THT-13-10	10.0	19.05	0.721	0.402	0.164	10.0	84.4	5.6	
⊙ THT-14-10	14.0	9.52	0.408	0.258	0.108	0.4	93.7	5.9	

PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-7



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	THT-14-10	@ 16.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.78	5.63
⊠	THT-14-10	@ 18.0 ft.	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.30	4.77
▲	THT-14-10	@ 20.0 ft.	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP	1.42	7.94
★	THT-15-10	@ 10.0 ft.	POORLY GRADED SAND(SP)	NP	NP	NP	1.02	3.99
⊙	THT-15-10	@ 20.0 ft.	SILTY SAND(SM)	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	THT-14-10	16.0	19.05	0.494	0.278	0.088	4.3	87.0	8.7	
⊠	THT-14-10	18.0	12.7	0.745	0.388	0.156	5.6	88.5	5.9	
▲	THT-14-10	20.0	19.05	0.613	0.26	0.077	11.5	78.8	9.7	
★	THT-15-10	10.0	19.05	0.641	0.323	0.161	13.1	82.0	4.9	
⊙	THT-15-10	20.0	4.75	0.205	0.121		0.0	87.4	12.6	

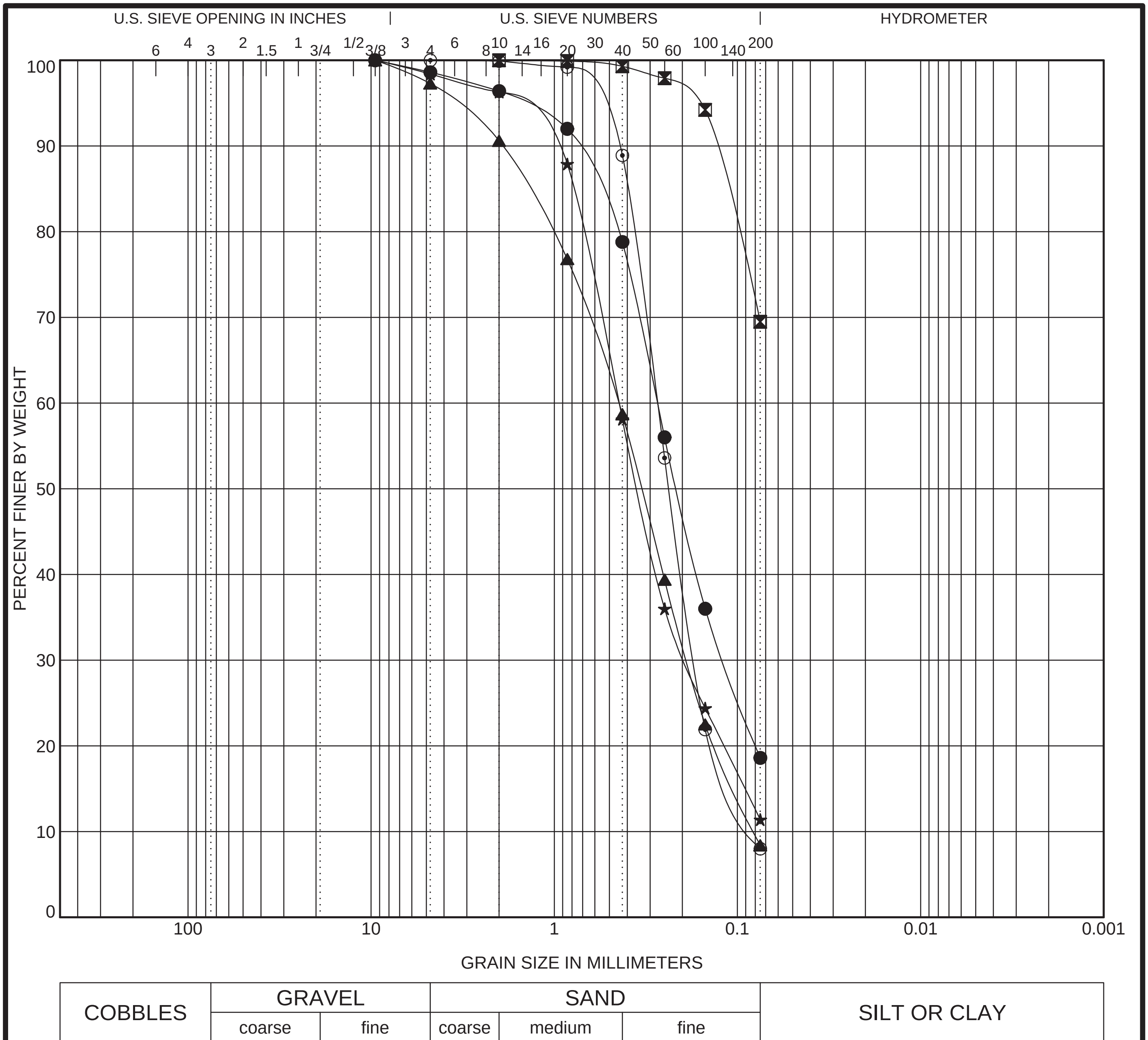
PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-8

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-16-10	@ 5.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
⊠ THT-16-10	@ 15.0 ft.	**SANDY SILT(ML)**	NP	NP	NP		
▲ THT-17-10	@ 0.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	0.98	5.51
★ THT-17-10	@ 5.0 ft.	**WELL-GRADED SAND with SILT(SW-SM)**	NP	NP	NP	1.19	6.38
⊙ THT-17-10	@ 20.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.28	3.32

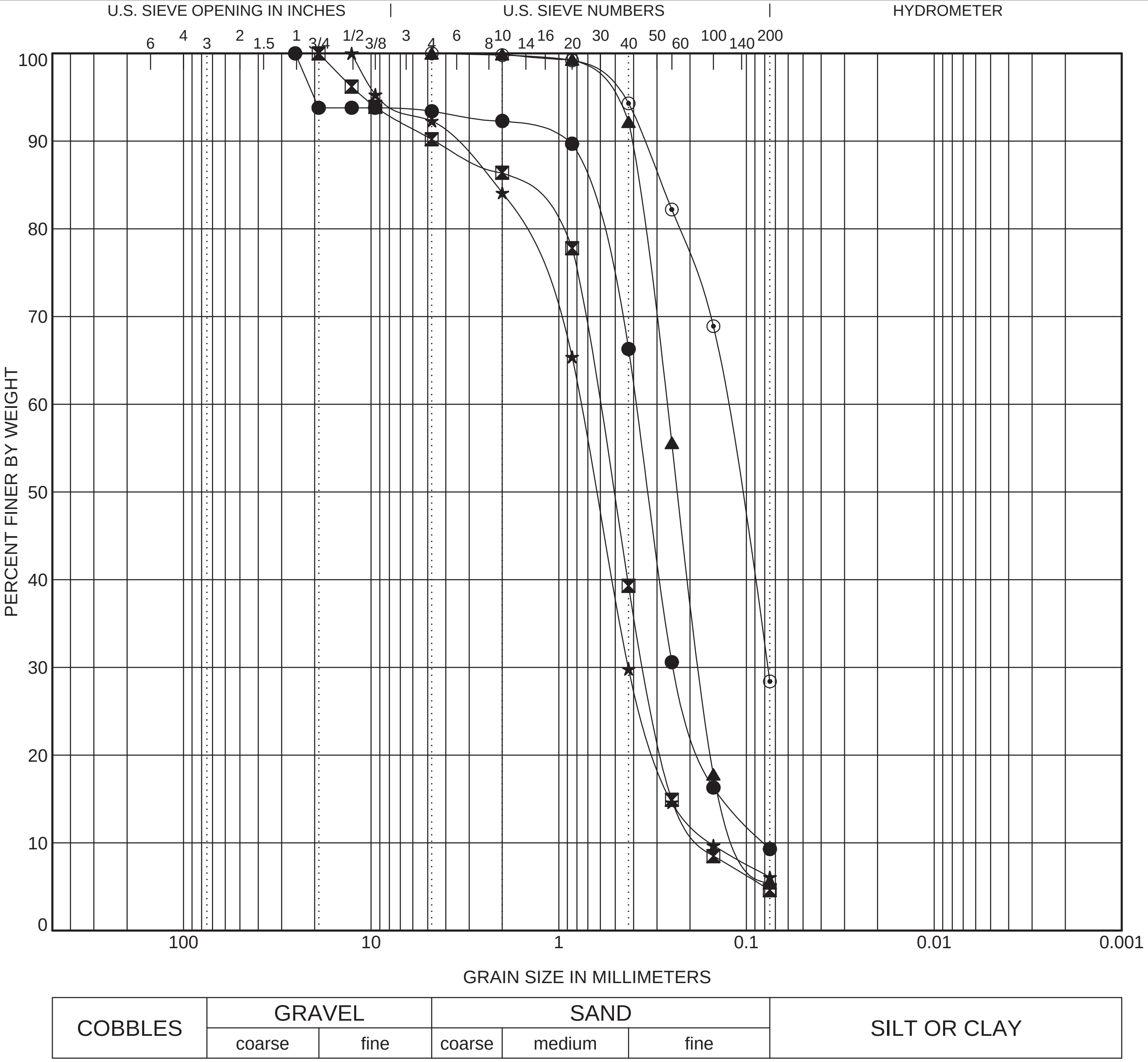
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
● THT-16-10	5.0	9.52	0.274	0.118		1.4	80.0	18.6
⊠ THT-16-10	15.0	2				0.0	30.5	69.5
▲ THT-17-10	0.0	9.5	0.447	0.188	0.081	2.7	88.9	8.4
★ THT-17-10	5.0	9.5	0.444	0.192		1.6	87.0	11.4
⊙ THT-17-10	20.0	4.75	0.275	0.171	0.083	0.0	92.0	8.0

PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-9



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-18-10	@ 1.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.92**	**4.81**
⊠ THT-18-10	@ 5.0 ft.	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**1.16**	**3.65**
▲ THT-18-10	@ 15.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.21**	**2.75**
★ THT-19-10	@ 5.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.54**	**4.94**
⊙ THT-19-10	@ 20.0 ft.	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-18-10	1.0	**25.4**	**0.387**	**0.245**	**0.08**	**6.6**	**84.1**	**9.3**	
⊠ THT-18-10	5.0	**19.05**	**0.617**	**0.347**	**0.169**	**9.8**	**85.6**	**4.6**	
▲ THT-18-10	15.0	**4.75**	**0.266**	**0.177**	**0.097**	**0.0**	**94.6**	**5.4**	
★ THT-19-10	5.0	**12.7**	**0.765**	**0.427**	**0.155**	**7.7**	**86.2**	**6.1**	
⊙ THT-19-10	20.0	**4.75**	**0.129**	**0.077**		**0.0**	**71.6**	**28.4**	

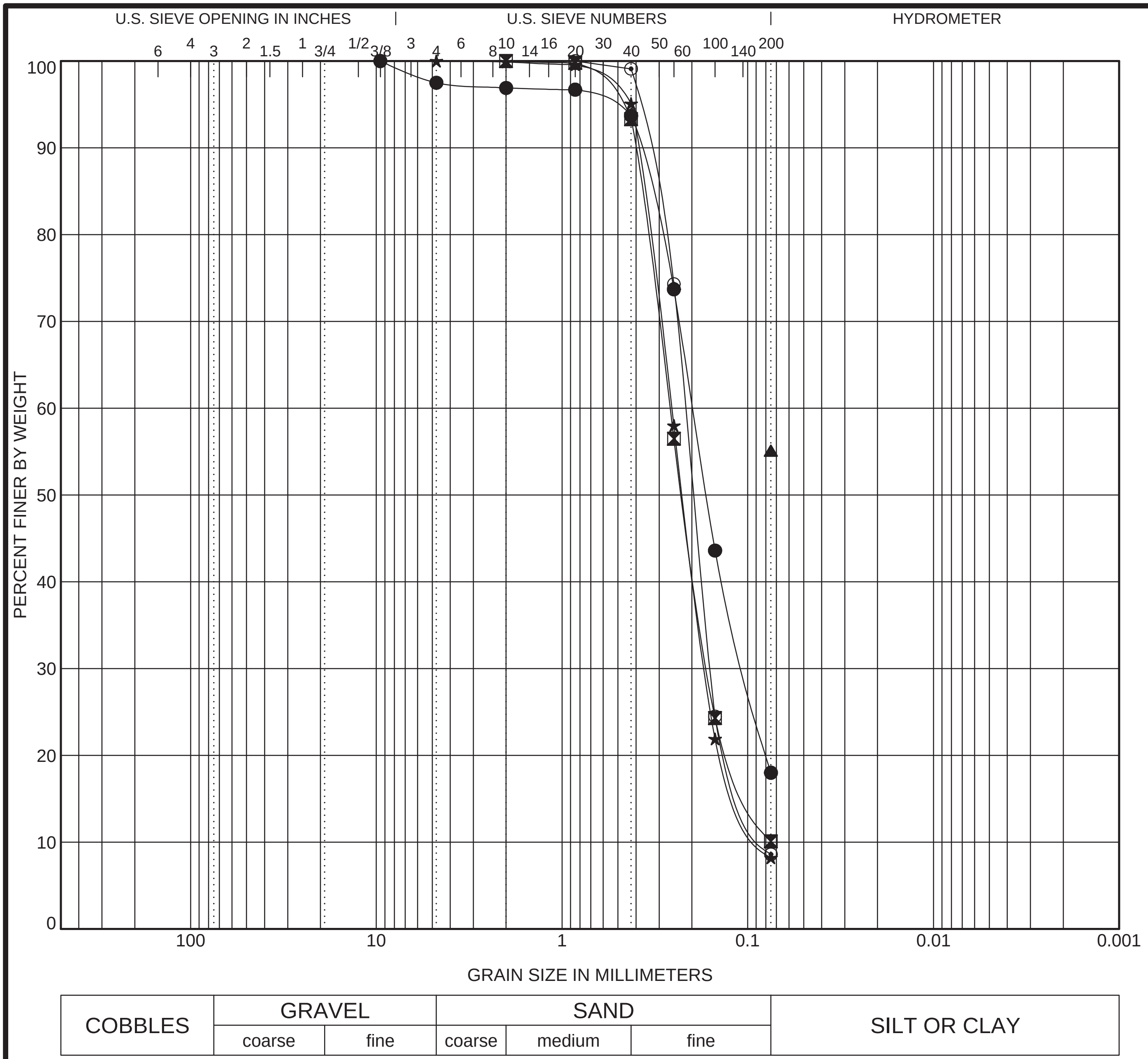
GRAIN SIZE DISTRIBUTION

PanGEO
INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-10

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-20-10	@ 25.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
⊠ THT-20-10	@ 30.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.37	3.52
▲ THT-20-10	@ 35.0 ft.	**SANDY SILT(ML)**	NP	NP	NP		
★ THT-20-10	@ 50.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.34	3.13
⊙ THT-20-10	@ 65.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.46	2.71

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
● THT-20-10	25.0	9.525	0.198	0.104		2.5	79.5	18.0
⊠ THT-20-10	30.0	2	0.263	0.164		0.0	89.9	10.1
▲ THT-20-10	35.0	0.075				0.0	0.0	55.1
★ THT-20-10	50.0	4.75	0.257	0.168	0.082	0.0	91.8	8.2
⊙ THT-20-10	65.0	0.85	0.216	0.159	0.08	0.0	91.4	8.6

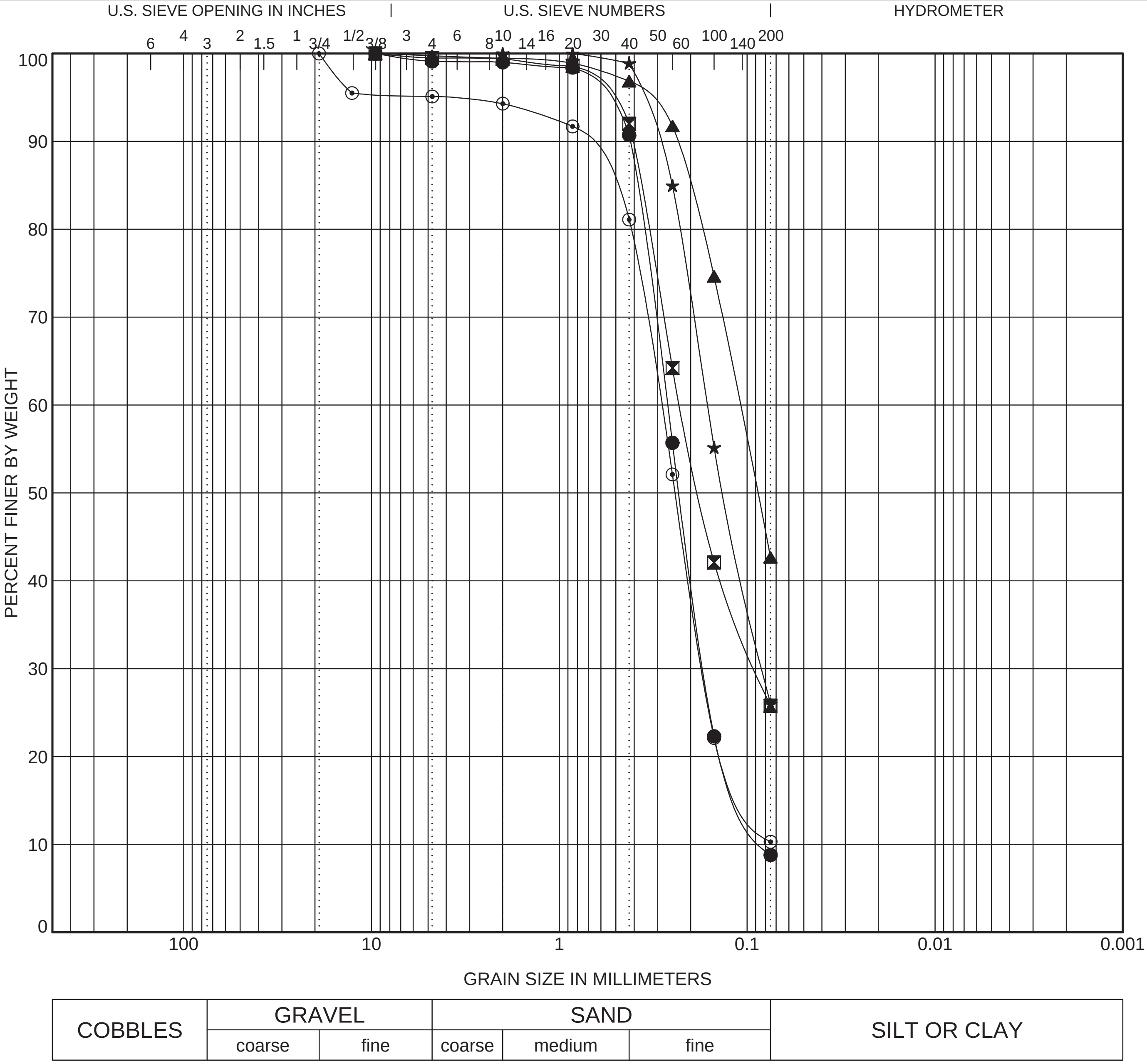
GRAIN SIZE DISTRIBUTION

PanGEO INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-11

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-21-10	@ 11.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.34	3.35
⊠ THT-21-10	@ 26.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
▲ THT-21-10	@ 46.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
★ THT-21-10	@ 61.0 ft.	**SILTY SAND(SM)**	NP	NP	NP		
⊙ THT-22-10	@ 5.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.38	3.92

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-21-10	11.0	9.525	0.267	0.169	0.08	0.9	90.3	8.8	
⊠ THT-21-10	26.0	9.525	0.227	0.09		0.5	73.7	25.8	
▲ THT-21-10	46.0	9.525	0.109			0.3	57.1	42.7	
★ THT-21-10	61.0	2	0.163	0.082		0.0	74.0	26.0	
⊙ THT-22-10	5.0	19.05	0.289	0.172		4.9	84.8	10.3	

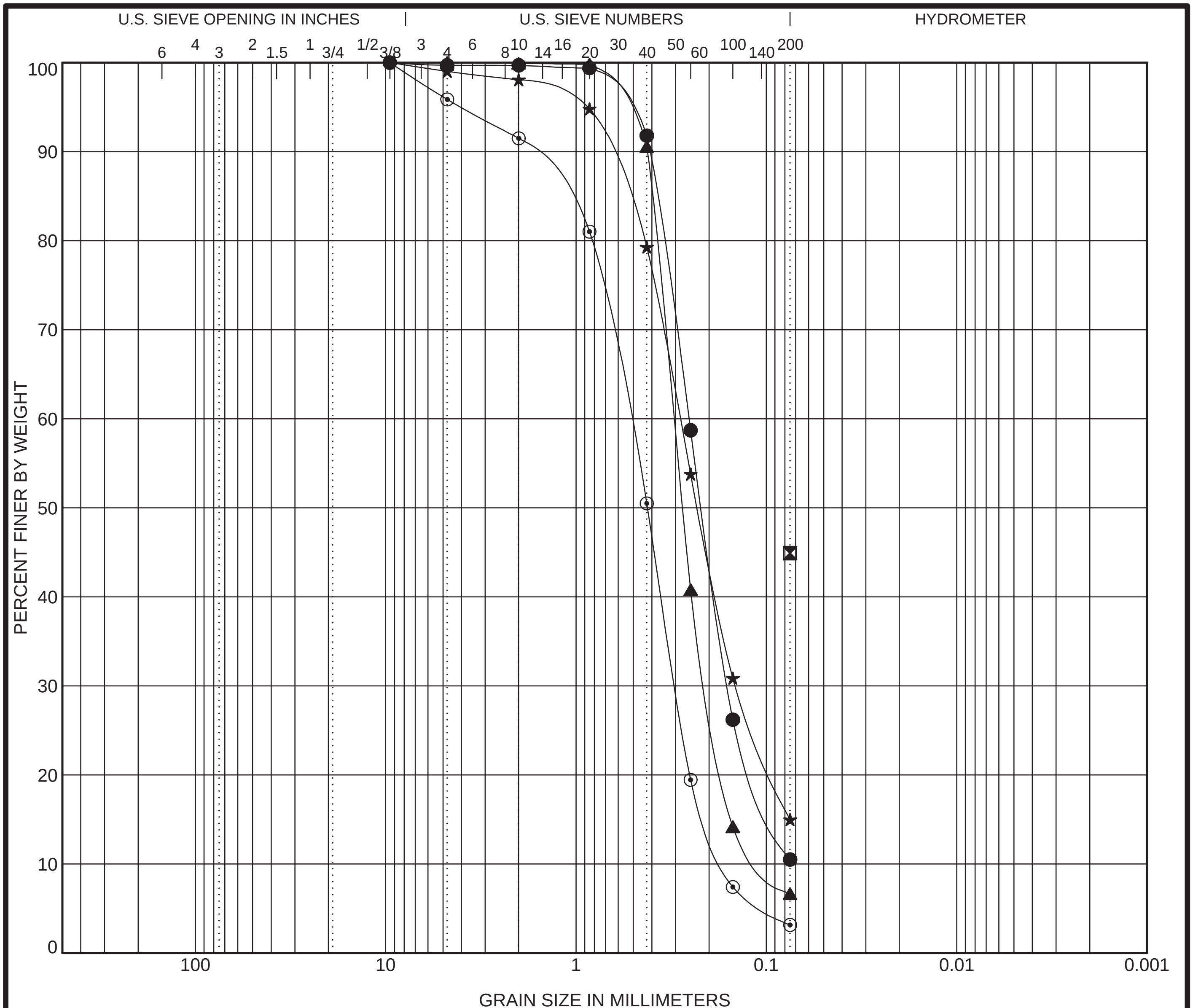
GRAIN SIZE DISTRIBUTION

PanGEO INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-12

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



<table>
<tr><td rowspan="2">COBBLES</td><td colspan="2">GRAVEL</td><td colspan="3">SAND</td><td rowspan="2">SILT OR CLAY</td></tr>
<tr><td>coarse</td><td>fine</td><td>coarse</td><td>medium</td><td>fine</td></tr>
</table>

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**THT-22-10**	**@ 20.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.35**	**3.48**
⊠	**THT-22-10**	**@ 40.0 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
▲	**THT-22-10**	**@ 65.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.32**	**3.01**
★	**THT-23-10**	**@ 1.5 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
⊙	**THT-23-10**	**@ 3.5 ft.**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**1.02**	**3.15**

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**THT-22-10**	**20.0**	**9.525**	**0.255**	**0.159**		**0.3**	**89.2**	**10.5**	
⊠	**THT-22-10**	**40.0**	**0.075**				**0.0**	**0.0**	**44.9**	
▲	**THT-22-10**	**65.0**	**4.75**	**0.307**	**0.203**	**0.102**	**0.0**	**93.3**	**6.7**	
★	**THT-23-10**	**1.5**	**9.525**	**0.284**	**0.144**		**1.0**	**84.0**	**15.0**	
⊙	**THT-23-10**	**3.5**	**9.525**	**0.527**	**0.299**	**0.167**	**4.1**	**92.7**	**3.2**	

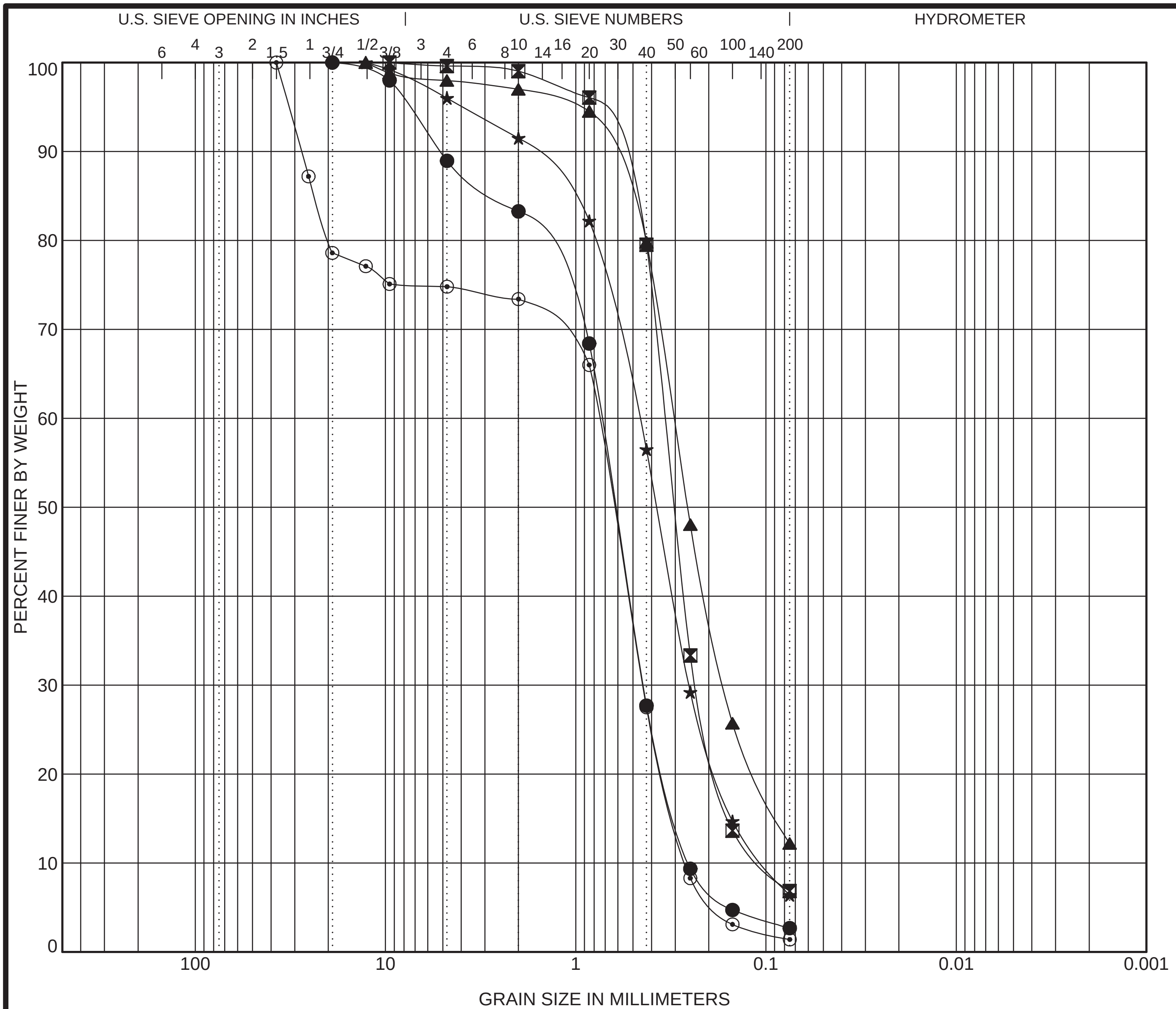
PanGEO
INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-13

GRAIN SIZE 10-069 116TH INTERCHANGE.GPJ PANGEO.GDT 11/30/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● THT-23-10	@ 5.5 ft.	**POORLY GRADED SAND(SP)**	NP	NP	NP	1.04	2.89
⊠ THT-23-10	@ 11.0 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.50	3.28
▲ TP-1	@ 2.5 ft.	**SILTY SAND(SM)**	NP	NP	NP	1.34	4.56
★ TP-1	@ 9.5 ft.	**POORLY GRADED SAND with SILT(SP-SM)**	NP	NP	NP	1.36	4.61
⊙ TP-2	@ 1.0 ft.	**POORLY GRADED SAND with GRAVEL(SP)**	NP	NP	NP	0.99	2.91

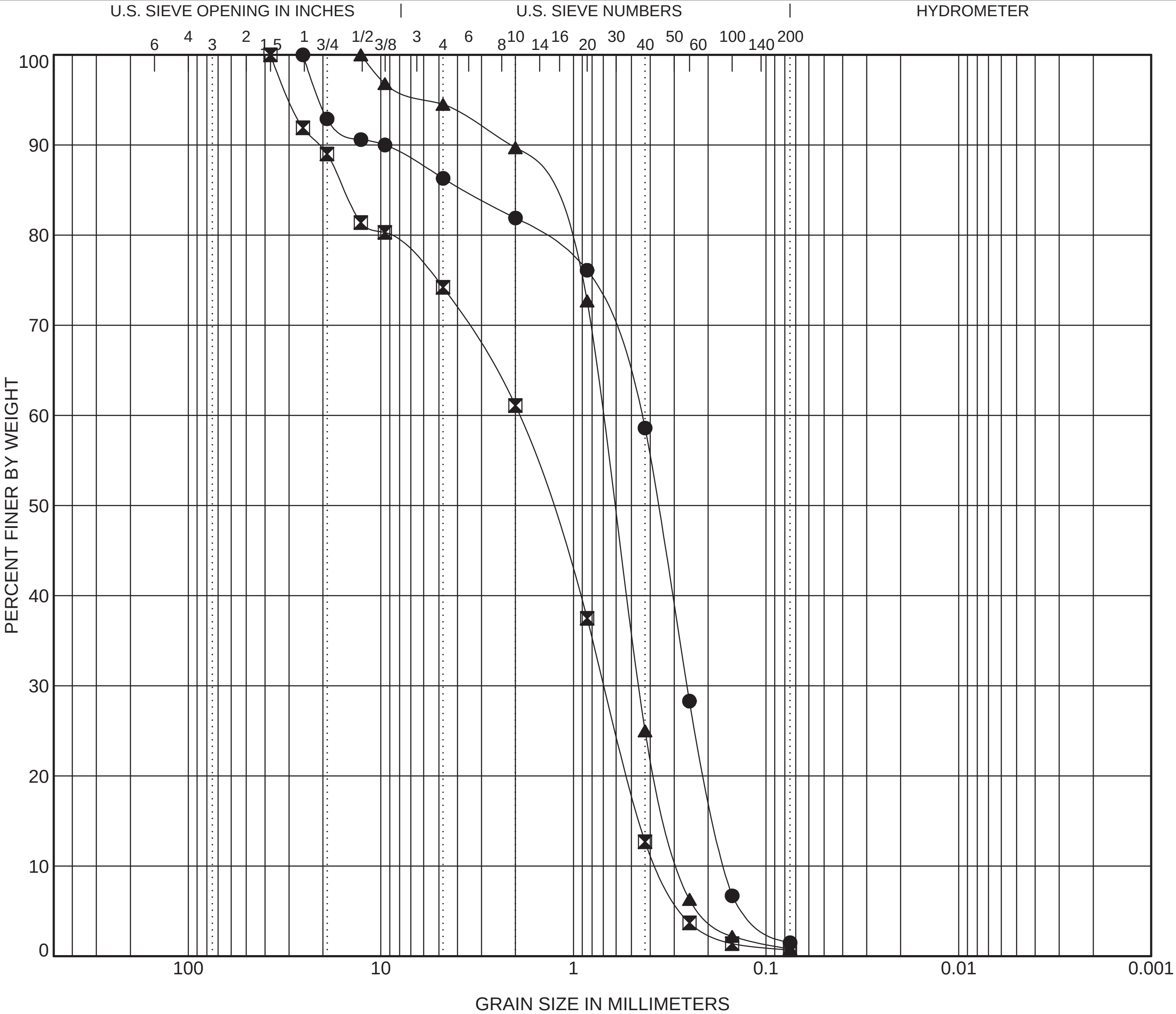
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● THT-23-10	5.5	19.05	0.737	0.442	0.255	11.1	86.3	2.7	
⊠ THT-23-10	11.0	9.525	0.34	0.229	0.103	0.4	92.8	6.8	
▲ TP-1	2.5	12.7	0.305	0.165		2.0	85.8	12.2	
★ TP-1	9.5	12.7	0.467	0.254	0.101	4.0	89.6	6.4	
⊙ TP-2	1.0	37.5	0.763	0.445	0.262	25.2	73.4	1.4	

PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**TP-2**	**@ 4.0 ft.**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**0.91**	**2.77**
⊠	**TP-3**	**@ 1.0 ft.**	**POORLY GRADED SAND with GRAVEL(SP)**	**NP**	**NP**	**NP**	**0.68**	**5.30**
▲	**TP-3**	**@ 4.0 ft.**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**1.06**	**2.55**

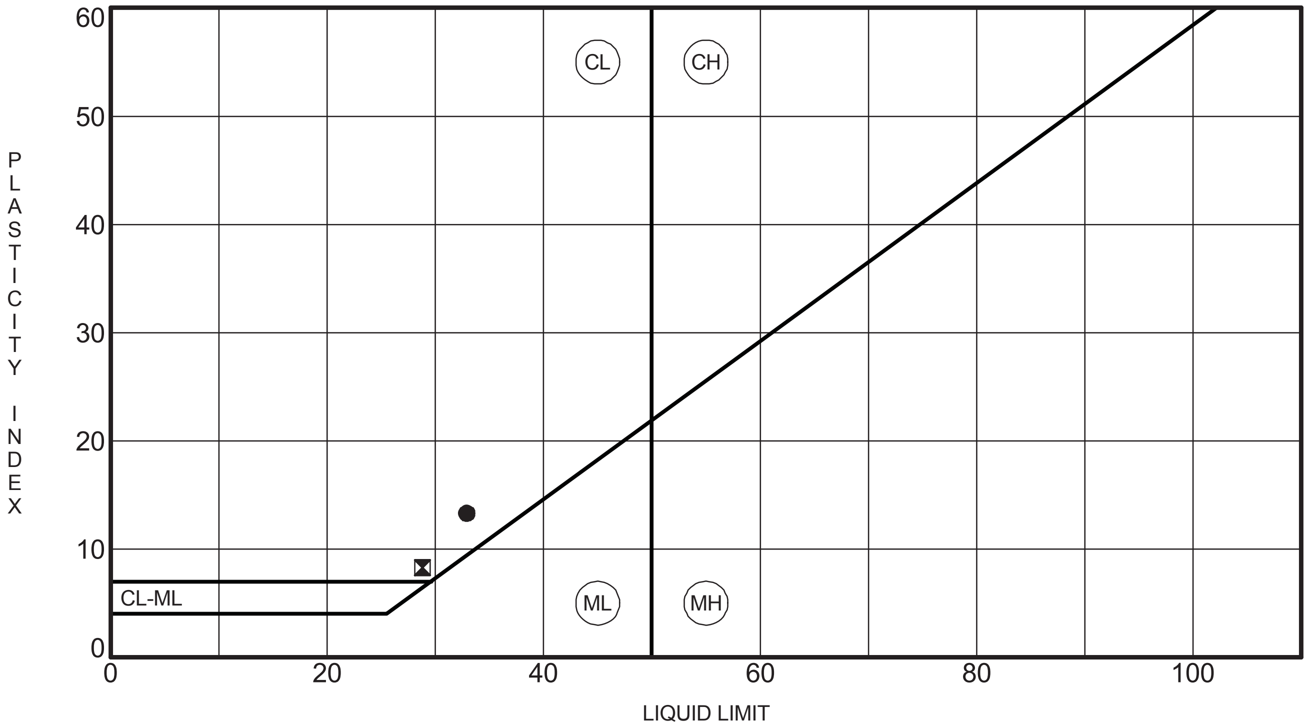
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-2**	**4.0**	**25.4**	**0.449**	**0.258**	**0.162**	**13.7**	**84.8**	**1.5**	
⊠	**TP-3**	**1.0**	**37.5**	**1.922**	**0.689**	**0.362**	**25.8**	**73.5**	**0.7**	
▲	**TP-3**	**4.0**	**12.7**	**0.707**	**0.457**	**0.278**	**5.5**	**93.7**	**0.8**	

PanGEO
INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-15



	Specimen Identification		M	LL	PL	PI	Fines	Classification
●	**THT-20-10**	**45.0**	**33**	**33**	**20**	**13**	**87**	**LEAN CLAY(CL)**
⧗	**THT-22-10**	**55.0**	**36**	**29**	**21**	**9**	**98**	**LEAN CLAY(CL)**

PanGEO INCORPORATED
Phone: 206.262.0370

ATTERBERG LIMITS

Project: I-5 NE 116th Interchange
Job Number: 10-069
Location: Marysville, Washington

Figure B-16

SAMPLE RESULTS-CONVENTIONALS
RF84-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/05/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 06/29/10
Date Received: 07/26/10

Client ID: THT-6-10 S-7 18-20
ARI ID: 10-17706 RF84K

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	95.50
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.03	2.49

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF84-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/05/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 06/29/10
Date Received: 07/26/10

Client ID: THT-6-10 S-8 20-22
ARI ID: 10-17707 RF84L

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	82.20
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.04	2.92

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF84-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/05/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 06/29/10
Date Received: 07/26/10

Client ID: THT-6-10 S-9 22-24
ARI ID: 10-17708 RF84M

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	83.00
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.03	2.45

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF84-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/05/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 06/29/10
Date Received: 07/26/10

Client ID: THT-6-10 S-10 24-26
ARI ID: 10-17709 RF84N

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	81.70
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.03	2.80

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF84-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/05/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/06/10
Date Received: 07/26/10

Client ID: THT-9-10 S-5 16-18
ARI ID: 10-17714 RF84S

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	95.00
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.03	1.26

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF84-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/05/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/06/10
Date Received: 07/26/10

Client ID: THT-9-10 S-6 18-20
ARI ID: 10-17715 RF84T

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	93.10
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.03	2.11

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
RF84-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/05/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	07/28/10	Percent	< 0.01 U
Cation Exchange Capacity	08/02/10	meq/100 g	< 0.03 U

SAMPLE RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/06/10
Date Received: 07/26/10

Client ID: THT-9-10 S-7 20-22
ARI ID: 10-17721 RF86A

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	93.60
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.03	2.74

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/06/10
Date Received: 07/26/10

Client ID: THT9-10 S-8 22-24
ARI ID: 10-17722 RF86B

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	60.90
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.05	3.69

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/02/10
Date Received: 07/26/10

Client ID: THT-10-10 S-2 10-12
ARI ID: 10-17723 RF86C

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	91.90
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.03	3.14

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/02/10
Date Received: 07/26/10

Client ID: THT-10-10 S-3 12-14
ARI ID: 10-17724 RF86D

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	89.80
Cation Exchange Capacity	08/02/10 080210#1	1N NH4OAc	meq/100 g	0.03	2.05

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/02/10
Date Received: 07/26/10

Client ID: THT-10-10 S-4 14-16
ARI ID: 10-17725 RF86E

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	84.80
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	27.76

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/01/10
Date Received: 07/26/10

Client ID: THT-11-10 S-2 10-12
ARI ID: 10-17726 RF86F

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	92.80
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	22.65

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/01/10
Date Received: 07/26/10

Client ID: THT-11-10 S-3 12-14
ARI ID: 10-17727 RF86G

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	89.60
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	3.24

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/01/10
Date Received: 07/26/10

Client ID: THT-11-10 S-4 14-16
ARI ID: 10-17728 RF86H

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	91.90
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	4.66

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/02/10
Date Received: 07/26/10

Client ID: THT-11-10 S-5 16-18
ARI ID: 10-17729 RF86I

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	89.20
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	2.69

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 06/29/10
Date Received: 07/26/10

Client ID: THT-14-10 S-4 14-16
ARI ID: 10-17733 RF86M

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	93.80
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	1.10

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 06/29/10
Date Received: 07/26/10

Client ID: THT-14-10 S-5 16-18
ARI ID: 10-17734 RF86N

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	95.20
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	1.24

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 06/29/10
Date Received: 07/26/10

Client ID: THT-14-10 S-6 18-20
ARI ID: 10-17735 RF86O

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	88.90
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	1.02

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 06/29/10
Date Received: 07/26/10

Client ID: THT-14-10 S-7 20-22
ARI ID: 10-17736 RF86P

Analyte	Date	Method	Units	RL	Sample
Total Solids	07/28/10 072810#1	EPA 160.3	Percent	0.01	85.10
Cation Exchange Capacity	08/04/10 080410#1	1N NH4OAc	meq/100 g	0.03	1.85

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	07/28/10	Percent	< 0.01 U
Cation Exchange Capacity	08/02/10	meq/100 g	< 0.03 U
	08/04/10		< 0.03 U

REPLICATE RESULTS-CONVENTIONALS
RF86-PanGeo Incorporated

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 08/09/10

Project: 116th and I-5 Interchange
Event: 10-069
Date Sampled: 07/06/10
Date Received: 07/26/10

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: RF86A Client ID: THT-9-10 S-7 20-22					
Total Solids	07/28/10	Percent	93.60	94.10	0.5%
ARI ID: RF86E Client ID: THT-10-10 S-4 14-16					
Cation Exchange Capacity	08/04/10	meq/100 g	27.76	27.08	2.5%

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: TP-1 S-1 2 1/2-3
ARI ID: 11-20269 TM68A

Analyte	Date	Method	Units	RL	Sample
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	95.90
Cation Exchange Capacity	09/19/11 091911#1	9080	meq/100 g	0.03	1.74

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: TP-1 S-3 9 1/2-10
ARI ID: 11-20270 TM68B

Analyte	Date	Method	Units	RL	Sample
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	94.00
Cation Exchange Capacity	09/19/11 091911#1	9080	meq/100 g	0.03	1.57

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: TP-2 S-1 1-1 1/2
ARI ID: 11-20271 TM68C

Analyte	Date	Method	Units	RL	Sample
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	97.20
Cation Exchange Capacity	09/19/11 091911#1	9080	meq/100 g	0.03	1.01

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: TP-3 S-1 1-1 1/2
ARI ID: 11-20273 TM68E

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	97.40
Cation Exchange Capacity	09/19/11 091911#1	9080	meq/100 g	0.03	0.95

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-13-10 S-1 0-1 1/2
ARI ID: 11-20275 TM68G

Analyte	Date	Method	Units	RL	Sample
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	97.50
Cation Exchange Capacity	09/19/11 091911#1	9080	meq/100 g	0.03	2.21

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-13-10 S-2 5-6 1/2
ARI ID: 11-20276 TM68H

Analyte	Date	Method	Units	RL	Sample
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	99.70
Cation Exchange Capacity	09/19/11 091911#1	9080	meq/100 g	0.03	0.92

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-18-10 S-1 0-1 1/2
ARI ID: 11-20277 TM68I

Analyte	Date	Method	Units	RL	Sample
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	99.40
Cation Exchange Capacity	09/19/11 091911#1	9080	meq/100 g	0.03	2.48

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-04-10 S-1 0-1 1/2
ARI ID: 11-20278 TM68J

Analyte	Date	Method	Units	RL	Sample	
pH	09/19/11 091911#1	SW9045	std units	0.01	5.14	
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	94.90	
Chloride	09/19/11 091911#1	EPA 325.2	mg/kg	8.4	< 8.4	U
Sulfate	09/19/11 091911#1	MSA 10-3	mg/kg	21.1	47.3	

RL Analytical reporting limit
U Undetected at reported detection limit

pH determined on 1:1 soil:D.I. water extracts.

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-05-10 S-2 5-6 1/2
ARI ID: 11-20279 TM68K

Analyte	Date	Method	Units	RL	Sample	
pH	09/19/11 091911#1	SW9045	std units	0.01	4.93	
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	99.00	
Chloride	09/19/11 091911#1	EPA 325.2	mg/kg	8.1	< 8.1	U
Sulfate	09/19/11 091911#1	MSA 10-3	mg/kg	20.2	56.2	

RL Analytical reporting limit
U Undetected at reported detection limit

pH determined on 1:1 soil:D.I. water extracts.

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-08-10 S-2 2-4
ARI ID: 11-20280 TM68L

Analyte	Date	Method	Units	RL	Sample	
pH	09/19/11 091911#1	SW9045	std units	0.01	5.90	
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	98.30	
Chloride	09/19/11 091911#1	EPA 325.2	mg/kg	9.8	< 9.8	U
Sulfate	09/19/11 091911#1	MSA 10-3	mg/kg	19.6	19.8	

RL Analytical reporting limit
U Undetected at reported detection limit

pH determined on 1:1 soil:D.I. water extracts.

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-12-10 S-3 10-11 1/2
ARI ID: 11-20281 TM68M

Analyte	Date	Method	Units	RL	Sample
pH	09/19/11 091911#1	SW9045	std units	0.01	6.10
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	94.50
Chloride	09/19/11 091911#1	EPA 325.2	mg/kg	52.3	56.8
Sulfate	09/19/11 091911#1	MSA 10-3	mg/kg	105	398

RL Analytical reporting limit
U Undetected at reported detection limit

pH determined on 1:1 soil:D.I. water extracts.

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-15-10 S-2 5-6 1/2
ARI ID: 11-20282 TM68N

Analyte	Date	Method	Units	RL	Sample	
pH	09/19/11 091911#1	SW9045	std units	0.01	5.96	
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	92.70	
Chloride	09/19/11 091911#1	EPA 325.2	mg/kg	51.2	< 51.2	U
Sulfate	09/19/11 091911#1	MSA 10-3	mg/kg	102	212	

RL Analytical reporting limit
U Undetected at reported detection limit

pH determined on 1:1 soil:D.I. water extracts.

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-20-10 S-2 10-11 1/2
ARI ID: 11-20283 TM68O

Analyte	Date	Method	Units	RL	Sample
pH	09/19/11 091911#1	SW9045	std units	0.01	6.22
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	86.30
Chloride	09/19/11 091911#1	EPA 325.2	mg/kg	56.7	99.8
Sulfate	09/19/11 091911#1	MSA 10-3	mg/kg	113	609

RL Analytical reporting limit
U Undetected at reported detection limit

pH determined on 1:1 soil:D.I. water extracts.

SAMPLE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Client ID: THT-22-10 S-2 10-11 1/2
ARI ID: 11-20284 TM68P

Analyte	Date	Method	Units	RL	Sample
pH	09/19/11 091911#1	SW9045	std units	0.01	6.38
Total Solids	09/20/11 092011#1	EPA 160.3	Percent	0.01	86.10
Chloride	09/19/11 091911#1	EPA 325.2	mg/kg	56.7	74.0
Sulfate	09/19/11 091911#1	MSA 10-3	mg/kg	113	461

RL Analytical reporting limit
U Undetected at reported detection limit

pH determined on 1:1 soil:D.I. water extracts.

MS/MSD RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Analyte	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: TM68J Client ID: THT-04-10 S-1 0-1 1/2						
Chloride	09/19/11	mg/kg	< 8.4	214	211	101.5%
Sulfate	09/19/11	mg/kg	47.3	285	256	92.9%

REPLICATE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: 09/16/11
Date Received: 09/16/11

Analyte	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: TM68J Client ID: THT-04-10 S-1 0-1 1/2					
pH	09/19/11	std units	5.14	5.11	0.03
Chloride	09/19/11	mg/kg	< 8.4	< 10.3 < 10.4	NA
Sulfate	09/19/11	mg/kg	47.3	41.1 54.9	14.5%

pH is evaluated as the Absolute Difference between the values rather than Relative Percent Difference

LAB CONTROL RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: NA
Date Received: NA

Analyte/Method	QC ID	Date	Units	LCS	Spike Added	Recovery
pH SW9045	ICVL	09/19/11	std units	6.98	7.00	0.02

pH is evaluated as the Absolute Difference between the values rather than Percent Recovery.

METHOD BLANK RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: NA
Date Received: NA

Analyte	Date	Units	Blank
Total Solids	09/20/11	Percent	< 0.01 U
Cation Exchange Capacity	09/19/11	meq/100 g	< 0.03 U
Chloride	09/19/11	mg/kg	< 10.0 U
Sulfate	09/19/11	mg/kg	< 20.0 U

STANDARD REFERENCE RESULTS-CONVENTIONALS
TM68-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 09/23/11

Project: I-5, 116th St. NE I.C. Impro
Event: 10-069
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Date	Units	SRM	True Value	Recovery
Chloride ERA #38084	09/19/11	mg/kg	48.0	50.0	96.0%
Sulfate SPEX #20-25AS	09/19/11	mg/kg	83.3	100	83.3%

Am Test Inc.
14603 N.E. 87th St.
Redmond, WA 98052
(425) 885-1664
www.amtestlab.com

AMTEST LABORATORIES

Professional Analytical Services

ANALYSIS REPORT

Shannon & Wilson
PO Box 300303
Seattle, WA 98103
Attention: Chad McMullen
Project Name: 116 St/I-5
Project #: 21-1-09896-007
All results reported on a dry weight basis.

Date Received: 06/01/07
Date Reported: 6/19/07

AMTEST Identification Number **07-A007060**
Client Identification **B-2 S-1 (2.5-4')**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
pH	5.2	unit			SW-846 9045	JR	06/04/07
Resistivity	40000	ohms cm			ASTM G-57	JR	06/04/07
Total Solids	95.6	%		0.1	SM 2540B	JR	06/07/07

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Sulfate	150	ug/g			SW-846 9038	MO	06/06/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Chloride	< 10	ug/g		10.	SW-846 9252	TE	06/06/07

AMTEST Identification Number 07-A007061
Client Identification B-3 S-2 (5.0-6.5)
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
pH	5.7	unit			SW-846 9045	JR	06/04/07
Resistivity	82000	ohms cm			ASTM G-57	JR	06/04/07
Total Solids	92.6	%		0.1	SM 2540B	JR	06/07/07

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Sulfate	< 11	ug/g			SW-846 9038	MO	06/06/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Chloride	< 10	ug/g		10.	SW-846 9252	TE	06/06/07

AMTEST Identification Number **07-A007062**
Client Identification **B-4 S-3 (7.5-9.0)**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
pH	5.8	unit			SW-846 9045	JR	06/04/07
Resistivity	130000	ohms cm			ASTM G-57	JR	06/04/07
Total Solids	95.9	%		0.1	SM 2540B	JR	06/07/07

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Sulfate	< 10	ug/g			SW-846 9038	MO	06/06/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Chloride	< 10	ug/g		10.	SW-846 9252	TE	06/06/07

AMTEST Identification Number **07-A007063**
Client Identification **B-5 S-11 (35-36.5)**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
pH	5.5	unit			SW-846 9045	JR	06/04/07
Resistivity	14000	ohms cm			ASTM G-57	JR	06/04/07
Total Solids	85.3	%		0.1	SM 2540B	JR	06/07/07

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Sulfate	67.	ug/g			SW-846 9038	MO	06/06/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Chloride	< 10	ug/g		10.	SW-846 9252	TE	06/06/07

AMTEST Identification Number **07-A007064**
Client Identification **B-7 S-10 (30-31.5)**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
pH	6.2	unit			SW-846 9045	JR	06/04/07
Resistivity	25000	ohms cm			ASTM G-57	JR	06/04/07
Total Solids	85.0	%		0.1	SM 2540B	JR	06/07/07

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Sulfate	< 12	ug/g			SW-846 9038	MO	06/06/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Chloride	< 10	ug/g		10.	SW-846 9252	TE	06/06/07

AMTEST Identification Number **07-A007065**
Client Identification **B-10 S-5 (6.5-8)**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Volatile Solids	1.5	%		0.1	SM 2540-G	JR	06/08/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Cation Exchange Capacity	3.4	meq/100g		0.5	SW-846 9081	MRW	06/08/07

AMTEST Identification Number **07-A007066**
Client Identification **B-11 S-5 (6.5-8)**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Volatile Solids	1.1	%		0.1	SM 2540-G	JR	06/08/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Cation Exchange Capacity	1.6	meq/100g		0.5	SW-846 9081	MRW	06/08/07

AMTEST Identification Number **07-A007067**
Client Identification **B-11 S-8 (11.5-13)**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Volatile Solids	1.3	%		0.1	SM 2540-G	JR	06/08/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Cation Exchange Capacity	2.7	meq/100g		0.5	SW-846 9081	MRW	06/08/07

AMTEST Identification Number **07-A007068**
Client Identification **B-10 S-6 (8-9.5)**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Volatile Solids	3.1	%		0.1	SM 2540-G	JR	06/08/07

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Cation Exchange Capacity	9.1	meq/100g		0.5	SW-846 9081	MRW	06/08/07

Aaron W Young

Aaron W. Young
Laboratory Manager

APPENDIX C

LOGS OF TEST BORINGS FROM PREVIOUS FIELD EXPLORATIONS

APPENDIX C: LOGS OF TEST BORINGS FROM PREVIOUS FIELD EXPLORATIONS

This appendix contains copies of the boring logs from the previous investigation for the interchange by WSDOT, dated October, 1967. The locations of the borings are included on Figure 3, Site and Exploration Plan, Central.

Also included in this appendix are copies of boring logs from previous field explorations by Shannon & Wilson, dated December, 2005 and November, 2007. The locations of the borings, where visible within the limits of the drawing, are included on Figure 3, Site and Exploration Plan, Central.

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER C.S. 3104
P.S.H.
S.B.H. No. 1 Section GNRR U'XING: PIER #4 Job No. L-2848
Hole No. H-1 Station Ry STA. 116+73 Offset 14.5' RT ℄ Ground Elev. 59.5
Type of Boring AUGER 8C48-8 & JET Water Table 19.0 Below Ground Casing AUGER 95.0
Inspector JOHN H. BARNHOUSE Date 5 JAN 67 To 9 JAN 67 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			B U-1	TOP SOIL - Silty Sand with bits of organic material & small amount fine gravel, dark brown, Very loose
	2		1 1 1 1 STD. PEN. 2	SLIGHTLY SILTY SAND - Very loose to Compact, brown, Very fine to medium: Occasional piece fine gravel
5				
			BC U-3	
	10		5 5 5 4 STD. PEN. 4	
10				
			B U-5	
	22		11 10 12 14 STD. PEN. 6	
15				
	19		7 9 10 11 STD. PEN. 7	Samples moist to 17.0 FT - wet thereon
20				
	18		6 7 11 12 STD. PEN. 8	SLIGHTLY SILTY SAND - Very fine to fine, compact to dense, brown, with lenses & thin layers of Extremely fine to fine dark brown sand.
25				
	19		8 8 11 7 STD. PEN. 9	
30				

H.F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
~~S.H.~~ No. 1 Section GNRR U'XING: PIER #4 Job No. 2-2848
Hole No. H-1 Station Ry STA. 116+73 Offset 14.5 FT RT ℄ Ground Elev. 59.5
Type of Boring AUGER & JET Water Table 19.0 Below GROUND Casing AUGER 95.0
Inspector JOHN H. BARNHOUSE Date 5-JAN.'67 - 9-JAN.'67 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	33		12 15 18 19 STD. PEN. 10	
35	50		12 22 28 29 STD. PEN. 11	
40	24		12 10 14 18 STD. PEN. 12	SAND - grey, clean & silty layered, very fine to fine compact to dense with lenses & thin layers to approximately 6" of extremely fine silty sand & sandy silt.
45	21		7 9 12 12 STD. PEN. 13	
50	28		11 11 17 14 STD. PEN. 14	
55	22		7 10 12 18 STD. PEN. 15	
60				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER

P.S.H.

~~S.S.H.~~ No. 1 Section GNRR U'XING: PIER #4 Job No. L-2848

Hole No. H-1 Station Ry 116+73 Offset 14.5 FT RT ℄ Ground Elev. 59.5

Type of Boring AUGER & JET Water Table 19.0 BELOW GROUND Casing AUGER 95.0

Inspector JOHN H. BARNHOUSE Date 5-JAN- To 9-JAN-'67 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	37		10, 18, 19, 24 STD. PEN. 16	MATERIAL DESCRIPTION REMAINS SAME
65				
	12		4, 6, 6, 11 STD. PEN. 17	
70				
			ABC U-18	
	37		12, 16, 21, 26 STD. PEN. 19	
75				
	20		6, 8, 12, 16 STD. PEN. 20	
80				
	41		11, 20, 21, 29 STD. PEN. 21	
85				
	24		9, 10, 14, 15 STD. PEN. 22	
90				

F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER
P.S.H.
S.S.H. No. 1 Section GN RR U'XING: PIER #4 Job No. L-2848
Hole No. H-1 Station Ry STA. 116+73 Offset 14.5 FT RT ℄ Ground Elev. 59.5
Type of Boring AUGER & JET Water Table 19.0' Below Ground AUGER Casing 95.0
Inspector JOHN H. BARNHOUSE Date 5 JAN '67 TO 9 JAN '67 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	50		16 20 30 33 STD. PEN. 23	MATERIAL DESCRIPTION REMAINS SAME
95				
	70		21 36 34 37 STD. PEN. 24	
100				
	78		18 28 50 38 STD. PEN. 25	TEST BORING STOPPED at 103'0"
105				

H.-F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
S.S.H. No. 1 Section GNRR U'XING: PIER # 5 C.S. 3104 Job No. L-2848
Hole No. H-2 Station Ry 117+13 Offset 15' RT ℄ Ground Elev. 61.0
Type of Boring AUGER 8C48-8 Water Table 21.5 Below GROUND Casing AUGER 102.0
Inspector JOHN H. BARNHOUSE Date 10-JAN. TO 11-JAN.-'67 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				TOP SOIL - Silty sand, fine, very loose, dark brown.
			B C U-1	SLIGHTLY SILTY SAND - Slightly compact to compact, fine to course, with occasional piece of fine to medium gravel, brown.
5	11		3 5 6 12 STD. PEN. 2	
10	32		12 15 17 18 STD. PEN. 3	
15	15		5 7 8 12 STD. PEN. 4	SLIGHTLY SILTY SAND - Slightly compact, fine to course, with occasional piece of fine gravel, brown. Occasional lens extremely fine sand & silt.
20	18		6 9 9 12 STD. PEN. 5	SLIGHTLY SILTY SAND - Compact, very fine to fine, brown.
25	23		12 12 11 10 STD. PEN. 6	SAND - Fairly clean, compact to very dense, very fine to fine, brown. Samples moist to 23.0' - wet thereon.
30	28		12 14 14 17 STD. PEN. 7	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
S.S.H. No. 1 Section GNRR U'XING : PIER # 5 Job No. L-2848
Hole No. H-2 Station Ry 117 + 13 Offset 15' RT ℄ Ground Elev. 61.0
Type of Boring AUGER Water Table 21.5 Below Ground AUGER Casing 102.0
Inspector JOHN H. BARNHOUSE Date 10-JAN-TO 11-JAN-67 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	75		23 33 42 43 STD. PEN. 8	
35				
	50		17 23 27 29 STD. PEN. 9	SAND - Clean & silty layered, compact to dense, very fine to fine with occasional silt lens, grey.
40				
	24		10 10 14 16 STD. PEN. 10	
45				
	30		11 14 16 15 STD. PEN. 11	
50				
	21		8 9 12 12 STD. PEN. 12	
55				
	27		8 13 14 13 STD. PEN. 13	
60				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 — MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
S.S.H. No. 1 Section GNRR U'XING. PIER #5 Job No. L-2848
Hole No. H-2 Station Ry 117+13 Offset 15' RT ℄ Ground Elev. 61.0
Type of Boring AUGER Water Table 21.5 BELOW GROUND Casing Auger 102.0
Inspector JOHN H. BARNHOUSE Date 10-JAN-TO 11-JAN-'67 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	21		7, 7, 14, 16 STD. PEN. 14	
65				
	20		7, 9, 11, 12 STD. PEN. 15	SAND & SILT - Compact extremely fine to fine silty sand with silt & clayey silt layers to approximately 6", grey.
70			U-16	SLIGHTLY SILTY SAND - Compact to dense, very fine to fine, grey.
	39		14, 19, 20, 21 STD. PEN. 17	
75				
	21		7, 9, 12, 12 STD. PEN. 18	
80				
	24		8, 12, 12, 15 STD. PEN. 19	
85				
	40		14, 19, 21, 25 STD. PEN. 20	
90				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER

P.S.H.

S.S.H. No. 1 Section GNAR U'XING: PIER #5 Job No. L-2848

Hole No. H-2 Station Ry 117+13 Offset 15' RT ℄ Ground Elev. 61.0

Type of Boring AUGER Water Table 21.5 BELOW GROUND Casing AUGER 102.0

Inspector JOHN H. BARNHOUSE Date 10-JAN-TO 11-JAN 67 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	16		7 7 9 20 STD. PEN. 21	SILTY SAND - SANDY SILT - CLAYEY SILT & SILTY CLAY - Variable layers to approximately 1', Compact, grey sand is extremely fine to fine.
95				
	18		5 7 11 13 STD. PEN. 22	
100				
			ABC 11-23	Layer approximately 1' - 102.0 - 103.0 - sands, silts & clays mixed.
			12 23 33 53 STD PEN. 24	SILTY SAND - Dense, extremely fine to very fine, grey.
105	56			TEST BORING STOPPED at 106' 0"
110				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER C.S. 3104
P.S.H.
~~S.R.~~ No. 1 Section GNAR U'XING: PIER #3 Job No. L-2848
Hole No. H-3 Station Ry 115+71 Offset 17' RT ℄ Ground Elev. 43.5
Type of Boring AUGER 8C48-8 Water Table 4.0 Below Ground Casing AUGER 101.5
Inspector JOHN H. BARNHOUSE Date 12-JAN-TO 13-JAN.-67 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			U-1	SILTY SAND - Compact, fine to course, brown, small amount fine gravel.
			D E	
	24		12, 11, 13, 14 STD. PEN. 2	
5				
	2		1, 1, 1, 2 STD. PEN. 3	SAND - Fairly clean, very loose to slightly compact, Very fine to medium with trace of fine gravel. Bits of peat throughout, brown.
10				Samples moist to 6.5 - wet thereon.
	5		2, 2, 3, 4 STD. PEN. 4	
15				
	14		STD. PEN. 5: 6, 5, 9, 12	
20				
	17		10, 7, 10, 17 STD PEN. 6	SAND - Fairly clean with sandy silt & clayey silt in thin Layers to approximately 6", compact to dense, very fine to fine, brown. SILT Layers are grey.
25				
	58		19, 30, 28, 33 STD. PEN 7	SILTY SAND - Dense, very fine to fine, grey.
30				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
P.S.H.
~~S.S.H.~~ No. 1 Section GNRR U'XING: PIER #3 Job No. L-2848
Hole No. H-3 Station Ry 115+71 Offset 17' RT ℄ Ground Elev. 43.5
Type of Boring AUGER Water Table 4.0 Below Ground AUGER Casing 101.5
Inspector JOHN H. BARNHOUSE Date 12-JAN.'67-13-JAN.'67 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	36		12, 17, 19, 21 STD. PEN. 8	
35				
	16		6, 9, 7, 9 STD. PEN. 9	SAND - Clean & silty layered, slightly Compact to compact, very fine to fine with silt & Clayey silt lenses, grey.
40				
	15		7, 6, 9, 13 STD. PEN. 10	
45				
	12 27		4, 8, 10, 17 STD. PEN. 11-A 11-B	Approximate 1' Layer Silty clay 46.5 - 47.5 - grey.
50				
	21		8, 9, 12, 15 STD. PEN. 12	
55				
	16		6, 7, 9, 11 STD. PEN. 13	
60				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5
P.S.H. MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
~~S.S.H.~~ No. 1 Section GNRR U'XING: PIER # 3 Job No. L-2848
Hole No. H-3 Station Ry 115+71 Offset 17' RT ℄ Ground Elev. 43.5
Type of Boring AUGER Water Table 4.0 Below Ground AUGER Casing 101.5
Inspector JOHN H. BARNHOUSE Date 12-JAN - 13-JAN-67 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	19		8, 9, 10, 11 STD. PEN. 14	
65				
	18		8, 8, 10, 15 STD. PEN. 15	
70				
	11		6, 5, 6, 17 STD. PEN. 16	SILTY SAND - SILT - CLAYEY SILT & SILTY CLAY - Variable lenses & Layers to approximately 2', slightly compact to compact, grey, sand is extremely fine to fine.
75				
	26		9, 10, 16, 19 STD. PEN. 17	
80				
	29		8, 12, 17, 19 STD. PEN. 18	SILTY SAND - Compact to dense, extremely fine to fine with occasional lens & thin Layer of silty clay, grey.
85				
	35		12, 12, 23, 25 STD. PEN. 19	
90				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to

S.R. No. 5 MARYSVILLE SCALEHOUSE TO STILLAGUAMISH RIVER
~~P.S.H.~~ ~~S.S.H.~~ No. 1 Section GNRR U'XING : PIER #3 Job No. L-2848
Hole No. H-3 Station Ry 115+71 Offset 17' RT ℄ Ground Elev. 43.5
Type of Boring AUGER Water Table 4.0 Below Ground Casing Auger 101.5
Inspector JOHN H. BARNHOUSE Date 12-JAN.-TO 13-JAN'67 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE. TUBE NOS.	DESCRIPTION OF MATERIAL
	47		20 21 26 30 STD. PEN. 20	
95				
	56		12 24 32 25 STD. PEN. 21	Approximate 2' layer very stiff clayey silt & silty clay 96.0 - 98.0
100				
	55		13 19 36 37 STD. PEN. 22	TEST BORING STOPPED at 103' 6"
105				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N.R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-4 Station Ry 114+56 Offset 13' RT. ℄ Ground Elev. 33.5
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 50'
Inspector E.E. DUVALL Date FEB. 7, 1967 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			A B U-1	SAND - VERY LOOSE BROWN TO GRAY, FINE TO COARSE, TRACE FINE GRAVEL, SCATTERED WOOD SATURATED
	1		1 1 1 1 STD. PEN. 2	
5			A U-3	
	8		2 4 4 6 STD. PEN. 4	
10				SAND - SLIGHTLY COMPACT, DARK BROWN TO GRAY, FINE TO COARSE, SCATTERED FINE GRAVEL, WET
			U-5	
	17		7 7 10 11 STD. PEN. 6	
15				15' ARTESIAN FLOW 1 GAL. 2 MIN.
	15		6 5 7 8 STD. PEN. 7	
				SILT - LOOSE GRAY, WET
20				SAND - SLIGHTLY COMPACT GRAY, SCATTERED SILT LENSES, SLIGHT TRACE FINE GRAVEL, SATURATED TO WET
			U-8	
	16		7 8 8 12 STD. PEN. 9	
25				
	19		6 6 13 20 STD. PEN. 10	
30			9	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N.R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-4 Station Ry 114 +56 Offset 13' RT. ℄ Ground Elev. 33.5
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 50'
Inspector E.E. DUVALL Date FEB. 7, 1967 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	18		9 9 15 STD. PEN. 11	SAND - SLIGHTLY COMPACT GRAY, SCATTERED SILT LENSES, SLIGHT TRACE FINE GRAVEL SATURATED TO WET
35				
	15		9 7 8 10 STD. PEN. 12	
40				
	28		14 13 15 20 STD. PEN. 13	
45				
	36		5 18 18 15 STD. PEN. 14	
50				
	26		13 11 15 23 STD. PEN. 15	
55				
	8 18		4 4 8 10 STD. PEN. 16	SILT - SLIGHTLY COMPACT GRAY, WITH EXTREMELY FINE SAND & LENSES FINE SAND, DAMP
60				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N. R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-4 Station Ry 114 + 56 Offset 13' RT. ℄ Ground Elev. 33.5
Type of Boring WASH BORE Water Table SEE NOTE Casing 3"X 50'
Inspector E.E. DUVALL Date FEB. 7 1967 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			C, D, E — U-17	
	15		6, 9 — STD. PEN.	SAND - COMPACT TO DENSE, GRAY, FINE,
	20		8, 12 — 18	OCCASIONAL SILT LENS, DAMP
65				
			A — U-19	
	24		9, 12, 12, 21 — STD. PEN. 20	
70				
	37		10, 16, 21, 23 — STD. PEN. 21	
75				
	31		9, 14, 17, 19 — STD. PEN. 22	
80				
	33		7, 12, 21, 22 — STD. PEN. 23	
85				
	44		15, 23, 21, 25 — STD. PEN. 24	
				SILT - COMPACT GRAY, DAMP
90				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N.R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2878
Hole No. H-4 Station Ry 114+56 Offset 13' RT. ℄ Ground Elev. 33.5
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 50'
Inspector E.E. DUVALL Date FEB. 7, 1967 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	24		8, 12, 12, 22 STD. PEN. 25	
95	34		7, 17, 17, 22 STD. PEN. 26	SAND - DENSE, FINE GRAY, DAMP
100				
105	57		18, 30, 27, 50 STD. PEN. 27	TEST BORING STOPPED 107'-0"
				WATER TABLE 2' BELOW GROUND WITH 50' CASING
				AFTER PULLING CASING, HAD ARTESIAN FLOW

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

G.N.R.R. U-XING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

S.R. No. 5
P.S.H.
S.S.H. No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-5 Station Ry 114+12 Offset 11' RT ℄ Ground Elev. 34
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" x 69'
Inspector E.E. DUVALL Date FEB. 15, 1967 Sheet No. 1 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				SILT - VERY LOOSE, BROWN, ORGANIC, ROOTS & WOOD, WET
			A B U-1	
				SAND - LOOSE, FINE GRAY, SCATTERED SILT, WET
	7		3 3 STD. PEN.	
5			4 4 2	
			B C U-3	
	4		1 3 STD. PEN.	SILTY SAND & SAND - LOOSE BROWN, FINE TO COARSE,
	7		2 5 4	TRACE FINE GRAVEL, WET
10				
			A B U-5	
	10		5 5 STD. PEN.	
			5 7 6	
15				
			A B U-7	
	10		6 4 STD. PEN.	SILTY SAND - SLIGHTLY COMPACT, FINE GRAY, WET
	16		5 11 8	GRAVEL - WATER BEARING, FINE, SLIGHTLY COMPACT
	19		8 11 STD. PEN.	SAND - COMPACT BROWN, FINE, WITH SILT LENSES, DAMP
20	27		10 17 9	
				SAND - SLIGHTLY COMPACT, FINE GRAY, SLIGHT TRACE
				FINE GRAVEL, DAMP
			7 9 STD. PEN.	
25	17		8 13 10	
30	31		8 15 STD. PEN.	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING
G.N.R.R. U-XING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-5 Station Ry 114+12 Offset 11' RT. ℄ Ground Elev. 34
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 69'
Inspector E. E. DUVALL Date FEB. 15, 1967 Sheet No. 2 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	31		16 13 ↓ 11	
				SAND & SILT- SLIGHTLY COMPACT, MIXED, GRAY FINE, WET
35	10		5 5 5 6 STD. PEN. 12	
			A U-13	SAND- SLIGHTLY COMPACT, FINE GRAY, SCATTERED SILTY SAND & SILT LENSES, WET
	10		5 6 4 8 STD. PEN. 14	
40			A U-15	
	12		6 8 4 11 STD. PEN. 16	
			AB U-17	
45	11		4 6 5 7 STD. PEN. 18	
				49' SLIGHT ARTESIAN FLOW
50	12		3 6 6 10 STD. PEN. 18	
55	11		4 5 6 9 STD. PEN 20	
				SILT & SANDY SILT- SLIGHTLY COMPACT GRAY, EXTREMELY FINE, WITH FINE SAND LENSES, DAMP
60	16		5 7 STD. PEN. 20	

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

LOG OF TEST BORING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

G.N.R.R. U-XING

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-5 Station Ry 114+12 Offset 11' RT. ℄ Ground Elev. 34
Type of Boring WASH BORE Water Table SEE NOTE Casing 3" X 69'
Inspector E.E. DUVALL Date FEB. 15, 1967 Sheet No. 3 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	16		9, 11 — 21	
65	11		6, 5, 6, 15 — STD. PEN. 22	SAND - COMPACT, FINE GRAY, OCCASIONAL SILT LENS, DAMP
70	36		U-23; 8, 14, 22, 29 — STD. PEN. 24	
75	41		11, 17, 24, 32 — STD. PEN. 25	
80	34		10, 15, 19, 24 — STD. PEN. 26	
85	32		16, 14, 18, 26 — STD. PEN. 27	SILT - SLIGHTLY COMPACT, GRAY, WITH FINE SAND LENSES, DAMP
90				

H. F. 26.66 (Rev. 10-64)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
LOG OF TEST BORING
G.N.R.R. U-XING

Original to Materials Engr.
Copy to Bridge Engr.
Copy to District Engr.
Copy to C.S. 3104

S.R. No. 5
P.S.H.
~~S.S.H.~~ No. 1 Section MARYSVILLE SCALE HOUSE TO STILLAGUAMISH RIVER Job No. L-2848
Hole No. H-5 Station RY 114+12 Offset 11' RT. ℄ Ground Elev. 34
Type of Boring WASH BORE Water Table SEE NOTE Casing 3"X 69'
Inspector E.E. DUVALL Date FEB. 15, 1967 Sheet No. 4 of 4

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	19		6, 8, 11, 19 STD. PEN. 28	
95	35		12, 16, 19, 29 STD. PEN. 29	SAND - COMPACT TO DENSE GRAY, FINE, SCATTERED SILT LENSES, DAMP
100	34		17, 17, 17, 35 STD. PEN. 30	
105	68		11, 32, 36, 37 STD. PEN. 31	TEST BORING STOPPED AT 107'-0"
				WATER TABLE - SLIGHT ARTESIAN FLOW WITH 70'5" CASING IN GROUND 69', AFTER PULLING CASING WATER TABLE AT GROUND ELEV.

Shannon & Wilson, Inc. (S&W), uses a soil classification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following page. Soil descriptions are based on visual-manual procedures (ASTM D 2488-93) unless otherwise noted.

S&W CLASSIFICATION OF SOIL CONSTITUENTS

- MAJOR constituents compose more than 50 percent, by weight, of the soil. Major consituents are capitalized (i.e., SAND).
- Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).
- Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace of gravel).

MOISTURE CONTENT DEFINITIONS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

ABBREVIATIONS

ATD	At Time of Drilling
Elev.	Elevation
ft	feet
FeO	Iron Oxide
MgO	Magnesium Oxide
HSA	Hollow Stem Auger
ID	Inside Diameter
in	inches
lbs	pounds
Mon.	Monument cover
N	Blows for last two 6-inch increments
NA	Not applicable or not available
NP	Non plastic
OD	Outside diameter
OVA	Organic vapor analyzer
PID	Photo-ionization detector
ppm	parts per million
PVC	Polyvinyl Chloride
SS	Split spoon sampler
SPT	Standard penetration test
USC	Unified soil classification
WLI	Water level indicator

GRAIN SIZE DEFINITION

DESCRIPTION	SIEVE NUMBER AND/OR SIZE
FINES	< #200 (0.08 mm)
SAND*	
- Fine	#200 to #40 (0.08 to 0.4 mm)
- Medium	#40 to #10 (0.4 to 2 mm)
- Coarse	#10 to #4 (2 to 5 mm)
GRAVEL*	
- Fine	#4 to 3/4 inch (5 to 19 mm)
- Coarse	3/4 to 3 inches (19 to 76 mm)
COBBLES	3 to 12 inches (76 to 305 mm)
BOULDERS	> 12 inches (305 mm)

* Unless otherwise noted, sand and gravel, when present, range from fine to coarse in grain size.

RELATIVE DENSITY / CONSISTENCY

COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
0 - 4	Very loose	Under 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
Over 50	Very dense	15 - 30	Very stiff
		Over 30	Hard

WELL AND OTHER SYMBOLS

Bent. Cement Grout	Surface Cement Seal
Bentonite Grout	Asphalt or Cap
Bentonite Chips	Slough
Silica Sand	Bedrock
PVC Screen	
Vibrating Wire	

I-5/116th Street NE Interchange Improvements Project - Phase 2
Tulalip, Washington

SOIL CLASSIFICATION AND LOG KEY

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 1 of 2

BORING CLASS1 21-09896-007.GPJ SWNEW.GDT 11/8/07

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(From ASTM D 2487-98 & 2488-93)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL DESCRIPTION
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Clean Gravels *(less than 5% fines)*	GW		Well-graded gravels, gravels, gravel/sand mixtures, little or no fines.
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines *(more than 12% fines)*	GM		Silty gravels, gravel-sand-silt mixtures
			GC		Clayey gravels, gravel-sand-clay mixtures
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Clean Sands *(less than 5% fines)*	SW		Well-graded sands, gravelly sands, little or no fines
			SP		Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines *(more than 12% fines)*	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Inorganic silts of low to medium plasticity, rock flour, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Organic	OL		Organic silts and organic silty clays of low plasticity
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			CH		Inorganic clays or medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	OH		Organic clays of medium to high plasticity, organic silts
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat, humus, swamp soils with high organic content (see ASTM D 4427)

NOTE: No. 4 size = 5 mm; No. 200 size = 0.075 mm

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, slightly silty fine SAND)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, silty CLAY/clayey SILT; GW/SW, sandy GRAVEL/gravelly SAND)* indicate that the soil may fall into one of two possible basic groups.

I-5/116th Street NE Interchange Improvements Project - Phase 2
Tulalip, Washington

SOIL CLASSIFICATION AND LOG KEY

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 2 of 2

BORING CLASS2 21-09896-007.GPJ SWNEW.GDT 11/8/07

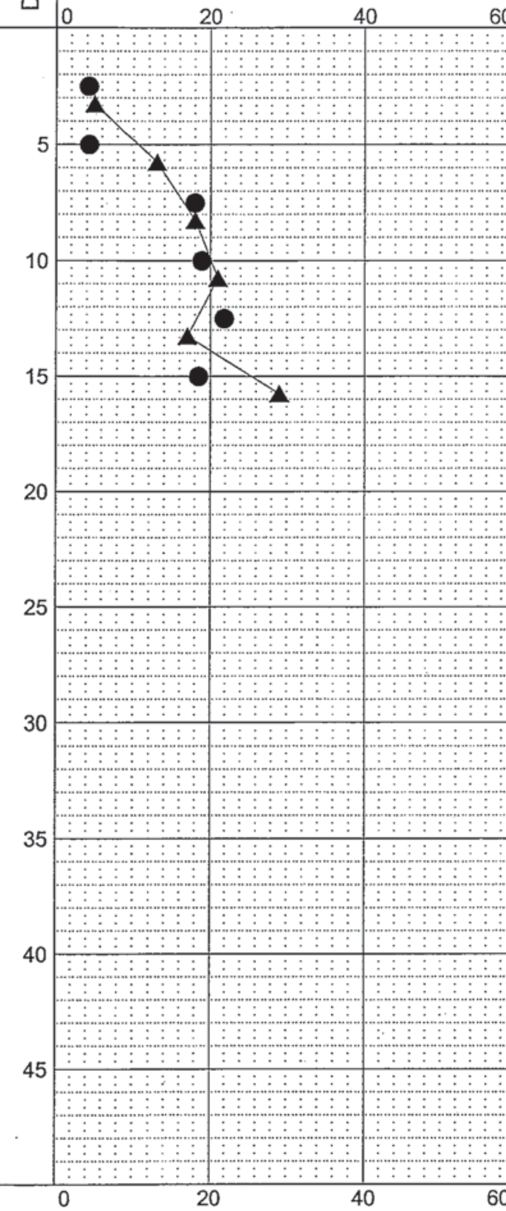
Total Depth:	*16.5 ft.*	Northing:		Drilling Method:	*Hollow Stem Auger*
Top Elevation:	*~ 73 ft.*	Easting:		Drilling Company:	*Boart Longyear*
Vert. Datum:		Station:		Drill Rig Equipment:	*B-59 Mobile*
Horiz. Datum:		Offset:		Other Comments:	

Hole Diam.:	*8 in.*
Rod Diam.:	
Hammer Type:	*Automatic*

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft	Symbol	PID, ppm	Samples	Ground Water
ASPHALT.	0.5				
Loose to medium dense, brown and gray, fine to medium SAND, trace of silt; moist; occasional coarse sand; SP.			0	1	
			0	2	
Medium dense, brown and gray SAND, trace of silt, trace of gravel after 14 feet below ground surface; moist, grading to wet; SW.	7.0		0	3	During Drilling ∇
			0	4	
			0	5	
			0	6	
BOTTOM OF BORING COMPLETED 5/15/2007	16.5				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
⌶ Standard Penetration Test
∇ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 1

November 2007 | 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth: 21.5 ft.	Northing:	Drilling Method: Hollow Stem Auger	Hole Diam.: 8 in.
Top Elevation: ~ 71 ft.	Easting:	Drilling Company: Boart Longyear	Rod Diam.:
Vert. Datum:	Station:	Drill Rig Equipment: B-59 Mobile	Hammer Type: Automatic
Horiz. Datum:	Offset:	Other Comments:	

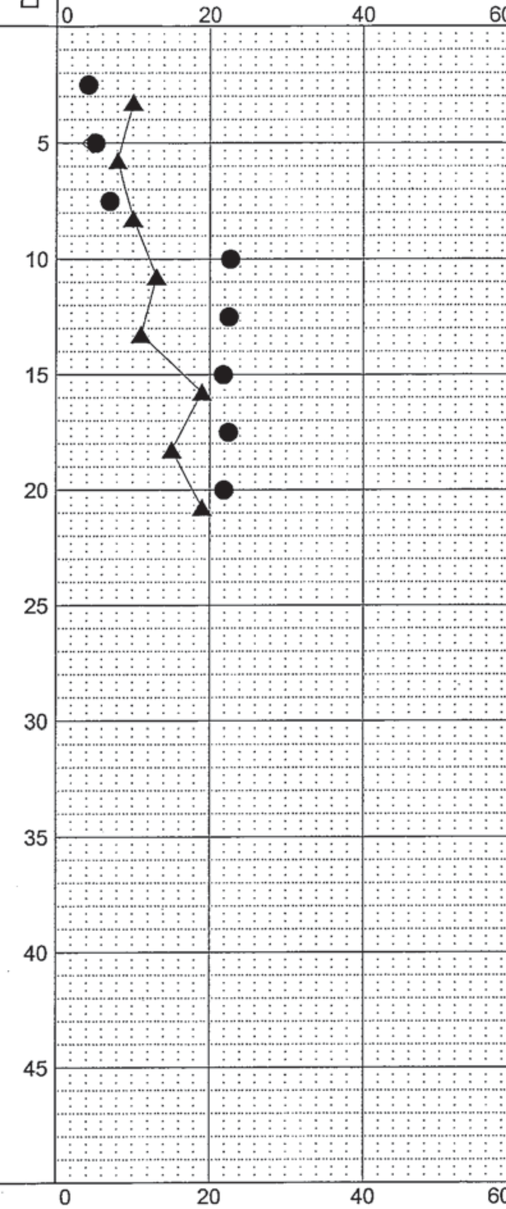
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft	PID, ppm	Samples	Ground Water
ASPHALT.	0.5			
Medium dense, brown-gray, trace to slightly silty, trace to slightly gravelly SAND; moist, grading to wet; abundant iron staining; SP/SP-SM.		0	1	
		0	2	
		0	3	
		0	4	During Drilling ▽
		0	5	
		0	6	
Medium dense, gray, slightly silty to silty, fine to medium SAND; wet; SP-SM/SM.	17.0	0	7	
		0	8	
BOTTOM OF BORING COMPLETED 5/15/2007	21.5			

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

Ⅰ Standard Penetration Test

▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 2

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3

Total Depth:	16.5 ft.	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation:	~ 73 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

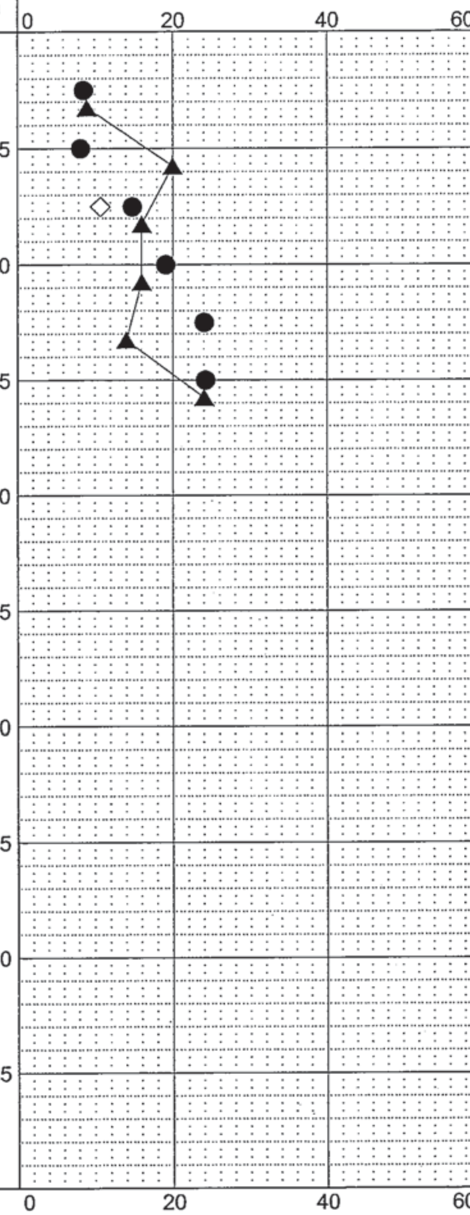
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft	PID, ppm	Samples	Ground Water
ASPHALT.	0.5			
Loose to medium dense, brown, trace to slightly silty SAND, occasionally fine gravelly; moist; iron staining; SP-SM.		0 0 0	1 2 3	
Medium dense, brown-gray, slightly silty to silty, fine to medium SAND; moist; iron staining; SP-SM/SM.	10.0	0 0	4 5	During Drilling ∇
Medium dense, gray, slightly silty, fine to medium SAND, trace of gravel; moist, grading to wet; iron staining; interbedded with stiff, gray SILT; wet; SP-SM/ML.	12.5	0	6	
BOTTOM OF BORING COMPLETED 5/15/2007	16.5			

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
⌶ Standard Penetration Test
∇ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 3

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4

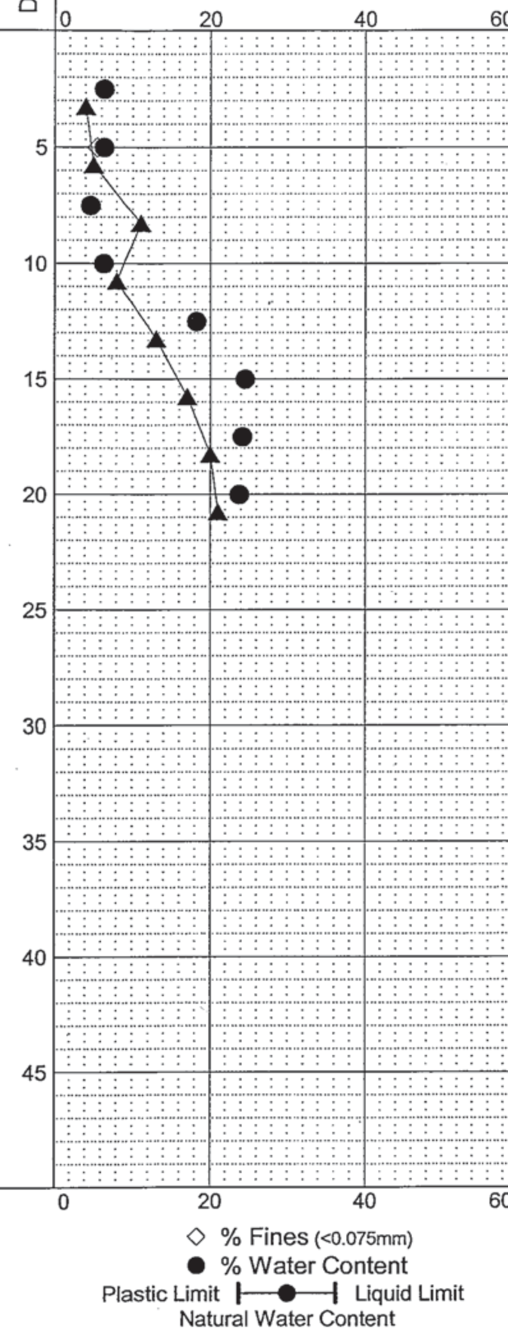
MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth: 21.5 ft.	Northing:	Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation: ~ 75 ft.	Easting:	Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:	Offset:	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft	Symbol	PID, ppm	Samples	Ground Water
Very loose to medium dense, brown to gray, slightly silty, slightly gravelly SAND; moist to wet at 14.5 feet below ground surface; iron staining; SP/SP-SM.			0 0 0 0 0 0	1 2 3 4 5 6	During Drilling ∇
Medium dense, brown and gray, silty, fine to medium SAND; wet; occasional fine sandy silt interbeds; iron staining; SM.	18.0		0 0	7 8	
BOTTOM OF BORING COMPLETED 5/15/2007	21.5				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

⌶ Standard Penetration Test

∇ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 4

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5

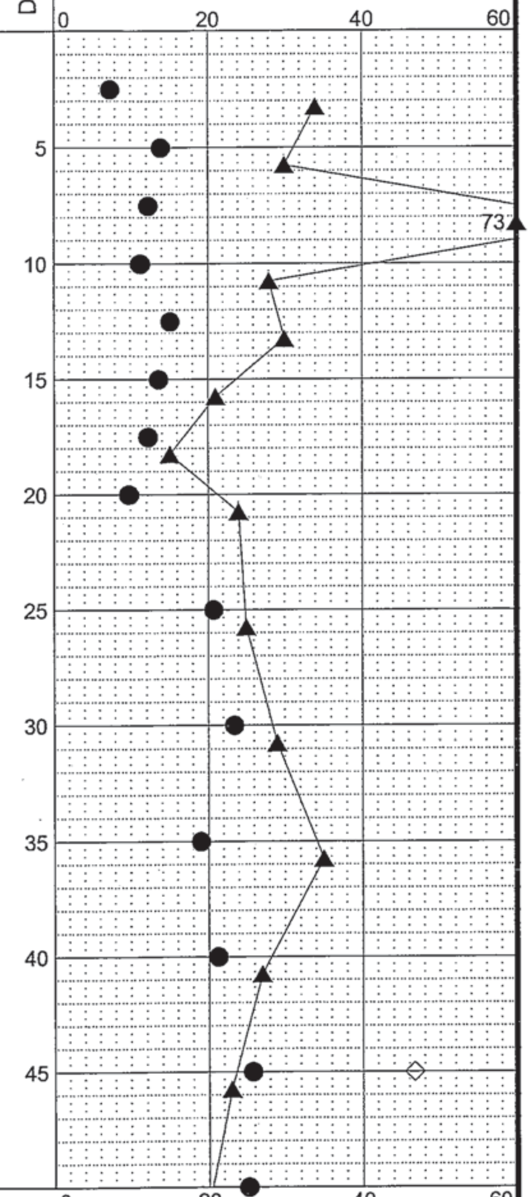
MASTER_LOG_E 21-09896-007.GPJ SHAN_WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth: 61.5 ft.	Northing:	Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation: ~ 75 ft.	Easting:	Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	B-59 Mobile	Hammer Type:	
Horiz. Datum:	Offset:	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft	Symbol	PID, ppm	Samples	Ground Water
Medium dense to dense, gray, trace to slightly silty, trace to gravelly SAND; moist; iron oxidation; occasional to scattered wood fragments; (Fill) SP/SP-SM.			0 0 0 0 0	1 2 3 4 5	
Medium dense, gray-brown to orange-brown, slightly silty, slightly gravelly SAND; moist; iron oxidation; (Marine/Alluvium Deltaic) SP-SM/SM.	14.0		0 0 0 0	6 7 8 9	
Medium dense, gray, interbedded, trace to silty SAND and slightly fine sandy, silty CLAY; moist to wet; (Recessional Outwash) SP-SM/SM/CL.	26.5		0 0 0 0	10 11 12 13	During Drilling
CONTINUED NEXT SHEET					

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

Standard Penetration Test

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 5

November 2007 | 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

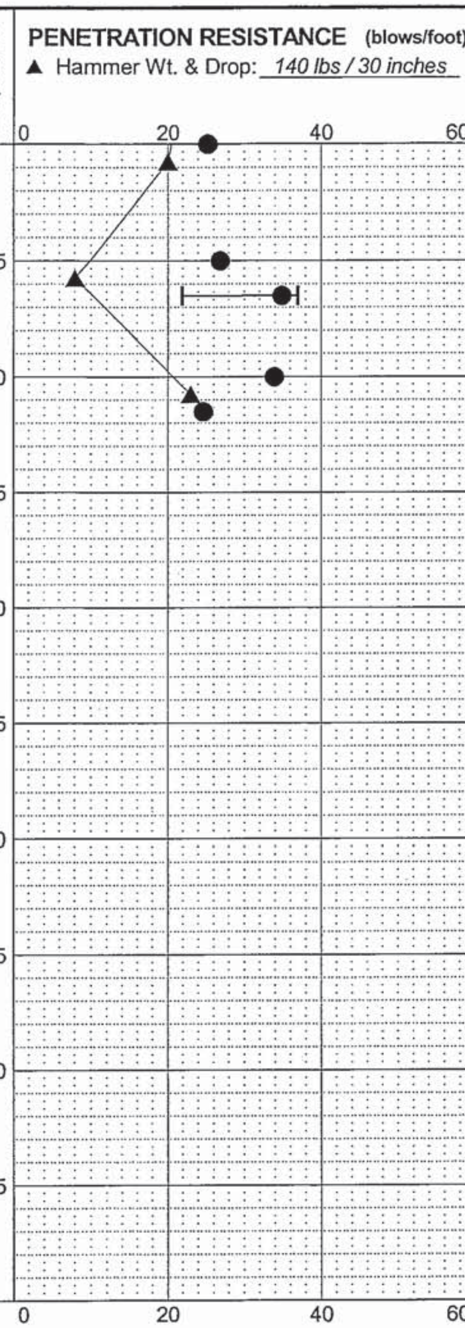
FIG. A-6
Sheet 1 of 2

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: CKS Rev: CKS Typ: LKD

Total Depth:	61.5 ft.	Northing:		Drilling Method:	Mud Rotary
Top Elevation:	~ 75 ft.	Easting:		Drilling Company:	Boart Longyear
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile
Horiz. Datum:		Offset:		Other Comments:	

Hole Diam.:
Rod Diam.:
Hammer Type:

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	Symbol	PID, ppm	Samples	Ground Water
Medium dense, gray, interbedded, trace to silty SAND and slightly fine sandy, silty CLAY; SP-SM/SM/CL (cont.).			0 0	14 15 16	
BOTTOM OF BORING COMPLETED 5/18/2007	61.5				



LEGEND

* Sample Not Recovered
Standard Penetration Test
Ground Water Level ATD

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 5

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-6
Sheet 2 of 2

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: CKS Rev: CKS Typ: LKD

Total Depth: 26.5 ft.	Northing:	Drilling Method:	Hollow Stem Auger	Hole Diam.:	4 in.
Top Elevation: ~ 65 ft.	Easting:	Drilling Company:	Boretec	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	Portable Acker	Hammer Type:	Manual
Horiz. Datum:	Offset:	Other Comments:			

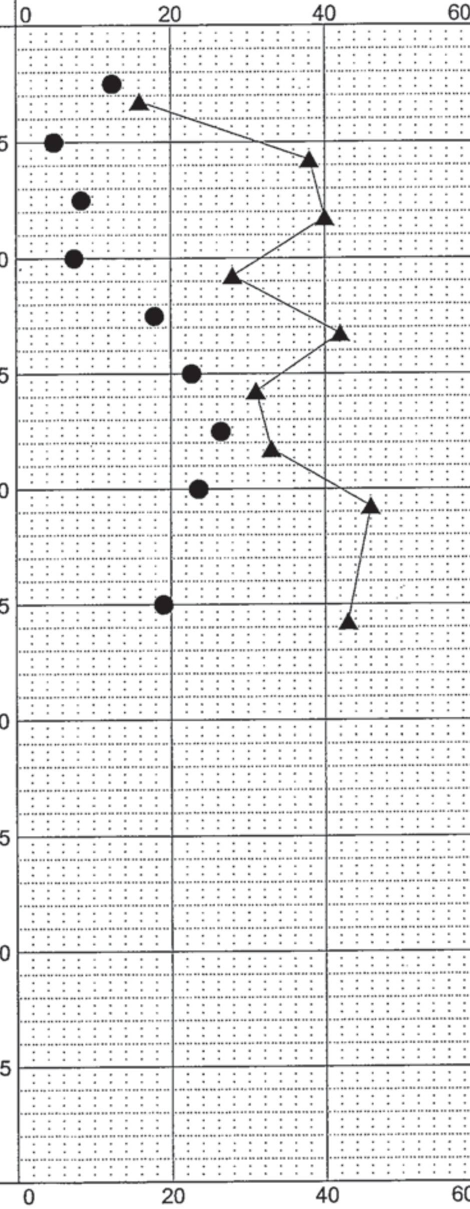
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

SOIL DESCRIPTION	Depth, ft	PID, ppm	Samples	Ground Water
Medium dense to dense, brown, gray, and orange SAND, trace of silt; moist; iron staining; SP.		0 0 0 0	1 2 3 4	
Dense, gray, slightly silty, fine SAND bedded with fine to coarse SAND, trace of fine gravel; moist; SM.	12.0	0	5	
Dense, gray, silty, fine SAND with interbeds of fine sandy SILT and slightly silty, fine to medium sand; wet; occasional organics around 15 feet below ground surface; SM.	15.0	0 0 0	6 7 8	During Drilling
Dense, gray, trace to slightly silty, fine to medium SAND; wet; SP/SP-SM.	23.0	0	9	
BOTTOM OF BORING COMPLETED 5/17/2007	26.5			

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

Standard Penetration Test

Ground Water Level ATD

Plastic Limit ●— Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 6

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

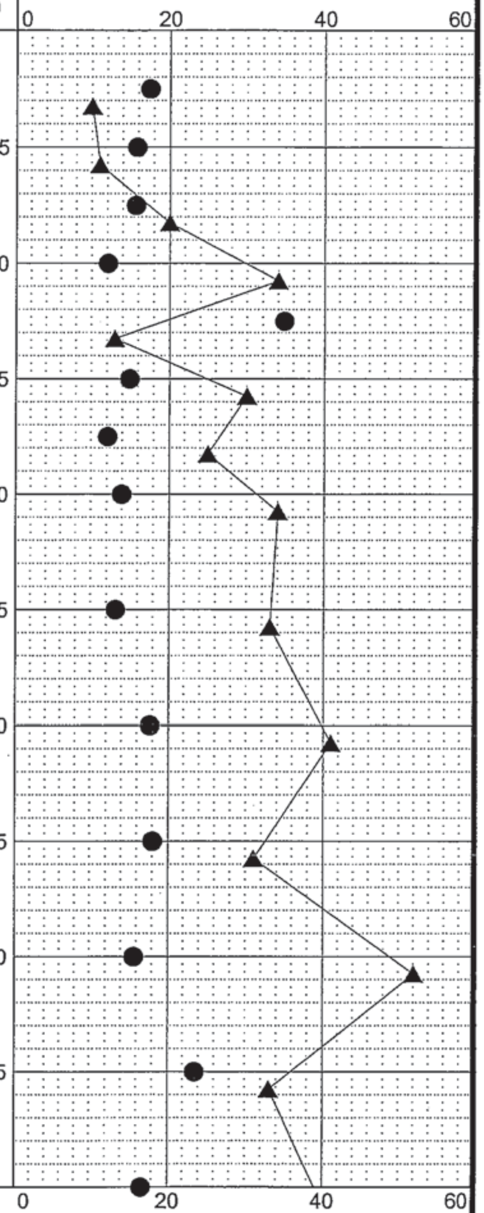
Total Depth:	71.5 ft.	Northing:		Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation:	~ 79 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	PID, ppm	Samples
Medium dense, brown to gray-brown, slightly gravelly, slightly silty to silty SAND; moist; slight iron oxidation; (Fill) SP-SM/SM.		0 0 0 0	1 2 3 4
Medium dense, brown-gray to black, slightly silty, gravelly SAND; moist; approximately 1.5-inch-thick layer of black, silty SAND; scattered to numerous wood fragments; (Fill/Buried Organics) SP-SM.	11.5	0	5
Medium dense to dense, gray-brown, slightly silty SAND, trace of fine gravel; moist; slight iron oxidation; (Marine/Alluvium Deltaic) SP-SM.	14.0	0 0 0 0	6 7 8 9
Dense, brown to gray, trace to slightly gravelly, slightly silty to silty SAND, trace of clay; moist; (Recessional Outwash) SP-SM/SM.	26.5	0 0 0 0	10 11 12 13

CONTINUED NEXT SHEET

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered

Standard Penetration Test

▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 7

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 1 of 2

Total Depth: 71.5 ft.	Northing:	Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation: ~ 79 ft.	Easting:	Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	B-59 Mobile	Hammer Type:	
Horiz. Datum:	Offset:	Other Comments:			

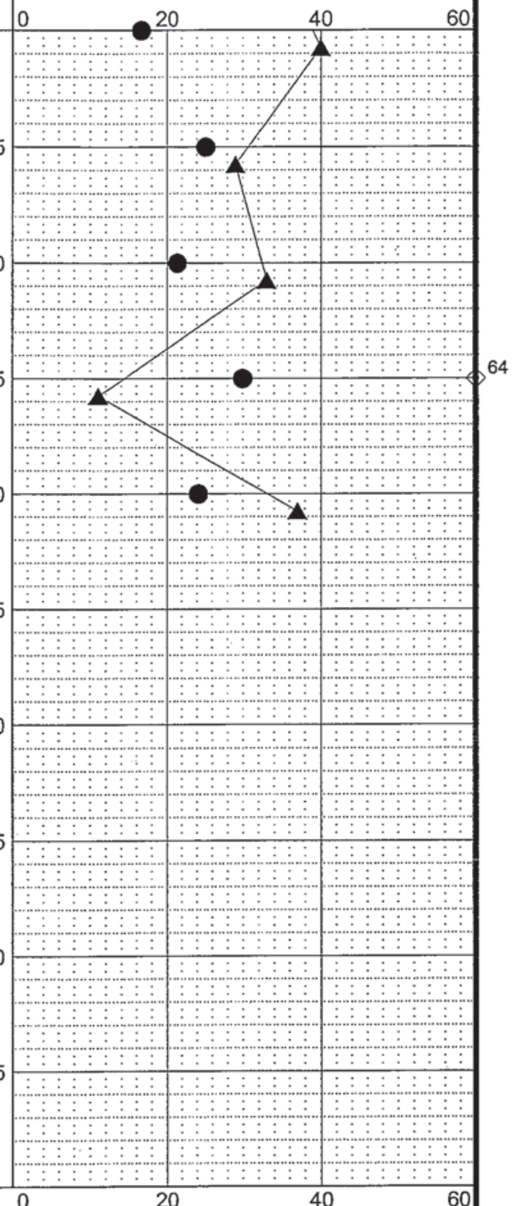
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	PID, ppm	Samples	Ground Water	Depth, ft.
Dense, brown to gray, trace to slightly gravelly, slightly silty to silty SAND, trace of clay; (Recessional Outwash) SP-SM/SM (cont.).		0	14	During Drilling	
		0	15		55
Medium dense, blue-gray to gray, slightly silty, fine to medium SAND; moist to wet; with scattered seams and layers of stiff, gray, slightly fine sandy, clayey SILT; (Recessional Outwash) SP-SM/SM.	56.5	0	16		60
		0	17		65
		0	18		70
BOTTOM OF BORING COMPLETED 5/17/2007	71.5				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

Standard Penetration Test

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit —●— Liquid Limit

Natural Water Content

I-5/116th Street NE Interchange Improvements Project - Phase 2 Tulalip, Washington

LOG OF BORING B- 7

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 2 of 2

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: CKS Rev: CKS Typ: LKD

Total Depth: 21.5 ft.	Northing:	Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation: ~ 79 ft.	Easting:	Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:	Offset:	Other Comments:			

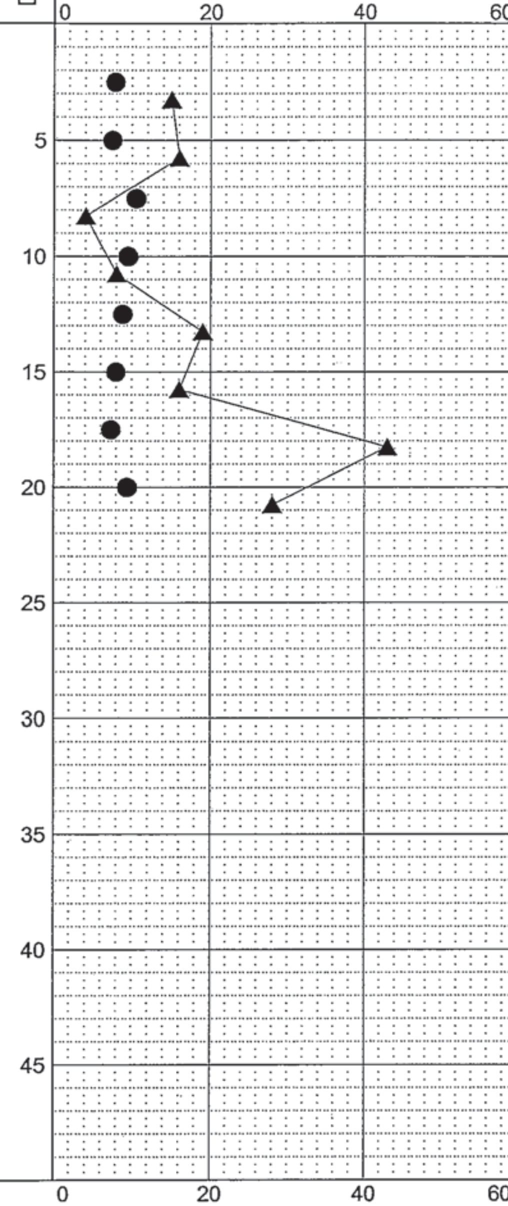
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft	PID, ppm	Samples	Ground Water
Loose to medium dense, gray and brown, trace to slightly silty, fine to medium SAND; moist; iron staining; SP/SP-SM.		0 / 0 / 2.1 / 0 / 0	1, 2, 3, 4, 5	None Observed During Drilling
Medium dense to dense, trace to slightly silty SAND; moist; iron staining; SW.	14.0	0 / 0	6, 7	
Medium dense, gray-brown, trace to slightly silty, fine to medium SAND, trace of fine gravel and coarse sand; moist; SP/SP-SM.	19.0	0	8	
BOTTOM OF BORING COMPLETED 5/16/2007	21.5			

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

Standard Penetration Test

Plastic Limit ⊢—●—⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 8

November 2007 — 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

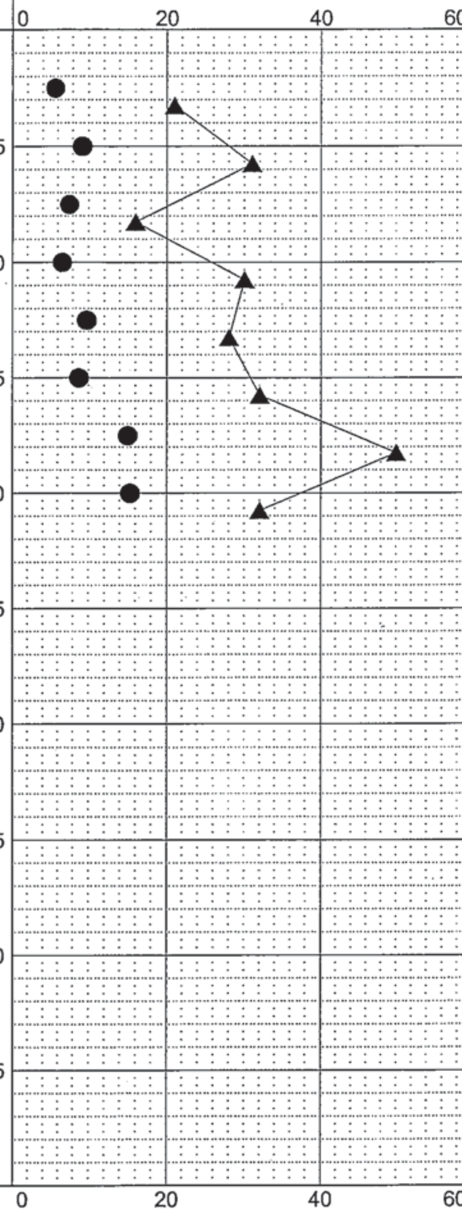
FIG. A-9

Total Depth: 21.5 ft.	Northing:	Drilling Method: Hollow Stem Auger	Hole Diam.: 8 in.
Top Elevation: ~ 81 ft.	Easting:	Drilling Company: Boart Longyear	Rod Diam.:
Vert. Datum:	Station:	Drill Rig Equipment: B-59 Mobile	Hammer Type: Automatic
Horiz. Datum:	Offset:	Other Comments:	

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	Symbol	PID, ppm	Samples	Ground Water
Medium dense, brown, trace to slightly silty, fine to medium SAND; moist; SP/SP-SM.			0	1	None Observed During Drilling
Medium dense to dense, brown, trace to slightly silty SAND, trace of fine gravels; moist; iron staining; SW.	4.0		0 0 0 0 0	2 3 4 5 6	
Dense, gray, slightly silty to silty, fine to coarse SAND; moist; SP-SM/SM.	17.0		0 0	7 8	
BOTTOM OF BORING COMPLETED 5/16/2007	21.5				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered

⌶ Standard Penetration Test

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B- 9

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-10

MASTER_LOG_E 21-09896-007.GPJ SHAN_WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth:	20 ft.	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation:	~ 70 ft.	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

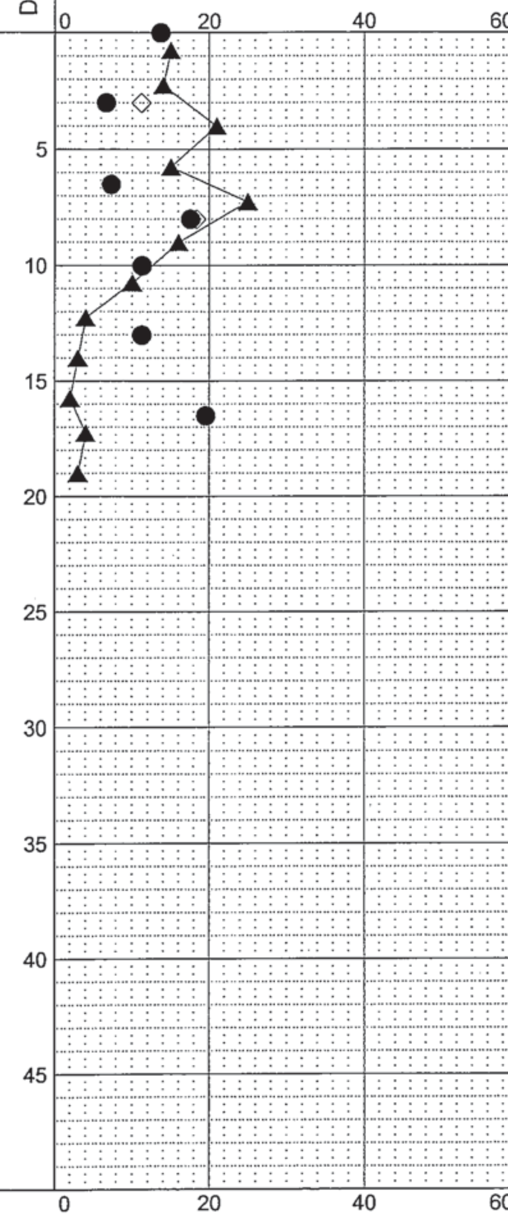
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft	PID, ppm	Samples	Ground Water
Medium dense, brown, silty, fine to medium SAND; moist; scattered roots; SM.	1.5	0	1	
Medium dense, brown, trace to slightly silty, trace to slightly gravelly SAND; moist; iron staining; SW-SM.		0	2	
		0	3	
		0	4	
	8.0	0	5	
Medium dense, dark brown, silty SAND, trace of gravel; numerous organics; SM.		0	6	
	11.0	0	7	
Very loose to loose, gray and brown, trace to slightly silty, fine to medium SAND; moist, grading to wet; frequent wood debris; SP.		0	8	
		0	9	
		0	10	During Drilling
		0	11	
	20.0	0	12	

BOTTOM OF BORING
COMPLETED 5/16/2007

PENETRATION RESISTANCE (blows/foot)
▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
Standard Penetration Test
Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B-10

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-11

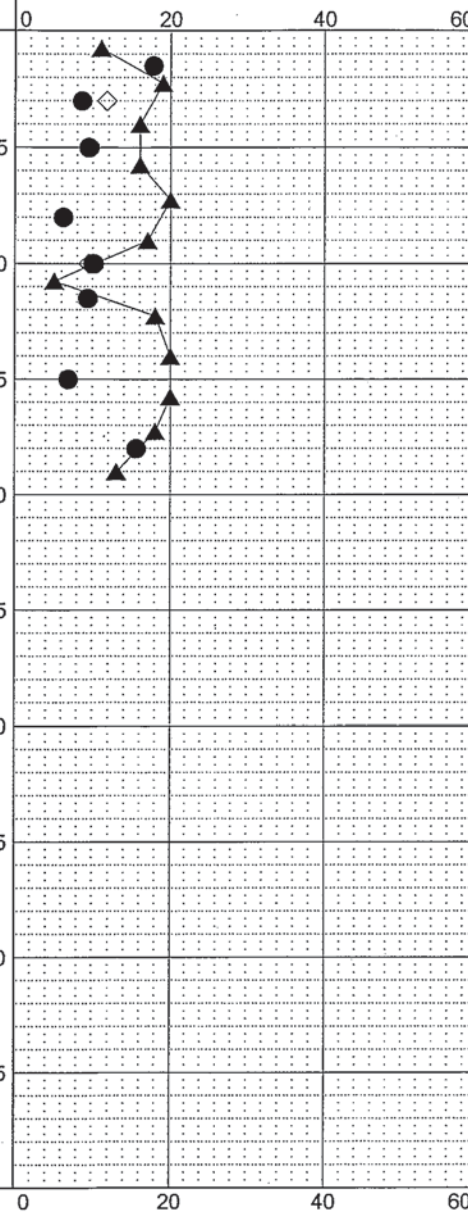
MASTER LOG E 21-09896-007.GPJ SHAN WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

Total Depth: 20 ft.	Northing:	Drilling Method:	Hollow Stem Auger	Hole Diam.:	8 in.
Top Elevation: ~ 70 ft.	Easting:	Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:	Station:	Drill Rig Equipment:	B-59 Mobile	Hammer Type:	Automatic
Horiz. Datum:	Offset:	Other Comments:			

SOIL DESCRIPTION
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	PID, ppm	Samples	Ground Water
Medium dense, brown and gray, trace silty to silty SAND, trace of gravel; moist; scattered organics; SW-SM.		0, 0, 0, 0	1, 2, 3, 4	
Medium dense, brown, slightly silty SAND; moist; SW.	6.5	0, 0	5, 6	
Loose to medium dense, brown, trace to slightly silty SAND; moist; occasional iron staining; occasional fine sandy silt beds; SW-SM.	10.0	0, 0, 0	7, 8, 9	
Medium dense, gray, fine SAND, trace to slightly silty; moist; SP.	15.0	0	10	
Medium dense, gray and brown, trace to slightly silty, trace to slightly fine gravelly SAND; wet; SW.	16.5	0, 0	11, 12	During Drilling ∇
BOTTOM OF BORING COMPLETED 5/16/2007	20.0			

PENETRATION RESISTANCE (blows/foot)
▲ Hammer Wt. & Drop: 140 lbs / 30 inches



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

LEGEND
* Sample Not Recovered
⌶ Standard Penetration Test
∇ Ground Water Level ATD

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured using a cloth tape from existing site features and should be considered approximate.

I-5/116th Street NE Interchange
Improvements Project - Phase 2
Tulalip, Washington

LOG OF BORING B-11

November 2007 21-1-09896-007

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12

MASTER_LOG_E 21-09896-007.GPJ SHAN_WIL.GDT 11/8/07 Log: KES Rev: KES Typ: LKD

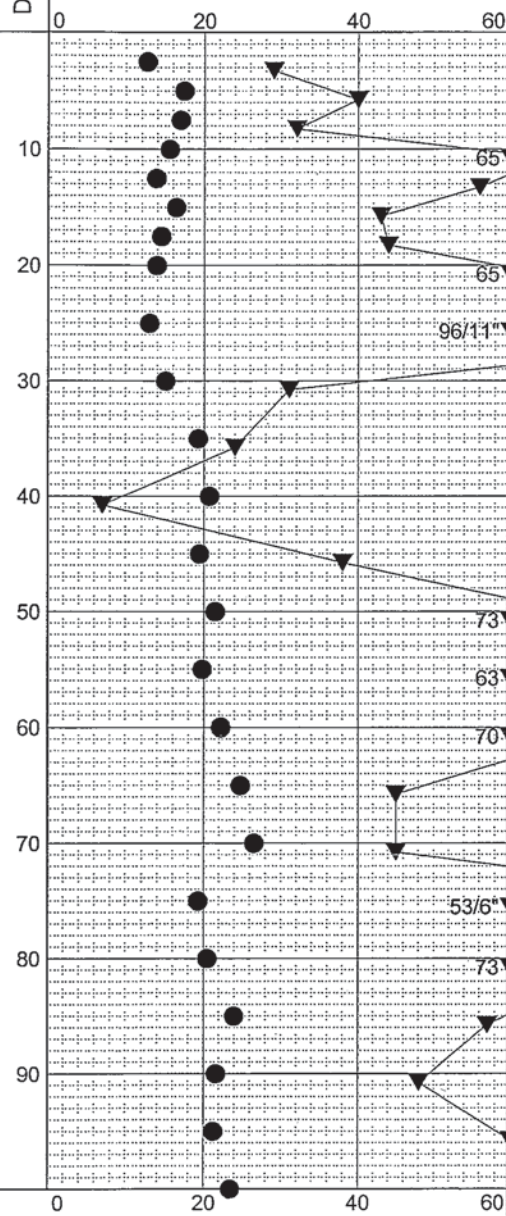
Total Depth:	131.5 ft.	Northing:		Drilling Method:		Hole Diam.:	
Top Elevation:	~ 87 ft.	Easting:		Drilling Company:		Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	Symbol	Samples	Ground Water
Medium dense to very dense, brown-tan-gray, slightly silty to silty, fine to medium SAND; moist; trace of coarse sand and gravel; scattered iron-oxide stains throughout; (Compacted Embankment Fill) SP-SM/SM.			1, 2, 3, 4, 5, 6, 7, 8, 9	
Loose to dense, brown-gray, trace to slightly silty, trace to slightly gravelly SAND; moist to wet; occasional silt partings; iron-oxide stains; (Recessional Outwash) SW-SM.	28.0		10, 11, 12, 13	During Drilling
Very dense, olive-gray, slightly silty to silty, fine to medium SAND; moist; occasional silt partings; massive; (Recessional Outwash) SP-SM/SM.	47.0		14, 15, 16	
Dense to very dense, gray, slightly silty to silty, fine SAND; moist to wet; massive; layers of gravelly, clayey sand at 89 to 92 feet; scattered organics at 75 to 77 feet; occasional clayey silt partings throughout; (Recessional Outwash) SP-SM/SM.	63.0		17, 18, 19, 20, 21, 22, 23	

CONTINUED NEXT SHEET

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: ______



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
Ⅰ Standard Penetration Test
▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING B-2-03

December 2005 | 21-1-09896-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1
Sheet 1 of 2

MASTER_LOG_E 21-09896-002.GPJ 21-20617.GPJ 6/5/07 Log: XHL Rev: SWC Typ: LKD

Total Depth:	*131.5 ft.*	Northing:		Drilling Method:		Hole Diam.:	
Top Elevation:	*~ 87 ft.*	Easting:		Drilling Company:		Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

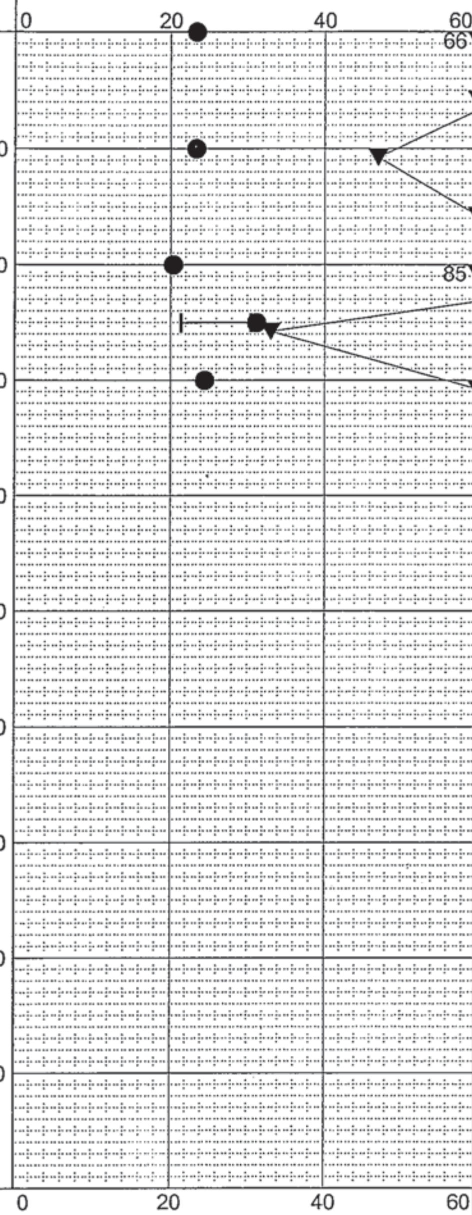
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples
		24, 25, 26, 27, 28
Hard, gray, slightly fine sandy, silty CLAY; moist; CL.	124.0	29
Very dense, gray, silty, fine SAND; wet; massive; (Recessional Outwash) SM.	127.0	30
BOTTOM OF BORING COMPLETED 5/30/2003	131.5	

Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop:



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
Standard Penetration Test
Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING B-2 -03

December 2005 | 21-1-09896-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1
Sheet 2 of 2

MASTER_LOG_E 21-09896-002.GPJ 21-20617.GPJ 6/5/07 Log: XHL Rev: SWC Typ: LKD

Total Depth:	51.5 ft.	Northing:		Drilling Method:		Hole Diam.:	
Top Elevation:	~ 80 ft.	Easting:		Drilling Company:		Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

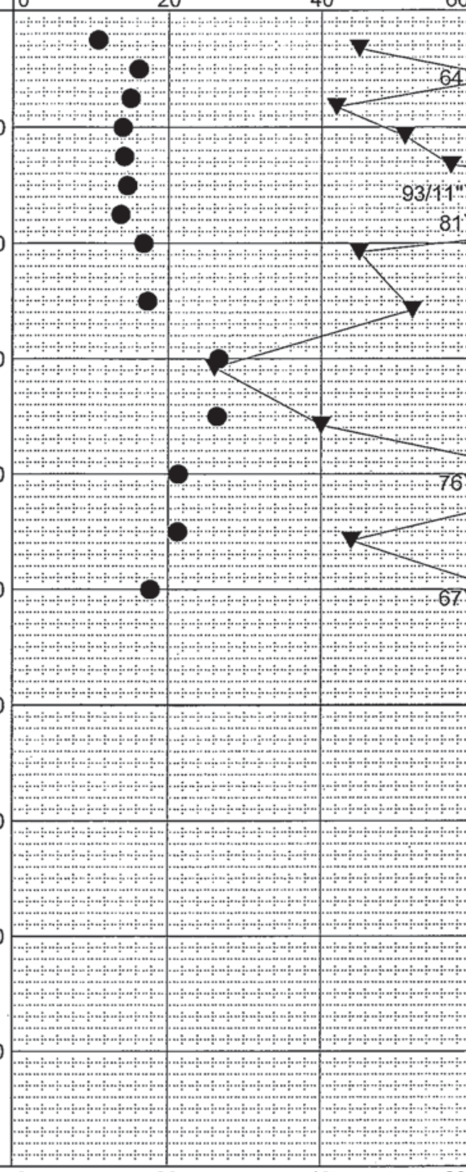
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

SOIL DESCRIPTION	Depth, ft	Samples	Ground Water
Dense to very dense, light brown to brown to dark brown, slightly silty to silty, fine to medium SAND; moist; occasional organics, trace of gravel; (Compacted Embankment Fill) SP-SM/SM.		1, 2, 3, 4, 5, 6, 7, 8	
Medium dense to very dense, tan-brown, slightly silty to silty, fine to medium SAND; moist to wet; scattered iron-oxide stains; fine roots at 25 to 27 feet; massive; (Recessional Outwash) SP-SM/SM.	24.0	9, 10, 11, 12	During Drilling ∇
Dense to very dense, gray, slightly silty, fine to medium SAND; wet; massive; (Recessional Outwash) SP-SM.	43.0	13, 14	
BOTTOM OF BORING COMPLETED 6/2/2003	51.5		

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: ____________



Depth, ft

LEGEND

* Sample Not Recovered

⌶ Standard Penetration Test

∇ Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING B-4 -03

December 2005 21-1-09896-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-2

MASTER LOG E 21-09896-002.GPJ 21-20617.GPJ 6/5/07 Log: XHL Rev: SWC Typ: LKD

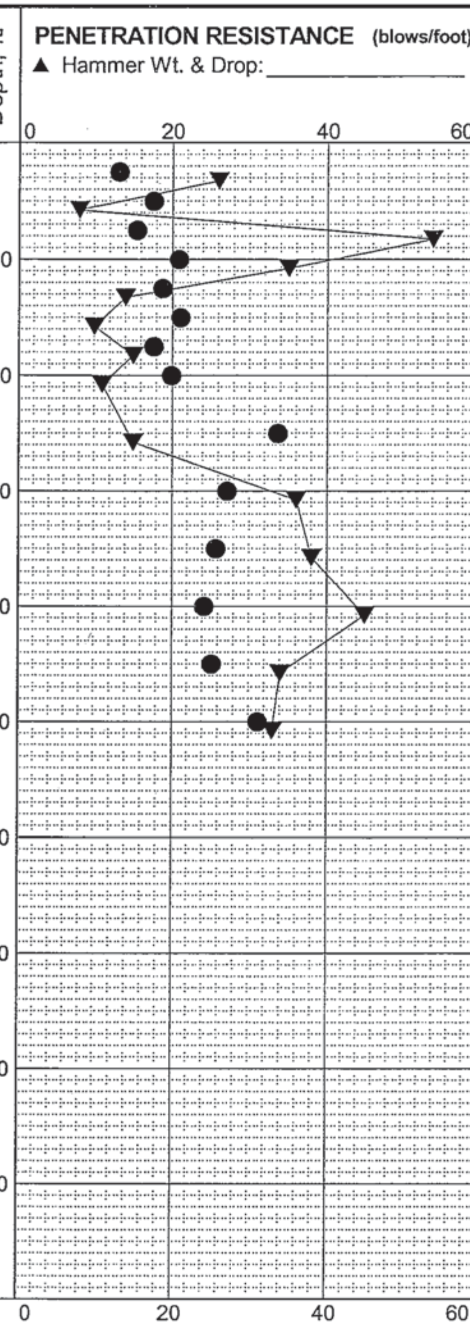
Total Depth:	51.5 ft.	Northing:		Drilling Method:		Hole Diam.:	
Top Elevation:	~ 63 ft.	Easting:		Drilling Company:		Rod Type:	
Vert. Datum:		Station:		Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples
Loose to vey dense, brown, slightly gravelly, slightly silty, fine to medium SAND; moist; (Embankment Fill) SP-SM.		1, 2, 3
Medium dense to dense, brown-gray, slightly silty to silty, gravelly, fine to medium SAND; moist to wet; scattered charcoals and organics at 12 to 14 feet; (Embankment Fill) SP-SM/SM.	10.0	4, 5, 6, 7
Medium dense, gray to dark brown, slightly silty to silty, fine to medium SAND; wet; slightly gravelly; numerous wood debris 25 to 27 feet; (Embankment Fill) SP-SM/SM.	17.0	8, 9
Dense, tan-olive-gray, silty, fine SAND; moist; massive; (Recessional Outwash) SM.	28.0	10, 11, 12
Dense, gray, silty, fine SAND; moist to wet; scattered silty clay partings; (Recessional Outwash) SM.	45.0	13, 14
BOTTOM OF BORING COMPLETED 5/30/2003	51.5	

Ground Water: During Drilling



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
Ground Water Level ATD
Standard Penetration Test

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING B-5 -03

December 2005 21-1-09896-002

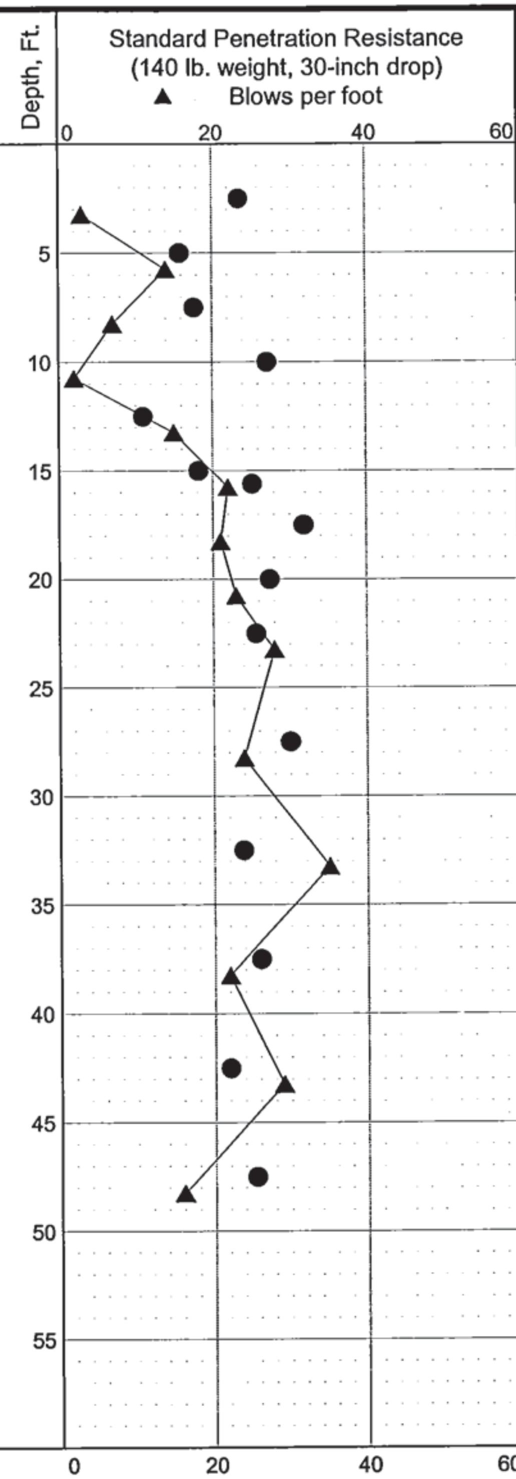
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-3

MASTER LOG E 21-09896-002.GPJ 21-20617.GPJ 6/5/07 Log: XHL Rev: SWC Typ: LKD

SOIL DESCRIPTION Surface Elevation: Approx. 61.0 Ft.	Depth, Ft.	Samples
Very loose, brown, trace to slightly silty, fine to medium SAND; moist; (Fill) SP.	3.5	1
Very loose, dark brown, silty, fine SAND/sandy SILT; moist; common organics; SM/ML.	5.5	2
Medium dense, brown to dark brown, slightly gravelly, silty, fine to medium SAND; moist; common organics; SM.	8.0	3, 4
Loose to very loose, dark brown, slightly gravelly, slightly silty and silty, fine to medium SAND; moist; scattered organics; SP-SM.	13.5	5
Medium dense, gray and dark brown, silty and slightly silty, fine to medium SAND; moist; scattered organics; moderately compact at top; SM.	15.7	6, 7, 8
Medium dense, gray, trace to slightly silty, fine to medium SAND; wet; SP. - Iron-stained at 16.2 to 18 feet, with scattered clay seams. - Brown below 17 feet. - Dense from about 31 to 36 feet.		9, 10, 11, 12
Medium dense, gray, trace to slightly silty, fine to medium SAND; wet; scattered organics and sandy silt/silty sand layers; SP-SM.	41.0	13, 14
BOTTOM OF BORING COMPLETED 4/24/2003	49.0	

Ground Water: 2/17/2005 ▼; During Drilling ▽



LEGEND

- * Sample Not Recovered
- Standard Penetration Test
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- ▽ Ground Water Level ATD
- ▼ Ground Water Level in Well

NOTES

1. The boring was performed using drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING GW-1

December 2005 21-1-09896-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-7

OLD MSTR LOG 21-09896-001.GPJ SHAN WIL.GDT 12/5/05 Log: PVH Rev: PVH Typ: LKD

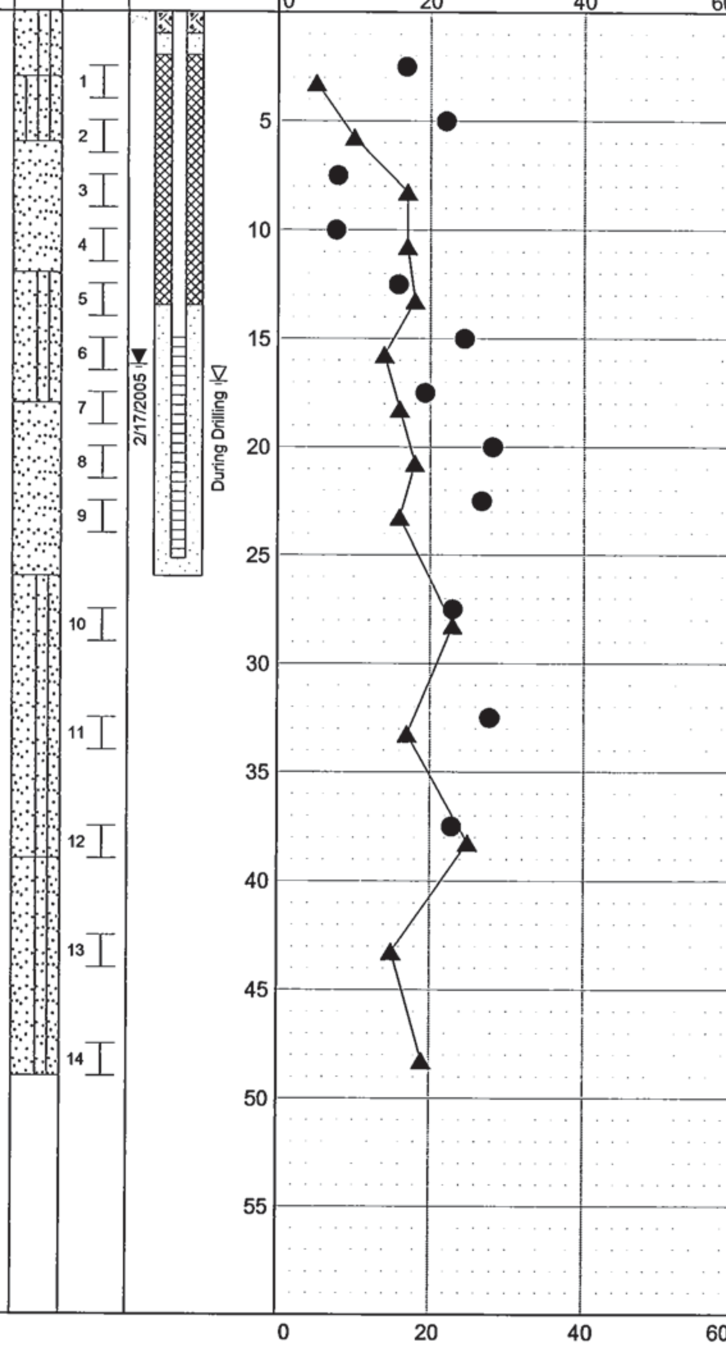
SOIL DESCRIPTION Surface Elevation: Approx. 71.0 Ft.	Depth, Ft.
Loose, dark brown, slightly gravelly, slightly silty to silty, fine to medium SAND; moist; (Fill) SP-SM/SM.	3.0
Loose, dark brown, slightly silty to slity, fine to medium SAND; moist; common organics; SM.	6.0
Medium dense, brown-gray, slightly gravelly, fine to medium SAND, trace of silt; moist; scattered organics; SP. - Minor iron staining at 11 to 11.2 feet.	12.0
Medium dense, interbedded dark brown, silty, fine to medium SAND and brown-gray, slightly silty, fine to medium SAND; moist; scattered organics; wet below 17 feet; SP-SM.	18.0
Medium dense, brown, fine to medium SAND, trace of silt; wet; minor iron staining; SP. - With fine to coarse sand layers and trace of gravel from about 20 to 21.4 feet. - With slightly silty to silty, fine sand layers and increasing iron staining below 21.4 feet.	26.0
Medium dense, brown, slightly silty to slity, fine SAND; wet; scattered iron staining; SP-SM.	39.0
Medium dense, gray, silghtly silty to silty, fine and fine to medium SAND; wet; SP-SM.	49.0

BOTTOM OF BORING
COMPLETED 4/24/2003

NOTE: First (deep) borehole was abandoned due to bridging of bentonite chips. Drilled 4 feet east of first hole for observation well installation on April 25, 2003.

Symbol | Samples | Ground Water | Depth, Ft.

Standard Penetration Resistance
(140 lb. weight, 30-inch drop)
▲ Blows per foot



LEGEND

- * Sample Not Recovered
- Standard Penetration Test
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD
- Ground Water Level in Well

● % Water Content

Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING GW-2

December 2005 21-1-09896-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-8

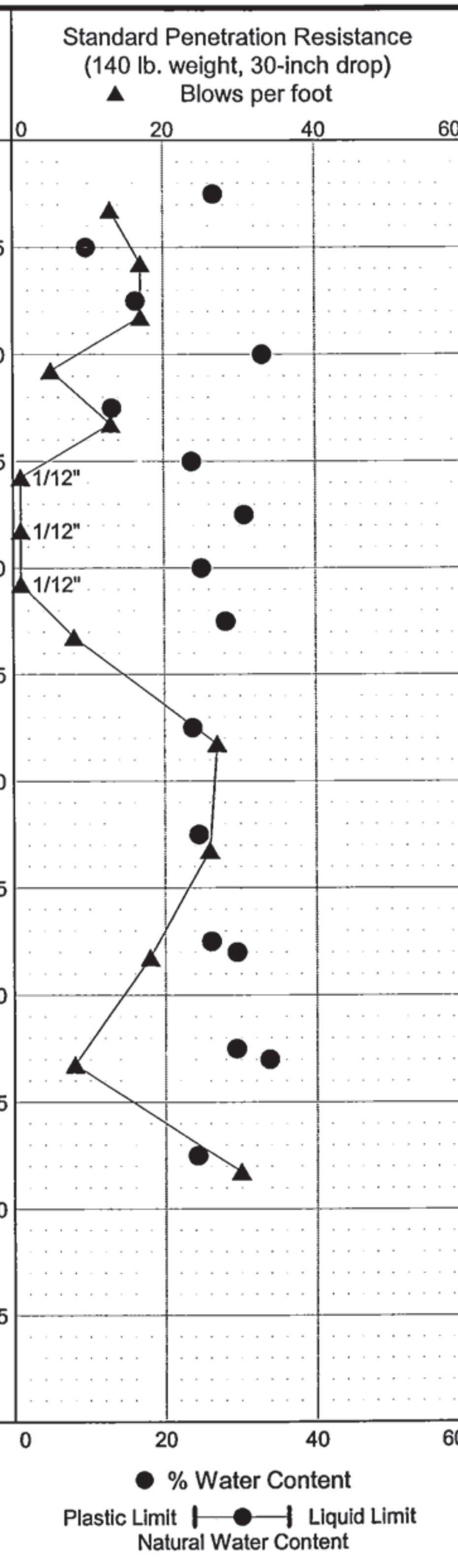
SOIL DESCRIPTION Surface Elevation: Approx. 69.0 Ft.	Depth, Ft.
Loose, dark brown, slightly gravelly, slightly silty to silty, fine to medium SAND; moist; (Fill) SP-SM/SM.	3.0
Medium dense, dark brown, slightly silty to silty, fine to medium SAND; moist; scattered organics; SP-SM. - Interbedded below 5.9 feet with gray, trace to slightly silty, fine to medium sand, trace of gravel. - Loose from 10 to 12 feet. - Very loose and wet below 14 feet.	17.0
Very loose, gray-brown, trace to slightly silty, fine to medium SAND; wet; iron-stained; scattered organics; SP. - Loose below 22 feet. - Medium dense below 27 feet. - With layers of silty, fine sand below 33 feet.	38.5
Medium dense, gray, silty, fine SAND and sandy SILT; wet; 30-degree bedding; minor iron staining; SM/ML. - Loose from about 41 to 43.3 feet.	43.3
Medium stiff, gray CLAY; wet; with 1-inch silty, fine sand layer in center; CH.	44.0
	45.0
Medium dense, gray and gray-green, silty, fine SAND; wet; iron-stained; SM.	49.0
Medium dense, gray, fine to medium SAND, trace of silt; wet; SP. - Scattered silt seams (30-degree bedding) below 48.7 ft.	

BOTTOM OF BORING
COMPLETED 4/25/2003

Symbol | Samples | Ground Water | Depth, Ft.

Samples: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

2/17/2005 | During Drilling



LEGEND

- * Sample Not Recovered
- Standard Penetration Test
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- ▽ Ground Water Level ATD
- ▼ Ground Water Level in Well

NOTES

1. The boring was performed using drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

The Tulalip Tribes
I-5/ 116th Street NE Interchange
Marysville, Washington

LOG OF BORING GW-3

December 2005 — 21-1-09896-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-9

OLD MSTR LOG 21-09896-001.GPJ SHAN WIL.GDT 12/5/05 Log: PVH Rev: PVH Typ: LKD

APPENDIX D

STRUCTURAL EARTH WALL ANALYSES

APPENDIX D: STRUCTURAL EARTH WALL ANALYSES

In accordance with the GDM (WSDOT, 2011), the walls are to be designed using LRFD methods. Specific Structural Earth Wall (SEW) design recommendations are presented in the report text, along with the general special provision (GSP) fill-ins presented in the currently recommended LRFD format. This appendix contains a summary of the results of analyses performed for the external design of the structural earth walls (SEW) and includes:

In addition, graphic presentation of our slope stability analyses for the most critical cross section of each wall are included as Figures D-1 through D-28 (see index below).

FIGURES

Table D-1: Summary of Global Stability Analyses & Recommended Minimum Reinforcement Lengths

Wall Designation	Wall Station	Wall Height (H)	Static Global Stability (Circular) SF[a]	Static Global Stability (Non-Circular) SF[a]	Compound Stability (Static) SF[a]	Compound Stability (Pseudo Static) SF[a]	Minimum Reinforcement Length (L) Based on Wall Height (H)
WA1 NE Line	10+06.98	26'	1.75	3.02	1.55	1.27	0.8H when H>22'
	11+08.00	21'	2.17	3.03	1.74	1.33	0.7H when 12≤H≤22'
	12+08.00	16'	2.10	2.81	1.72	1.35	
	13+08.00	11'	2.62	2.61	2.51	1.62	8' when H<12'
	14+20.00	6'	3.54	4.16	3.54	2.15	
WA2 WN Line	10+06.08	28'	2.08	2.76	1.62	1.28	0.7H when H≥12'
	11+80.00	16'	2.08	2.73	1.74	1.37	
	12+95.00	10'	2.34	3.06	1.82	1.46	8' when H<12'
WA3 ES Line	118+66.00	13'	1.85	2.70	1.51	1.21	0.7H when H≥12'
	116+20.00	10'	2.39	2.94	2.06	1.50	8' when H<12'
WA4 ES Line	15+50.86	30'	2.07	2.74	1.61	1.33	0.7H when H≥12'
	13+40.00	21'	2.21	2.95	1.74	1.35	
	11+60.00	11'	2.02	2.83	1.63	1.29	8' when H<12'
WA5 SW Line	2+12.28	12'	3.50	3.60	2.53	1.94	0.7H when H≥12'
	1+72.00	8'	2.60	3.49	2.16	1.62	8' when H<12'

[a] SF: Safety Factor

Table D-1 (continued): Summary of Global Stability Analyses & Recommended Minimum Reinforcement Lengths

Wall Designation	Wall Station	Wall Height (H)	Static Global Stability (Circular) SF[a]	Static Global Stability (Non-Circular) SF[a]	Compound Stability (Static) SF[a]	Compound Stability (Pseudo static) SF[a]	Minimum Reinforcement Length (L) Based on Wall Height (H)
WA6 SW Line	16+55.29	30’	2.25	3.00	1.80	1.39	0.7H when H≥12’
	13+80.00	18’	2.07	2.95	1.69	1.41	
	11+40.00	10’	2.05	2.80	1.86	1.38	8’ when H<12’
WA7 SW Line	121+52.00	21’	2.38	3.79	2.09	1.43	0.7H when H≥12’
	122+20.00	12’	2.01	2.95	1.81	1.25	
	122+80.00	6’	1.91	3.11	1.86	1.26	8’ when H<12’

[a] SF: Safety Factor

Notes: 1. Minimum reinforcement length (L) of 0.7H or 8 feet per LRFD Bridge Design Specifications (AASHTO, 2012) Section 11.10.2.1.
2. Please note that the results of the pseudo static global stability analysis are not shown in the table above because the pseudo static compound stability case is more critical.

Table D-2: Summary of Estimated Nominal Bearing Resistance for Proposed SEW Walls

Wall Designation	Wall Station	Wall Height (ft)	Wall Base Width (ft)	Nominal Bearing Resistance (psf)
WA1 NE Line	10+07	26	21	22,000
	13+08	11	8	11,000
WA2 WN Line	10+06	28	19	28,000
	12+95	11	8	15,000
WA3 ES Line	114+60	4	8	11,000
	117+60	15	10	13,000
WA4 ES Line	15+51	30	21	18,000
	11+40	11	8	11,000
WA5 SW Line	2+12	13	9	15,000
WA6 SW Line	11+40	10	8	14,000
	16+55	30	21	18,000
WA7 SW Line	120+50	21	15	21,000
	122+20	11	8	12,000

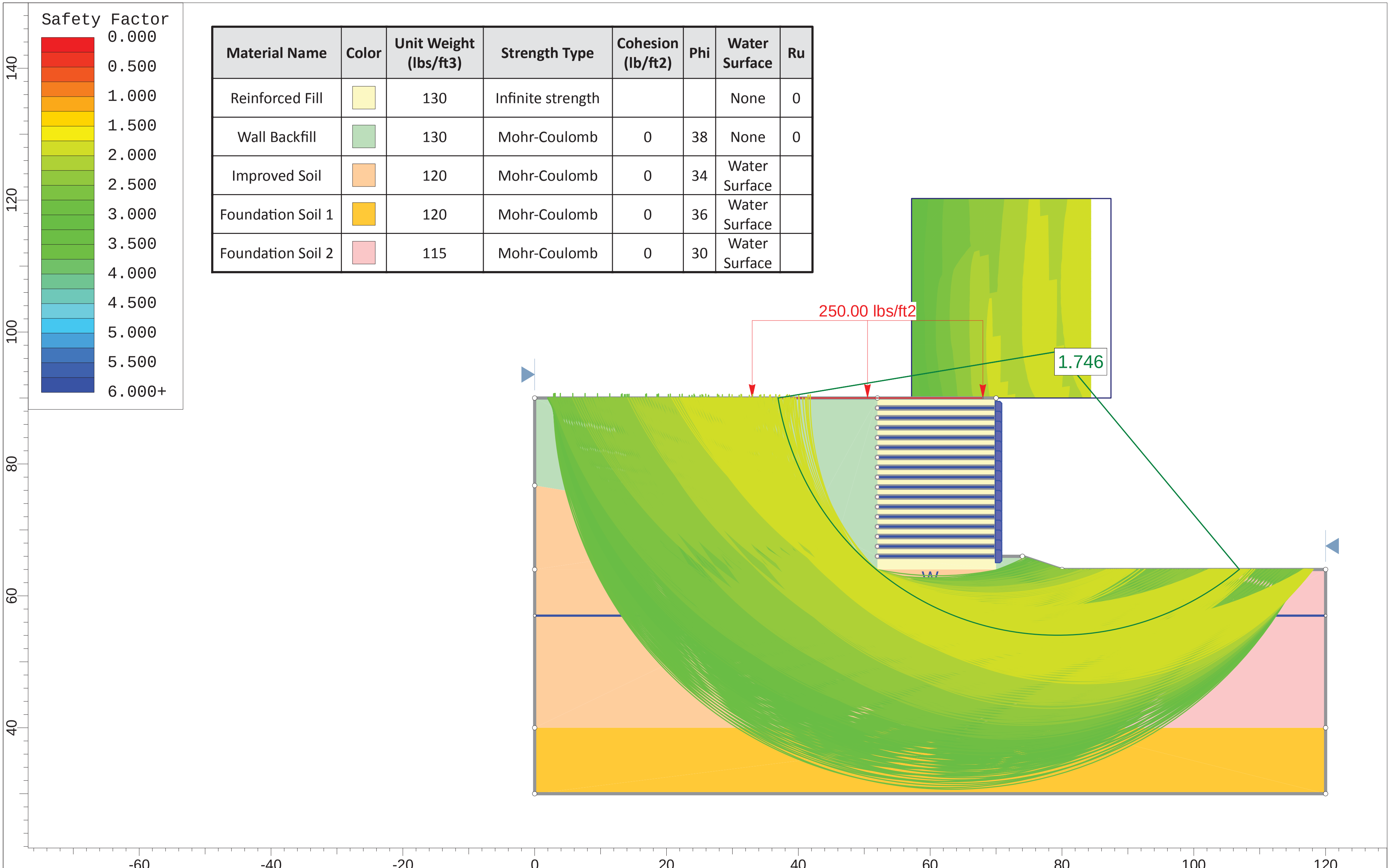
Note: Bearing resistance for locations situated between the wall stations indicated in the Table may be estimated based on linear interpolation between the stations.

Table D-3: Summary of Estimated Total and Differential Wall Settlements

Wall Designation	Wall Station	Wall Height (ft)	Wall Base Width (ft)	Estimated Total Settlement (in)	Approximate Maximum Differential Settlement Over 100' of Wall Alignment (in)
WA1 NE Line	10+06.98	26	21	2.8	0.7
	11+08.00	21	15	2.1	
	12+08.00	16	11	1.4	
	13+08.00	11	8	0.9	
	14+20.00	6	8	0.5	
WA2 WN Line	10+06.08	28	19	3.0	1.1
	11+08.00	19	13	2.2	
	12+08.00	15	11	1.7	
	12+95.00	10	8	0.6	
	14+00.00	4	8	0.3	
WA3 ES Line	114+60.00	4	8	0.5	1.1
	115+60.00	7	8	0.8	
	116+60.00	12	8.5	1.2	
	117+60.00	15	10	2.3	
	118+66.00	13	9	1.3	
WA4 ES Line	15+50.86	30	21	4.6	1.4
	14+40.00	26	18	3.2	
	12+08.00	21	15	3.3	
	12+40.00	16	11	2.2	
	11+40.00	11	8	1.4	
	10+40.00	7	8	1.4	
WA5 SW Line	1+24.00	7	8	0.8	0.5
	1+72.00	8	8	0.8	
	2+12.00	13	9	1.3	
WA6 SW Line	10+40.00	8	8	0.9	1.6
	11+40.00	10	8	1.0	
	12+40.00	14	10	1.5	
	13+40.00	17	12	1.7	
	14+40.00	19	13	2.3	
	15+52.00	26	18	3.9	
	16+55.29	30	21	4.5	

Table D-3 (continued): Summary of Estimated Total and Differential Wall Settlements

Wall Number	Station Number	Wall Height (ft)	Wall Base Width (ft)	Estimated Total Settlement (in)	Approximate Maximum Differential Settlement Over 100' of Wall Alignment (in)
WA7 SE Line	120+16.00	19	13	2.4	1.6
	121+16.00	21	15	2.7	
	122+19.00	12	8.5	1.1	
	123+07.00	4.5	8	0.5	



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
Reinforced Fill		130	Infinite strength			None	0
Wall Backfill		130	Mohr-Coulomb	0	38	None	0
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface	
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface	
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface	

PanGEO INCORPORATED

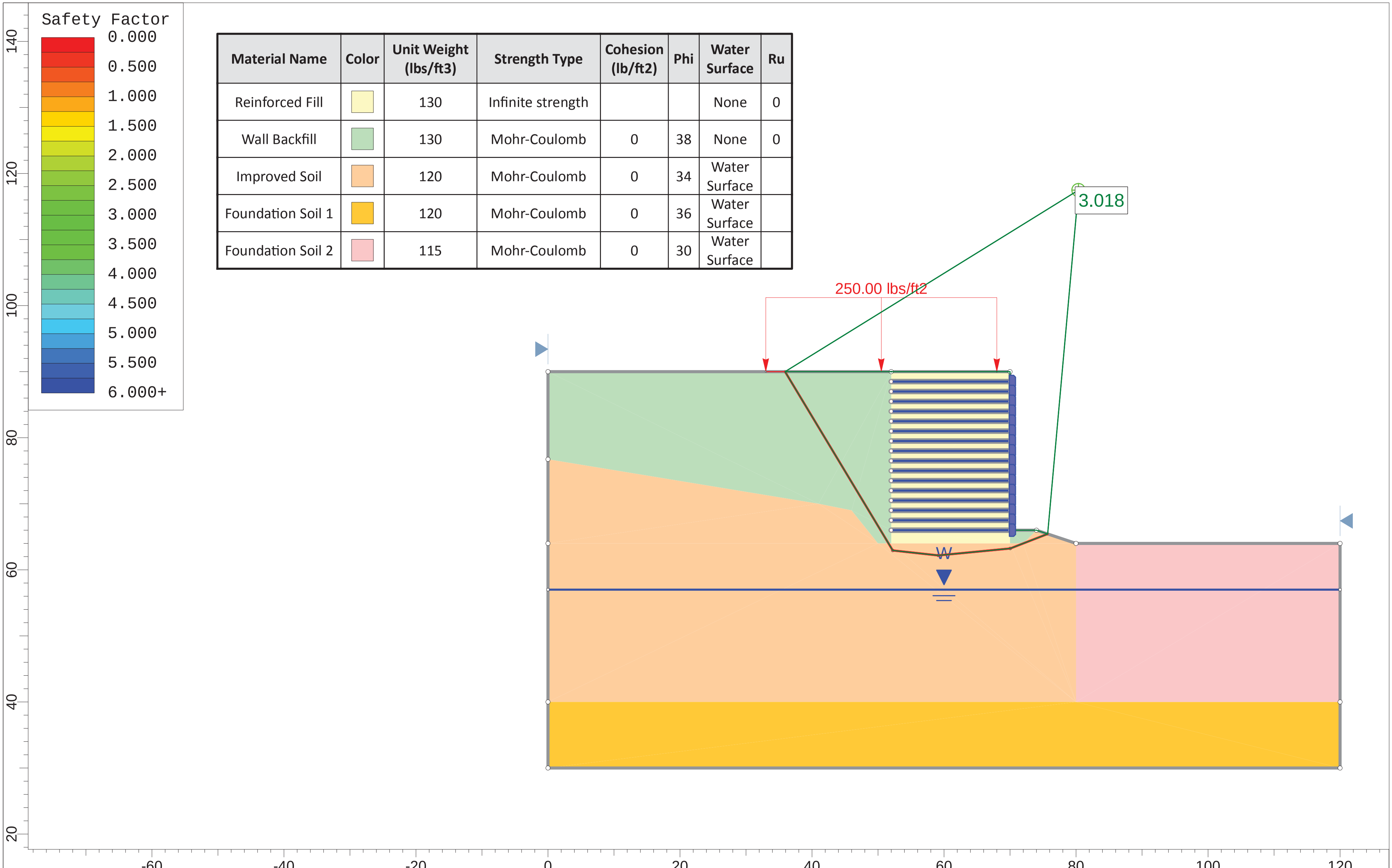
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Circular Surface - Wall WA1 (STA 10+07)

PROJECT NO. **10-069**

FIGURE NO. **D-1**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
Reinforced Fill		130	Infinite strength			None	0
Wall Backfill		130	Mohr-Coulomb	0	38	None	0
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface	
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface	
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface	

PanGEO INCORPORATED

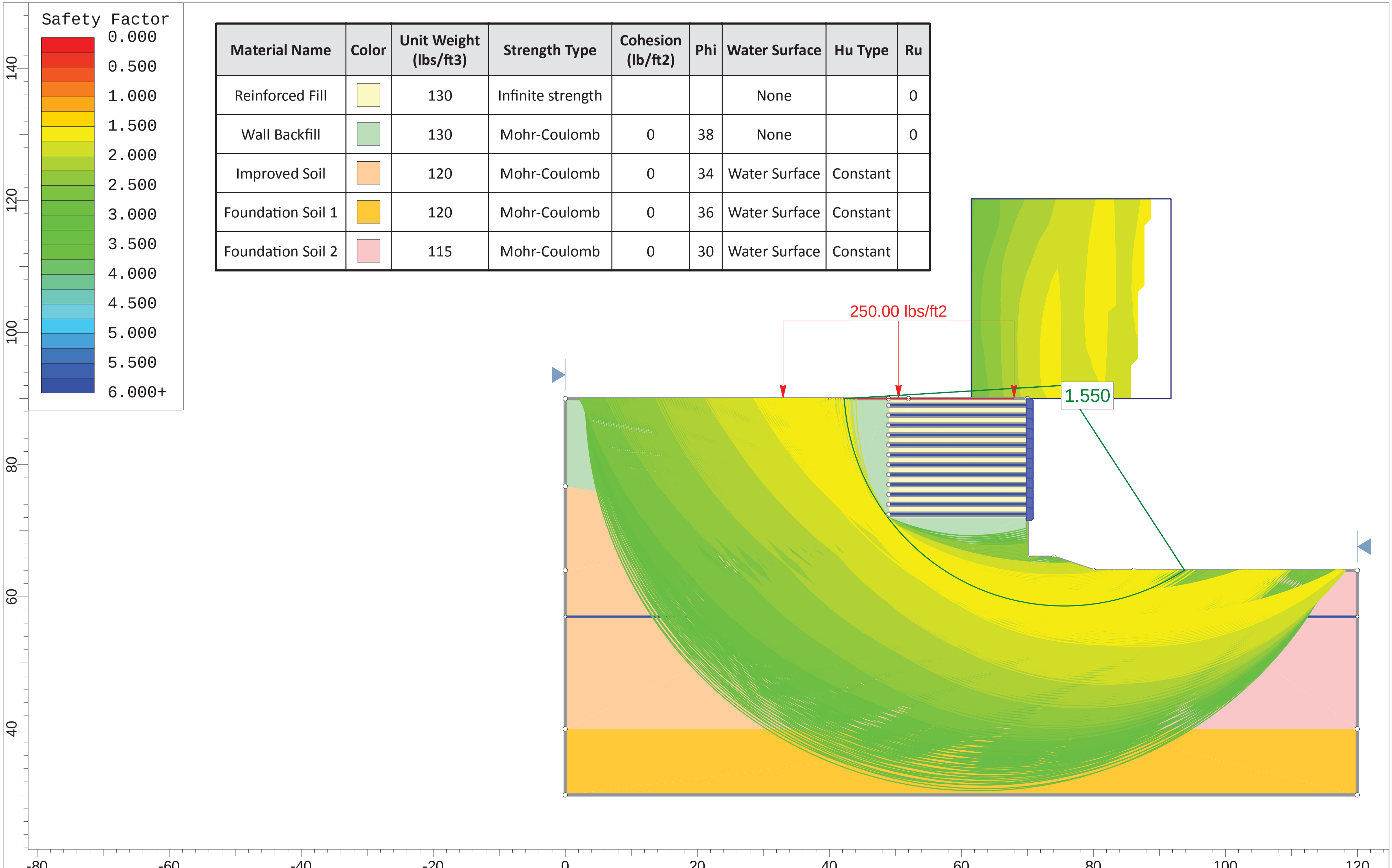
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall WA1 (STA 10+07)

PROJECT NO. 10-069

FIGURE NO. D-2



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface	Constant	
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface	Constant	
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface	Constant	

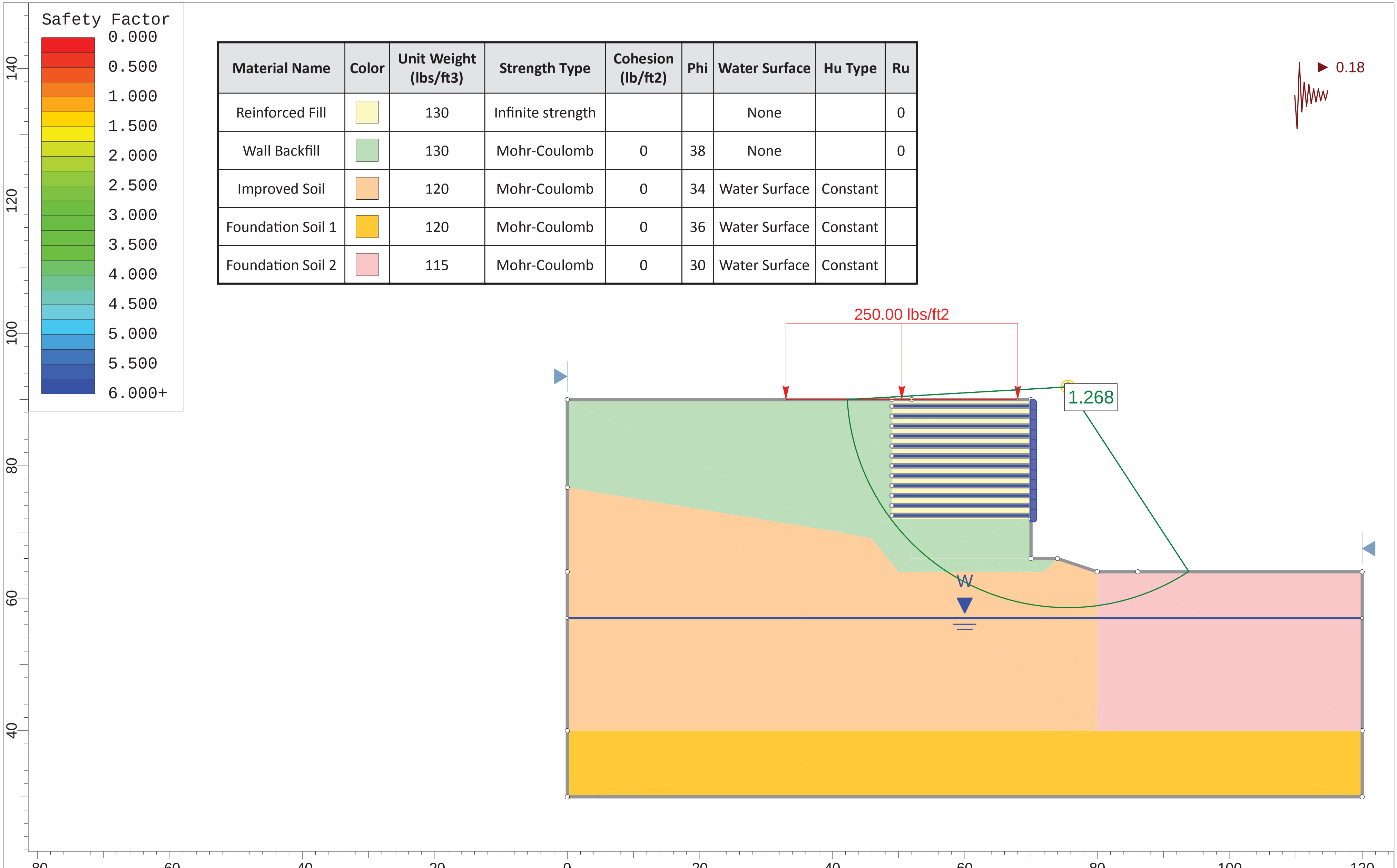
PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Compound Stability Analysis
Wall WA1 (STA 10+07)

PROJECT NO. **10-069**

FIGURE NO. **D-3**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface	Constant	
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface	Constant	
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface	Constant	

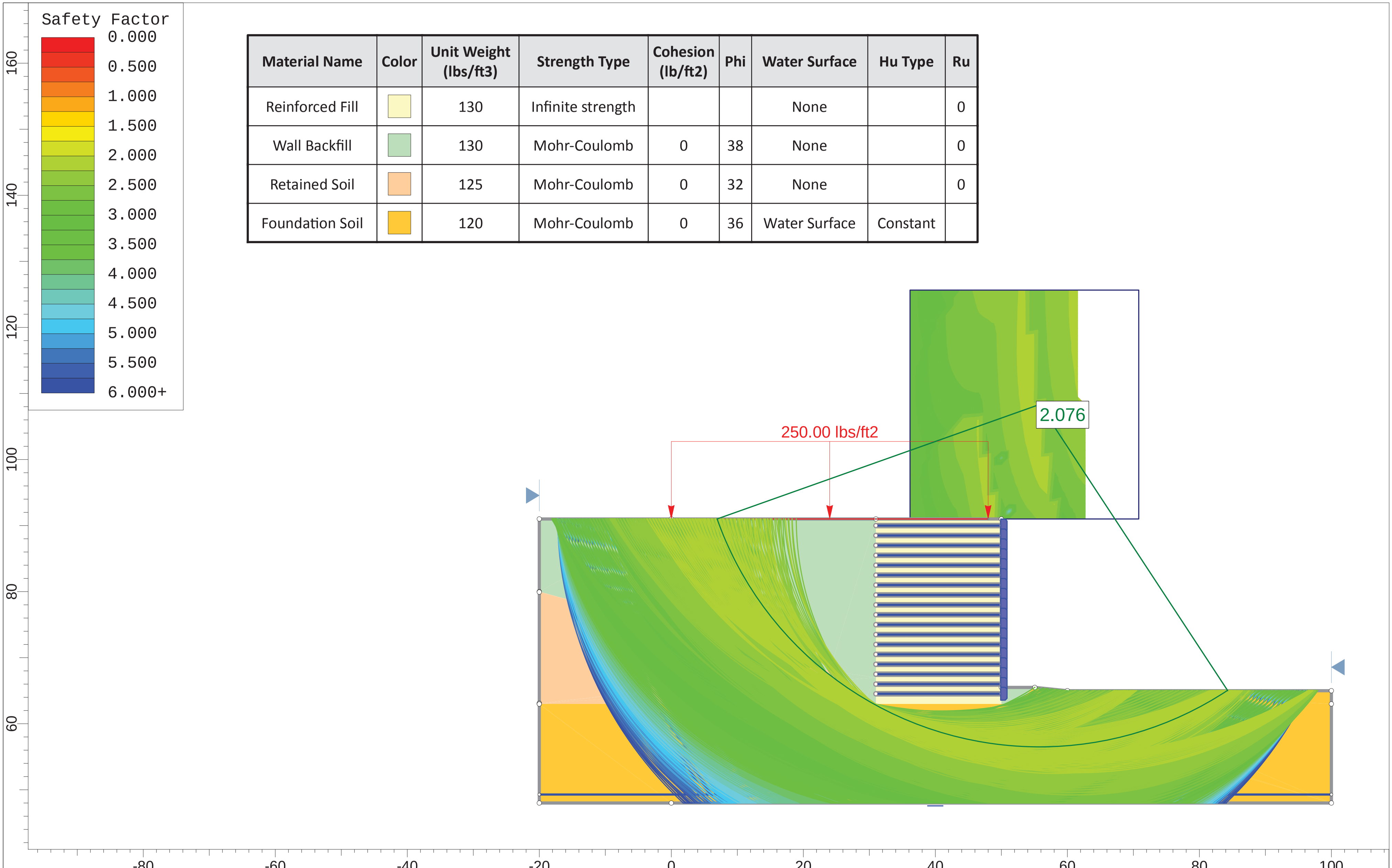
PanGEO INCORPORATED
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo Static Compound Stability Analysis
Wall WA1 (STA 10+07)

PROJECT NO. 10-069

FIGURE NO. D-4



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retained Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

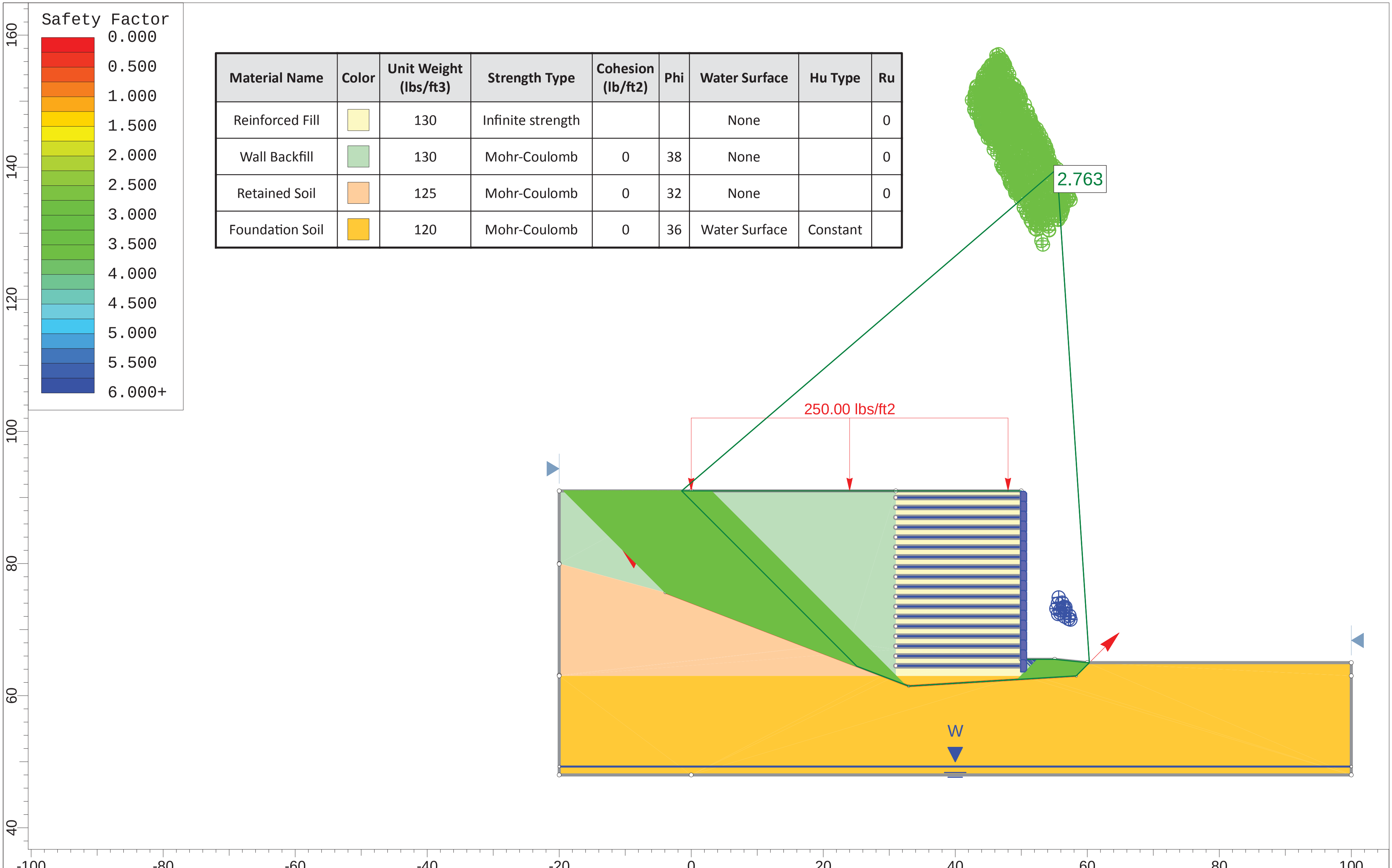
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Circular Surface - Wall WA2 (STA 10+06)

PROJECT NO. **10-069**

FIGURE NO. **D-5**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retained Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

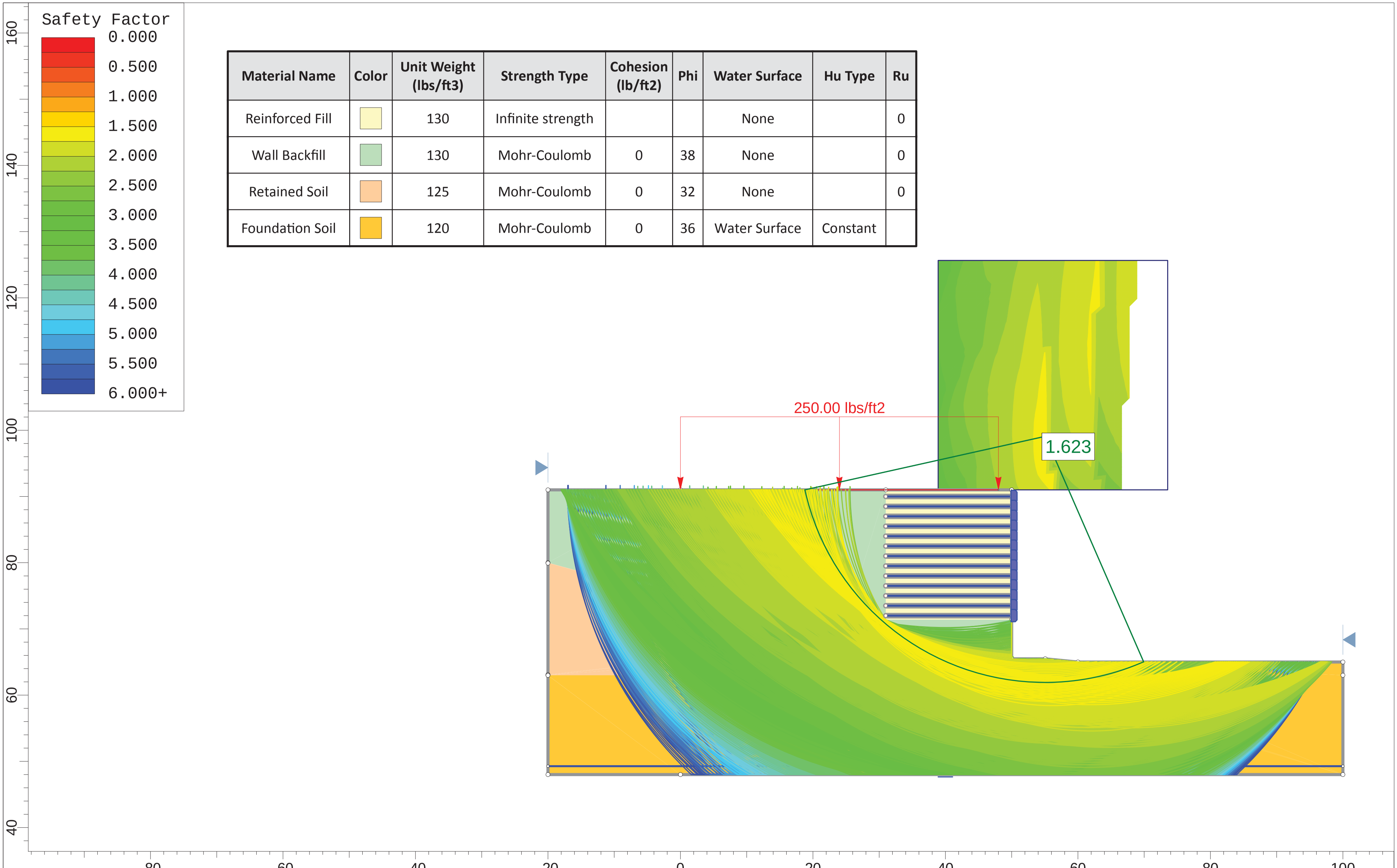
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall WA2 (STA 10+06)

PROJECT NO. 10-069

FIGURE NO. D-6



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retained Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

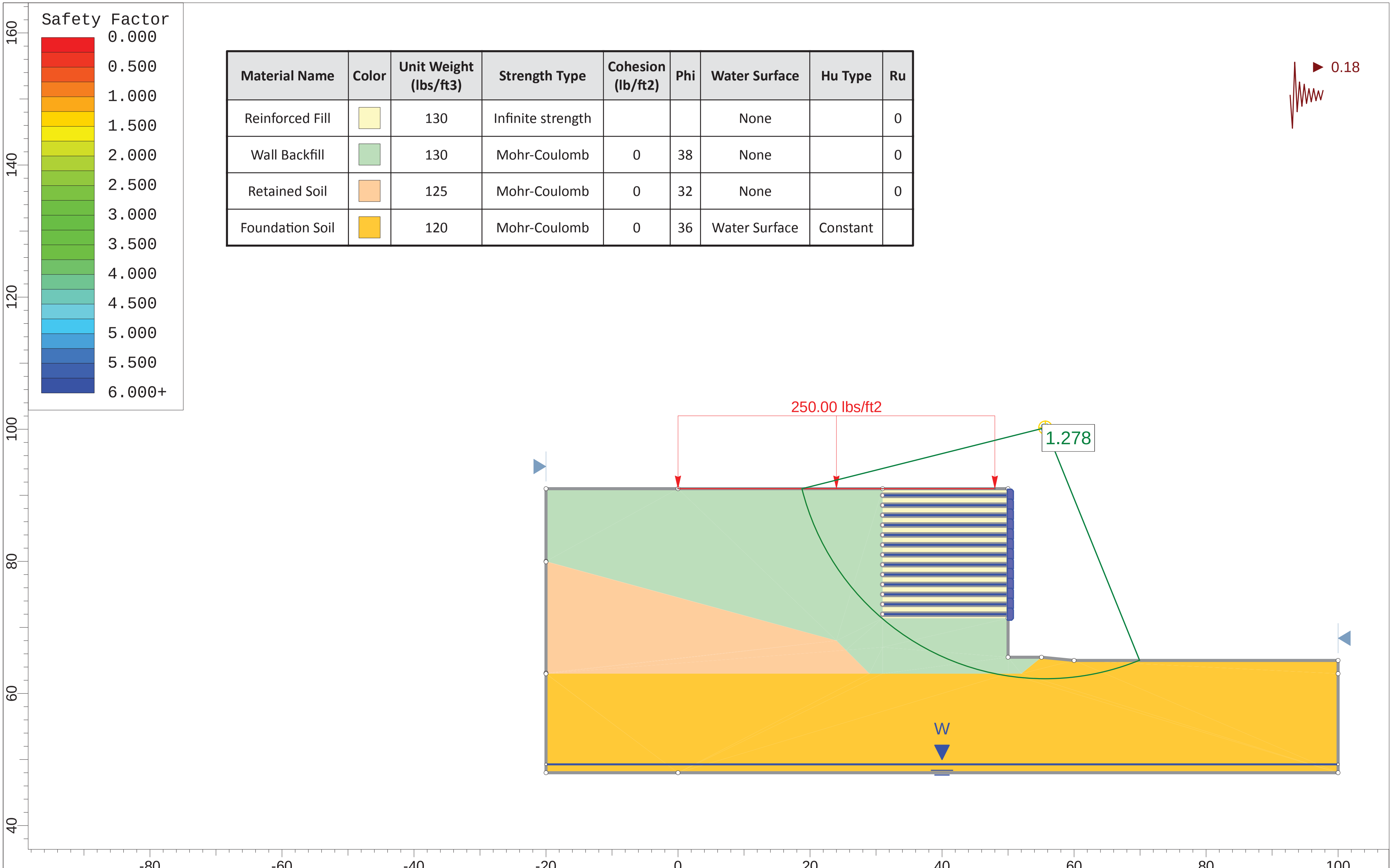
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Compound Stability Analysis
Wall WA2 (STA 10+06)

PROJECT NO. **10-069**

FIGURE NO. **D-7**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retained Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

SLIDEINTERPRET 6.008

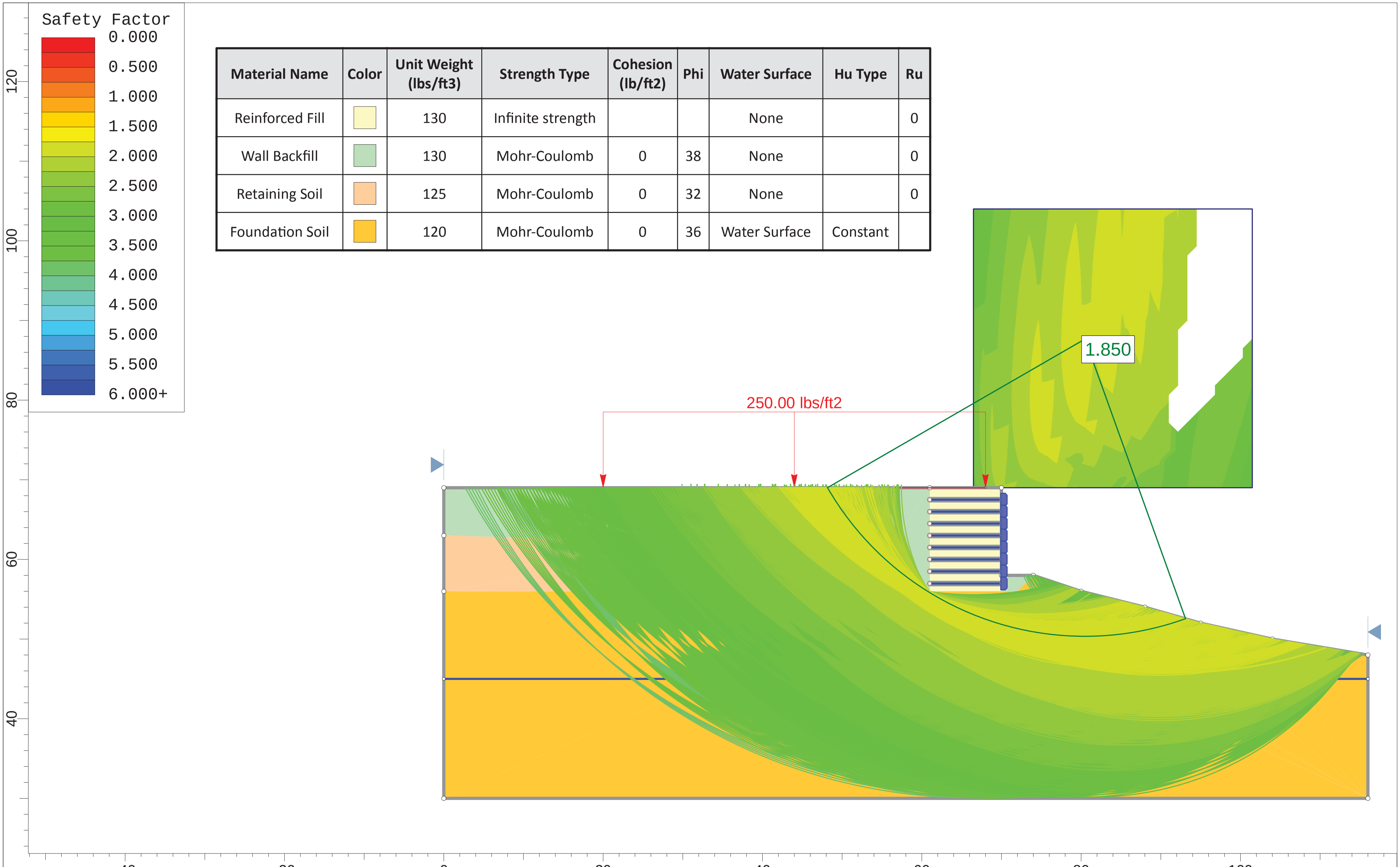
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo Static Compound Stability Analysis
Wall WA2 (STA 10+06)

PROJECT NO. 10-069

FIGURE NO. D-8

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	



PanGEO INCORPORATED

SLIDEINTERPRET 6.008

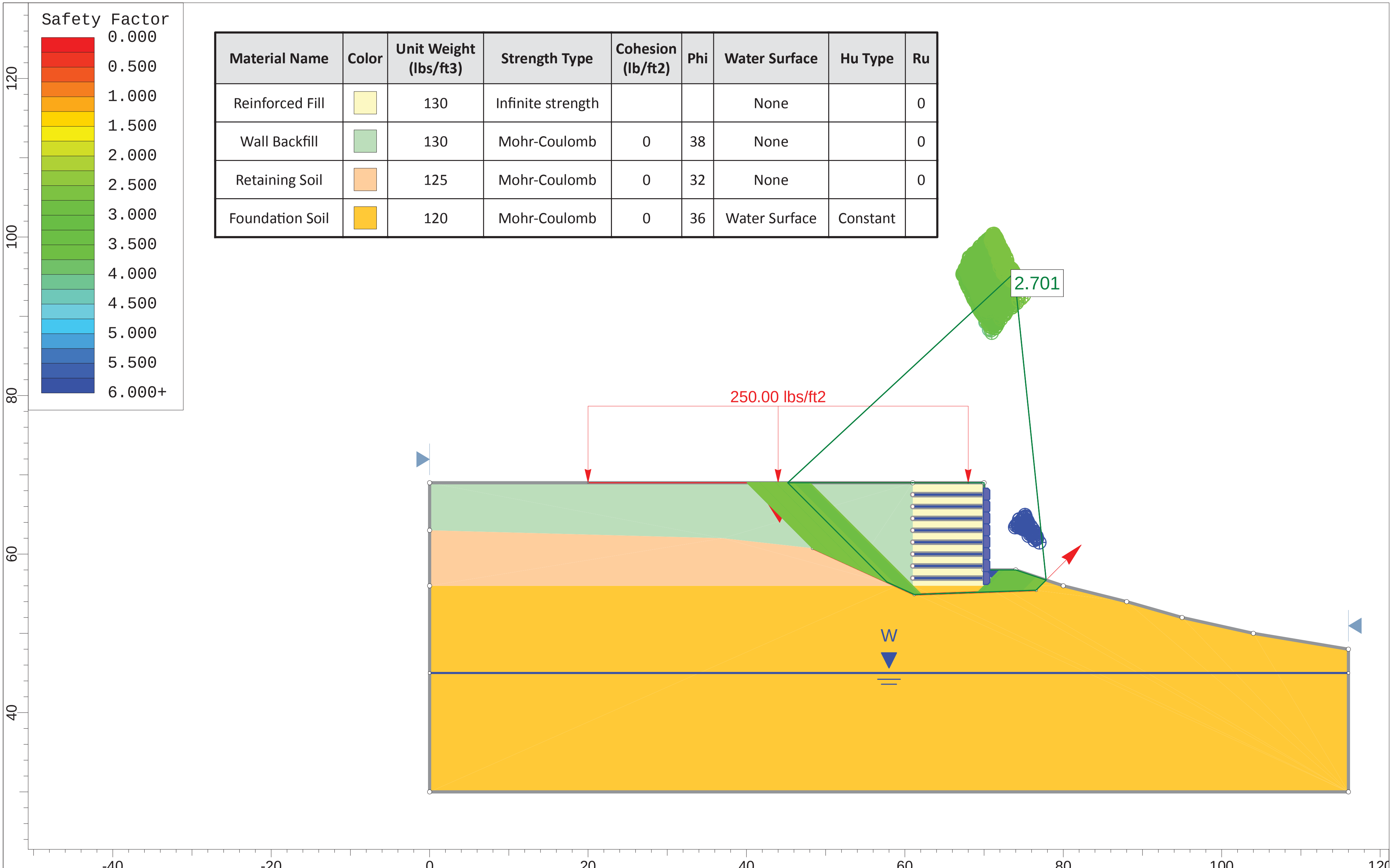
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Circular Surface - Wall WA3 (STA 118+66)

PROJECT NO. 10-069

FIGURE NO. D-9

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	



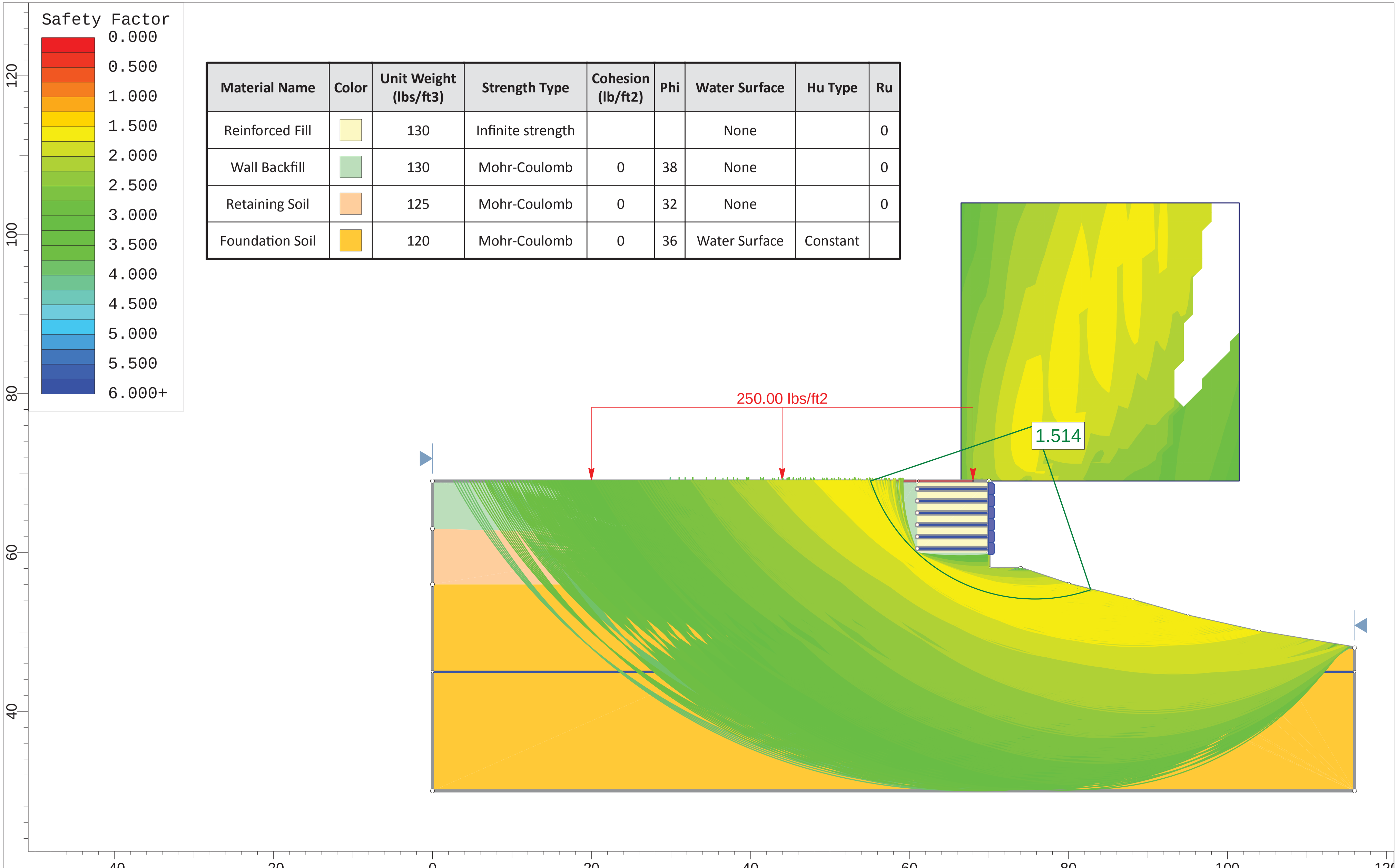
PanGEO INCORPORATED

SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall WA3 (STA 118+66)

PROJECT NO.	FIGURE NO.
10-069	D-10



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

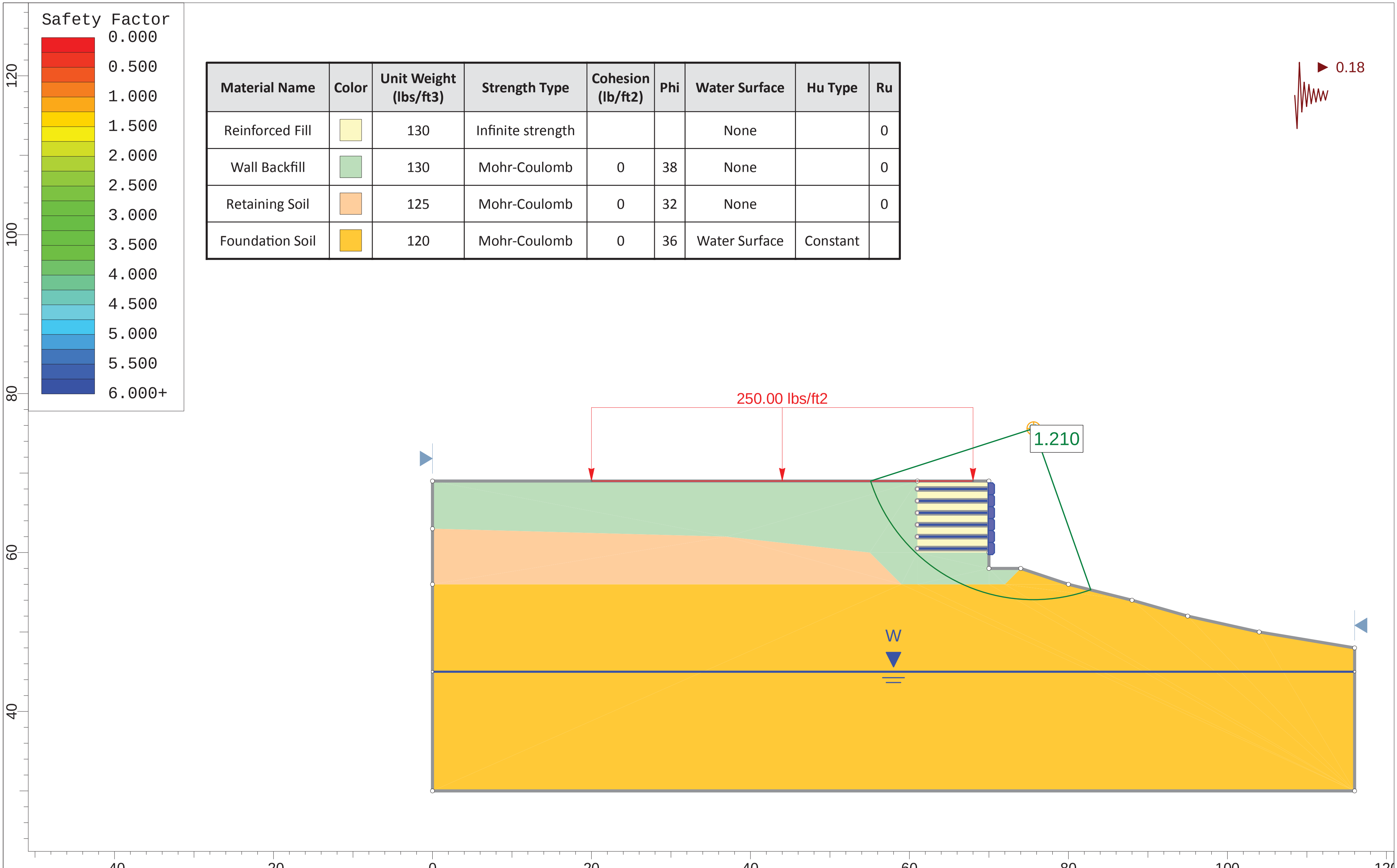
PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Compound Stability Analysis
Wall WA3 (STA 118+66)

PROJECT NO. **10-069**

FIGURE NO. **D-11**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

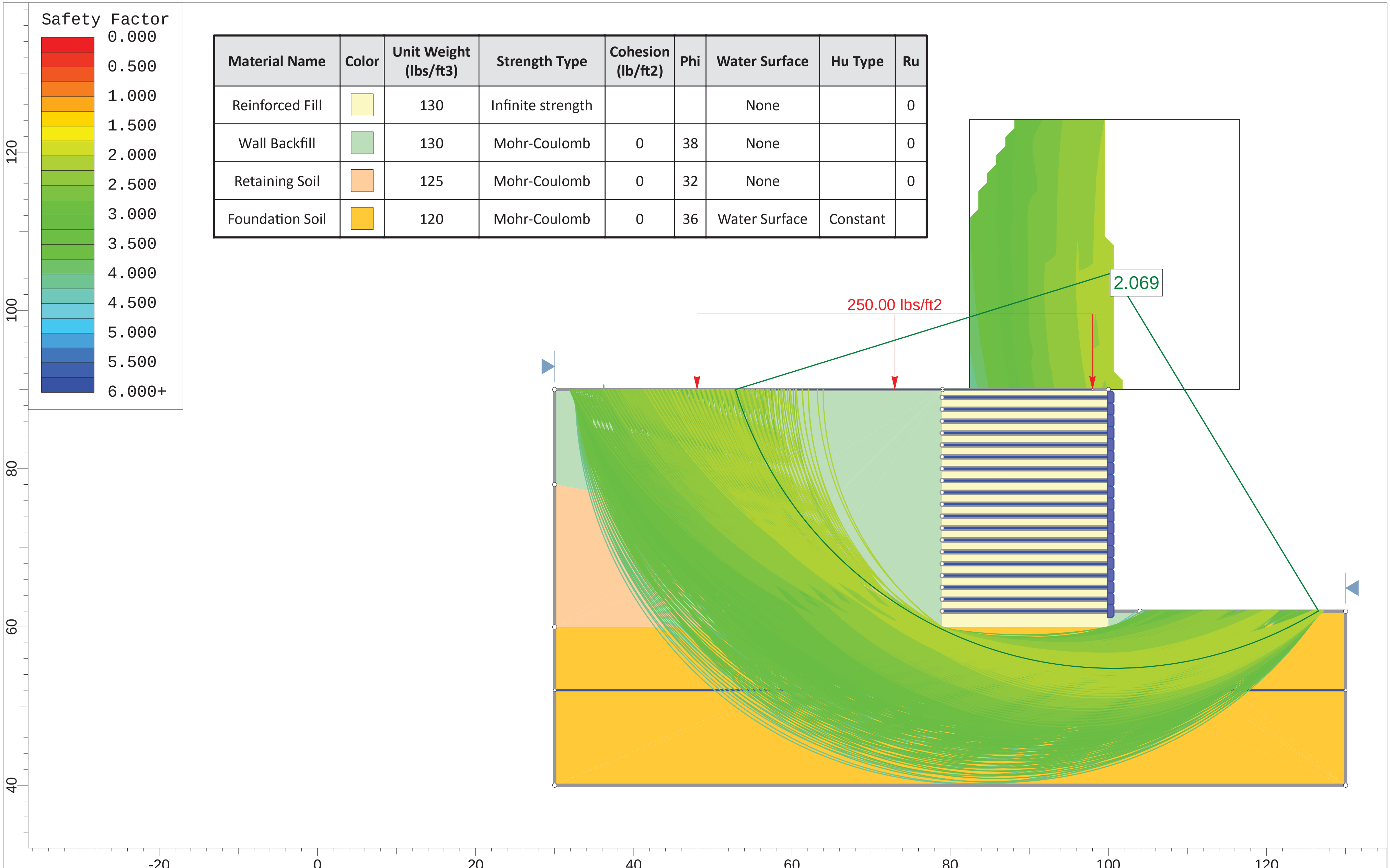
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo Static Compound Stability Analysis
Wall WA3 (STA 118+66)

PROJECT NO. **10-069**

FIGURE NO. **D-12**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

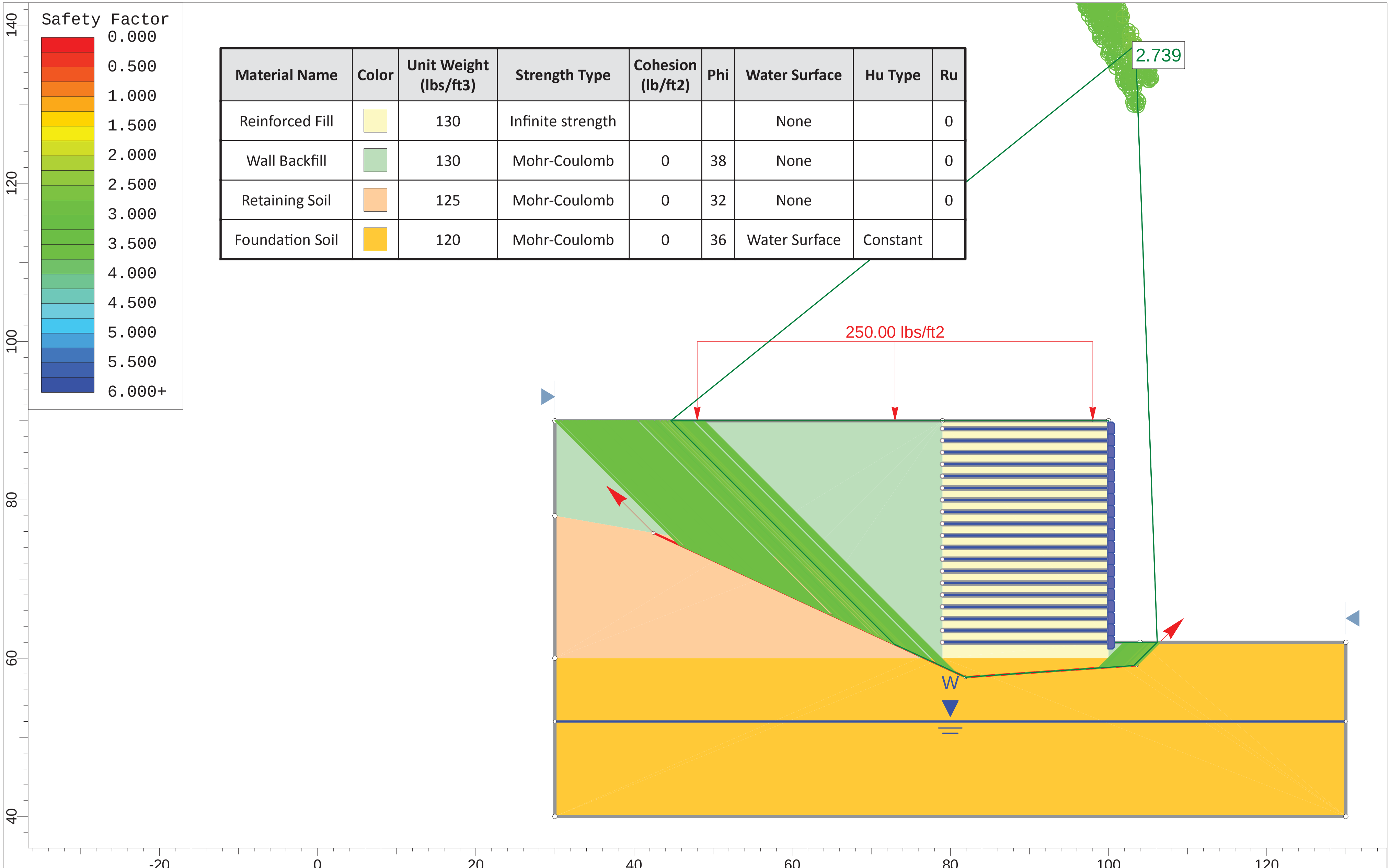
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Circular Surface - Wall WA4 (STA 15+51)

PROJECT NO. 10-069

FIGURE NO. D-13



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

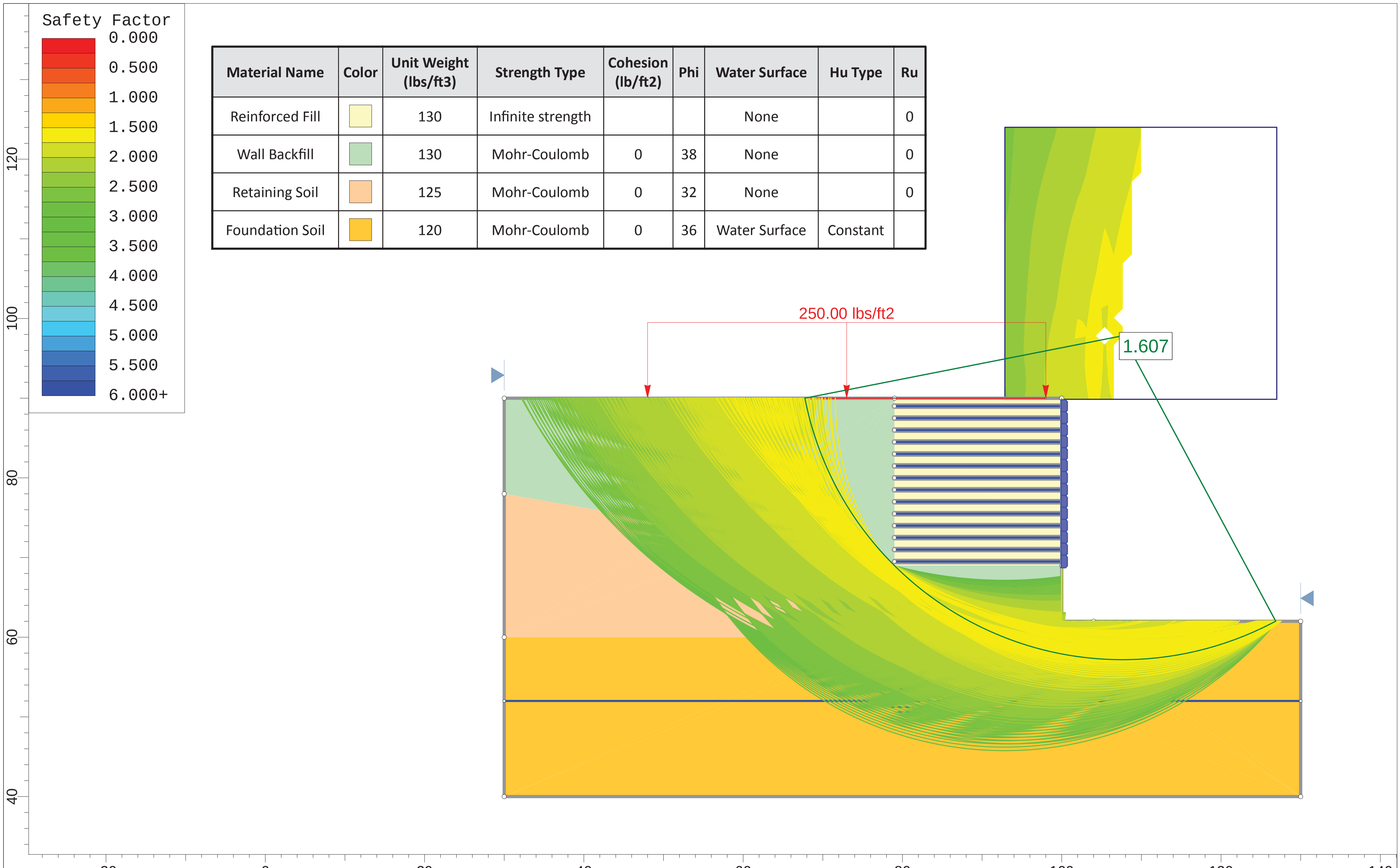
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall WA4 (STA 15+51)

PROJECT NO. **10-069**

FIGURE NO. **D-14**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

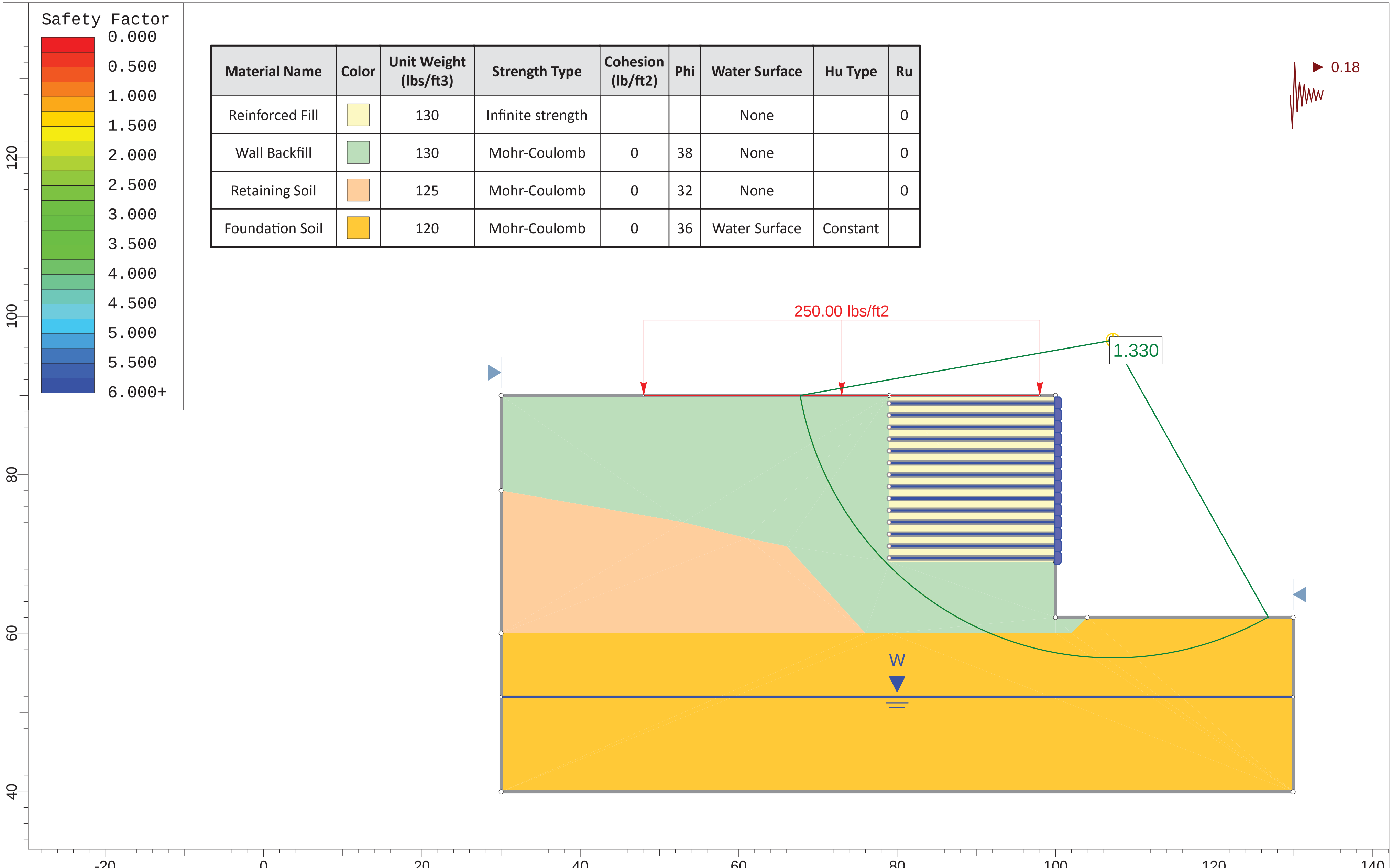
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Compound Stability Analysis
Wall WA4 (STA 15+51)

PROJECT NO. 10-069

FIGURE NO. D-15



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

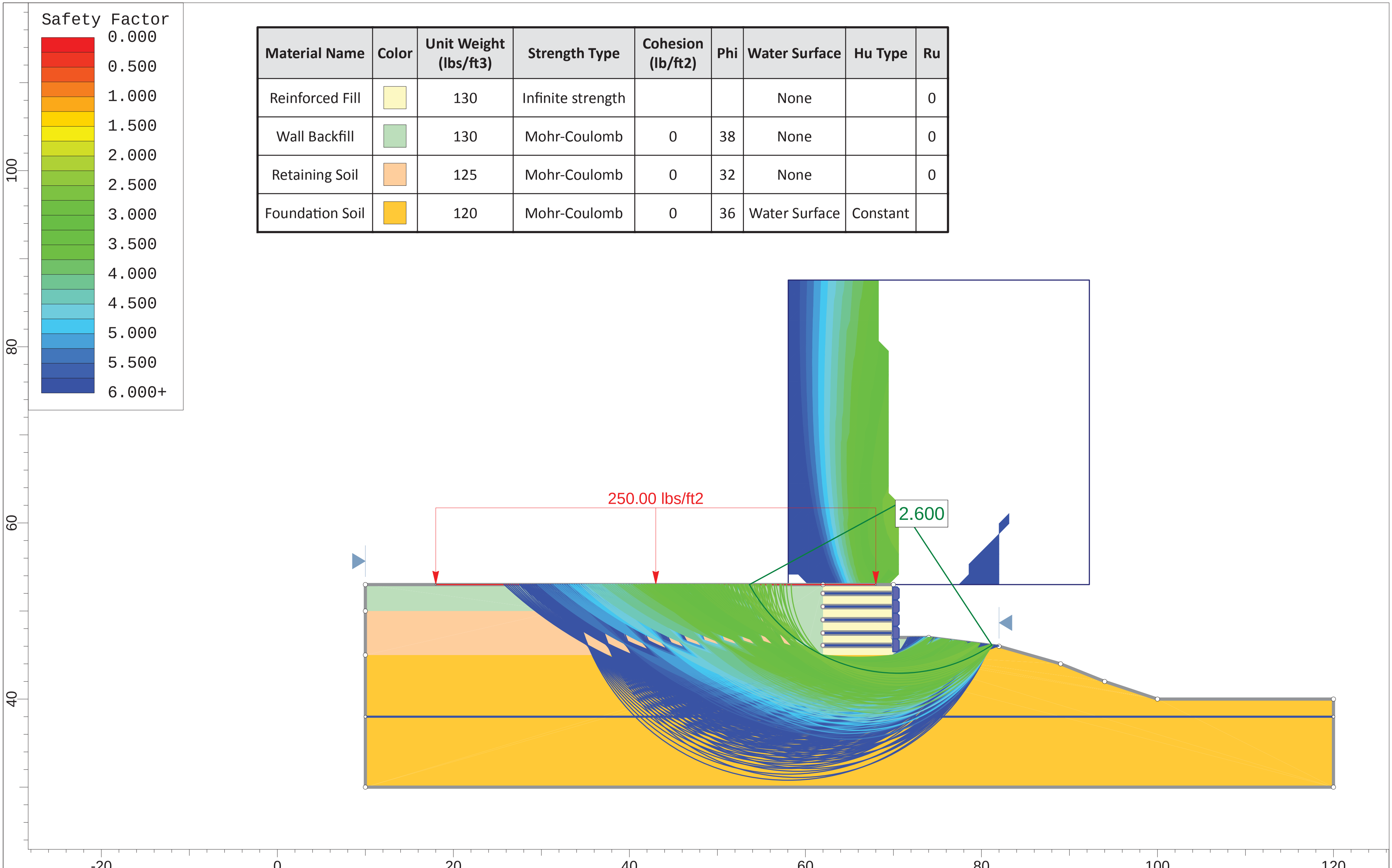
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo Static Compound Stability Analysis
Wall WA4 (STA 15+51)

PROJECT NO. 10-069

FIGURE NO. D-16



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

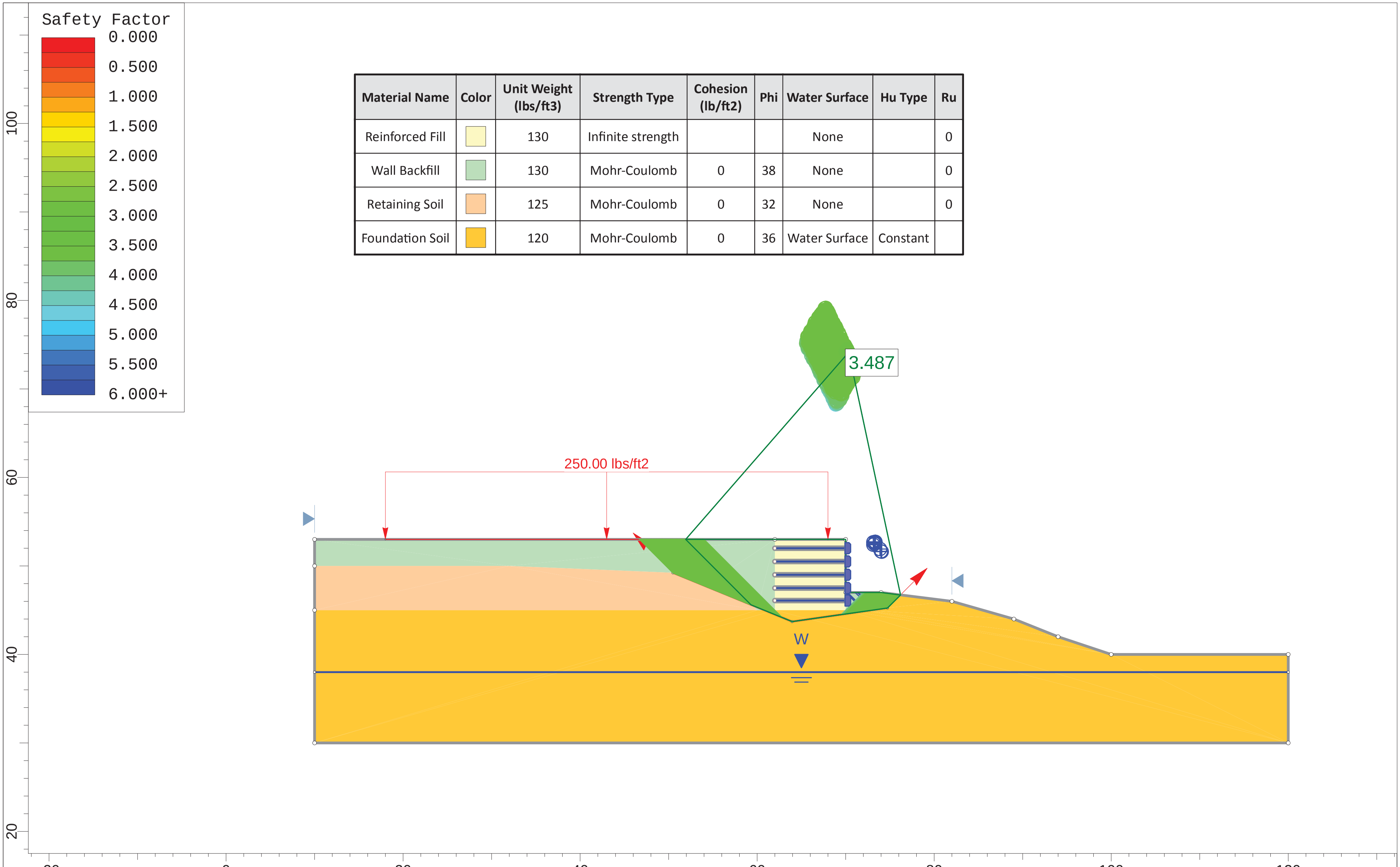
PanGEO INCORPORATED

SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Circular Surface - Wall WA5 (STA 1+72)

PROJECT NO.	FIGURE NO.
10-069	D-17



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

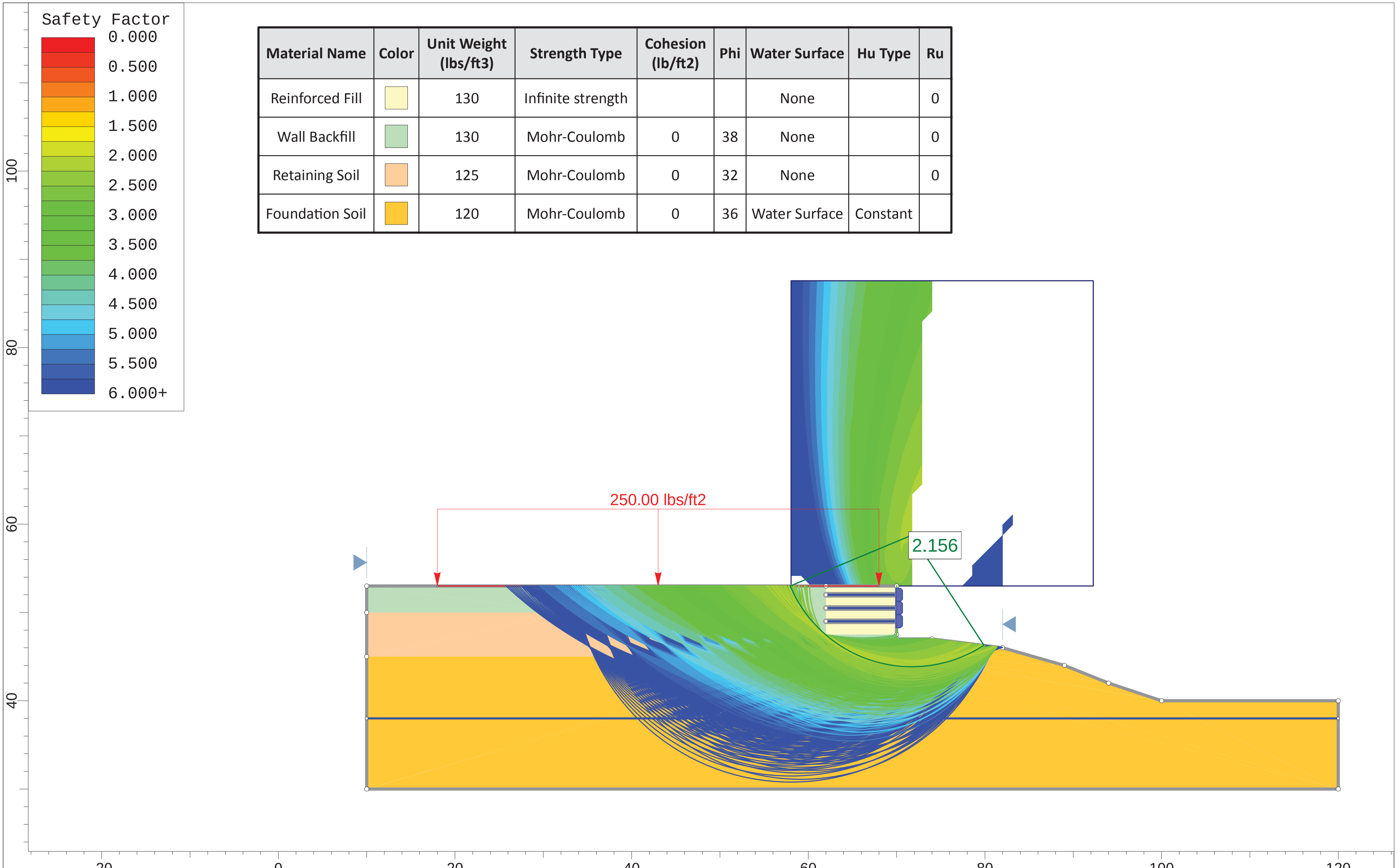
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall WA5 (STA 1+72)

PROJECT NO. 10-069

FIGURE NO. D-18



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

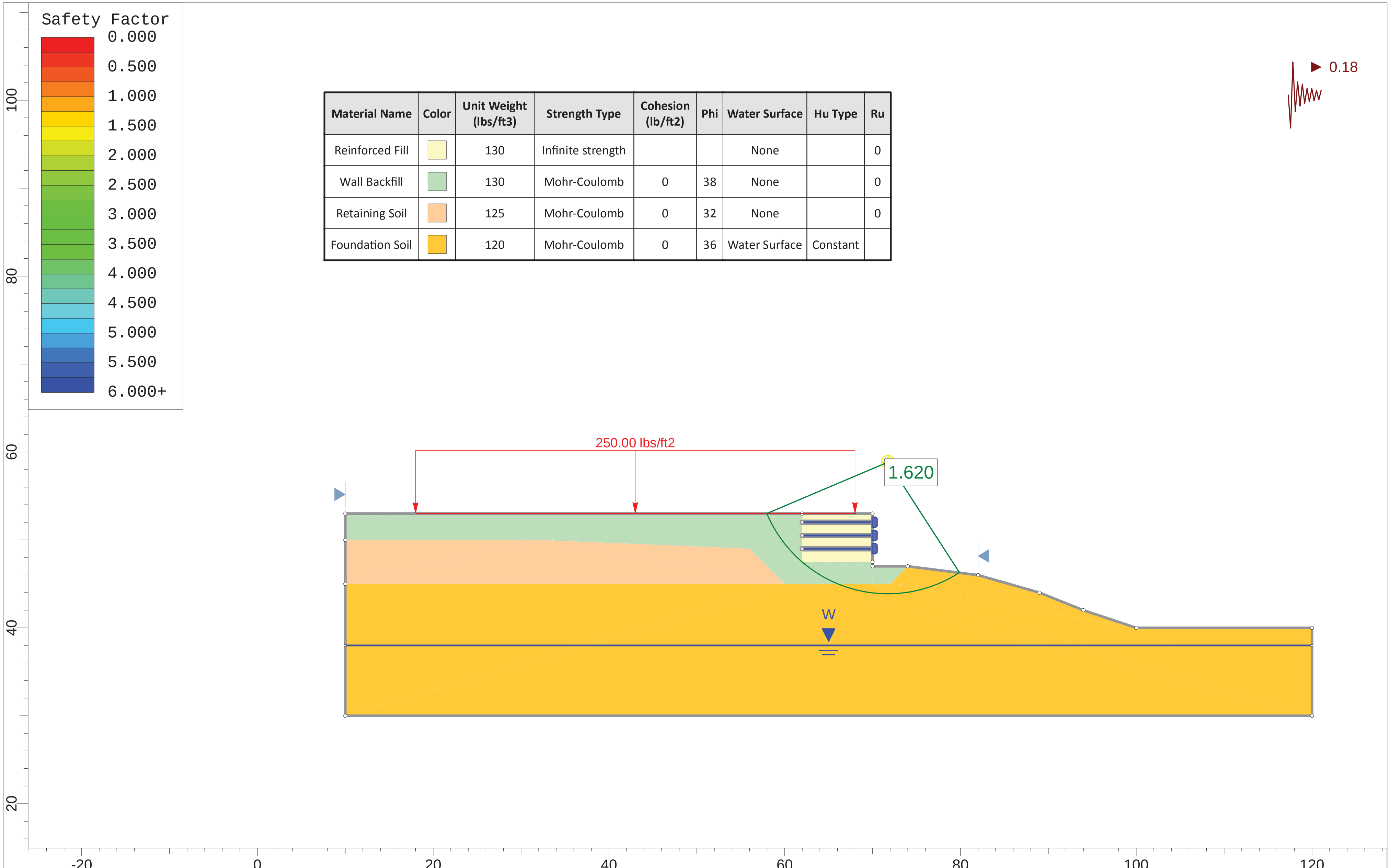
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Compound Stability Analysis
Wall WA5 (STA 1+72)

PROJECT NO. **10-069**

FIGURE NO. **D-19**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

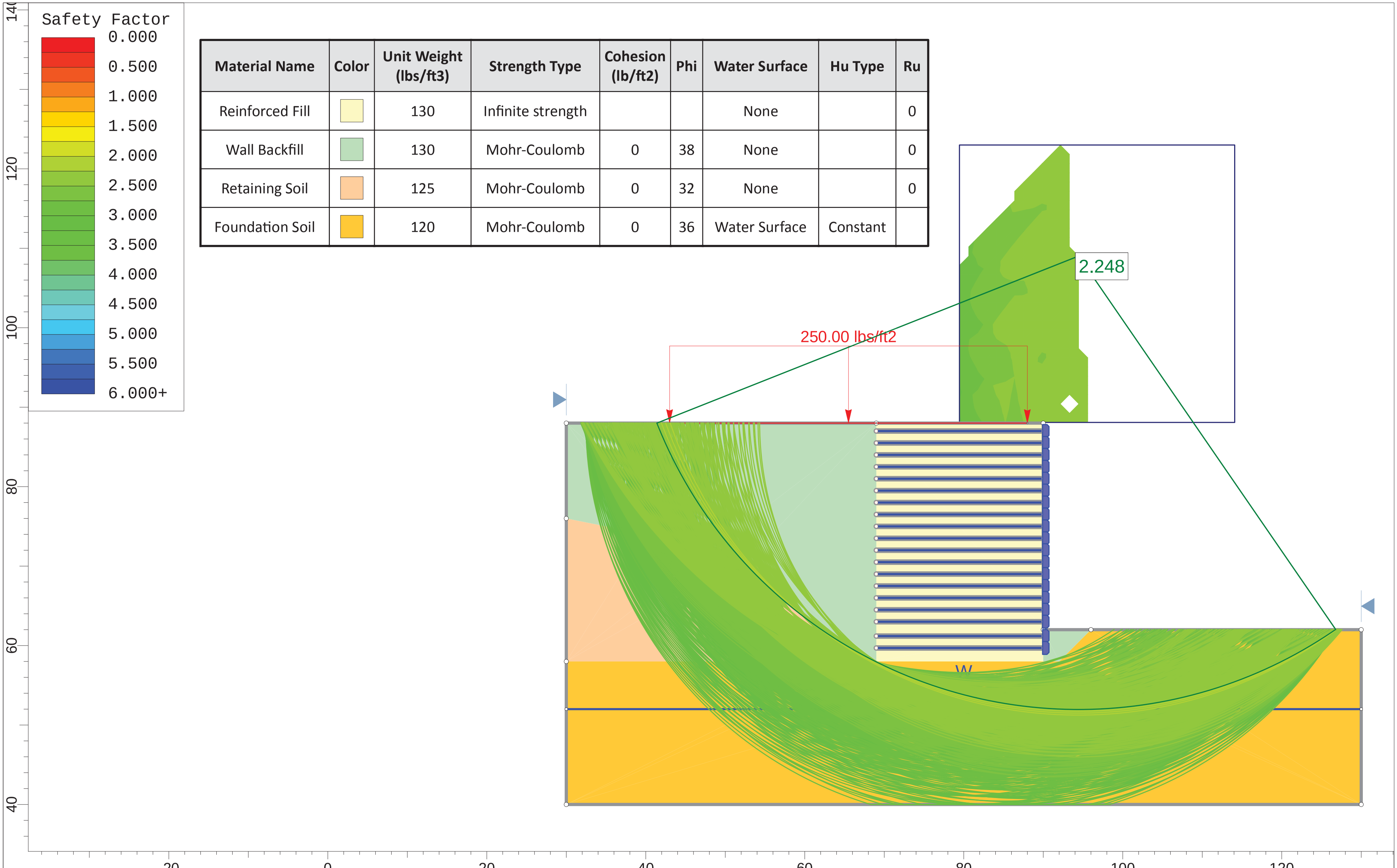
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo Static Compound Stability Analysis
Wall WA5 (STA 1+72)

PROJECT NO. **10-069**

FIGURE NO. **D-20**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

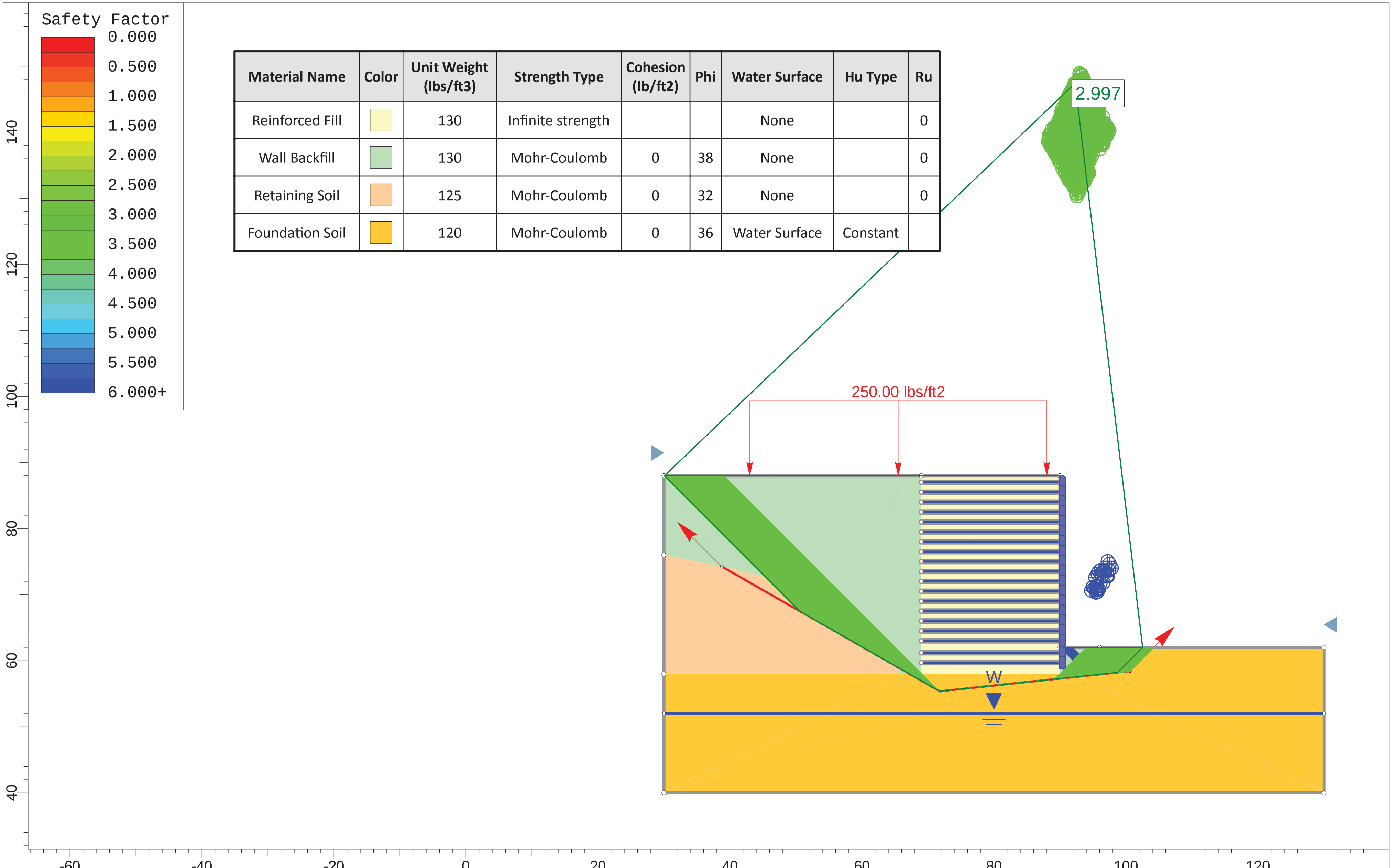
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Circular Surface - Wall WA6 (STA 16+55)

PROJECT NO. **10-069**

FIGURE NO. **D-21**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

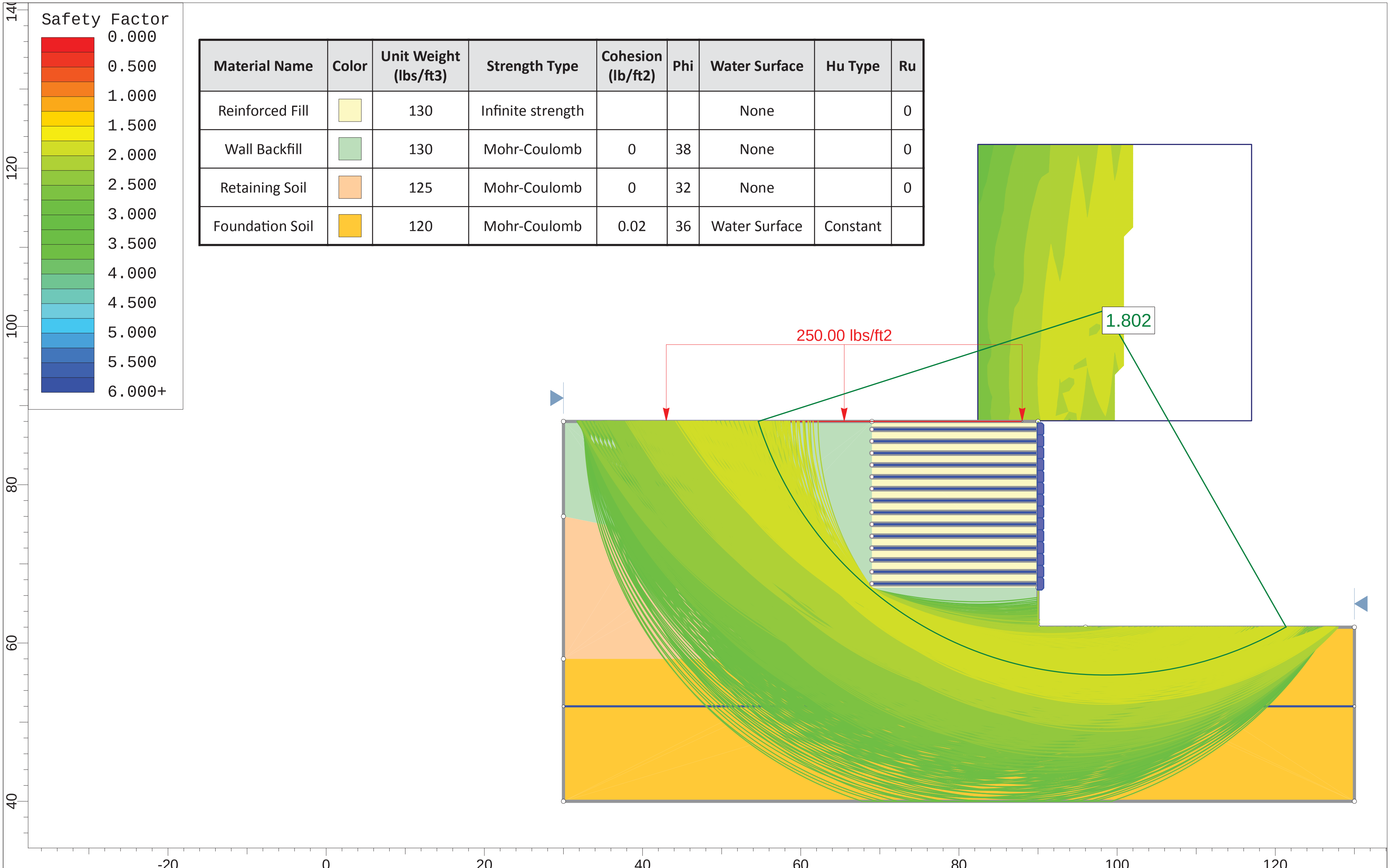
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall WA6 (STA 16+55)

PROJECT NO. 10-069

FIGURE NO. D-22



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0.02	36	Water Surface	Constant	

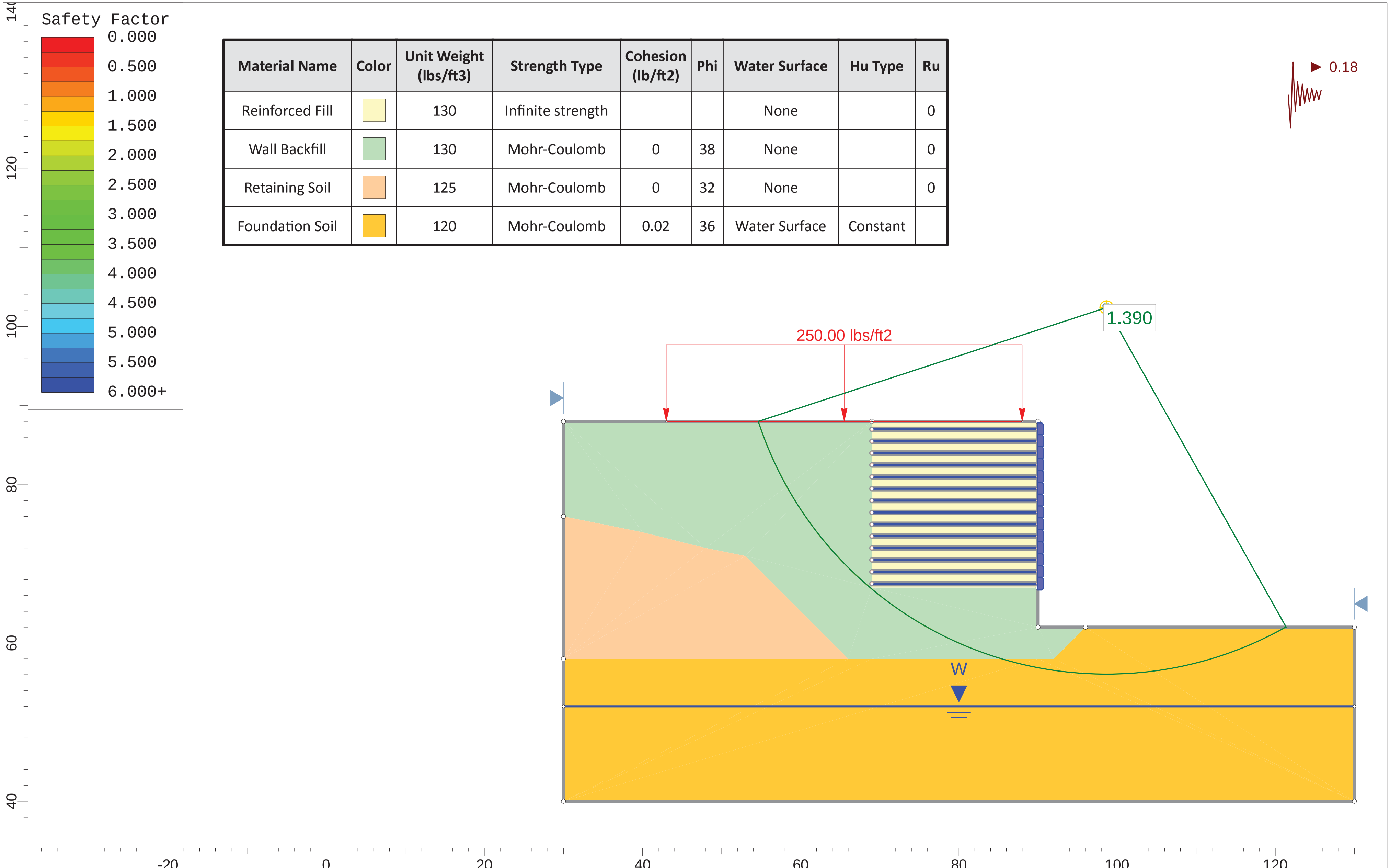
PanGEO INCORPORATED

SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Compound Stability Analysis
Wall WA6 (STA 16+55)

PROJECT NO.	FIGURE NO.
10-069	D-23



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0.02	36	Water Surface	Constant	

PanGEO INCORPORATED

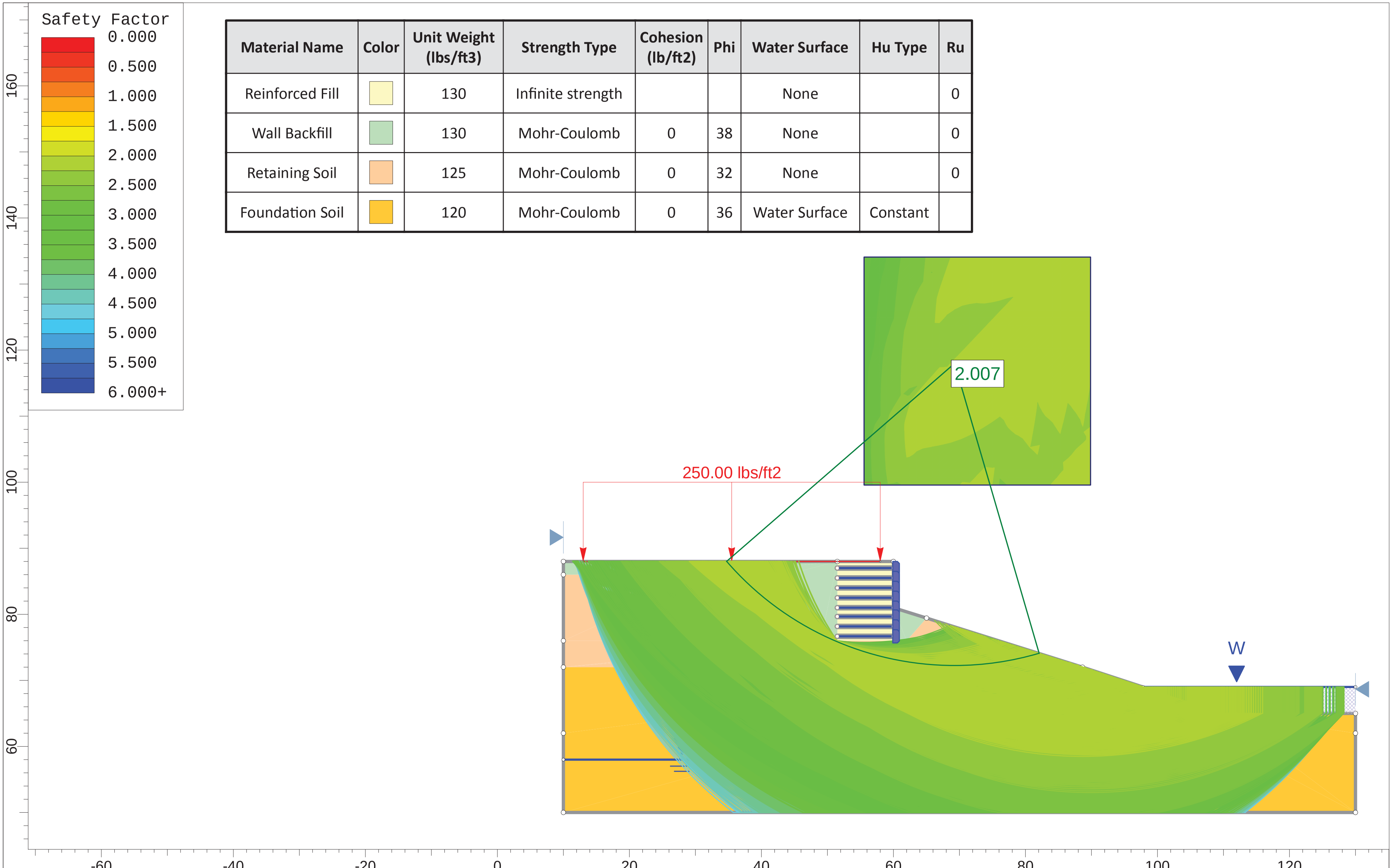
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo Static Compound Stability Analysis
Wall WA6 (STA 16+55)

PROJECT NO. 10-069

FIGURE NO. D-24



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

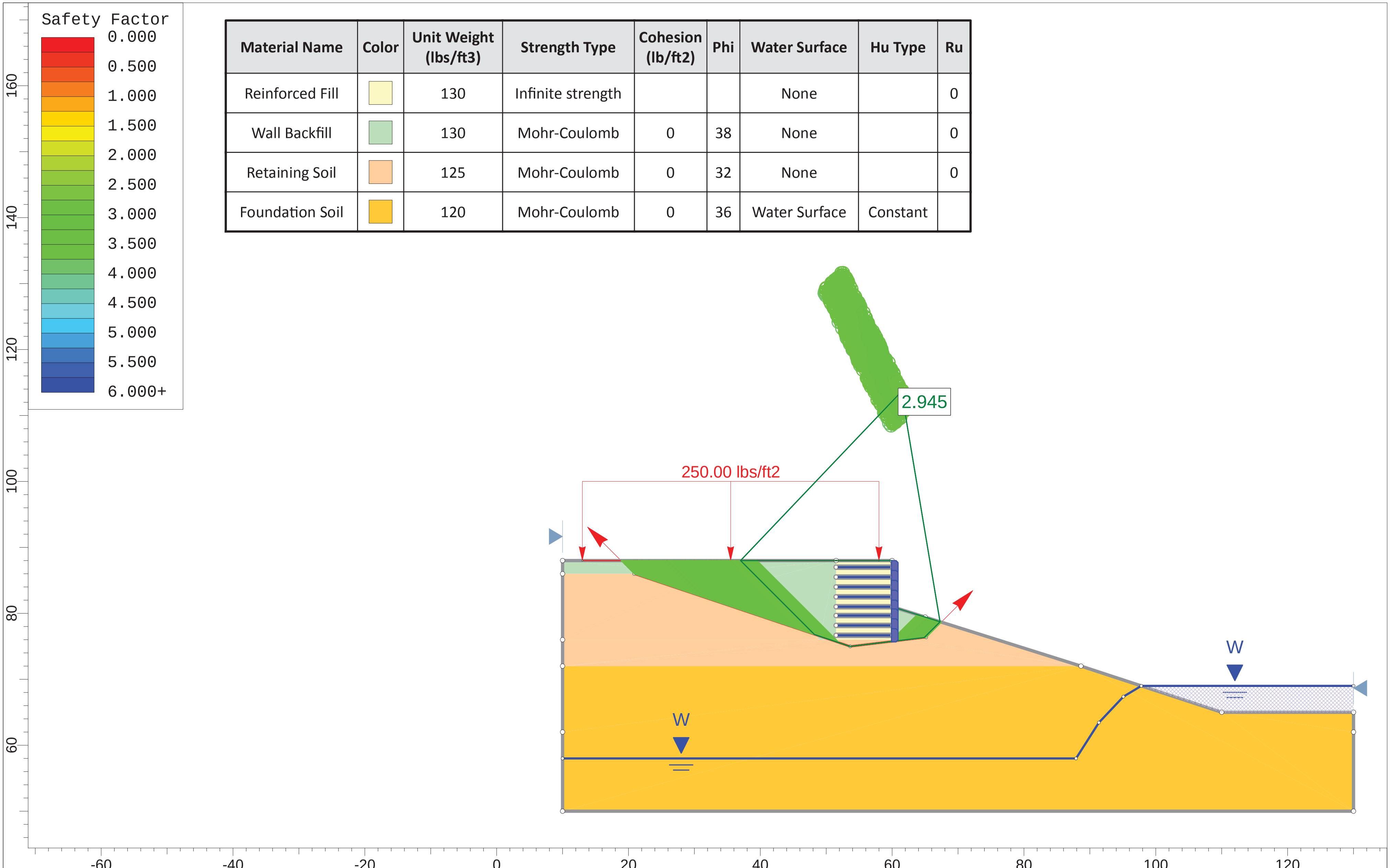
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Circular Surface - Wall WA7 (STA 122+20)

PROJECT NO. **10-069**

FIGURE NO. **D-25**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	

PanGEO INCORPORATED

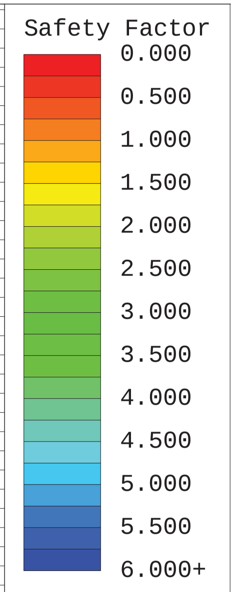
SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

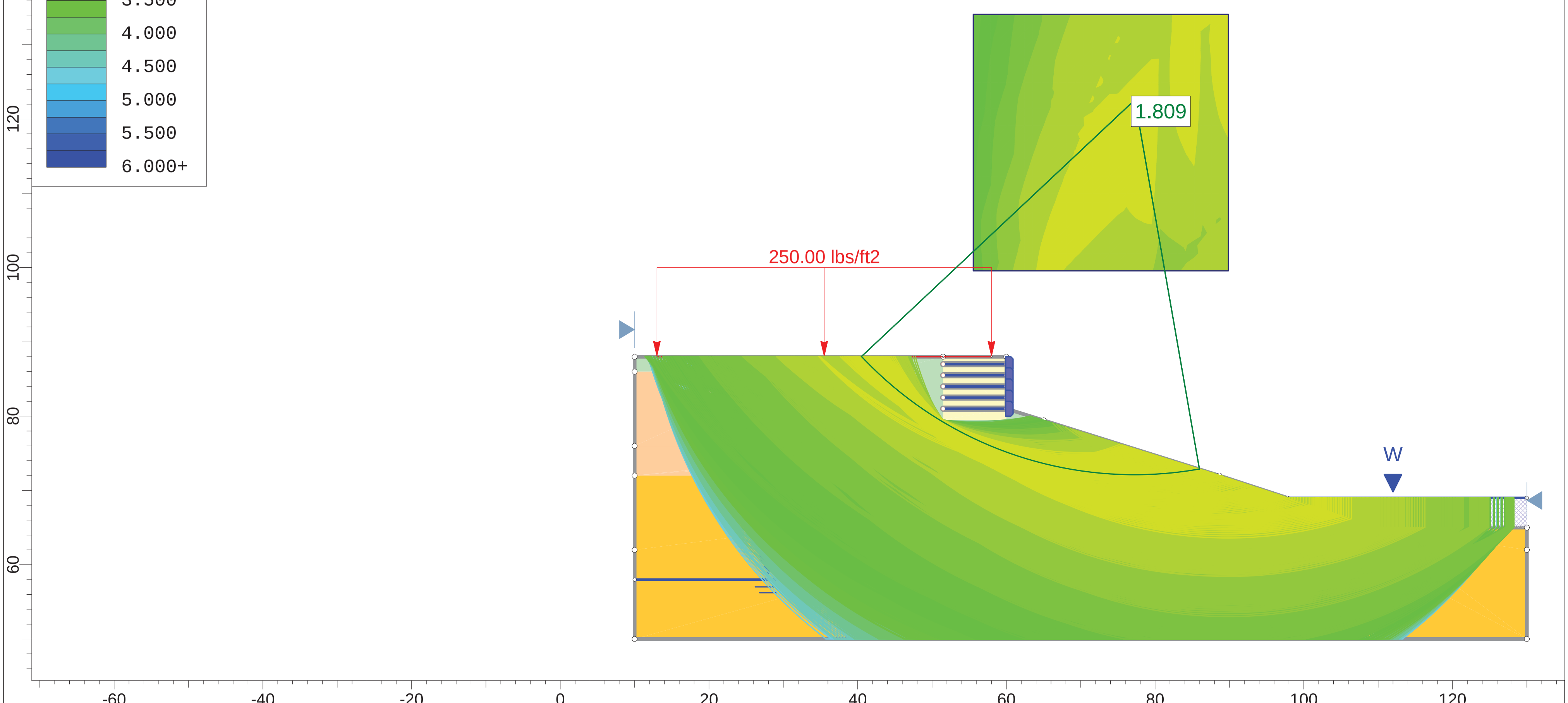
Static Global Stability Analysis
Non-Circular Surface - Wall WA7 (STA 122+20)

PROJECT NO. **10-069**

FIGURE NO. **D-26**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	



PanGEO INCORPORATED

SLIDEINTERPRET 6.008

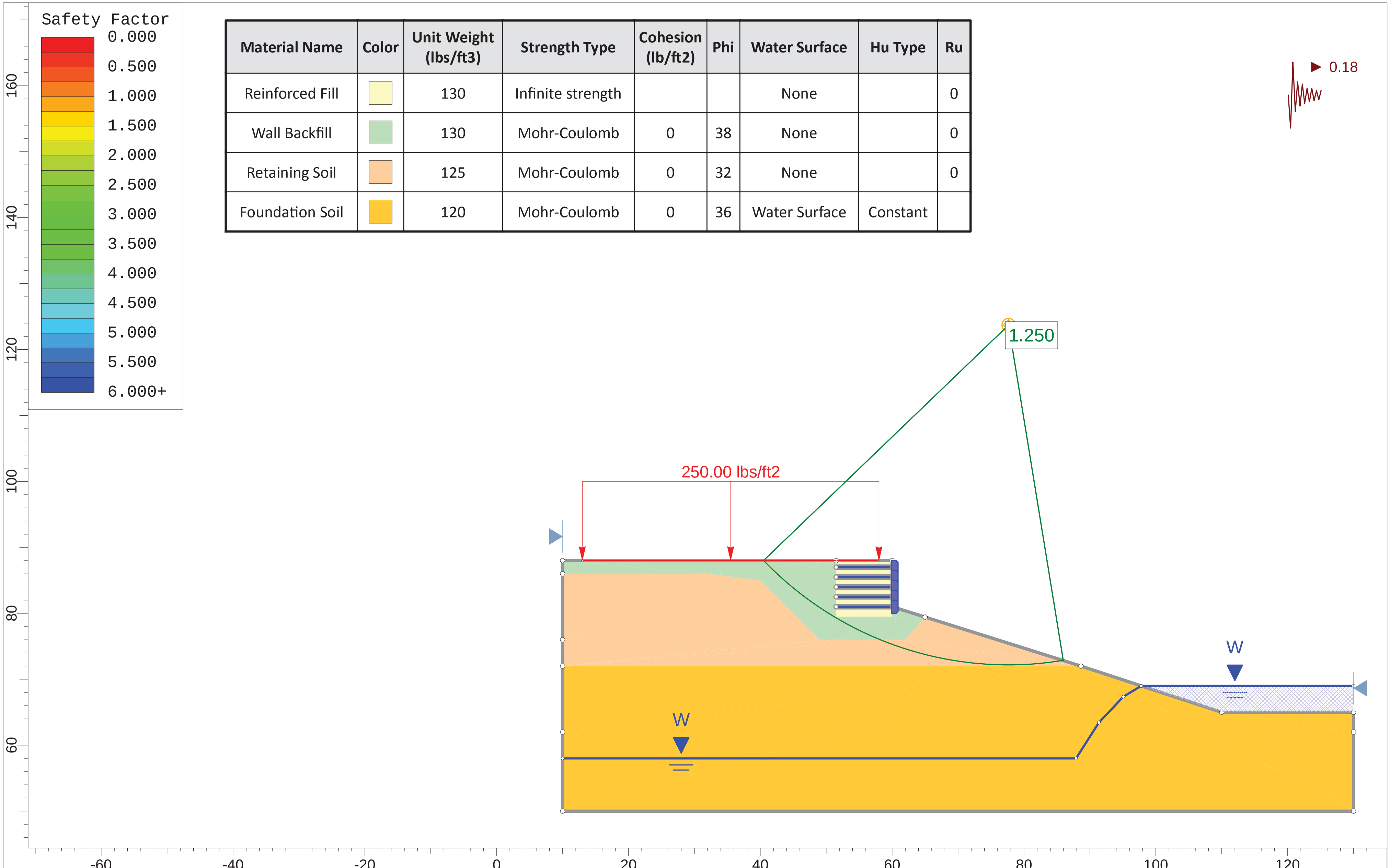
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Compound Stability Analysis
Wall WA7 (STA 122+20)

PROJECT NO. 10-069

FIGURE NO. D-27

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Hu Type	Ru
Reinforced Fill		130	Infinite strength			None		0
Wall Backfill		130	Mohr-Coulomb	0	38	None		0
Retaining Soil		125	Mohr-Coulomb	0	32	None		0
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface	Constant	



PanGEO INCORPORATED

SLIDEINTERPRET 6.008

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo Static Compound Stability Analysis
Wall WA7 (STA 122+20)

PROJECT NO.	FIGURE NO.
10-069	**D-28**

FINAL GEOTECHNICAL REPORT

Bridge Only - I-5, 116th Street NE Interchange Improvements The Tulalip Tribes

Snohomish County, Washington

Prepared for:

Parametrix

Project No. 10-069.200
July 2013

PanGEO
INCORPORATED

Geotechnical & Earthquake
Engineering Consultants

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES (follows text)

LIST OF APPENDICES

July 10, 2013
Project No. 10-069.200

FINAL GEOTECHNICAL REPORT
BRIDGE ONLY - I-5 116TH STREET NE
INTERCHANGE IMPROVEMENTS
THE TULALIP TRIBES
SNOHOMISH COUNTY, WASHINGTON

PROJECT DESCRIPTION

The Tulalip Tribe plans to replace the existing full diamond interchange at the I-5 undercrossing of 116th Street NE with a single-point urban interchange (SPUI) for improved traffic movements and to relieve congestion. PanGEO Inc. (PanGEO) previously prepared a geotechnical report for this project entitled, *Supplemented Final Geotechnical Report, I-5, 116th Street NE Interchange Improvements*, dated July 2012.

As currently proposed, the interchange reconstruction project will be performed in two phases. The first phase will consist of construction of the bridge structure only, and the interchange will remain in the full diamond configuration. The second phase will construct the ramps for the SPUI configuration, as well as the associated features such as the stormwater ponds, sound walls, and traffic signals. As part of the "Bridge Only" interim design, four MSE walls will be needed to allow for the backfill of the bridge abutments. In addition, the interim design will include several new traffic signals and new stormwater management facilities. We understand that the new stormwater management facilities will consist solely of compost amended vegetated filter strips (CAVFS).

The purpose of this report is to provide geotechnical recommendations for the interim "Bridge Only" design elements that differ from the full SPUI configuration. Refer to the *Supplemented Final Geotechnical Report* (PanGEO, 2012) for details and recommendations for the bridge structure itself. The bid documents for the "Bridge Only" contract should include both reports.

SITE DESCRIPTION

The existing interchange of I-5 and 116th Street NE is located in the west central portion of Snohomish County, north of the city of Marysville. The site location is shown on Figure 1, Vicinity Map and Figure 2, Site and Exploration Plan.

The project site lies in a broad, relative level valley between two ridges that are elongated in the north-south direction. The project site is at an elevation of roughly 80 feet above sea level, while the ridges rise up as high as 400 feet. The topography immediately surrounding the project site is relatively level with a gentle slope down to the south. The only significant relief in the project area is associated with streams, drainages and the existing embankments built as part of the original interchange construction.

FIELD EXPLORATIONS

Numerous subsurface investigations have been completed at the site. Explorations were not only completed for the currently proposed “Bridge Only” project, but also for the future SPUI configuration project (PanGEO, 2012) and the existing interchange. Please refer to the PanGEO report dated July 2012 for detailed explanations of the previous investigations at the site.

To support the interim “Bridge Only” design, the current (2013) subsurface exploration program consisted of advancing five test borings at the site. Two test borings were advanced for the originally proposed stormwater infiltration system along the existing southbound on-ramp, and three borings were advanced near the on- and off-ramp intersections of 116th Street NE to support the design of new signal poles. The shallow borings for the stormwater system and signal poles (PG-1-13 to PG-5-13) were performed using hollow-stem auger drilling equipment. The drill used was a limited access, Acker rig, provided by Boretec Drilling of Valleyford, Washington. The field explorations were completed on May 6 and 7, 2013.

The soils encountered in the test borings were sampled using conventional standard penetration test (SPT) split-spoon samplers. A sampling interval of 2½ and 5 feet was used for the borings. A representative of PanGEO was on site during all drilling operations to supervise drilling, select sample intervals and log the test borings.

The locations of all (previous and recent) subsurface explorations near the bridge only project area are indicated on Figure 2, Site and Exploration Plan.

Appendix A contains summary logs of the test borings completed during PanGEO’s current scope of work and describes the field exploration methodology in greater detail.

LABORATORY TESTING

Laboratory testing of soils included determination of moisture content, grain size distribution, and cation exchange capacity. Testing was in accordance with appropriate ASTM, AASHTO and/or EPA standards. The test results and a discussion of laboratory test methodology are presented in Appendix B. Where appropriate, test results are displayed on the summary boring logs presented in Appendix A.

REGIONAL GEOLOGY

According to a geologic map of the area (Minard, 1985), the entire area around the 116th Street NE interchange as underlain by the Marysville Sand Member, a unit of recessional outwash (Qvro). Minard (1985) describes the Marysville Sand as consisting of sand with a little gravel and some interbeds of silt and/or clay. Minard (1985) also mapped a Clay Member for the recessional materials (Qvrl), which has limited surface outcrop to the east of Marysville. The recessional materials are underlain by Vashon till, which also underlies the ridges to the east and west of the project area.

SUBSURFACE CONDITIONS

SOILS

The soil borings drilled as part of the 2013 field exploration program encountered generally consistent soil conditions. All borings encountered fill soil, as expected, due to the borings being located on the existing overpass approaches and the access ramps. The fill soils appeared to have been borrowed locally, and generally consist of slightly silty to silty sand. The soils encountered in each of the five test borings are described in more detail below.

Borings PG-1-13 and PG-2-13, which were located along the west side of the existing southbound on-ramp, encountered about 2 to 4 feet of loose to medium dense, slightly gravelly, slightly silty sand. Below of depth of about 2 to 4 feet, the borings encountered dense to very dense, slightly silty to silty sand with generally trace amounts of gravel to the termination depth of the borings.

Boring PG-3-13, which was advanced at the southeast corner of the existing intersection of the southbound ramps and 116th Street NE, encountered about 2 feet of medium dense, slightly silty, gravelly sand. Below the medium dense sand, dense to very dense slightly silty, slightly gravely sand was encountered to the termination depth of the boring.

Borings PG-4-13 and PG-5-13 were advanced at the northwest and northeast corner of the intersection of the northbound ramps and 116th Street SE, respectively. The soils encountered in the explorations generally consisted of 1 to 2 feet of loose to medium dense, slightly silty to silty sand over dense to very dense slightly silty to silty sand with trace gravel, to the termination depth of the borings. One exception was in PG-5-13, where a medium dense layer of sand with coal bits and organics was observed between about 10 and 10½ feet below the ground surface.

Scattered silt pockets, coal and organics were encountered throughout the depth of the explorations.

Subsurface profiles along the four retaining walls that will be constructed as part of the “Bridge Only” phase are included as Figures 3 and 4.

GROUNDWATER

Free water was not encountered within the drilling depths of the 2013 test borings. Please see the PanGEO report dated July 2012 for a detailed explanation of groundwater conditions at the site.

CONCLUSIONS AND RECOMMENDATIONS

STORMWATER MANAGEMENT CONSIDERATIONS

This section describes the geotechnical conditions affecting the feasibility of the proposed stormwater management locations and addresses the issues affecting the potential suitability of the sites for quantity treatment of the stormwater runoff. The two main geotechnical issues affecting the suitability of sites for storm water facilities are the rate at which the site soils allow infiltration, and the depth to the water table or a confining low permeability layer. The results of our assessment are summarized below.

Based on our review of the final drainage report (Parametrix, 2013), the stormwater management facilities associated with the current “Bridge Only” phase of the project will include a total of seven compost amended vegetated filter strips (CAVFS). Four of the CAVFS, which are designated CAVFS “F”, “G”, “H” and “I” will be located along the sides of the existing approach embankments to the new bridge. These CAVFS will be located within new embankment fill consisting of gravel borrow. The other three CAVFS will be located along the sides of the on- and off- ramps. CAVFS “G1” will be located along the east side of the south end of the southbound off ramp. CAVFS “H1” will be located along the east side of the middle portion of the northbound on-ramp. Lastly, CAVFS “J” will be located along the west side of the north end of the northbound off-ramp. The three CAVFS located along the on- and off-ramps (G1, H1 and J) will generally be located in existing soil, however, at some locations up to about 4 feet of Gravel Borrow fill will be placed to reach final design grades. A site plan showing the locations and designations of the seven CAVFS currently proposed for the “Bridge Only” project is included in Appendix D of this report.

Infiltration Rates Based on ASTM Gradation Tests

A CAVFS was originally proposed along the west side of the existing southbound on-ramp. As such, the subsurface conditions in this area were explored with borings PG-1-13 and PG-2-13. To evaluate the potential long-term (design) infiltration rates of the existing soils in this area, selected soil samples from the test borings were tested for gradation. The samples were selected to provide data from shallow depths ranging from about ½-foot to 5 feet below the existing ground surface. Both borings were drilled to a termination depth of 16½ feet below the ground surface, and uniform soil conditions were encountered throughout the depth of the explorations.

Based on our review of the final drainage report (Parametrix, 2013), we understand that no CAVFS will be located along the southbound on-ramp. However, the following information regarding the estimated infiltration rate at this location is presented below as it may aid the design team if revisions to the stormwater management plan are required.

The Highway Runoff Manual (HRM; WSDOT, 2011) allows for infiltration rates to be estimated based on ASTM gradation testing (page 4-51). The rates are estimated based on the D_{10} values (i.e., the particle diameter at which 10 percent, by weight, of the sample is smaller), using ASTM Test Method D422. Infiltration rates were estimated for the selected sampling and testing intervals, based on the HRM methodology. For samples that had more than 10% fines (i.e., particle sizes smaller than the U.S. Standard No. 200 sieve), no D_{10} values were calculated; however, the D_{10} value for a previously tested sample (24' sample in THT-06-10) was obtained using hydrometer testing equipment to extend the gradation curve. Using the results of the hydrometer as a control, other D_{10} values could be estimated by projecting the gradation curves to the D_{10} gridline.

Table 1 on page 7 summarizes the D_{10} values and the associated estimated infiltration rates for the existing site soils at the location of PG-1-13 and PG-2-13. All of the D_{10} values from the tested samples were within a range of 0.05 to 0.1. Based on the infiltration values from Table 4-6 and Figure 4-15 of the HRM (WSDOT, 2011), we anticipate that the estimated long-term (design) infiltration rates will be between 0.8 to 2.0 inch/hour for the fill soils along the west side of the southbound on-ramp. The infiltration rates from the HRM (WSDOT, 2011) are considered conservative for the purpose of determining the size of infiltration facilities.

The currently proposed CAVFS “G1”, “H1” and “J” will be located in areas where infiltration ponds were proposed for the full SPUI configuration. As such, the previous recommendations presented in our *Supplemented Final Geotechnical Report* (PanGEO, 2012) regarding estimated infiltration rates at the pond locations may be used to design the CAVFS at these same locations. Specifically, the D_{10} values and associated infiltration rates presented in Table 2A of our *Supplemented Final Geotechnical Report* from borings THT-10-10, THT-14-10 and THT-06-10 may be utilized in the design of CAVFS “G1”, “H1” and “J”, respectively.

Because CAVFS “F”, “G”, “H” and “I” will be located within embankments constructed of newly placed structural fill, we understand that the infiltration rate of Gravel Borrow (Section 9-03.14(1), WSDOT Standard Specifications, 2012) is needed for design of the CAVFS. Because there is a range of materials that meet the gravel borrow gradation specification, there is correspondingly a range of estimated infiltration rates. For materials meeting the Gravel Borrow specification, the lowest D_{10} is approximately 0.1 mm, which corresponds to an estimated long-term infiltration rate of 2 inches per hour (per Table 4-6 and Figure 4-15 of the HRM). However, the largest D_{10} is approximately 0.7 mm, which would correspond to an estimated long-term infiltration rate of 9 in/hour. For sizing the infiltration facility for quantity treatment of the storm water runoff, we recommend using a conservative estimated infiltration rate at the low end of the range.

SSC-4 Depth to Bedrock, Water Table, or Impermeable Layer

The Highway Runoff Manual (WSDOT, 2011) defines one of the nine Site Suitability Criteria (SSC's) as *Depth to bedrock, water table or impermeable layer* (SSC-4). The Manual specifies that the base (bottom elevation) of infiltration features shall be at least 5 feet above the seasonal high water mark or limiting aquitard unit. Based on the results of our recent and previous test borings, we do not expect the water table or impermeable soil layers to be within 5 feet of the base of the currently proposed CAVFS.

SSC-7 – Soil Physical and Chemical Suitability for Treatment

The Highway Runoff Manual (WSDOT, 2011) defines one of the nine Site Suitability Criteria (SSC's) as *Soil Physical and Chemical Suitability for Treatment* (SSC-7). The Manual specifies that the cation exchange capacity (CEC) of treatment soils must be considered when determining if the soil can adequately remove the target pollutants. As such, CEC tests were performed on four soil samples collected from test borings PG-1-13 and PG-2-13. Table 2 on page 7 summarizes the results of the CEC tests. For the currently proposed CAVFS "G1", "H1" and "J", which will be located in areas where infiltration ponds were previously proposed for the full SPUI configuration, please refer to Table 2b in our *Supplemented Final Geotechnical Report* (PanGEO, 2012) for the CEC of the soil samples obtained from test borings THT-10-10, THT-14-10 and THT-06-10, respectively.

Table 1
Summary of Stormwater Infiltration Feasibility

Facility	Exploration Number	Depth (in feet)	LM Line Station	Offset	D_{10} value	Long-term Infiltration rate (in/hr)[2]	Water Table Below Facility	Grading Mitigation Measures Needed to Meet SSC-4
Originally Proposed SB On-Ramp CAVFS (not included in current design)	PG-1-13	0	220+40	285' LT	0.081	1.6	>5'	None
		2.5			0.084	1.6		
		5			~ 0.07 [1]	1.4		
	PG-2-13	0	221+70	375' LT	0.099	2.0	>5'	None
		2.5			~ 0.05 [1]	0.8		
		2.8			~ 0.05 [1]	0.8		
		5			0.079	1.6		

Table 1 Notes:
(1) More than 10 percent fines; D_{10} estimated.
(2) These are "design" infiltration rates based on ASTM D422 gradation D_{10} value, per 2011 WSDOT Highway Runoff Manual.

Table 2 Cation Exchange Capacity

Facility	Exploration Number	Depth (in feet)	LM Line Station	Offset	Cation Exchange Capacity (meq/100g)
Originally Proposed SB On-Ramp CAVFS (not included in current design)	PG-1-13	2.5	220+40	285' LT	2.49
		5.0			1.98
	PG-2-13	3	221+70	375' LT	2.19
		5			1.13

ROADWAY EMBANKMENTS

New embankments should be constructed with slopes no steeper 2H:1V for slope stability considerations. New embankment material should conform to the specification requirements for Select or Gravel Borrow, Section 9-03.14 of the Standard Specifications (WSDOT, 2012b). However, in areas where CAVFS will be located, the embankment material must be constructed using Gravel Borrow. Embankments should be constructed in accordance with the requirements of Section 2-03 of the Standard Specifications (WSDOT, 2012b).

STRUCTURAL EARTH WALLS (SEW)

Current plans for the "Bridge Only" project call for four new retaining structures, all of which are fill applications. We understand that the proposed walls are structural earth walls (SEW), and will have nominal 5' x 5' standard precast concrete facing panels. During the "Bridge Only" portion of the project, the four walls (W1, W2, W3, and W4) will be used to retain the new bridge abutment backfill soils. During the second and final phase of the project, we understand that a fill embankment, with sides slopes constructed at 2H:1V, will be constructed above the SEW walls to support the four new ramps of the SPUI that face mainline I-5. As such, the currently proposed SEW walls will need to be designed for the final condition with the 2H:1V backslopes, and not the bridge only grading configuration. Figure 2 shows the final grading configuration behind the SE walls. Table 3 below summarizes the wall locations, length, and height:

Table 3
SEW Summary Table

Wall ID	Wall Alignment (Final Configuration)	Approximate Wall Length (lf)	Approximate Wall Height (ft)
W1	**ES Line**	**134**	**3 to 30**
W2	**NE Line**	**90**	**2 to 24**
W3	**SW Line**	**134**	**2 to 30**
W4	**WN Line**	**109**	**2 to 26**

Structural earth walls are generally recommended on the basis of relative cost and tolerance for modest settlements. Per Chapter 15 of the GDM (WSDOT, 2011a), recommendations concerning the external design of the proposed structural earth walls are presented below.

Global Stability of Retaining Walls

The overall stability of the retaining walls was analyzed in accordance with Section 11.10.4.3 of the LRFD Bridge Design Specifications (AASHTO, 2012). The stability analyses for the walls was assessed using limit equilibrium methods (Spencer's method) and the computer program SLIDE v. 6.0, developed by Roc Science. Both circular and non-circular failure surfaces were included in the analyses. The critical wall sections for the stability analyses were established based on wall height, subsurface soil and groundwater conditions, and the proposed surface grades in front of the wall. Soil strength parameters were assigned based on soil and groundwater conditions in the test borings. The analyses incorporated the design recommendations presented below. The seismic stability was analyzed using pseudo-static procedures, where the effect of earthquake ground shaking is represented by the use of a "seismic coefficient" in the stability calculations. One-half of the design peak ground acceleration was used for the seismic coefficient in our pseudo-static stability analysis. A compound stability analysis was conducted for the static and seismic condition assuming the failure surface goes through the bottom 20% to 30% of the reinforcement, per the GDM (WSDOT, 2011a) Section 15.5.3.3.

Based on our analyses, provided the minimum recommended grid lengths are used for wall design, minimum static and seismic factors of safety for the critical wall sections were found to be above 1.5 and 1.1, respectively, per the GDM (WSDOT, 2011a) Section 15.4.12 for the service limit state, and Section 6.4.3.1 for the extreme event limit state.

As discussed under Seismic Considerations in our July 2012 report along wall W2 (NE Line) there is liquefaction potential in a zone from about 15 to 30 feet below the ground surface in this area. Considering the post-liquefaction settlement potential and the marginal post-liquefaction stability, ground improvement in this area is recommended. Ground improvement recommendations are provided below, under Bridge Foundations. The limits of the recommended ground improvements are depicted on Figure 5. The stability analyses for W2 utilized improved foundation soil properties due to the recommended ground improvement.

Table C-1 in Appendix C provides a summary of the calculated factors of safety against global instability for critical wall sections. Selected stability analyses, which depict the wall geometry and soil properties utilized in the analyses, are presented in Figure C-1 through C-48. It may be noted that the stability analyses utilized the minimum reinforcement length to achieve the required factor of safety, but that longer reinforcement lengths are recommended in the text section *Special Design Provisions* below, to satisfy other external stability requirements (e.g., sliding).

Bearing Resistance

The nominal bearing resistance of the structural earth walls was calculated based on the methodology in Section 11.10.5.4 the LRFD Bridge Design Specifications (AASHTO, 2012). The nominal bearing resistance is a function of the soil properties and groundwater conditions below the wall, as well as the wall geometry. Soil strength parameters were assigned based on soil and groundwater conditions in the test borings closest to the wall section being analyzed. Because liquefaction is either not anticipated at shallow depths, or will be mitigated in the case of W2, the nominal bearing resistance for the extreme event limit state is the same as the nominal bearing resistance for the strength limit state. Provided that the recommendations presented below are incorporated into the wall design, the factored resistances exceed the factored loads for the strength and extreme event limit state.

Sliding Stability and Eccentricity

The sliding stability and eccentricity were evaluated for anticipated wall configurations in accordance with Section 11.10.5.1 and 11.10.5.3 of the LRFD Bridge Design Specifications (AASHTO, 2012). The wall configurations evaluated consisted of walls with 2H:1V backslopes, as well as walls with broken backslopes. Per AASHTO, we assumed a friction angle between the reinforcement and soil to be two-thirds of the foundation soil friction angle. Our analyses indicated that sliding governed design for walls with backslopes of 2H:1V at the extreme limit state. Provided that the minimum recommended reinforcement lengths are used in the design of the wall, the factored resistance against sliding exceeded the factored loads for all applicable limit states. As part of the actual wall design, the wall designer will need to evaluate the sliding stability and eccentricity based on the final wall geometry, and use the proper frictional coefficient associated with the type of reinforcement that will be actually used for the project.

Estimated Settlement

The settlement of the proposed walls at the service limit state was evaluated using the Hough method, in accordance with Section 10.6.2.4.2 of the LRFD Bridge Design Specifications (AASHTO, 2012). Soil parameters were assigned based on soil and groundwater conditions in the test borings. Maximum estimated total settlements for each of the four walls range from about 3 to 5 inches, and the maximum calculated differential settlements for the walls ranged from 2.6 to 4.2 inches over 100 linear feet of wall. Per the GDM (WSDOT, 2011a), for MSE walls with precast panel facings up to 75 ft^2 in area, the limiting differential settlements shall be as defined in the AASHTO LRFD Specifications, Article C11.10.4.1. Per Section 11.10.4.1 of the LRFD Bridge Design Specifications (AASHTO, 2012), to accommodate the anticipated differential settlement of the subject walls, the joint width needs to be a minimum of 0.5 inches for facing elements with an area under 30 ft^2, or 0.75 inches for facing elements with an area between 30 ft^2 and 75 ft^2. Table C-2 in Appendix C presents a summary of the calculated total settlements along the proposed walls in 50 foot increments, as well as the maximum calculated differential settlement over a 100 foot increment for each of the four walls.

Special Design Provisions

In accordance with the GDM (WSDOT, 2011a), the walls are to be designed using LRFD methods, and the general special provision (GSP) fill-ins presented below are in the currently recommended LRFD format. The following recommendations should be satisfied to provide external stability of the proposed structural earth walls. Structural earth walls should be constructed in accordance with Section 6-13 of the Standard Specifications (WSDOT, 2012b), with the following information included in the general special provisions.

1. The wall may be constructed near vertical, without a specified batter.
2. The wall should be placed on a level foundation in the horizontal direction perpendicular to the wall face.
3. Wall embedment depth should be a minimum of 2 feet with a level front slope, or H/10 with 3H:1V front slope, where H is the total height of the wall.
4. A minimum 4-foot wide horizontal bench should be provided in front of the wall.
5. For all walls, the reinforcing length should not be less than 100 percent of the wall height, with a minimum reinforcing length of 8 feet. These recommended minimum reinforcing lengths are needed to maintain adequate external stability. Greater reinforcing lengths may be needed to provide adequate internal stability.
6. The uppermost reinforcing layer should be placed no lower than 2 feet below the top of wall. Welded wire faced systems should include a top mat at the top of the wall.
7. Since the wall will be constructed above existing grades, there is limited potential for water to reach or build up in the reinforced zone. Special drainage elements are therefore not required.

The retaining wall supporting the NE Line (W2) will be constructed over improved ground, due to the presence of very loose recent alluvium below the wall alignment. A separate GSP fill-in is therefore recommended for this wall. Table 4 on the following page lists design parameters that should be included in the special provision for a pre-approved, proprietary structural earth wall for wall W2 (the NE Line ramp).

Table 4
Design Parameters for Pre-approved, Proprietary SEW for W2

Wall Name or Number: W2 (NE Line Wall)			
Soil Properties	**Wall Backfill[1]**	**Retained Soil**	**Foundation Soil**
Unit Weight (pcf)	130	125	120
Friction Angle (deg)	38	32	34
Cohesion (psf)	0	0	0
For the Service Limit State, the wall shall be designed to accommodate a differential settlement of 3 inches per 100 feet of wall length.			
For the Extreme Event I Limit State, the wall shall be designed for a horizontal seismic acceleration coefficient K_h of 0.18g and a vertical seismic acceleration coefficient k_v of 0.0g.			

Note: [1] – Wall backfill should be good quality, free-draining, granular material such as Gravel Backfill for Walls (WSDOT, 2012b).

Table 5 lists design parameters that should be included in the special provision for pre-approved, proprietary structural earth walls for proposed walls W1, W3 and W4.

Table 5
Design Parameters for Pre-approved, Proprietary SEW for W1, W3 & W4

Wall Name or Number: W1, W3, W4			
Soil Properties	**Wall Backfill[1]**	**Retained Soil**	**Foundation Soil**
Unit Weight (pcf)	130	125	120
Friction Angle (deg)	38	32	36
Cohesion (psf)	0	0	0
For the Service Limit State, the wall shall be designed to accommodate a differential settlement of 4 inches per 100 feet of wall length.			
For the Extreme Event I Limit State, the wall shall be designed for a horizontal seismic acceleration coefficient K_h of 0.18g and a vertical seismic acceleration coefficient k_v of 0.0g.			

Note: [1] – Wall backfill should be good quality, free-draining, granular material such as Gravel Backfill for Walls (WSDOT, 2012b).

Ground Improvement

Soils below the NE Line wall (currently proposed wall W2), are likely to liquefy during a design seismic event. Ground improvement by vibro-compaction (stone columns) may be used to mitigate the liquefaction potential. The recommended plan limits of ground improvement are shown on Figure 5, per Figure 6-18 (WSDOT, 2011a). Stone columns should extend to elevation +40 feet. The recommended ratios of stone column to untreated soil area (area replacement ratios) are provided in Table 6 on the following page.

Stone columns should be installed using a method that minimizes the return of water and soil to the ground surface. Stone columns should be circular in cross-section and continuous. Stone columns should have a minimum diameter of 2 feet, be plumb, and of sufficient length to reach the minimum treatment elevations shown in the plans. The stone columns should meet the minimum requirements outlined in Table 6.

Table 6
Recommended Stone Column Minimum Requirements

			Minimum Area Replacement Ratio	
Pattern	**Minimum Diameter (ft)**	**Max. Center-to-Center Distance (ft)**	**Square Pattern**	**Equilateral Triangular Pattern**
A	2	10	0.18	0.20

The stone column diameters and spacings should be determined using the minimum area replacement ratios and the following equations:

$$R_s = 0.785(D/S)^2$$
$$R_t = 0.907(D/S)^2$$

Where: R_s = Area Replacement Ratio for a Square Pattern
R_t = Area Replacement Ratio for an Equilateral Triangular Pattern
D = Diameter of Stone Column
S = Spacing of Stone Column (center to center)

To ensure compaction of the stone column, the gravel should be vibrated. The Contractor should demonstrate that the installation procedures and methods meet the densification requirements by completing a test section and obtaining field SPT or CPT measurements of the completed installation. Production installation of stone columns should be subject to approval of the QCM and Engineer based on the performance of the test section installations.

Performance criteria presented in Table 7 (following page) should be met for acceptance of test section and production stone columns installed within improvement pattern ‘A’.

Table 7
Stone Column Performance Criteria

Depth Below Existing Ground Surface (feet)	Minimum Uncorrected SPT Blowcount[1]	Minimum CPT Tip Resistance[2] (tons per square foot)
15-30	20	125

Notes: [1] – Field measured blows per foot over the last 12 inches of an 18-inch drive using an Auto-trip Safety Hammer obtained in accordance with ASTM D-1586. Wireline or cathead operated hammers should not be used.
[2] – Minimum CPT tip resistance should be calculated as the average over any consecutive 5-foot penetration.

The contractor should provide the final stone column design.

SIGNAL POLE FOUNDATIONS

The currently proposed bridge only phase of the project will include the construction of several new signal poles at the intersections of the on- and off-ramps and 116th Street NE. Borings PG-3-13, PG-4-13 and PG-5-13 were advanced near the locations of the proposed signal poles to evaluate the existing soil conditions. Based on the results of the test borings at the site and our understanding of site conditions, the upper 15 feet of existing soil generally consists of medium dense to very dense slightly gravelly, slightly silty sand. As such, we recommend that signal pole foundations may be sized using the WSDOT Standard Plans (WSDOT, 2010) and an allowable lateral bearing pressure of 2,500 pounds per square foot. In addition, we anticipate that the new bridge construction will establish slightly higher grades with compacted granular fill materials. For these conditions, the foundations for signal poles may also be sized using the WSDOT Standard Plans (WSDOT, 2010) and an allowable lateral bearing pressure of 2,500 pounds per square foot.

CONSTRUCTION CONSIDERATIONS

The following items should be considered during the final roadway design and development of the contract specifications and special provisions.

1. Temporary shoring and/or slopes will be required during construction of the various structures discussed above. The design and construction of temporary shoring/slopes should be the responsibility of the contractor.

2. Depending on the time of year, groundwater seepage into excavations could occur. Depending on the depth of excavation below the water, inflows may be controllable with sumps and pumps.

ADDITIONAL SERVICES

PanGEO should review the final project plans and specifications to confirm that our recommendations were properly incorporated into the contract documents.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

PanGEO, Inc. (PanGEO) prepared this report for use by Parametrix, Inc, the Tulalip Tribe, and the Washington State Department of Transportation in the design and construction of the "Bridge Only" portion of the I-5 116th Street NE Interchange improvements project. The recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project.

Variations in soil conditions may exist between the locations of the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, PanGEO should be immediately notified to review the applicability of the recommendations presented herein. Additionally, PanGEO should also be notified to review the applicability of these recommendations if there are any changes in the project scope.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 36 months from its issuance. PanGEO should be notified if the project is delayed by more than 36 months from the date of this report so that the applicability of the conclusions and recommendations presented herein may be evaluated considering the time lapse.

Within the limitations of scope, schedule and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time this report and/or its contents was prepared. No warranty, express or implied, is made. The scope of PanGEO's work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water or ground water at this site. PanGEO does not practice or consult in the field of safety engineering. PanGEO does not direct the contractor's operations, and cannot be held responsible for the safety of personnel other than our own on the site; the safety of others is the responsibility of the contractor.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes shall be at the contractor's sole option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

CLOSURE

PanGEO is pleased to support Parametrix, the Tulalip Tribe, WSDOT and the design team with geotechnical engineering recommendations. If you have any questions regarding this report, please call (206) 262-0370.

Sincerely,

PanGEO, Inc.

JON C. REHKOPF
STATE OF WASHINGTON
40412
REGISTERED
PROFESSIONAL ENGINEER
7/10/2013
EXPIRES 7/4/2014

Nick Weikel
Project Geotechnical Engineer

Jon Rehkopf, P.E.
Senior Project Geotechnical Engineer

ROBERT E. KIMMERLING
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER
7/10/13

Robert E. Kimmerling, P.E.
Principal Geotechnical Engineer

REK/JCR/rek

REFERENCES

AASHTO, 2012 LRFD bridge design specifications, 6th edition, American Association of State Highway and Transportation Officials.

Minard, J.P., 1985, Geologic map of the Marysville Quadrangle, Snohomish County, Washington. U.S.G.S. Miscellaneous Field Studies Map MF-1743.

PanGEO, 2012. *Supplemented Final Geotechnical Report, I-5, 116th Street NE, Interchange Improvements, The Tulalip Tribes, Snohomish County, Washington*. PanGEO Project No. 10-069, July 2012.

Parametrix, 2013. *Final Addenda 01 to the 100% Hydraulic Report, SR 005, I-5/116th ST NE I/C Improvements Phase 3 – Bridge Replacement, MP 202.33 to MP 202.52*, prepared for the Tulalip Tribes, June 2013.

WSDOT, 2010. Standard Plans, M21-01, Washington State Department of Transportation, 2010.

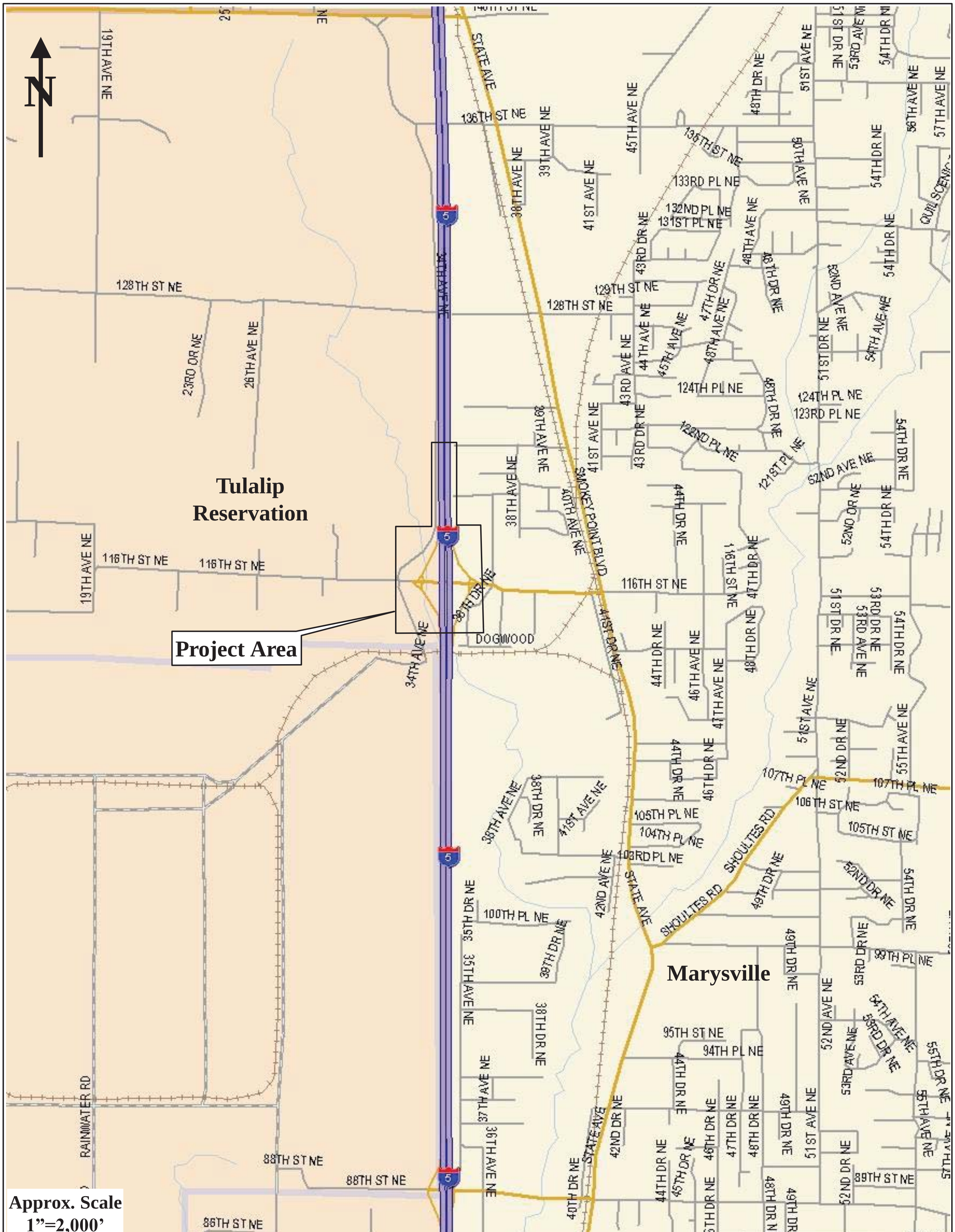
WSDOT, 2011. Highway Runoff Manual, M 31-16, Washington State Department of Transportation, November 2011.

WSDOT, 2011a. Geotechnical Design Manual, M 46-03.02, Washington State Department of Transportation, 2011.

WSDOT, 2012a. Bridge Design Manual (LRFD), M 23-50, Washington State Department of Transportation, January 2012.

WSDOT, 2012b. Standard Specifications for Road, Bridge and Municipal Construction, M41-10, Washington State Department of Transportation, 2012.

FIGURES



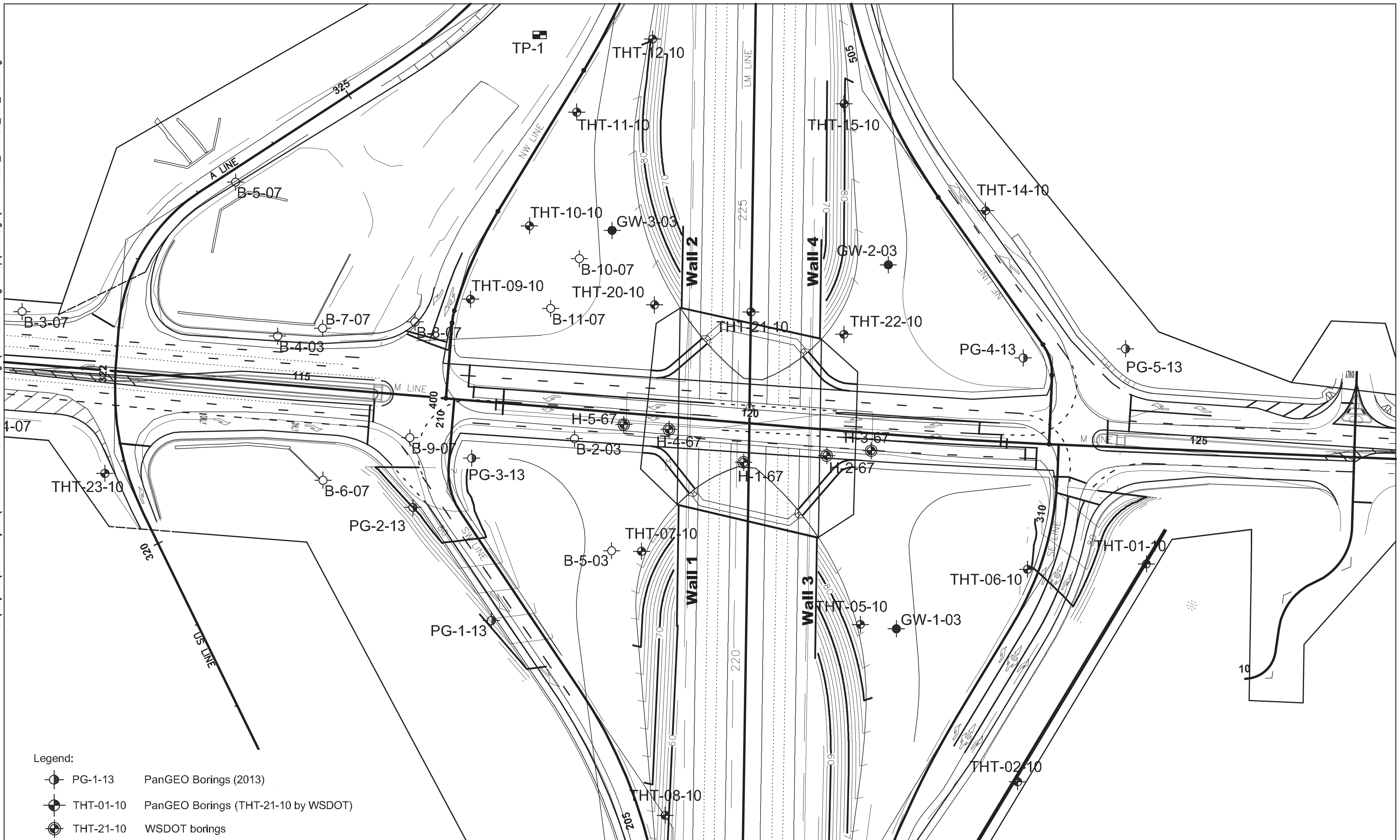
PanGEO INCORPORATED

I-5, 116th St. NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

VICINITY MAP

Project No.	Figure No.
10-069.200	1

10-069_Vic_Map_Fig-1.ppt 6/6/2013(10:12 AM) SHE



Legend:

	PG-1-13	PanGEO Borings (2013)
	THT-01-10	PanGEO Borings (THT-21-10 by WSDOT)
	THT-21-10	WSDOT borings
	TP-1	PanGEO Test Pits (2011)
	GW-1-03	Monitoring Wells (Shannon & Wilson 2003)
	B-5-07	Borings by Shannon & Wilson (2003, 2007)

50 0 50 100
scale in feet

Scale: 1" = 100'

PanGEO INCORPORATED

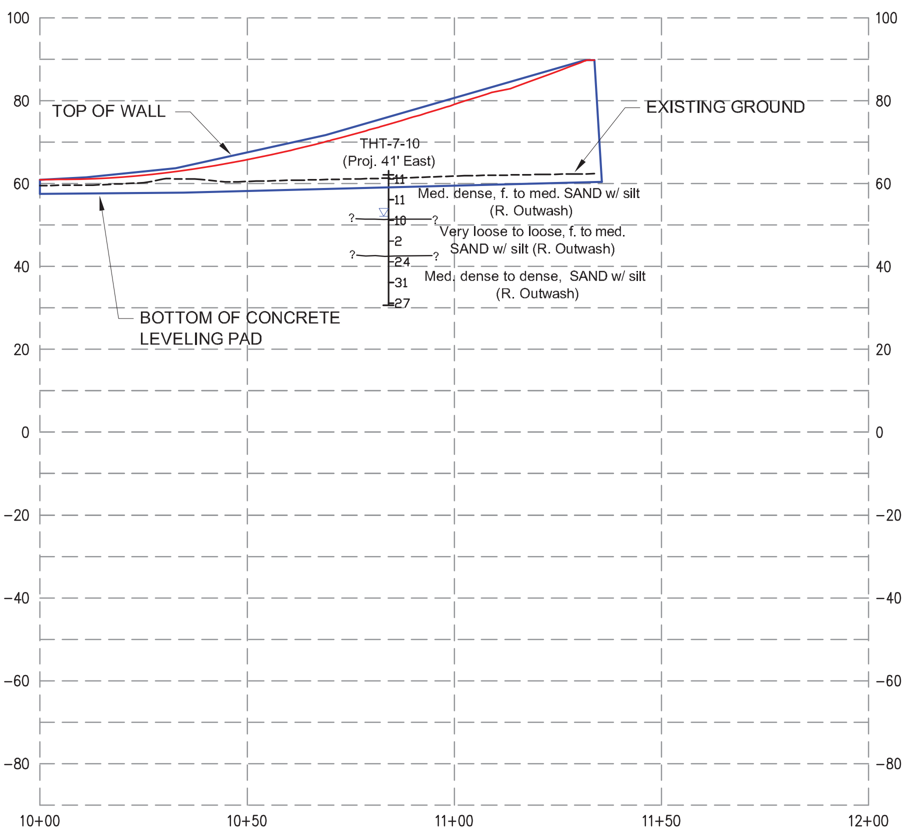
I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

SITE AND EXPLORATION PLAN

PROJECT NO. 10-069.200

FIGURE NO. 2

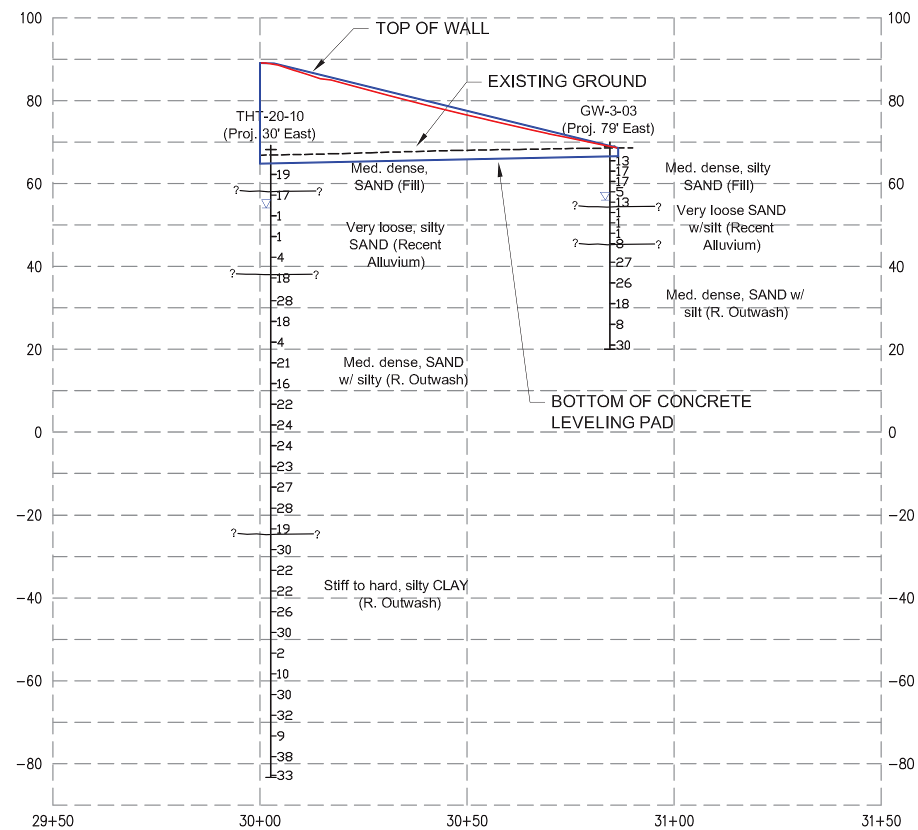
DRAWN BY: SHE/NTW CHECKED BY: REK DATE: 06.03.2013 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Task 200 Bridge Only\Drawings\10-069.200_PanGEO_Site_Plan.dwg



WALL 1

1" = 30'

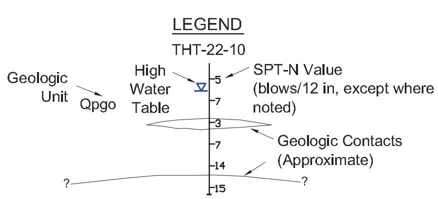
15 0 15 30
scale in feet



WALL 2

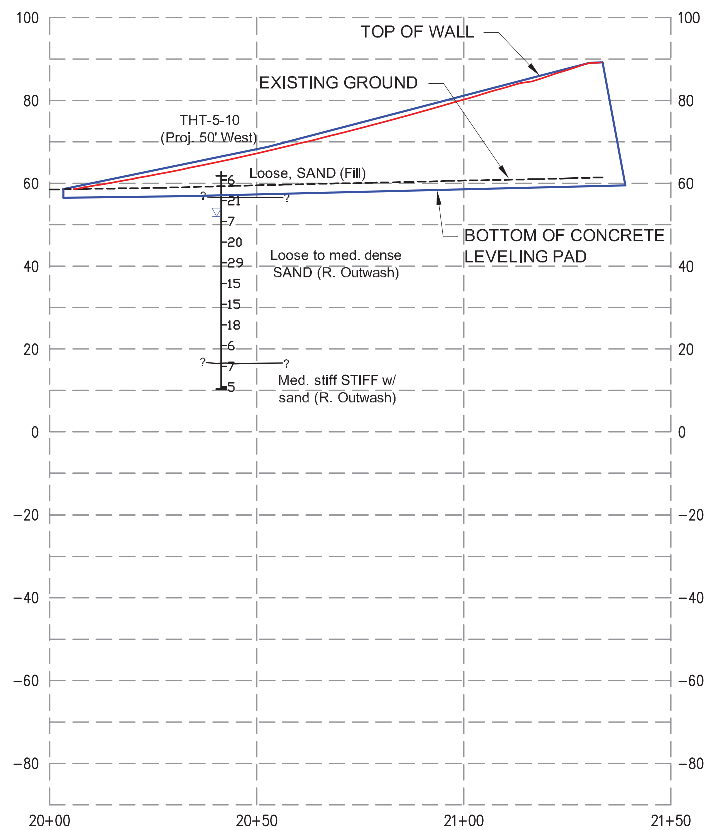
1" = 30'

15 0 15 30
scale in feet



PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	SUBSURFACE PROFILE WALLS W1 & W2	
		PROJECT NO. 10-069.200	FIGURE NO. 3

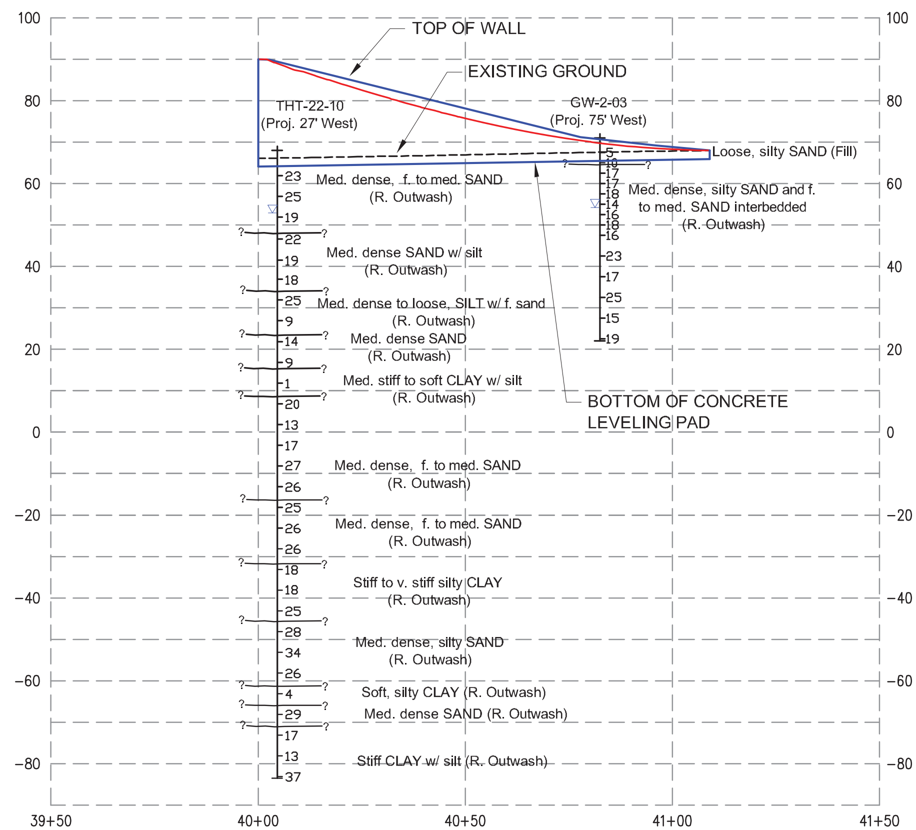
DRAWN BY: NTW CHECKED BY: REK DATE: 06.04.2013 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Task 200 Bridge Only\Drawings\10-069.200_PanGEO_Wall_Profiles.dwg



WALL 3

1" = 30'

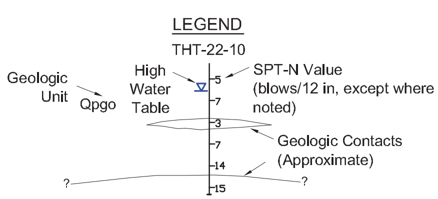
15 0 15 30
scale in feet



WALL 4

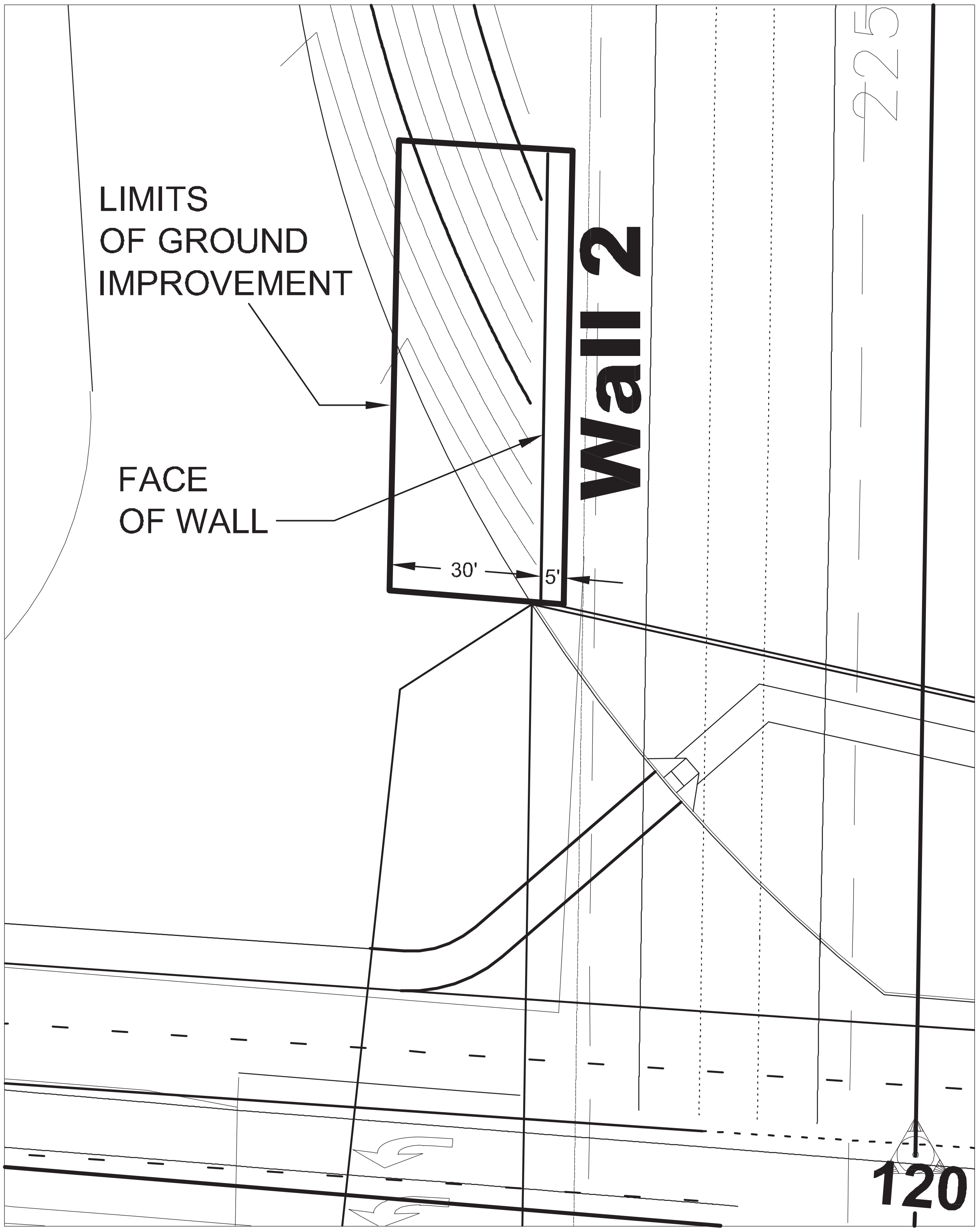
1" = 30'

15 0 15 30
scale in feet



PanGEO INCORPORATED	I-5, 116th Street NE Interchange Improvements The Tulalip Tribes Snohomish Co., Washington	SUBSURFACE PROFILE WALLS W3 & W4 PROJECT NO. 10-069.200 FIGURE NO. 4

DRAWN BY: NTW CHECKED BY: REK DATE: 06.04.2013 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Task 200 Bridge Only\Drawings\10-069.200_PanGEO_Wall_Profiles.dwg



15 0 15 30
scale in feet

Scale: 1" = 30'

PanGEO INCORPORATED

I-5, 116th Street NE
Interchange Improvements
The Tulalip Tribes
Snohomish Co., Washington

GROUND IMPROVEMENT LIMITS

PROJECT NO.	FIGURE NO.
10-069.200	5

DRAWN BY: REK CHECKED BY: JCR DATE: 06.06.13 Z:\Projects\2010 Projects\10-069 I-5 NE 116th Interchange\Task 200 Bridge Only\Drawings\10-069.200_PanGEO_Site_Plans_ACAD2007.dwg

APPENDIX A

FIELD EXPLORATIONS
&
LOGS OF TEST BORINGS

APPENDIX A: FIELD EXPLORATIONS

Appendix A contains written and graphical logs of test borings presenting the factual and interpretive results of our 2013 exploration program at the subject site that was completed in support of the “Bridge Only” project. The descriptions of the materials encountered in the test borings are primarily based on the soil samples extracted from the borings. The sample descriptions are augmented by observation of the drilling action and drill cuttings brought to the surface during field operations, as well as the results of laboratory testing. The following sections describe the field operations and sampling procedures used during the 2013 geotechnical field explorations.

Numerous subsurface investigations were previously conducted at the site in support of the full SPUI configuration project, as well as for the existing interchange. Figure 2 of this report depicts the locations and designations of current (2013) and past subsurface investigations at the site. Please refer to Appendix A of the *Supplemented Final Geotechnical Report* (PanGEO, 2012) for detailed explanations of the previous investigations at the site, as well as the summary boring logs for the explorations depicted on Figure 2.

FIELD EXPLORATIONS

The 2013 subsurface exploration program consisted of five test borings, which were completed on May 6th and 7th to a termination depth of 16½ feet below the ground surface. The boring sites were marked in the field prior to drilling, based on the mapped locations of specific facilities. Following drilling, the final locations of the borings were measured from existing site features, and were plotted on the attached Figure 2, Site and Exploration Plan. All five borings were drilled by Boretech Inc., of Valleyford, Washington, using a 4-inch diameter hollow stem auger drill string powered by a drill head mounted on a portable acker rig.

SAMPLING METHODS

Soil samples were obtained from the borings at 2½- and 5-foot intervals. Standard Penetration Tests (SPT) sampling was performed in general accordance with ASTM D-1586 using a 2-inch outside diameter split-spoon sampler. The samplers were driven into the soil a distance of 18 inches using a 140-pound weight falling a distance of 30 inches. The hammer was operated by means of a rope and cathead mechanism. The number of blows to drive the sampler each 6 inches over an 18-inch interval was recorded and indicated on the boring logs. The number of blows to drive the sampler the final 12 inches is termed the SPT resistance, or N-value, and is used to evaluate the strength and consistency/relative density of the soil.

An engineer from PanGEO was present throughout the field exploration program to observe the borings, assist in sampling, and to prepare descriptive logs of the explorations. Soils were described in general accordance with the guidelines shown on Figure A-1. The stratigraphic contacts shown on the summary logs represent the approximate boundaries between soil types; actual stratigraphic contacts encountered at other locations in the field may differ from the contact elevations shown on the logs, and may be gradual rather than abrupt. The soil and groundwater conditions depicted are only for the specific date and locations reported, and therefore, are not necessarily representative of other locations and times.

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean SILT
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes: 1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.

2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered:	Units of material distinguished by color and/or composition from material units above and below	Fissured:	Breaks along defined planes
Laminated:	Layers of soil typically 0.05 to 1mm thick, max. 1 cm	Slickensided:	Fracture planes that are polished or glossy
Lens:	Layer of soil that pinches out laterally	Blocky:	Angular soil lumps that resist breakdown
Interlayered:	Alternating layers of differing soil material	Disrupted:	Soil that is broken and mixed
Pocket:	Erratic, discontinuous deposit of limited extent	Scattered:	Less than one per foot
Homogeneous:	Soil with uniform color and composition throughout	Numerous:	More than one per foot
		BCN:	Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

CBR	California Bearing Ratio
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)

3.25-inch OD Spilt Spoon (300-lb hammer, 30" drop)

Non-standard penetration test (see boring log for details)

Thin wall (Shelby) tube

Grab

Rock core

Vane Shear

MONITORING WELL

Groundwater Level at time of drilling (ATD)

Static Groundwater Level

Cement / Concrete Seal

Bentonite grout / seal

Silica sand backfill

Slotted tip

Slough

Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

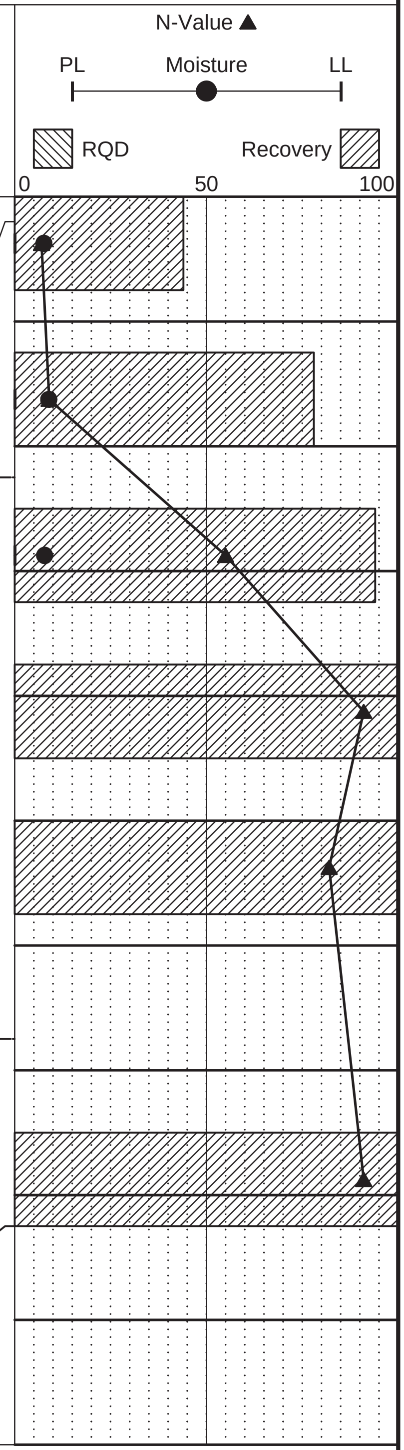
PanGEO INCORPORATED
Phone: 206.262.0370

Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	I-5 NE 116th Interchange (Bridge Only)	Surface Elevation:	~73 ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	1	SPT	2, 3, 4	GS		Grass at surface. Loose, brown, silty SAND with organics and fine roots, moist; SM (Topsoil).
						Loose, brown, slightly gravelly, slightly silty SAND, iron-oxide staining at about 2.7 feet, moist; SP-SM (Fill).
2	2	SPT	3, 3, 6	GS		Grab sample from 2.5 to 3.5 feet for CEC testing.
4						Very dense, brown to gray, slightly silty, slightly gravelly SAND, trace of iron-oxide staining, moist; SP-SM (Fill).
6	3	SPT	16, 20, 35	CEC GS		
						Grades brown and none to trace of gravel.
8	4	SPT	18, 41, 50			
10	5	SPT	32, 42, 40			Scattered iron-oxide staining at about 10.3 feet.
						Scattered silt pockets between about 11 to 11.5 feet.
12						
14						Very dense, brown to orange, slightly silty to silty SAND, moist; SP-SM/SM (Fill).
						Becomes moist to wet between about 15 and 15.7 feet.
16	6	SPT	21, 41, 50			Coal debris at about 15.7 feet.
						Grades slightly gravelly at about 16 feet.
						Bottom of boring at 16.5 feet below ground surface. No groundwater encountered during drilling.
18						
20						



Completion Depth:	16.5ft
Date Borehole Started:	5/6/13
Date Borehole Completed:	5/6/13
Logged By:	William Chao
Drilling Company:	Boretec

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Groundwater was not encountered during drilling. Surface elevation estimated from existing topographic survey.

PanGEO INCORPORATED
Phone: 206.262.0370

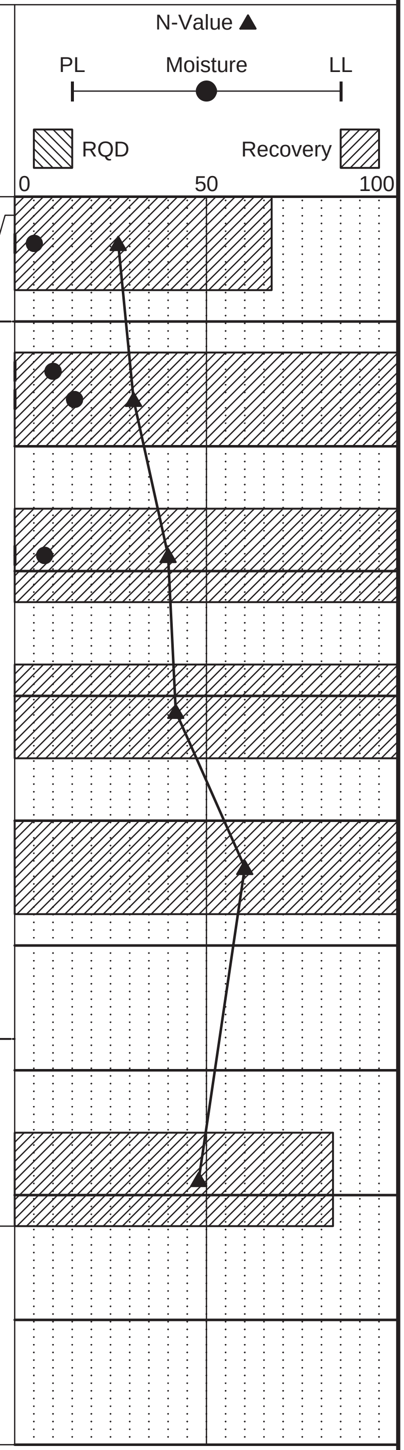
LOG OF TEST BORING PG-1-13

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange (Bridge Only)	Surface Elevation:	~80 ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	1		10, 14, 13	GS		Grass at surface. Loose, brown, silty SAND with organics and fine roots, moist; SM (Topsoil). Medium dense, brown, slightly gravelly and slightly silty, SAND, moist; SP-SM (Fill).
2	2		16, 15, 16	GS GS		Dense to very dense, brown, trace to slightly gravelly and slightly silty to silty, SAND, moist; SP-SM (Fill). Redish between about 2 and 2.5 feet. Grab sample from 3 to 4 feet for CEC testing.
4						Grades none to trace of gravel.
6	3		16, 20, 20	CEC GS		Trace of coal debris at about 6 feet.
8	4		22, 22, 20			Grades slightly redish and slightly gravelly. Scattered silt pockets between about 8.5 and 8.8 feet.
10	5		13, 20, 40			Scattered silt pockets and organics at about 10.5 feet.
12						
14						Dense, brown, slightly silty to silty SAND, scattered iron-oxide staining, trace of silt seams, moist; SP-SM/SM (Fill).
16	6		22, 20, 28			Bottom of boring at 16.5 feet below ground surface. No groundwater encountered during drilling.
18						
20						



Completion Depth:	16.5ft
Date Borehole Started:	5/6/13
Date Borehole Completed:	5/6/13
Logged By:	William Chao
Drilling Company:	Boretec

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Groundwater was not encountered during drilling. Surface elevation estimated from existing topographic survey.

PanGEO INCORPORATED
Phone: 206.262.0370

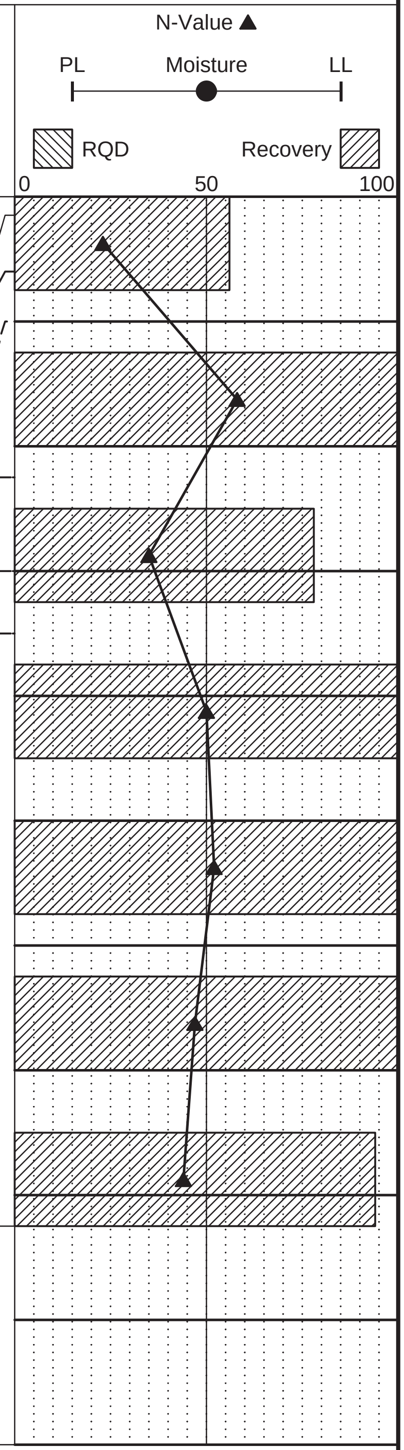
LOG OF TEST BORING PG-2-13

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange (Bridge Only)	Surface Elevation:	~82 ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	1	SPT	8, 11, 12		SM	Grass at surface. Loose, brown, silty SAND with organics and fine roots, moist; SM (Topsoil).
					SP-SM	Medium dense, brown, slightly silty, gravelly SAND, scattered iron-oxide staining, trace of organics, moist; SP-SM (Fill).
2					SM	Medium dense, dark brown to red, silty, fine gravelly SAND, scattered organics and coal debris, moist; SM (Fill).
	2	SPT	15, 30, 28		SP-SM	Very dense, brown, slightly silty and slightly gravelly, SAND, trace of organics between 3.5 to 4 feet moist; SP-SM (Fill).
4					SM	Dense, dark brown to red, slightly silty, slightly gravelly SAND, scattered iron-oxide staining, moist; SM (Fill).
6	3	SPT	17, 17, 18		SP	Dense, gray, medium to slightly coarse SAND, trace of silt, moist; SP (Fill).
					SP-SM	Dense to very dense, brown to slightly gray, slightly silty and slightly gravelly, SAND, scattered iron-oxide staining, moist; SP-SM (Fill).
8	4	SPT	23, 25, 25			
10	5	SPT	16, 24, 28			Grades brown and trace of gravel.
12						Grades slightly gravelly with scattered redish sand pockets.
	6	SPT	24, 25, 22			Trace of silt pockets between about 13 and 16.5 feet.
14						
16	7	SPT	24, 22, 22			Trace of organics and coal debris.
						Bottom of boring at 16.5 feet below ground surface. No groundwater encountered during drilling.
18						
20						



Completion Depth:	16.5ft
Date Borehole Started:	5/6/13
Date Borehole Completed:	5/6/13
Logged By:	William Chao
Drilling Company:	Boretec

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Groundwater was not encountered during drilling. Surface elevation estimated from existing topographic survey.

PanGEO INCORPORATED
Phone: 206.262.0370

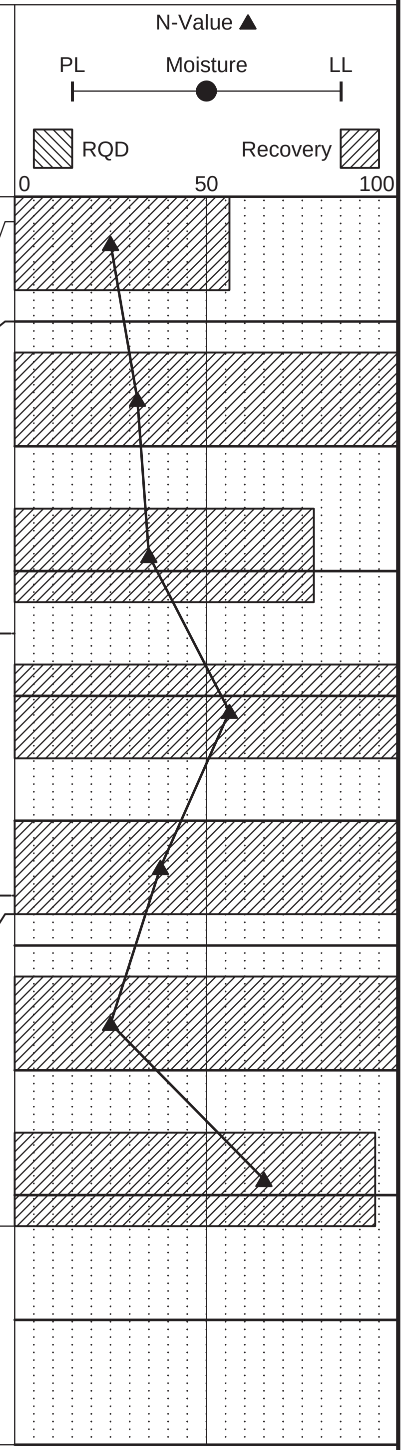
LOG OF TEST BORING PG-3-13

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange (Bridge Only)	Surface Elevation:	~77 ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	1		8, 14, 11			Grass at surface. Loose, brown, silty SAND with organics and fine roots, moist; SM (Topsoil).
						Medium dense, brown, silty SAND, numerous organics and fine roots at top 6 inches, coal fragments between about 1.2 to 1.5 feet, moist; SM (Fill).
2	2		15, 11, 21			Dense, brown slightly silty to silty, SAND, moist; SP-SM/SM (Fill).
4						Grades silty with scattered silt pockets and iron-oxide staining.
	3		14, 15, 20			Becomes moist to wet.
6						
8	4		20, 23, 33			Dense to very dense, slightly silty, SAND, trace of gravel, scattered iron-oxide staining, moist to wet; SP-SM (Fill).
10	5		22, 20, 18			Scattered trace of gravel, laminated.
						Medium dense, dark brown to black, slightly gravelly, sandy SILT, scattered organics, fine roots, and coal debris, moist; ML (Fill).
12	6		11, 13, 12			Medium dense, brown to orange, silty fine SAND, trace of organics and fine roots, moist to slightly wet; SM (Fill).
14						Grades very dense and light brown/gray.
16	7		32, 40, 25			
						Bottom of boring at 16.5 feet below ground surface. No groundwater encountered during drilling.
18						
20						



Completion Depth:	16.5ft
Date Borehole Started:	5/7/13
Date Borehole Completed:	5/7/13
Logged By:	William Chao
Drilling Company:	Boretec

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Groundwater was not encountered during drilling. Surface elevation estimated from existing topographic survey.

PanGEO INCORPORATED
Phone: 206.262.0370

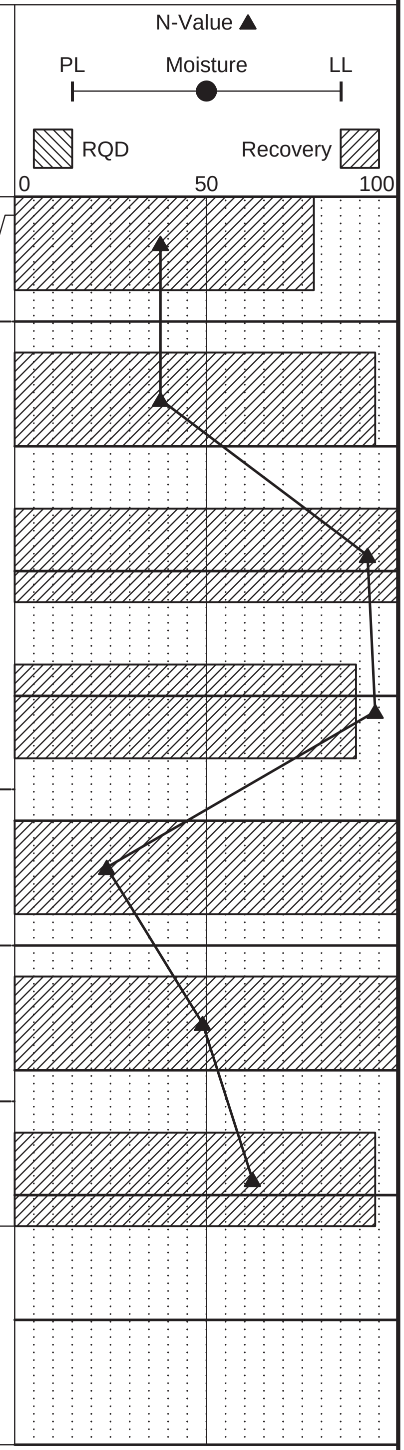
LOG OF TEST BORING PG-4-13

Figure A-5

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	I-5 NE 116th Interchange (Bridge Only)	Surface Elevation:	~79 ft
Job Number:	10-069	Top of Casing Elev.:	N/A
Location:	Marysville, Washington	Drilling Method:	Hollow Stem Auger
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	1		13, 17, 21			Grass at surface. Loose, brown, silty SAND with organics and fine roots, moist; SM (Topsoil). Dense, brown, slightly silty, gravelly SAND, numerous organics and fine roots at first 12 inches, moist to dry; SP-SM (Fill).
2	2		16, 18, 20			Dense to very dense, slightly silty and slightly gravelly, SAND, scattered iron-oxide staining, moist; SP-SM (Fill).
4–6	3		40, 45, 47			Grades to trace of gravel.
8	4		35, 44, 50			Coal debris at about 8.5 feet.
10	5		14, 12, 12			Medium dense, brown to red, slightly gravelly, silty SAND, numerous coal debris and scattered organics/fine roots between about 10 and 10.5 feet, moist (moist to wet between about 10 to 10.5 feet); SM (Fill).
12	6		18, 22, 27			Dense, brown, slightly silty SAND, trace of gravel and silt pockets, scattered iron-oxide staining, moist, SP-SM (Fill).
14–16	7		16, 22, 40			Very dense, brown to gray, slightly gravelly to gravelly, SAND, scattered iron-oxide staining, moist; SP (Fill).
16.5						Bottom of boring at 16.5 feet below ground surface. No groundwater encountered during drilling.
18						
20						



Completion Depth:	16.5ft
Date Borehole Started:	5/7/13
Date Borehole Completed:	5/7/13
Logged By:	William Chao
Drilling Company:	Boretec

Remarks: Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Groundwater was not encountered during drilling. Surface elevation estimated from existing topographic survey.

PanGEO INCORPORATED
Phone: 206.262.0370

LOG OF TEST BORING PG-5-13

Figure A-6

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX B

LABORATORY TESTING AND RESULTS

APPENDIX B: LABORATORY TESTING AND RESULTS

This appendix contains descriptions of the procedures and results of physical (geotechnical) and electrochemical laboratory testing conducted on soil samples retained during the 2013 field explorations for the "Bridge Only" project. Please refer to Appendix B of the *Supplemented Final Geotechnical Report* (PanGEO, 2012) for explanations of the previous laboratory testing in support of the full SPUI configuration, as well as the results of the previously conducted laboratory tests.

The methodology of the soil sampling from the borings was described in Appendix A. The samples were tested to determine basic physical index properties of the soils for purposes of classifying the material types encountered and to measure or correlate parameters used in the geotechnical design. In addition, tests were conducted to determine the chemistry parameters of the on-site soils to help determine the treatment potential of infiltrated stormwater.

Laboratory testing of the samples selected for testing under PanGEO's scope of work was performed by Analytical Resources, Incorporated, of Tukwila, Washington, in general accordance with the following ASTM Standard Test Methods (TM):

D 2216	TM for Laboratory Determination of Water (Moisture) Content of Soil and Rock
D 422	TM for Particle-size Analysis of Soils

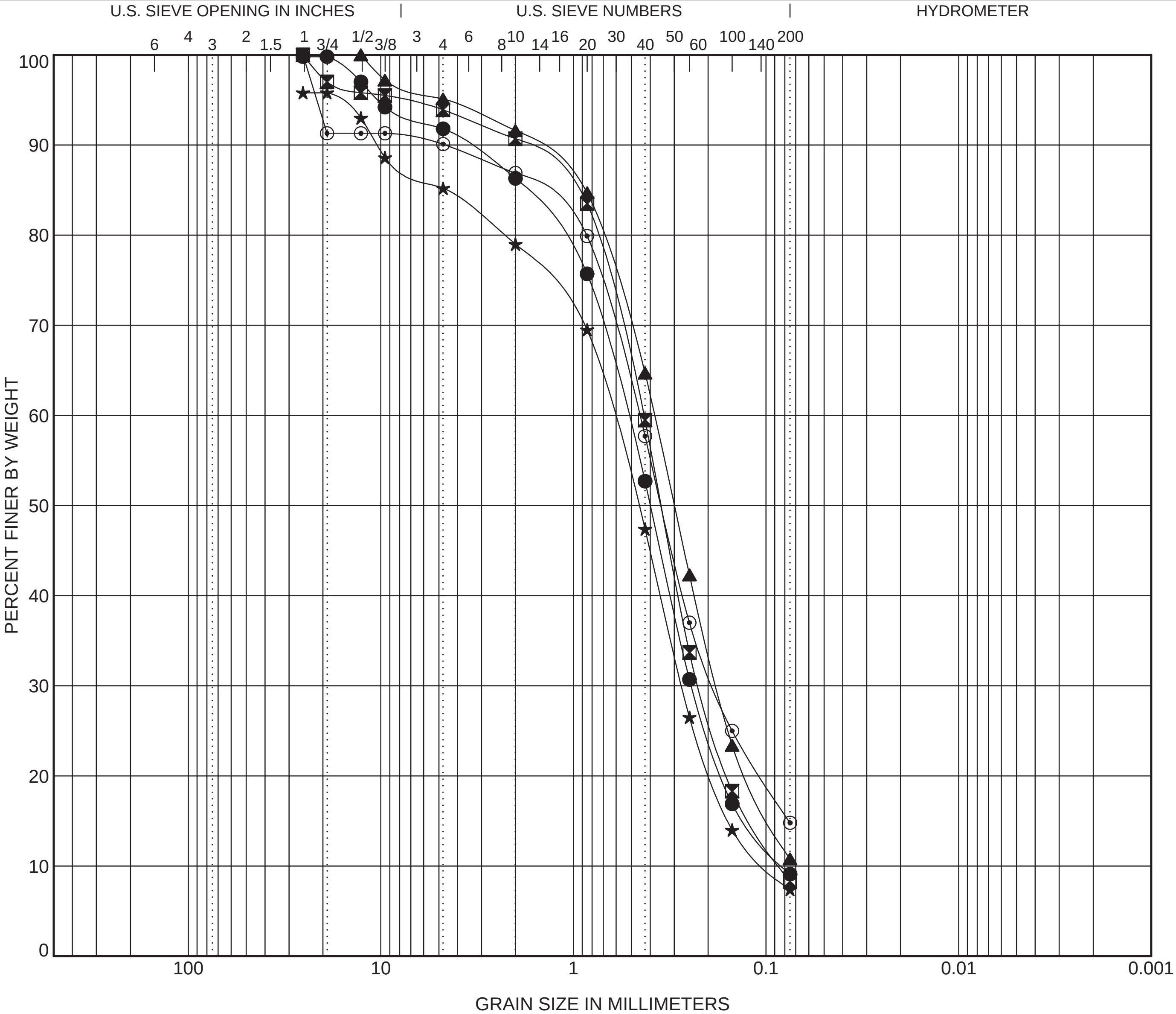
Moisture contents are shown on the logs of test borings in Appendix A.

Grain size results are shown on Figures B-1 through B-2.

Electrochemical property testing of the samples selected for testing under PanGEO's scope of work was also performed by Analytical Resources, Incorporated, of Tukwila, Washington, in general accordance with the following test method: Cation Exchange capacity by Method 9080.

The results of the cation exchange capacity test are shown in Table 2 of the report.

The raw laboratory test results are included at the end of this Appendix.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**PG-1-13**	**@ 0.0 ft.**	**WELL-GRADED SAND with SILT(SW-SM)**	**NP**	**NP**	**NP**	**1.38**	**6.52**
⊠	**PG-1-13**	**@ 2.5 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.34**	**5.11**
▲	**PG-1-13**	**@ 5.0 ft.**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**1.18**	**5.30**
★	**PG-2-13**	**@ 0.0 ft.**	**WELL-GRADED SAND with SILT(SW-SM)**	**NP**	**NP**	**NP**	**1.20**	**6.40**
⊙	**PG-2-13**	**@ 2.5 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		

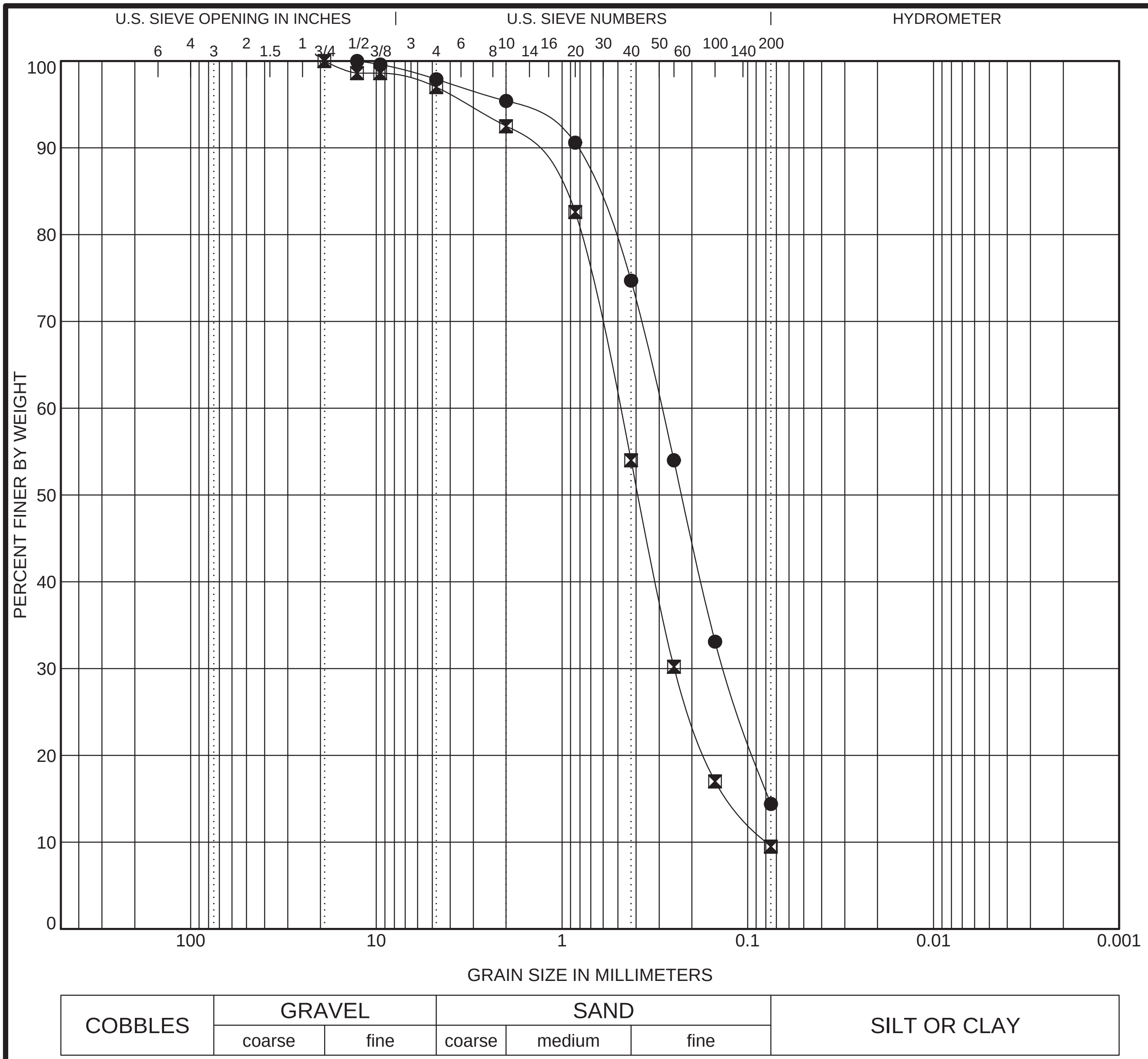
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**PG-1-13**	**0.0**	**25.4**	**0.53**	**0.244**	**0.081**	**8.0**	**82.7**	**9.1**	
⊠	**PG-1-13**	**2.5**	**25.4**	**0.431**	**0.221**	**0.084**	**6.1**	**85.6**	**8.3**	
▲	**PG-1-13**	**5.0**	**12.7**	**0.38**	**0.179**		**4.9**	**84.3**	**10.8**	
★	**PG-2-13**	**0.0**	**25.4**	**0.631**	**0.273**	**0.099**	**10.6**	**77.8**	**7.4**	
⊙	**PG-2-13**	**2.5**	**25.4**	**0.457**	**0.186**		**9.9**	**75.3**	**14.8**	

PanGEO INCORPORATED
Phone: 206.262.0370

GRAIN SIZE DISTRIBUTION

Project: I-5 NE 116th Interchange (Bridge Only)
Job Number: 10-069
Location: Marysville, Washington

Figure B-1



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**PG-2-13**	**@ 2.8 ft.**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
⊠	**PG-2-13**	**@ 5.0 ft.**	**WELL-GRADED SAND with SILT(SW-SM)**	**NP**	**NP**	**NP**	**1.59**	**6.26**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**PG-2-13**	**2.8**	**12.7**	**0.292**	**0.134**		**2.1**	**83.5**	**14.4**	
⊠	**PG-2-13**	**5.0**	**19.05**	**0.492**	**0.248**	**0.079**	**3.0**	**87.5**	**9.5**	

GRAIN SIZE DISTRIBUTION

PanGEO
INCORPORATED
Phone: 206.262.0370

Project: I-5 NE 116th Interchange (Bridge Only)
Job Number: 10-069
Location: Marysville, Washington

Figure B-2

GRAIN SIZE 10-069 I-5 NE 116TH INTERCHANGE.GPJ PANGEO.GDT 6/4/13

SAMPLE RESULTS-CONVENTIONALS
WP26-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized
Reported: 05/22/13

Project: I-5 NE 116th Interchange
Event: 10-069
Date Sampled: 05/08/13
Date Received: 05/08/13

Client ID: PG-1S-3 5'-6.5'
ARI ID: 13-9988 WP26C

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/13/13 051313#1	SM2540B	Percent	0.01	93.00
Cation Exchange Capacity	05/15/13 051513#1	9080	meq/100 g	0.01	1.98

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
WP26-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/22/13

Project: I-5 NE 116th Interchange
Event: 10-069
Date Sampled: 05/08/13
Date Received: 05/08/13

Client ID: PG-1 S-2G 2.5'-3.5'
ARI ID: 13-9989 WP26D

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/13/13 051313#1	SM2540B	Percent	0.01	93.54
Cation Exchange Capacity	05/15/13 051513#1	9080	meq/100 g	0.01	2.49

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
WP26-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/22/13

Project: I-5 NE 116th Interchange
Event: 10-069
Date Sampled: 05/08/13
Date Received: 05/08/13

Client ID: PG-2 S-3 5'-6.5'
ARI ID: 13-9993 WP26H

Analyte	**Date**	**Method**	**Units**	**RL**	**Sample**
Total Solids	05/13/13 051313#1	SM2540B	Percent	0.01	92.80
Cation Exchange Capacity	05/15/13 051513#1	9080	meq/100 g	0.01	1.13

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
WP26-PanGeo

ANALYTICAL RESOURCES INCORPORATED

Matrix: Soil
Data Release Authorized:
Reported: 05/22/13

Project: I-5 NE 116th Interchange
Event: 10-069
Date Sampled: 05/08/13
Date Received: 05/08/13

Client ID: PG-2 S-2G 3'-4'
ARI ID: 13-9994 WP26I

Analyte	Date	Method	Units	RL	Sample
Total Solids	05/13/13 051313#1	SM2540B	Percent	0.01	93.37
Cation Exchange Capacity	05/15/13 051513#1	9080	meq/100 g	0.01	2.19

RL Analytical reporting limit
U Undetected at reported detection limit

APPENDIX C

STRUCTURAL EARTH WALL ANALYSES

APPENDIX C: STRUCTURAL EARTH WALL ANALYSES

In accordance with the GDM (WSDOT, 2011), the walls are to be designed using LRFD methods. Specific Structural Earth Wall (SEW) design recommendations are presented in the report text, along with the general special provision (GSP) fill-ins presented in the currently recommended LRFD format. This appendix contains a summary of the results of analyses performed for the external design of the structural earth walls (SEW) and includes:

Table C-1: Summary of Global Stability Analyses & Minimum Reinforcement Lengths
Table C-2: Summary of Estimated Total and Differential Wall Settlements

In addition, graphic presentation of our slope stability analyses for the most critical cross section of each wall are included as Figures C-1 through C-48 (see index below).

FIGURES

Figures C-1 to C-4: Wall W1 Global Stability Analyses (STA 10+70)
Figures C-5 to C-8: Wall W1 Global Stability Analyses (STA 11+00)
Figures C-9 to C-12: Wall W1 Global Stability Analyses (STA 11+34)
Figures C-13 to C-16: Wall W2 Global Stability Analyses (STA 30+00)
Figures C-17 to C-20: Wall W2 Global Stability Analyses (STA 30+25)
Figures C-21 to C24: Wall W2 Global Stability Analyses (STA 30+50)
Figures C-25 to C-28: Wall W3 Global Stability Analyses (STA 20+50)
Figures C-29 to C-32: Wall W3 Global Stability Analyses (STA 21+00)
Figures C-33 to C-36: Wall W3 Global Stability Analyses (STA 21+34)
Figures C-37 to C-40: Wall W4 Global Stability Analyses (STA 40+00)
Figures C-41 to C-44: Wall W4 Global Stability Analyses (STA 40+25)
Figures C-45 to C-48: Wall W4 Global Stability Analyses (STA 40+50)

Table C-1: Summary of Global Stability Analyses & Minimum Reinforcement Lengths

Wall Designation	Wall Station	Wall Height (H)	Static Global Stability (Circular) SF[a]	Static Global Stability (Non-Circular) SF[a]	Pseudo Static Compound Stability (Circular) SF[a]	Pseudo Static Compound Stability (Non-Circular) SF[a]	Minimum Reinforcement Length (L) Based on Wall Height (H)
W1 ES Line	10+70	12’	1.84	1.68	1.25	1.13	8’ when H<12’
	11+00	19’	1.91	1.77	1.31	1.23	0.9H when H≥12’
	11+34[b]	30’	2.10	1.86	1.36	1.26	
W2 NE Line	30+00[c]	25’	2.01	1.82	1.32	1.24	0.9H when H≥11’
	30+25	18’	1.88	1.72	1.29	1.22	
	30+50	11’	1.76	1.62	1.22	1.15	10’ when H<11’
W3 SW Line	20+50	10’	1.78	1.65	1.23	1.13	8’ when H<10’
	21+00	22’	1.98	1.80	1.35	1.27	0.9H when H≥10’
	21+34[b]	30’	2.07	1.83	1.35	1.25	
W4 WN Line	40+00[b]	26’	2.11	1.87	1.38	1.27	0.9H when H≥11’
	40+25[b]	18’	1.91	1.74	1.32	1.24	
	40+50	11’	1.80	1.68	1.26	1.21	10’ when H<11’

[a] SF: Safety Factor
[b] Safety Factors shown are associated with reinforcement lengths of 0.7H.
[c] Safety Factors shown are associated with reinforcement lengths of 0.8H.

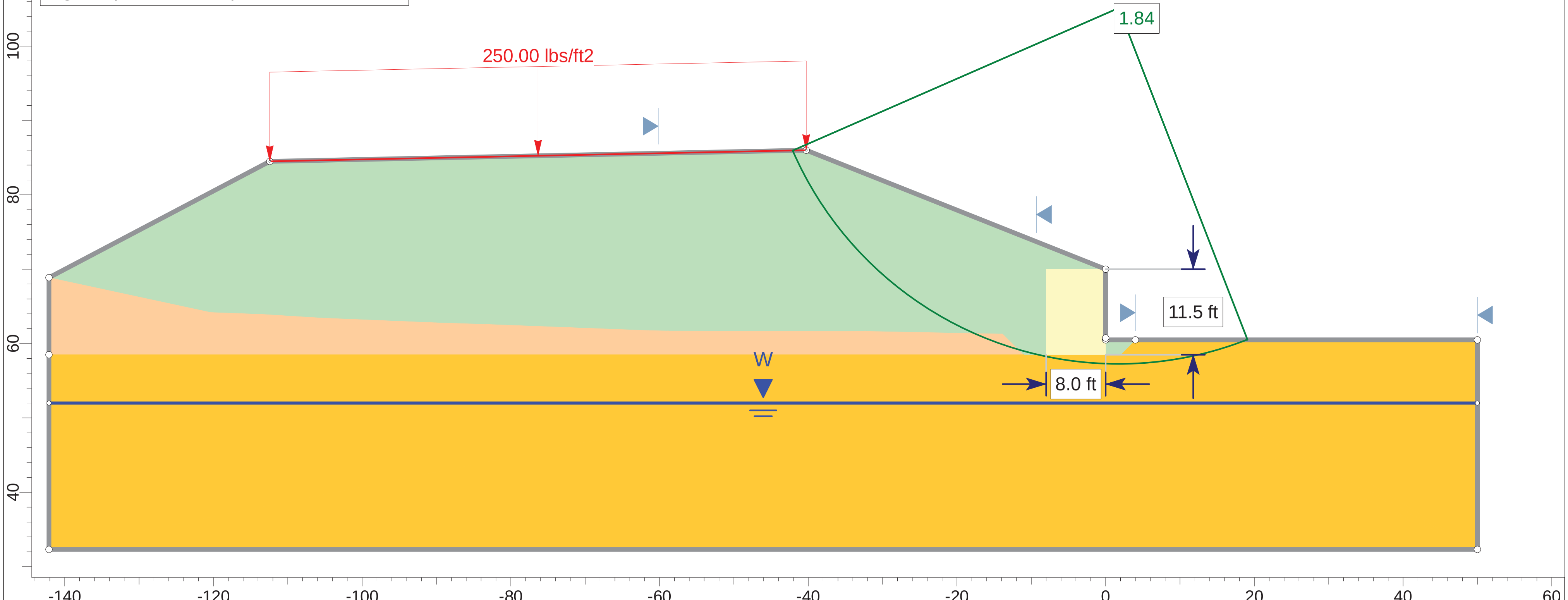
Note: The results of the pseudo static global stability analysis are not shown in the table above because the pseudo static compound stability case is more critical.

Table C-2: Summary of Estimated Total and Differential Wall Settlements

Wall Designation	Wall Station	Wall Height (ft)	Wall Base Width (ft)	Estimated Total Settlement (in)	Approximate Maximum Differential Settlement Over 100' of Wall Alignment (in)
W1 ES Line	11+34	30	30	5.0	4.2
	10+84	15	15	2.1	
	10+34	5	8	0.8	
	10+00	3	8	0.6	
W2 NE Line	30+00	25	25	3.0	2.6
	30+50	11	11	1.1	
	30+90	2	8	0.4	
W3 SW Line	21+34	30	30	5.0	4.0
	20+84	18	18	2.9	
	20+34	7	8	1.0	
	20+04	2	8	0.5	
W4 WN Line	40+00	26	26	3.2	2.6
	40+50	11	11	1.4	
	41+00	3	8	0.6	

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.84
Center: 1.750, 105.117
Radius: 47.862
Left Slip Surface Endpoint: -42.112, 85.962
Right Slip Surface Endpoint: 19.073, 60.500



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

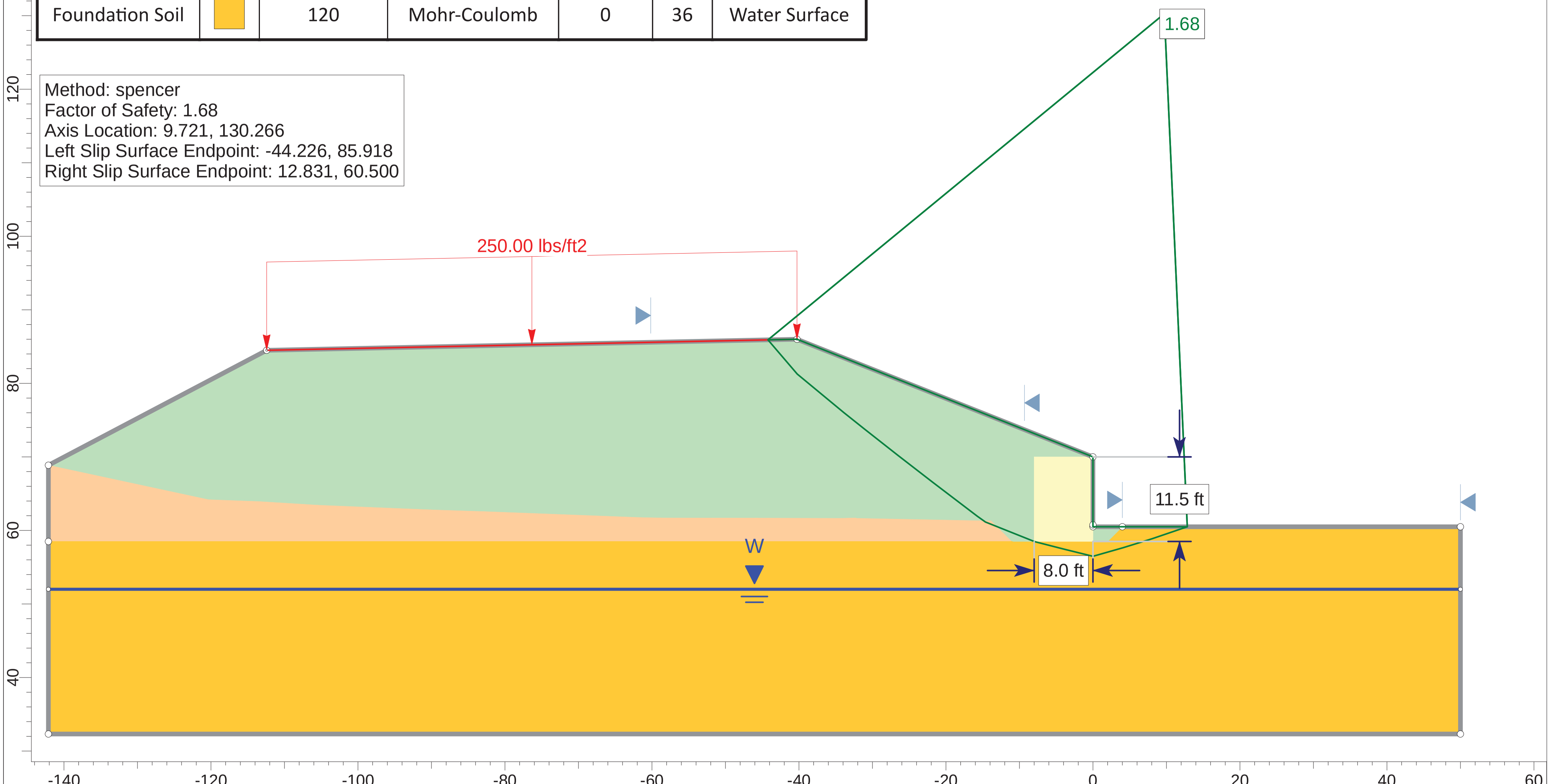
Static Global Stability Analysis

Circular Surface - Wall 1 (STA. 10+70)

Project No.	Figure No.
10-069.200	C-1

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.68
Axis Location: 9.721, 130.266
Left Slip Surface Endpoint: -44.226, 85.918
Right Slip Surface Endpoint: 12.831, 60.500



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

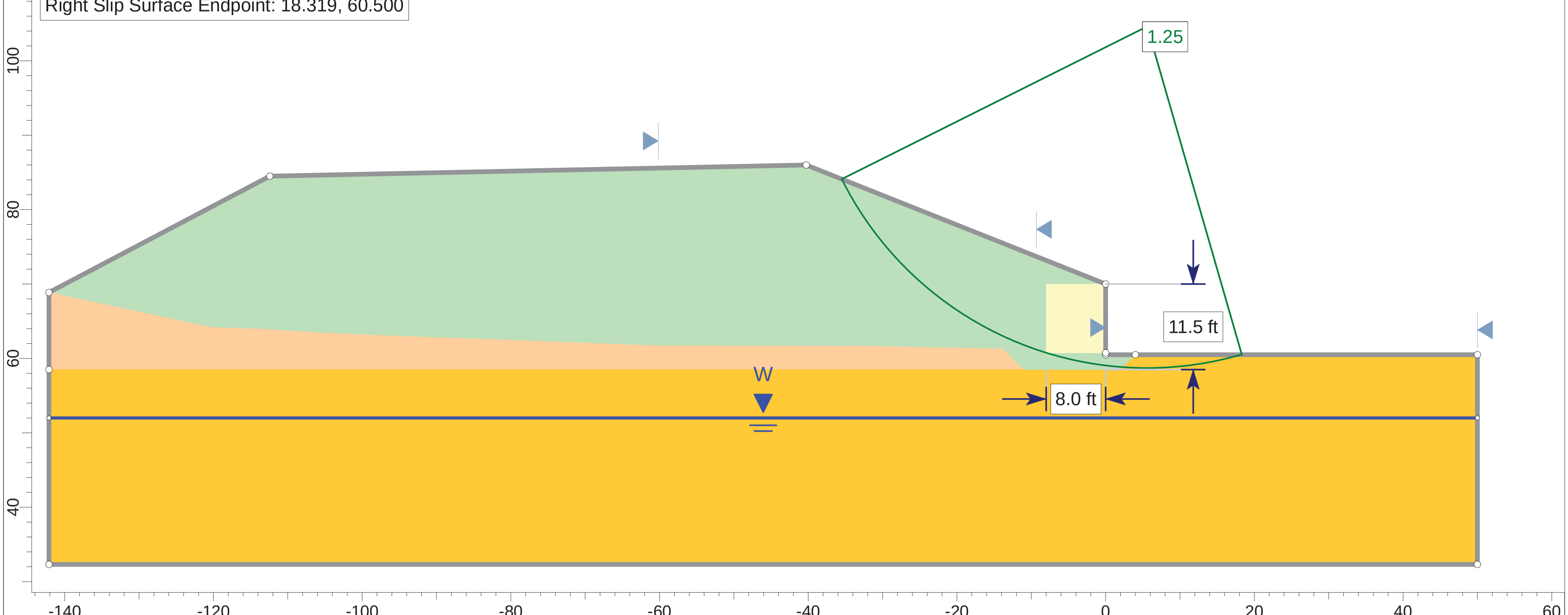
Static Global Stability Analysis
Non-Circular Surface - Wall 1 (STA. 10+70)

Project No. 10-069.200

Figure No. C-2

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.25
Center: 5.577, 104.620
Radius: 45.923
Left Slip Surface Endpoint: -35.511, 84.110
Right Slip Surface Endpoint: 18.319, 60.500



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

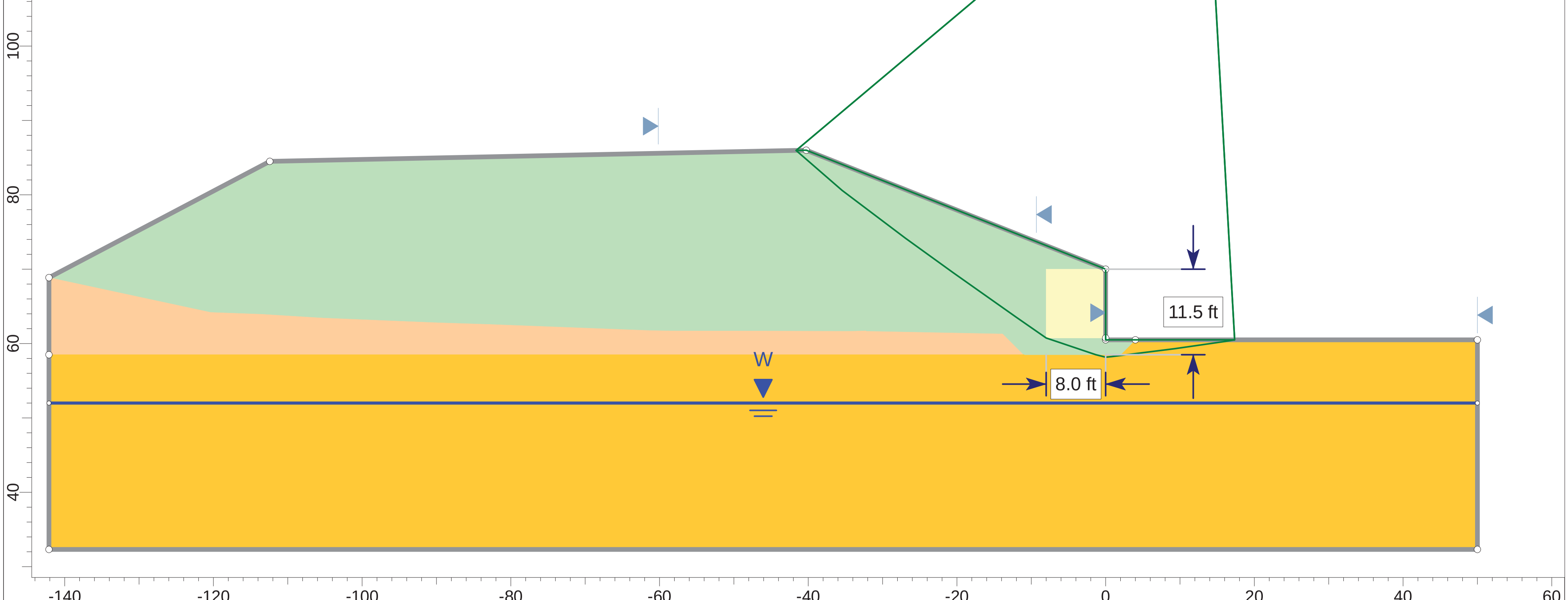
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis
Circular Surface - Wall 1 (STA. 10+70)

Project No.	Figure No.
10-069.200	C-3

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.13
Axis Location: 13.324, 132.222
Left Slip Surface Endpoint: -41.641, 85.972
Right Slip Surface Endpoint: 17.345, 60.500



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

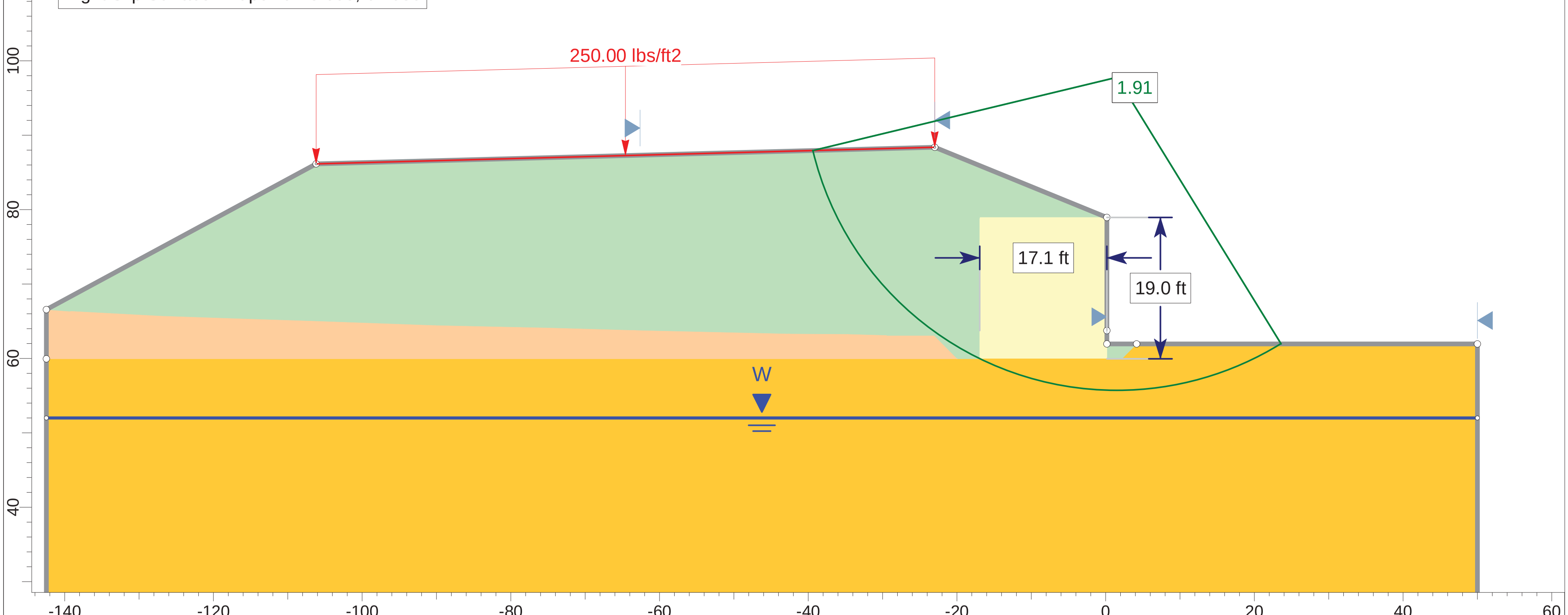
Non-Circular Surface - Wall 1 (STA. 10+70)

Project No. 10-069.200

Figure No. C-4

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.91
Center: 1.521, 97.781
Radius: 42.082
Left Slip Surface Endpoint: -39.395, 87.945
Right Slip Surface Endpoint: 23.605, 61.959



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

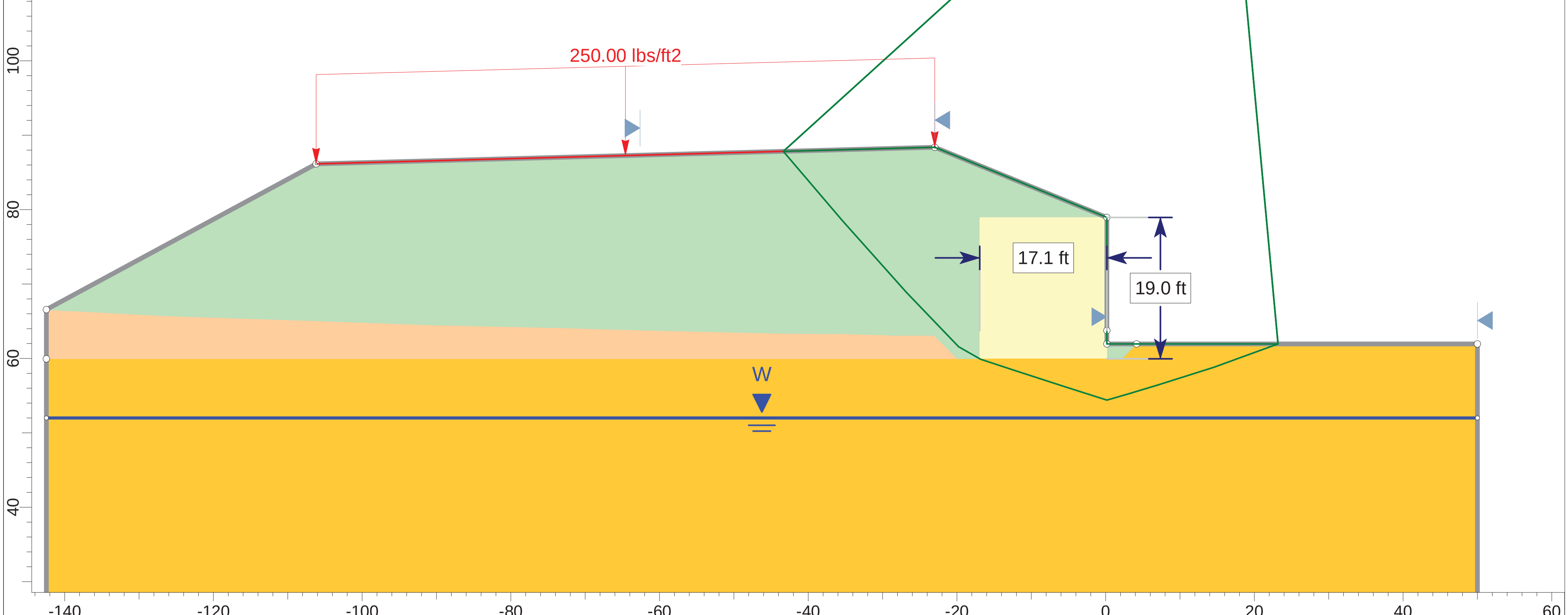
Circular Surface - Wall 1 (STA. 11+00)

Project No. 10-069.200

Figure No. C-5

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.77
Axis Location: 15.796, 141.442
Left Slip Surface Endpoint: -43.356, 87.839
Right Slip Surface Endpoint: 23.187, 61.959



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

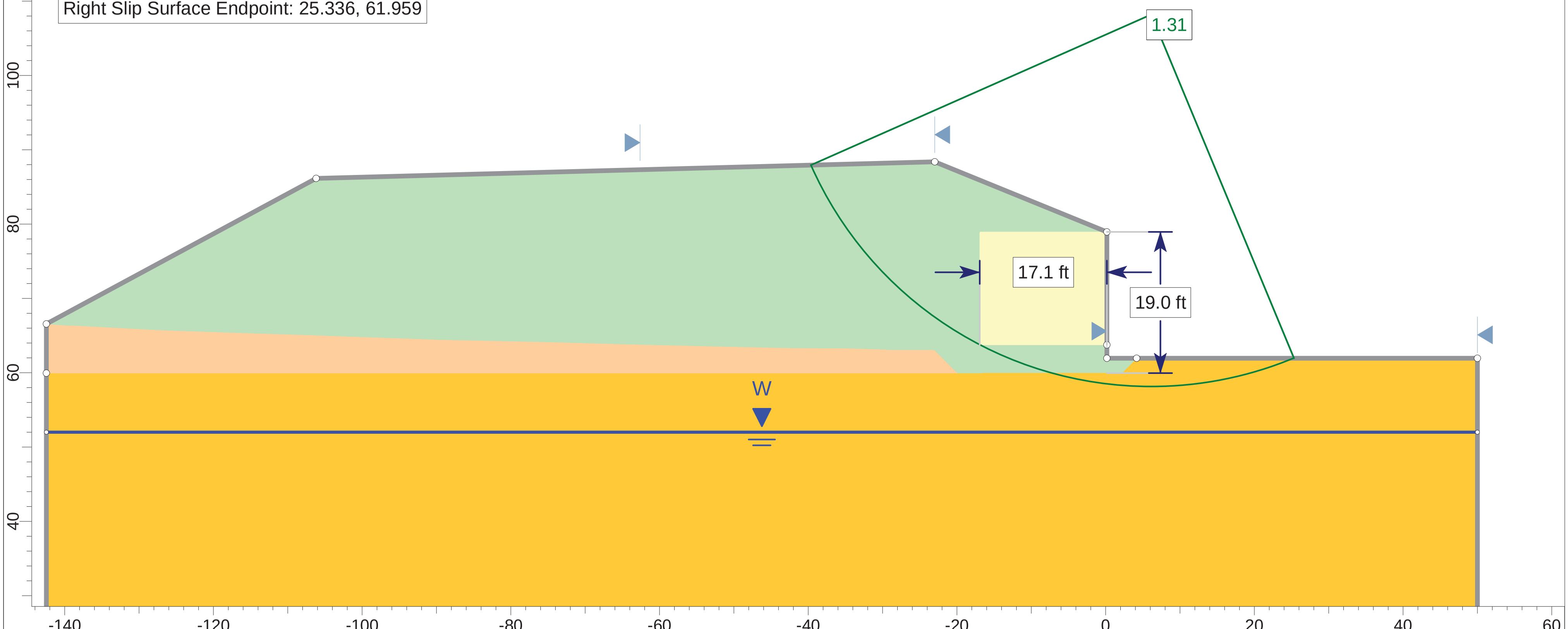
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall 1 (STA. 11+00)

Project No. 10-069.200
Figure No. C-6

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.31
Center: 6.134, 108.204
Radius: 50.072
Left Slip Surface Endpoint: -39.654, 87.938
Right Slip Surface Endpoint: 25.336, 61.959



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

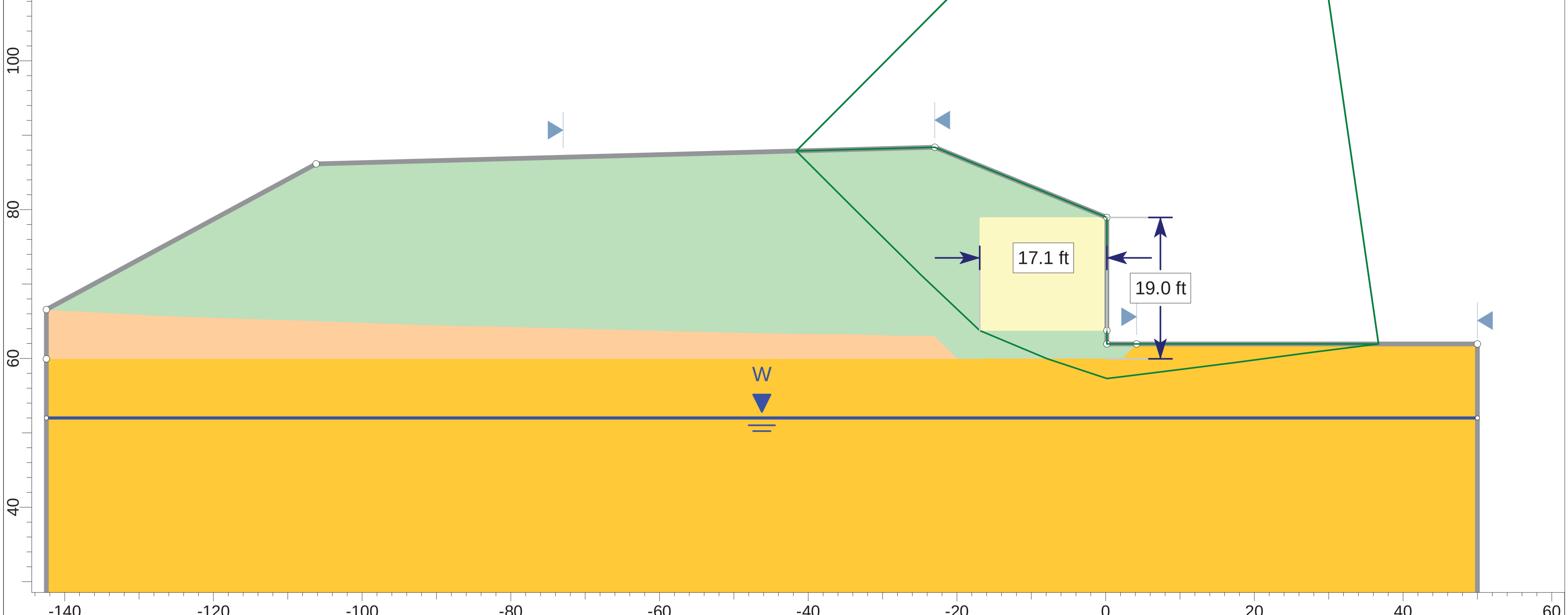
Circular Surface - Wall 1 (STA. 11+00)

Project No. 10-069.200

Figure No. C-7

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.23
Axis Location: 23.470, 153.237
Left Slip Surface Endpoint: -41.614, 87.886
Right Slip Surface Endpoint: 36.700, 61.959



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

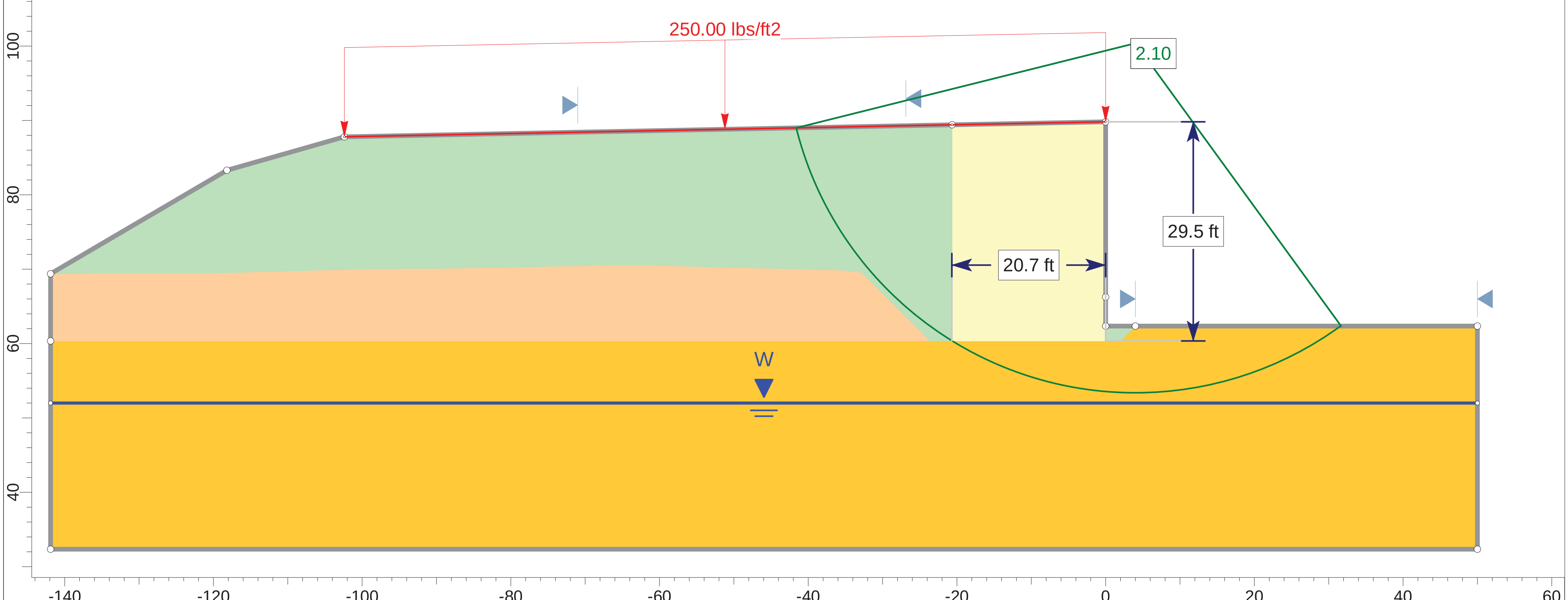
Pseudo-Static Compound Stability Analysis

Non-Circular Surface - Wall 1 (STA. 11+00)

Project No.	Figure No.
10-069.200	C-8

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 2.10
Center: 4.013, 100.381
Radius: 47.009
Left Slip Surface Endpoint: -41.599, 89.006
Right Slip Surface Endpoint: 31.659, 62.361



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

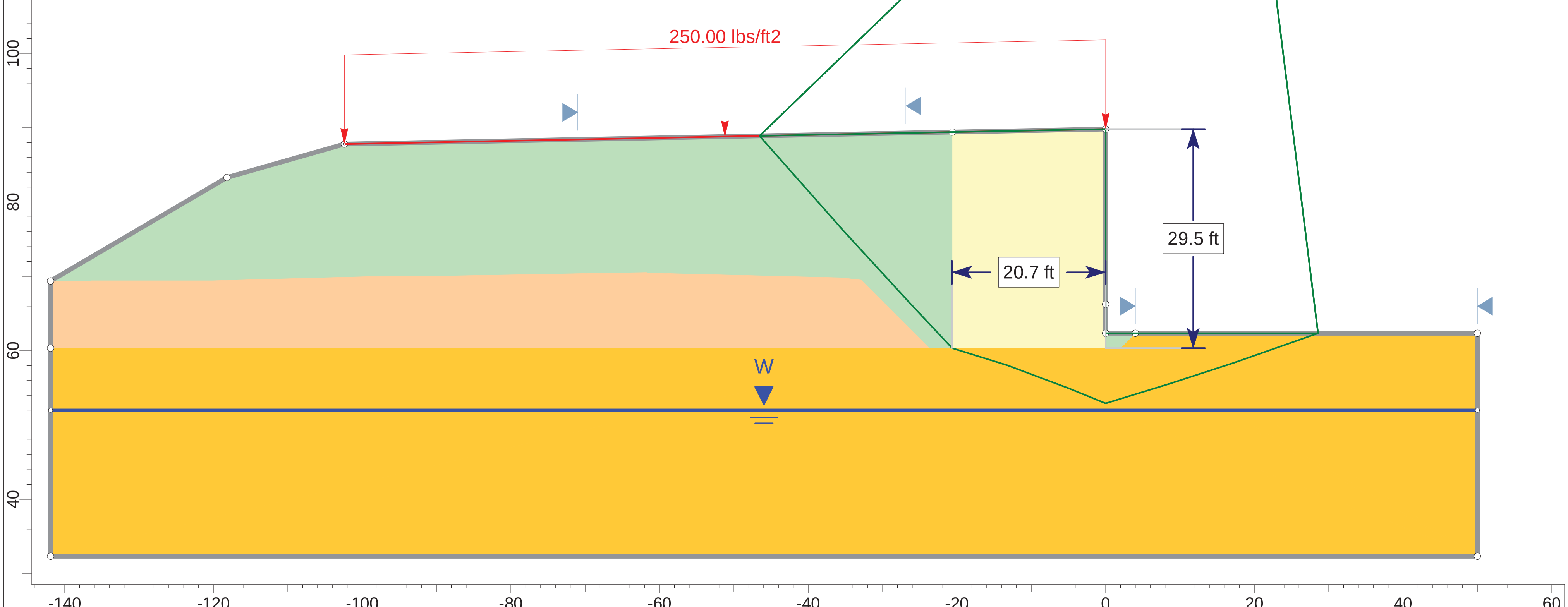
Circular Surface - Wall 1 (STA. 11+34)

Project No. **10-069.200**

Figure No. **C-9**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.86
Axis Location: 17.552, 150.738
Left Slip Surface Endpoint: -46.547, 88.909
Right Slip Surface Endpoint: 28.556, 62.361



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

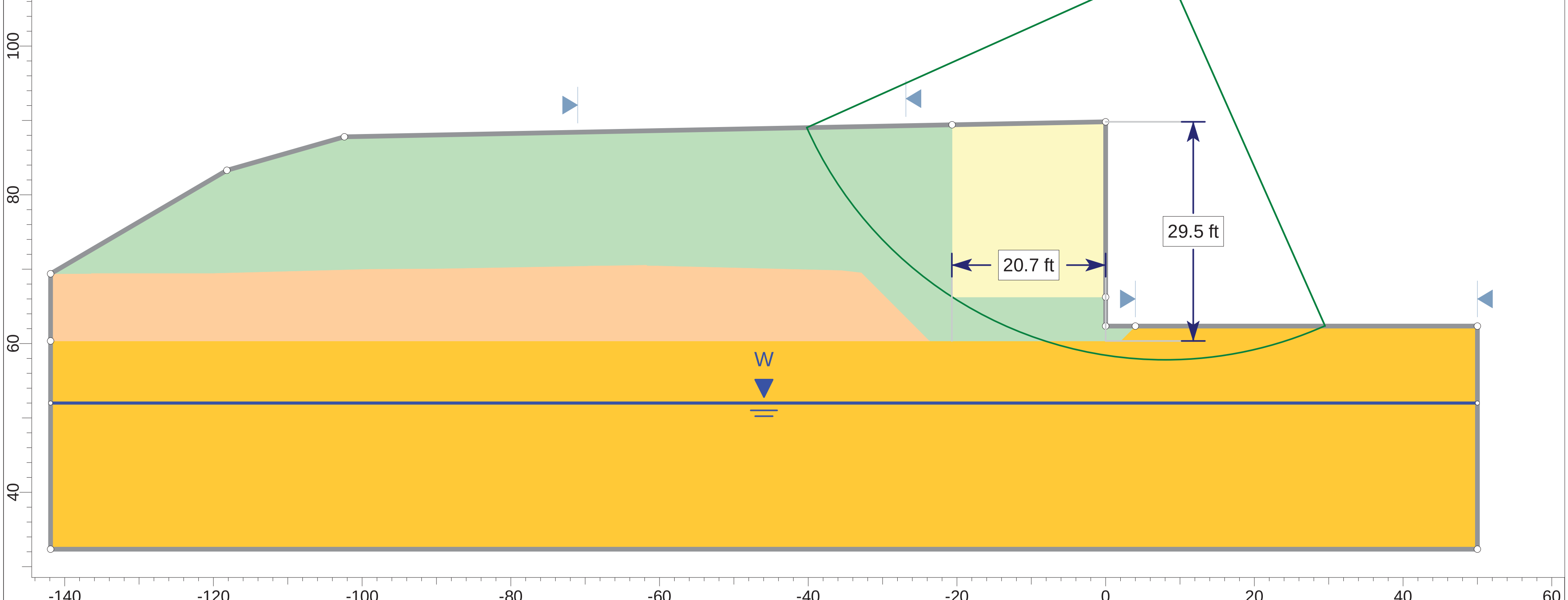
Non-Circular Surface - Wall 1 (STA. 11+34)

Project No. 10-069.200

Figure No. C-10

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.36
Center: 8.039, 110.691
Radius: 52.888
Left Slip Surface Endpoint: -40.211, 89.034
Right Slip Surface Endpoint: 29.517, 62.361



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

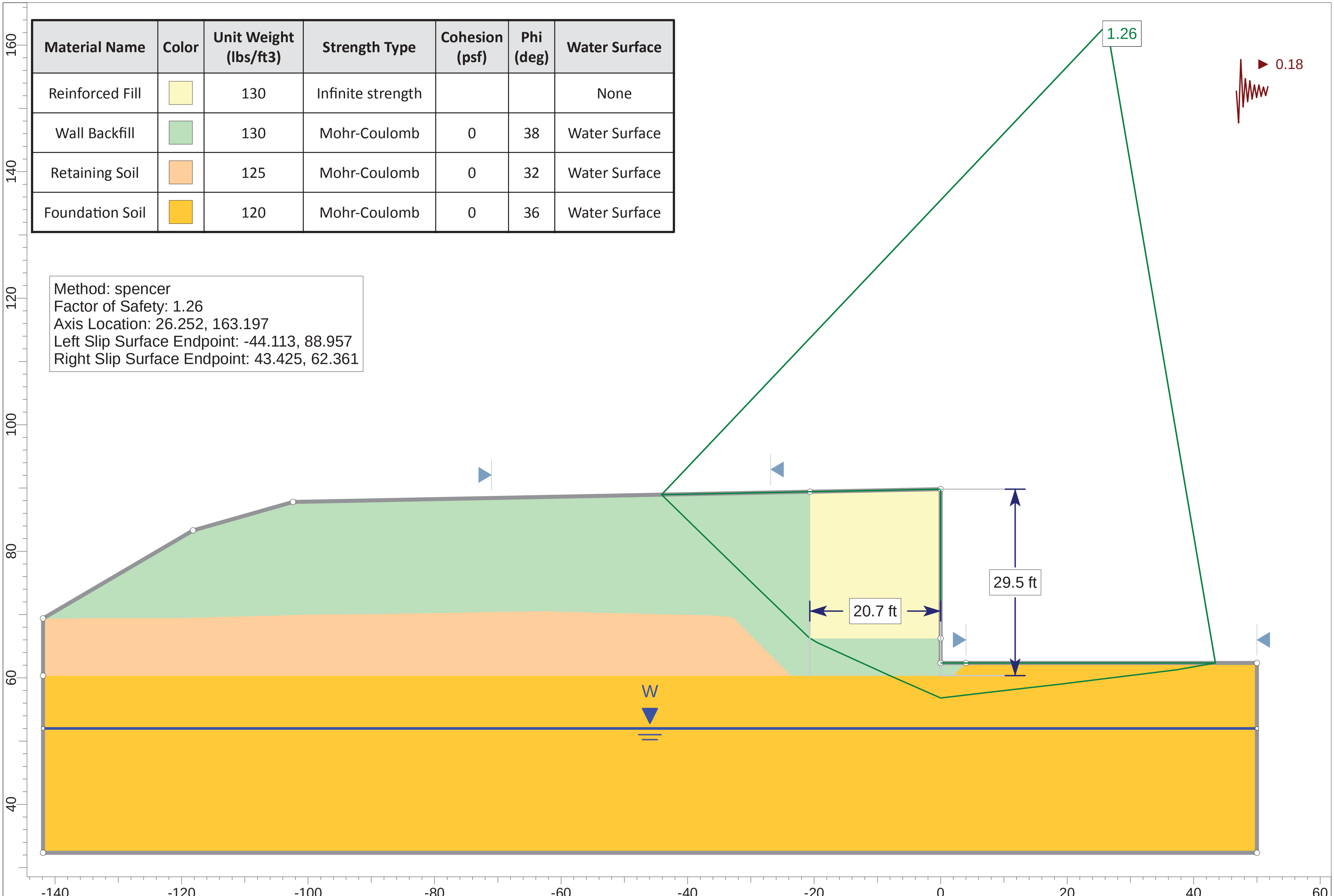
Circular Surface - Wall 1 (STA. 11+34)

Project No. 10-069.200

Figure No. C-11

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.26
Axis Location: 26.252, 163.197
Left Slip Surface Endpoint: -44.113, 88.957
Right Slip Surface Endpoint: 43.425, 62.361



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

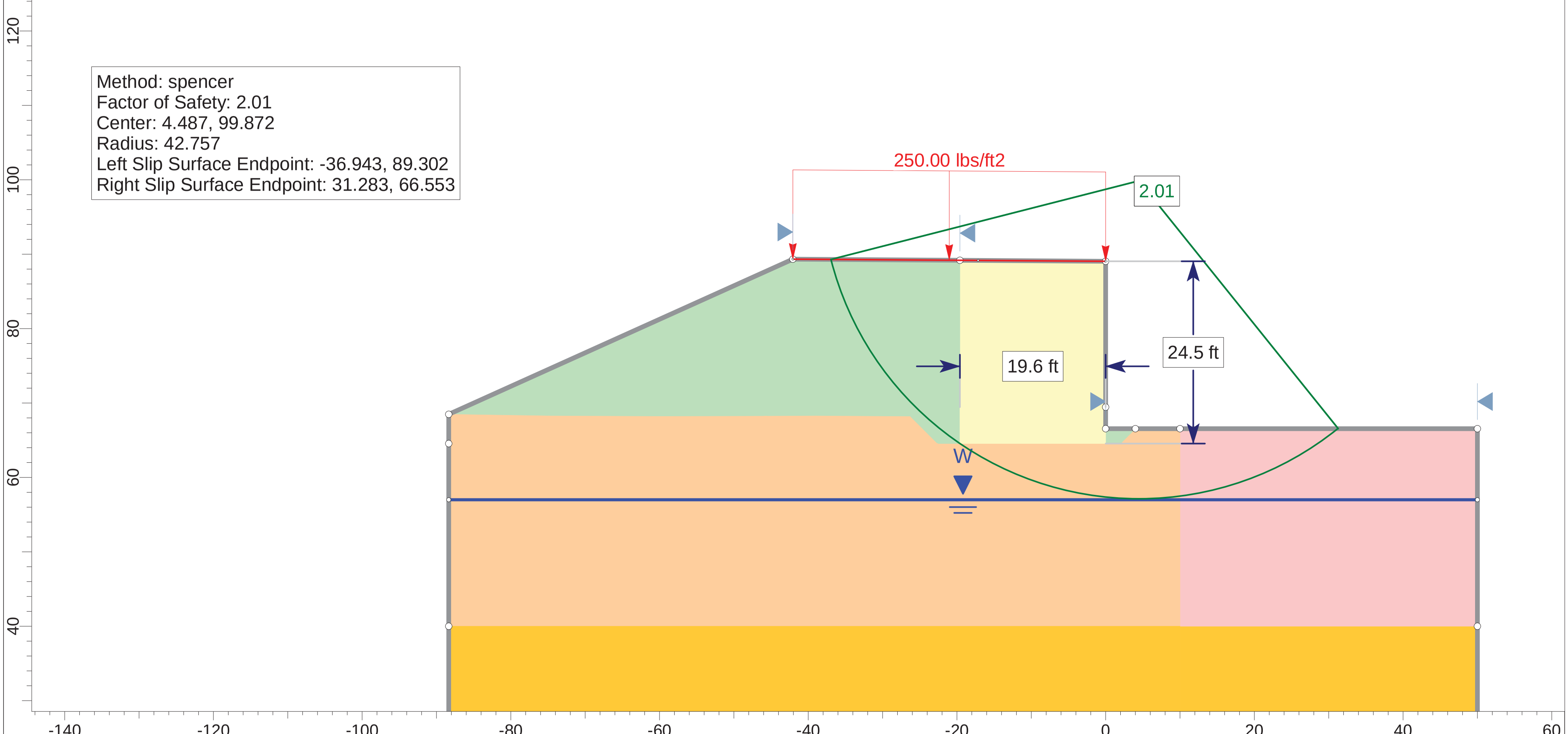
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis
Non-Circular Surface - Wall 1 (STA. 11+34)

Project No. 10-069.200
Figure No. C-12

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 2.01
Center: 4.487, 99.872
Radius: 42.757
Left Slip Surface Endpoint: -36.943, 89.302
Right Slip Surface Endpoint: 31.283, 66.553



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

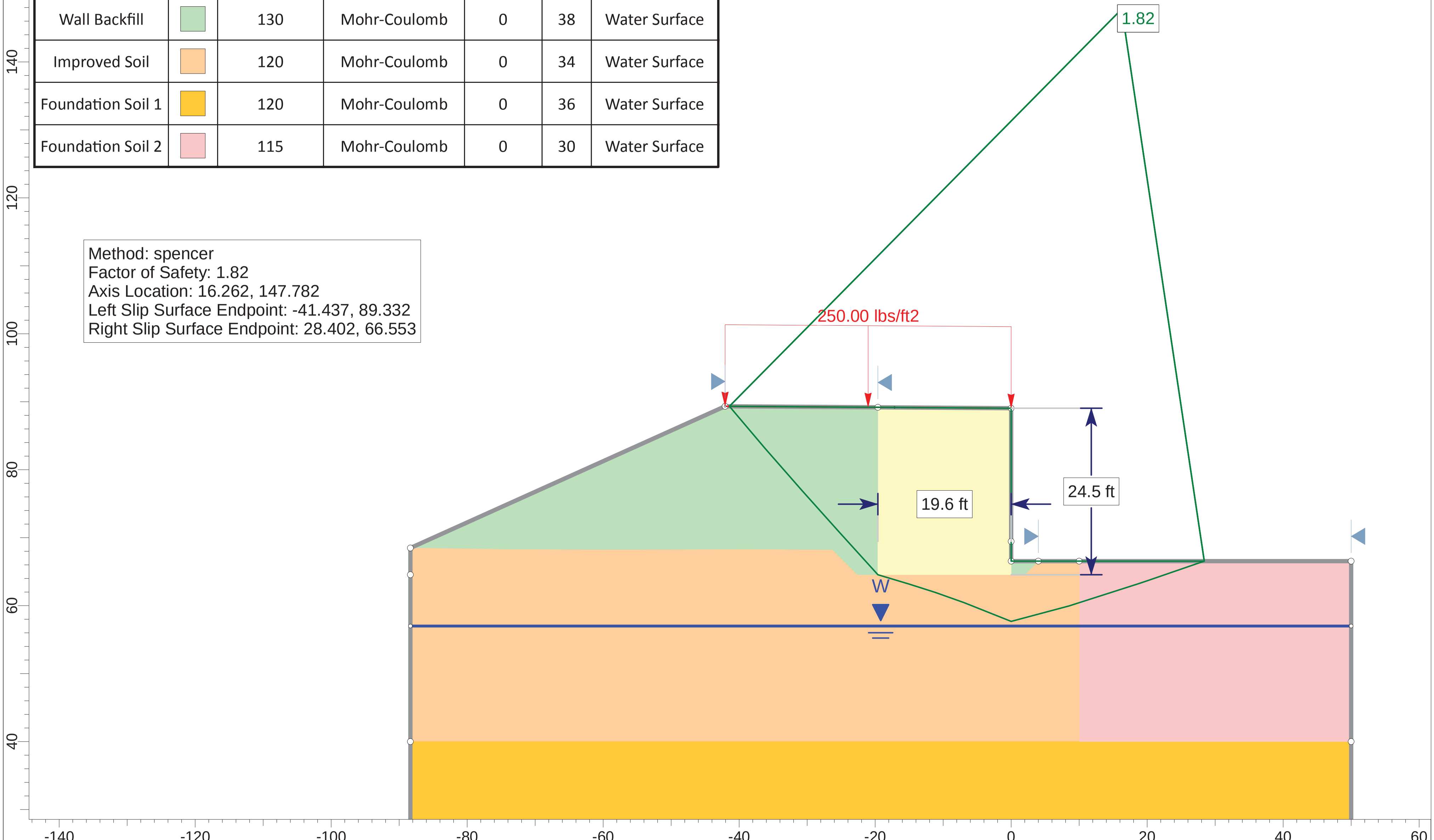
Circular Surface - Wall 2 (STA. 30+00)

Project No. 10-069.200

Figure No. C-13

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.82
Axis Location: 16.262, 147.782
Left Slip Surface Endpoint: -41.437, 89.332
Right Slip Surface Endpoint: 28.402, 66.553



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

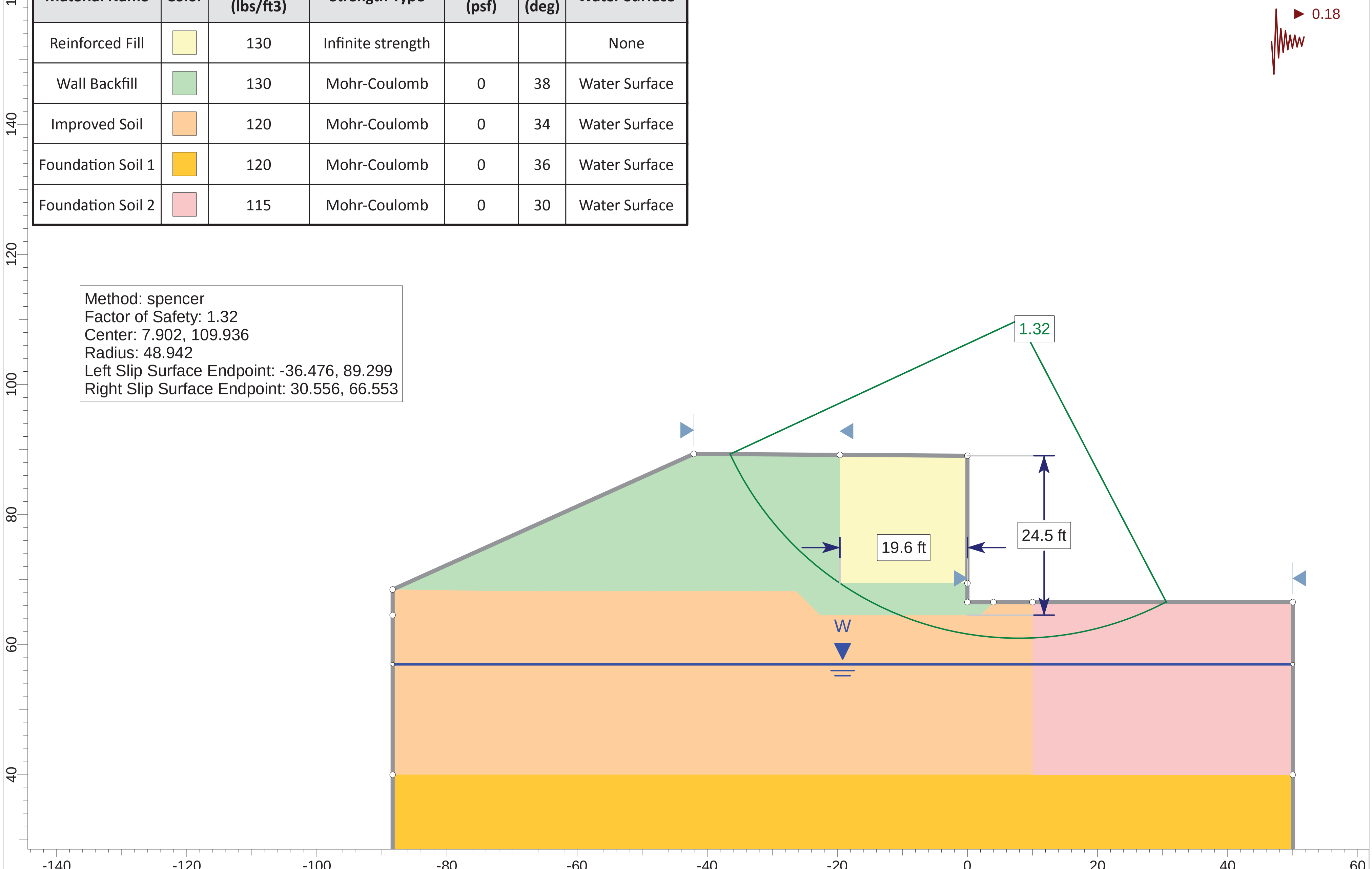
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall 2 (STA. 30+00)

Project No. 10-069.200
Figure No. C-14

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.32
Center: 7.902, 109.936
Radius: 48.942
Left Slip Surface Endpoint: -36.476, 89.299
Right Slip Surface Endpoint: 30.556, 66.553



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

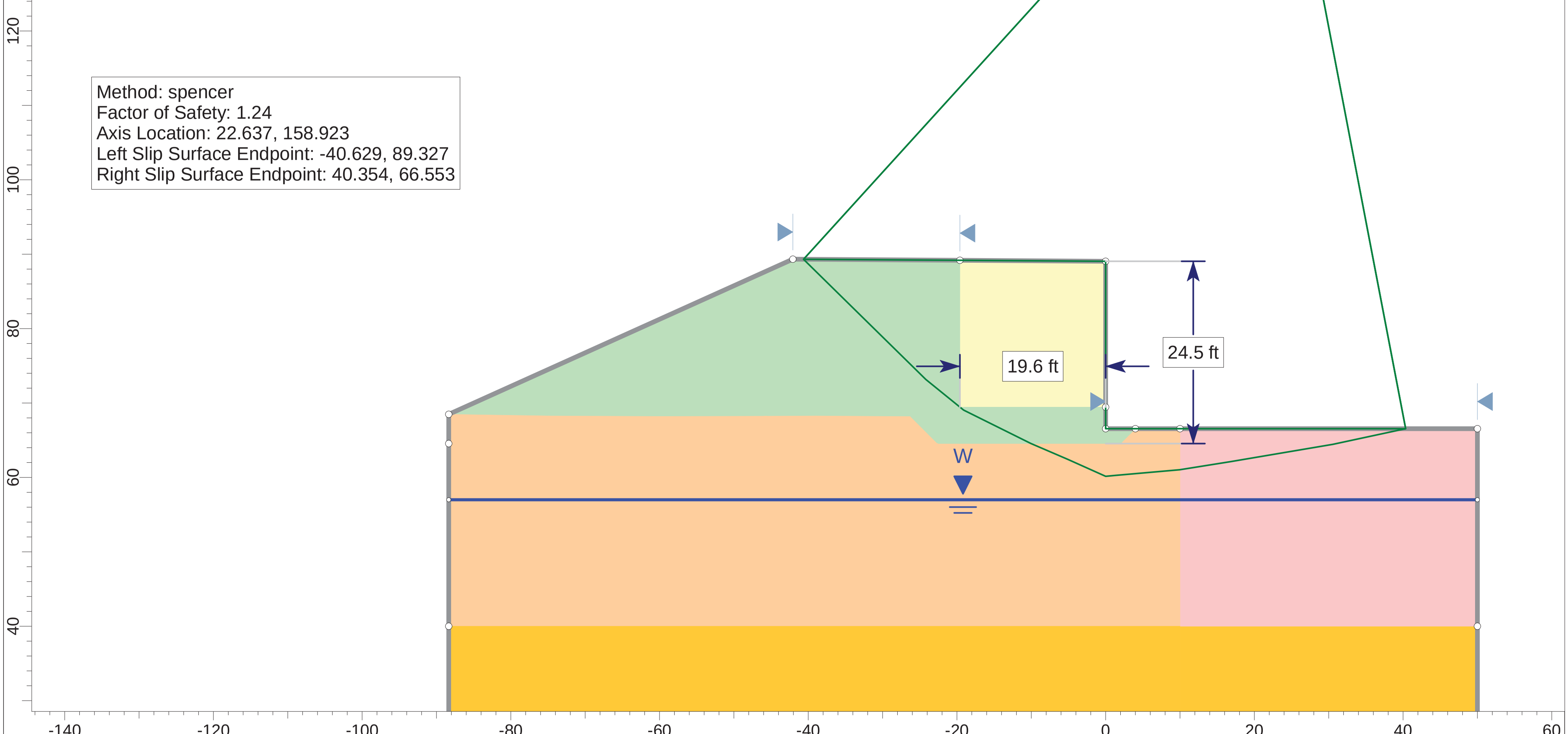
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis
Circular Surface - Wall 2 (STA. 30+00)

Project No. **10-069.200**
Figure No. **C-15**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.24
Axis Location: 22.637, 158.923
Left Slip Surface Endpoint: -40.629, 89.327
Right Slip Surface Endpoint: 40.354, 66.553



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

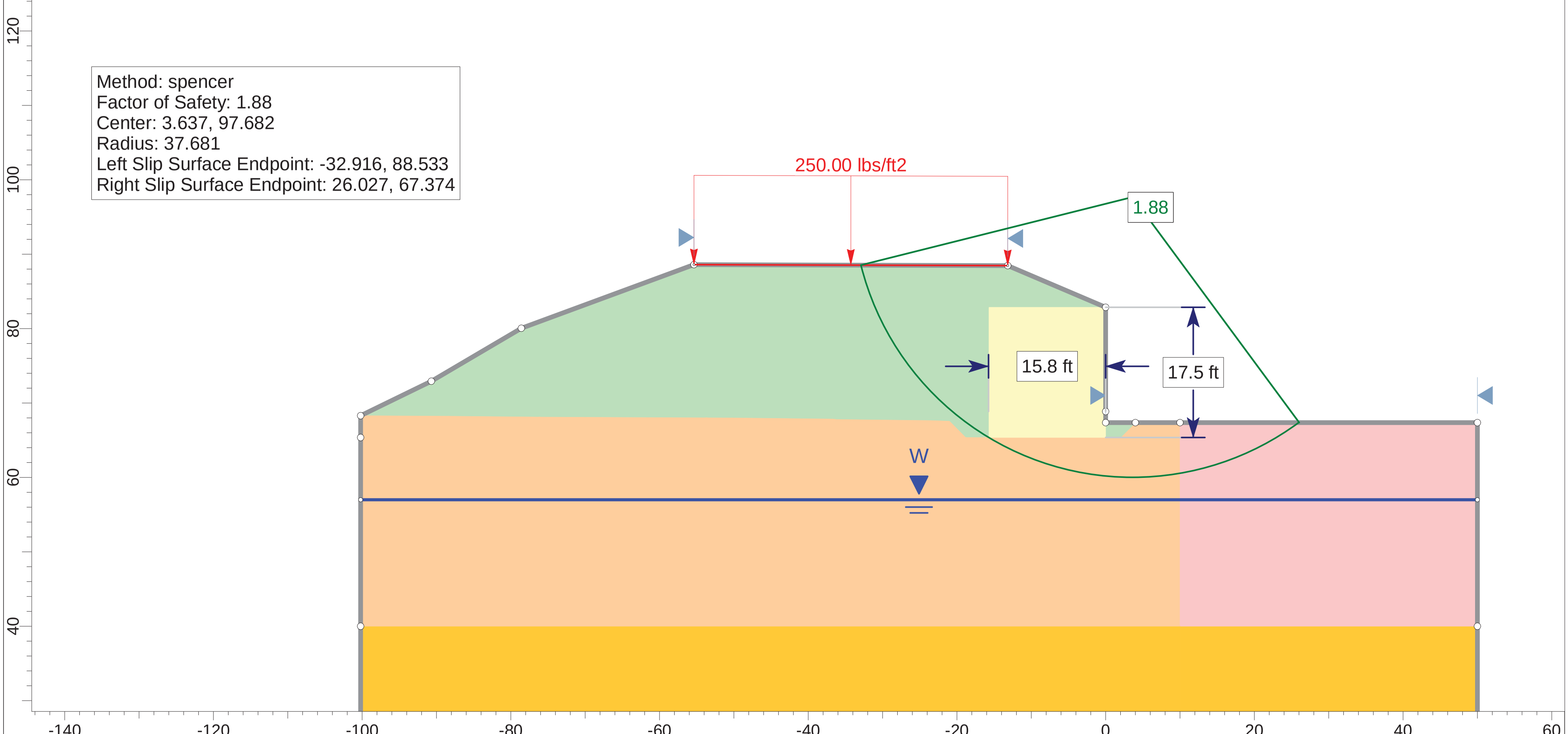
Non-Circular Surface - Wall 2 (STA. 30+00)

Project No. 10-069.200

Figure No. C-16

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.88
Center: 3.637, 97.682
Radius: 37.681
Left Slip Surface Endpoint: -32.916, 88.533
Right Slip Surface Endpoint: 26.027, 67.374



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

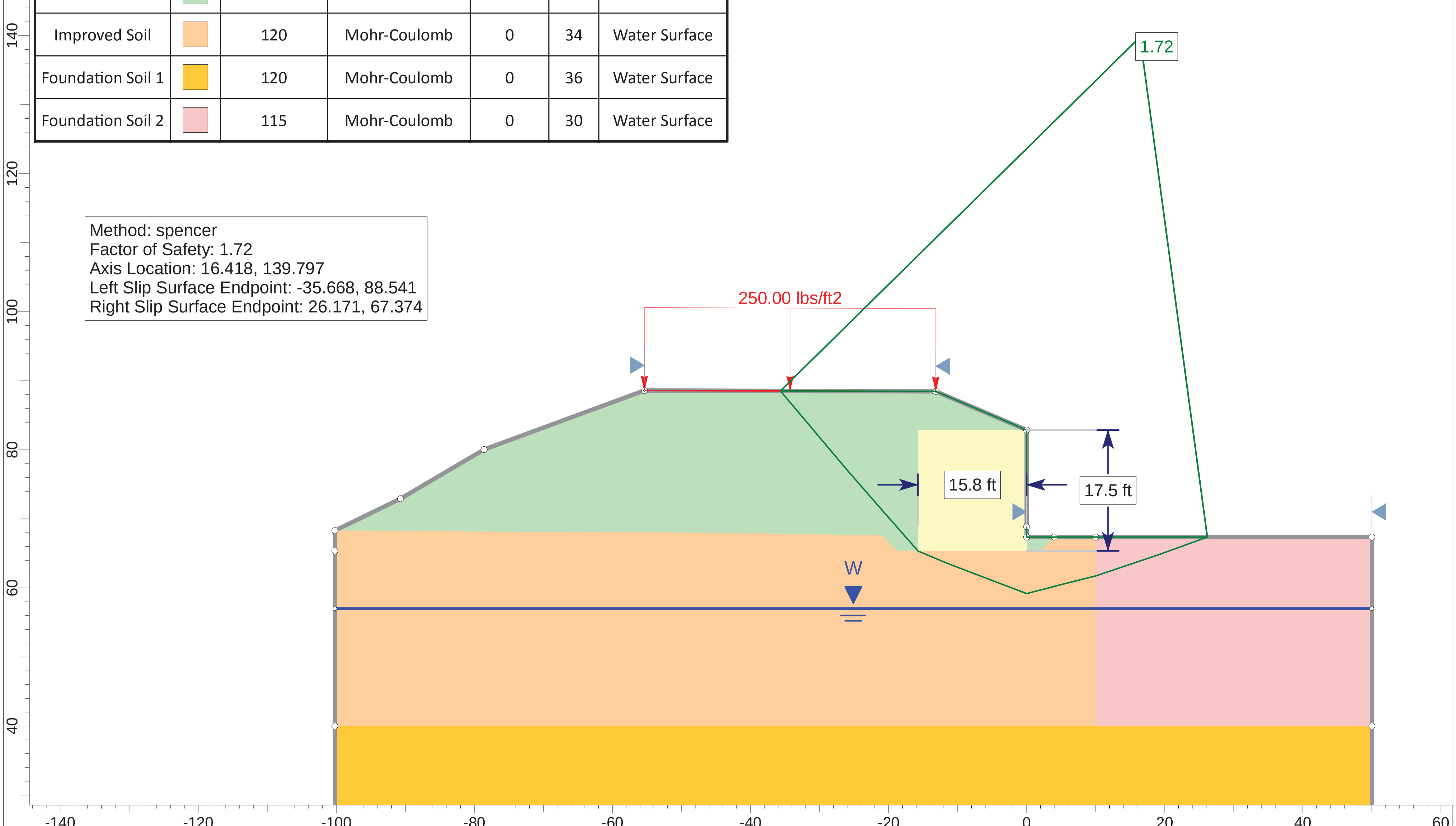
Circular Surface - Wall 2 (STA. 30+25)

Project No. 10-069.200

Figure No. C-17

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.72
Axis Location: 16.418, 139.797
Left Slip Surface Endpoint: -35.668, 88.541
Right Slip Surface Endpoint: 26.171, 67.374



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

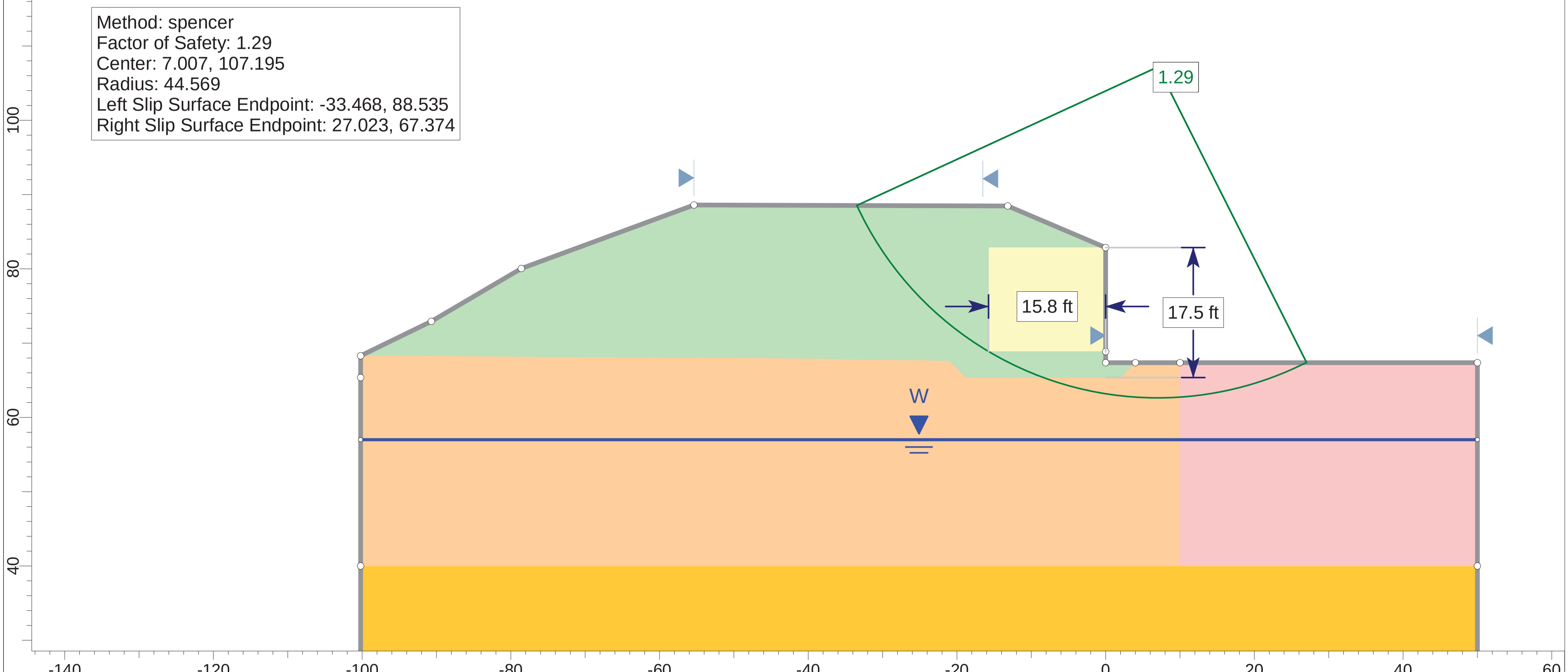
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis
Non-Circular Surface - Wall 2 (STA. 30+25)

Project No.	Figure No.
10-069.200	C-18

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.29
Center: 7.007, 107.195
Radius: 44.569
Left Slip Surface Endpoint: -33.468, 88.535
Right Slip Surface Endpoint: 27.023, 67.374



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

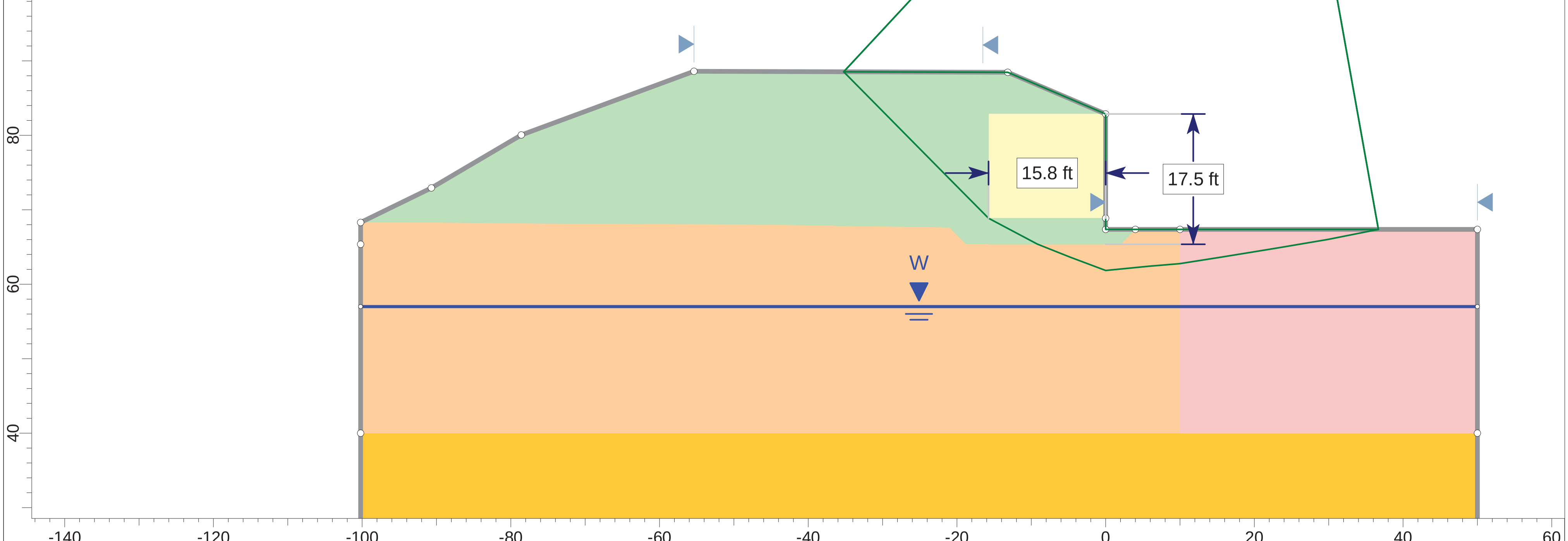
Circular Surface - Wall 2 (STA. 30+25)

Project No. 10-069.200

Figure No. C-19

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.22
Axis Location: 21.892, 149.872
Left Slip Surface Endpoint: -35.232, 88.540
Right Slip Surface Endpoint: 36.683, 67.374



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

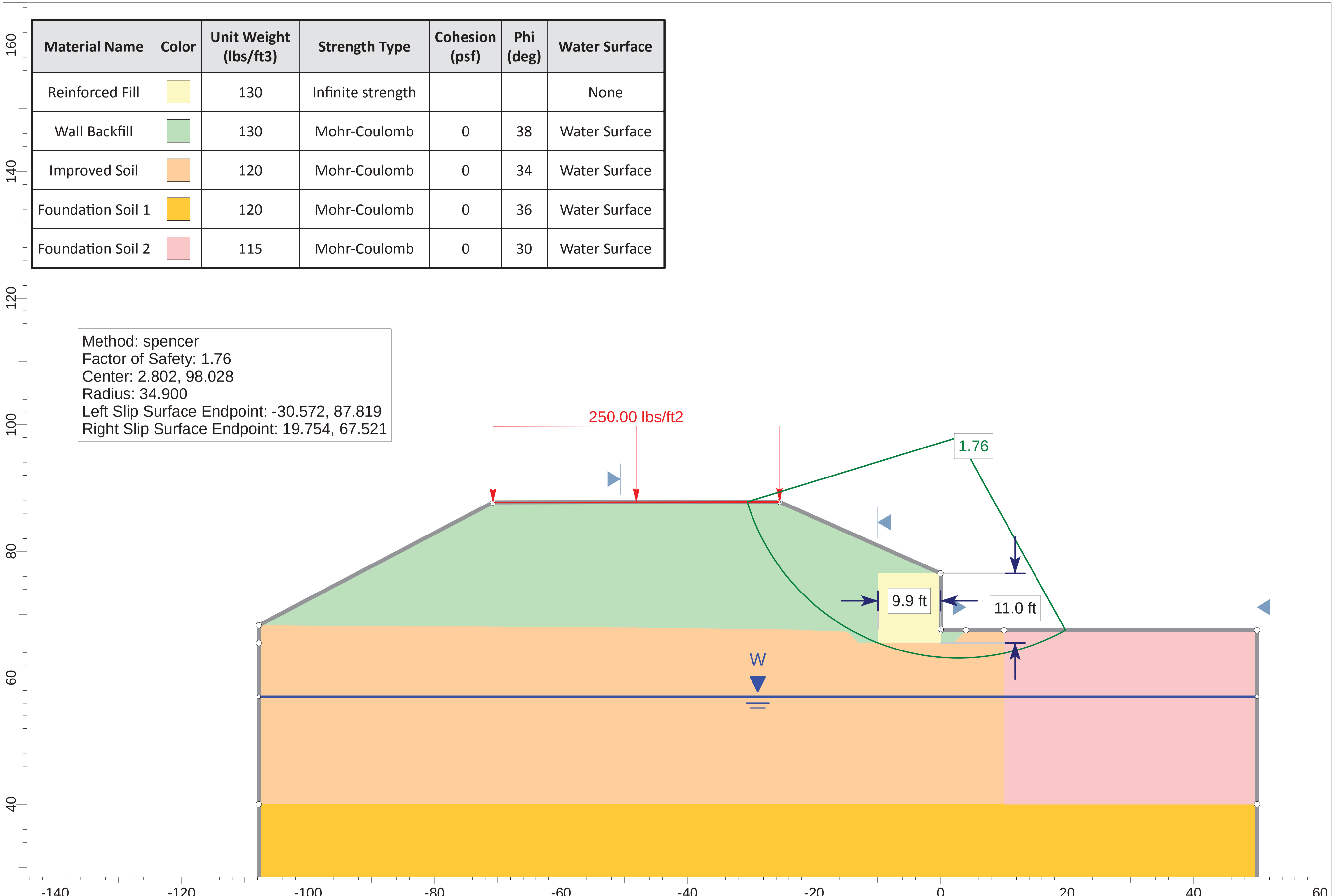
Pseudo-Static Compound Stability Analysis

Non-Circular Surface - Wall 2 (STA. 30+25)

Project No.	Figure No.
10-069.200	C-20

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.76
Center: 2.802, 98.028
Radius: 34.900
Left Slip Surface Endpoint: -30.572, 87.819
Right Slip Surface Endpoint: 19.754, 67.521



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

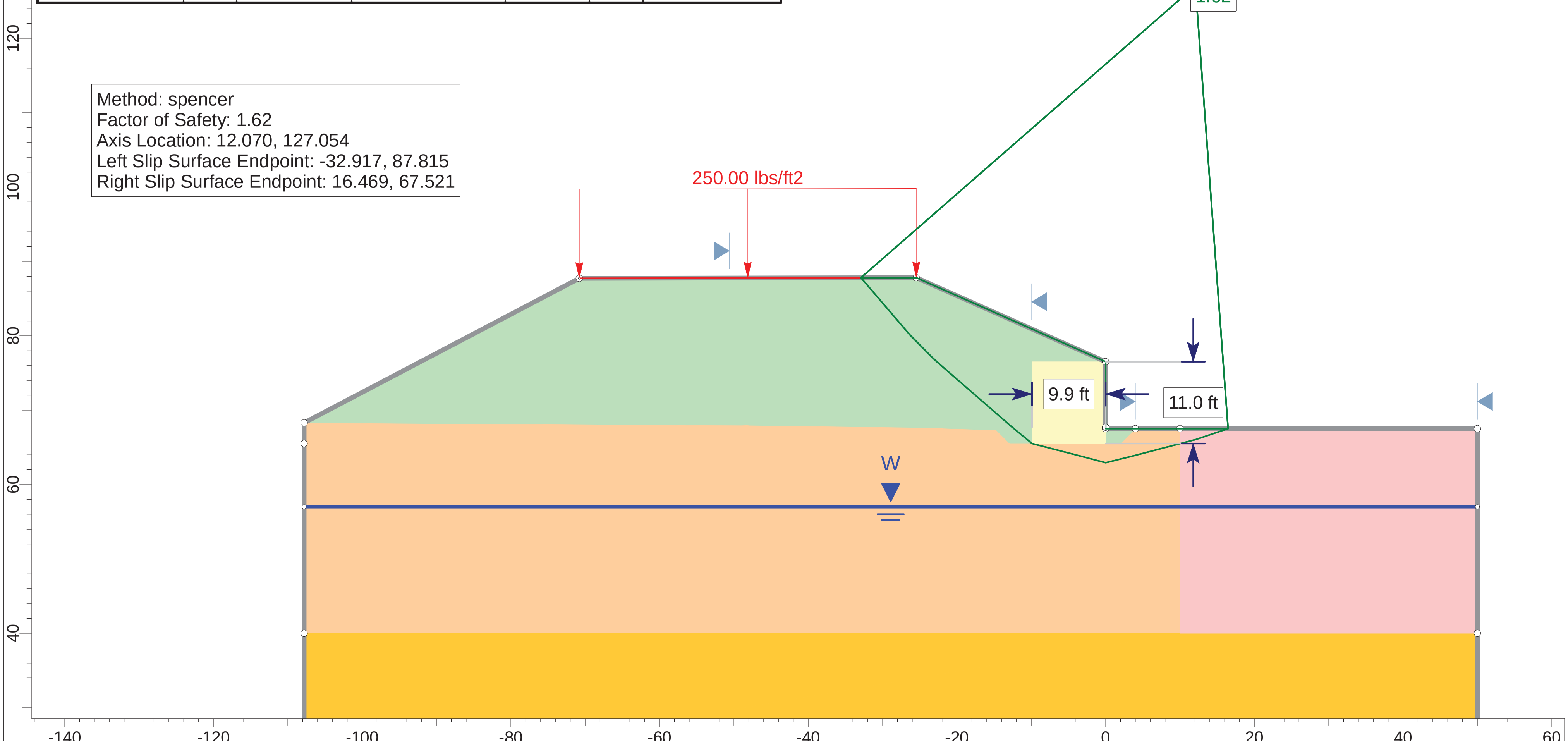
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

Circular Surface - Wall 2 (STA. 30+50)

Project No.	Figure No.
10-069.200	C-21

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

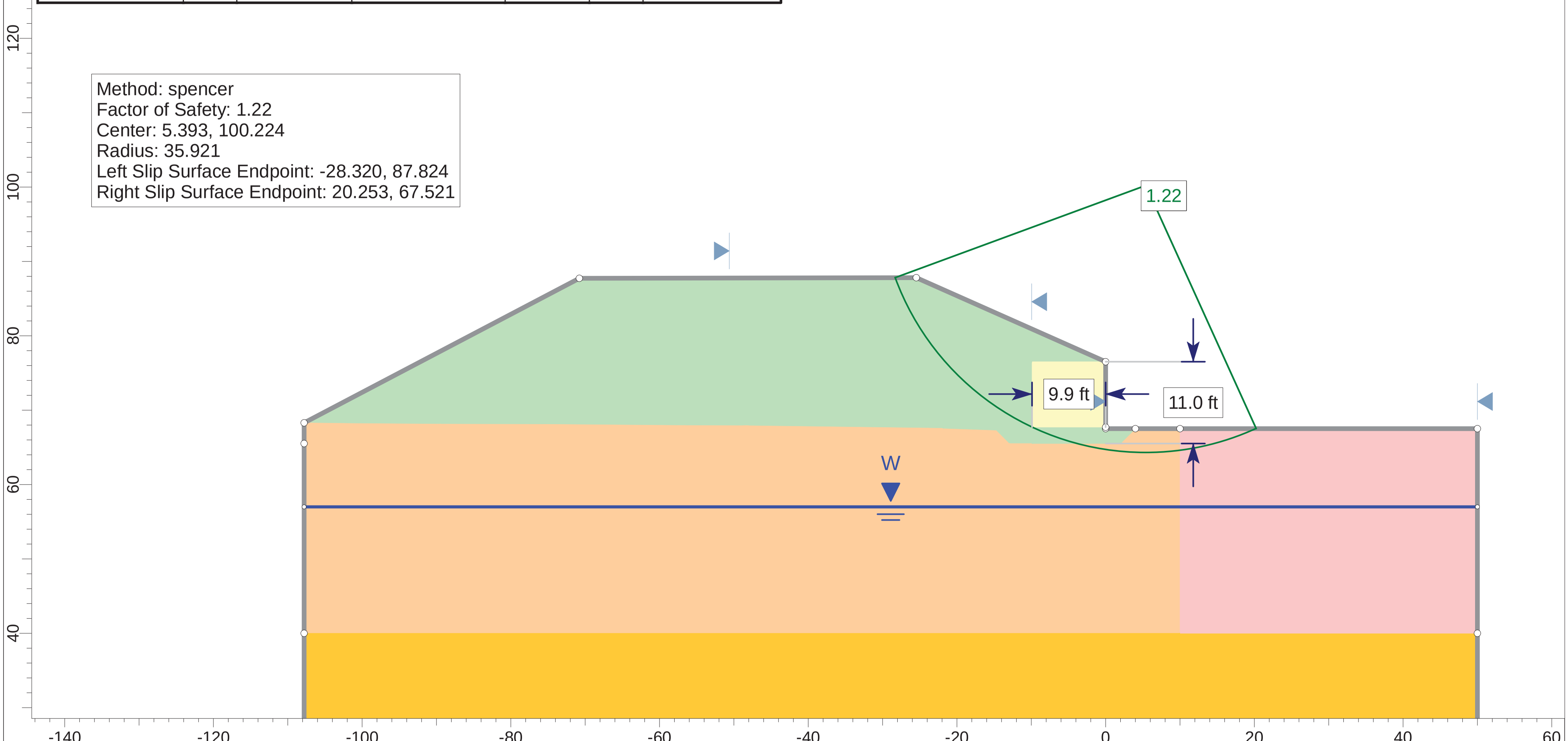
Static Global Stability Analysis

Non-Circular Surface - Wall 2 (STA. 30+50)

Project No.	Figure No.
10-069.200	C-22

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.22
Center: 5.393, 100.224
Radius: 35.921
Left Slip Surface Endpoint: -28.320, 87.824
Right Slip Surface Endpoint: 20.253, 67.521



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

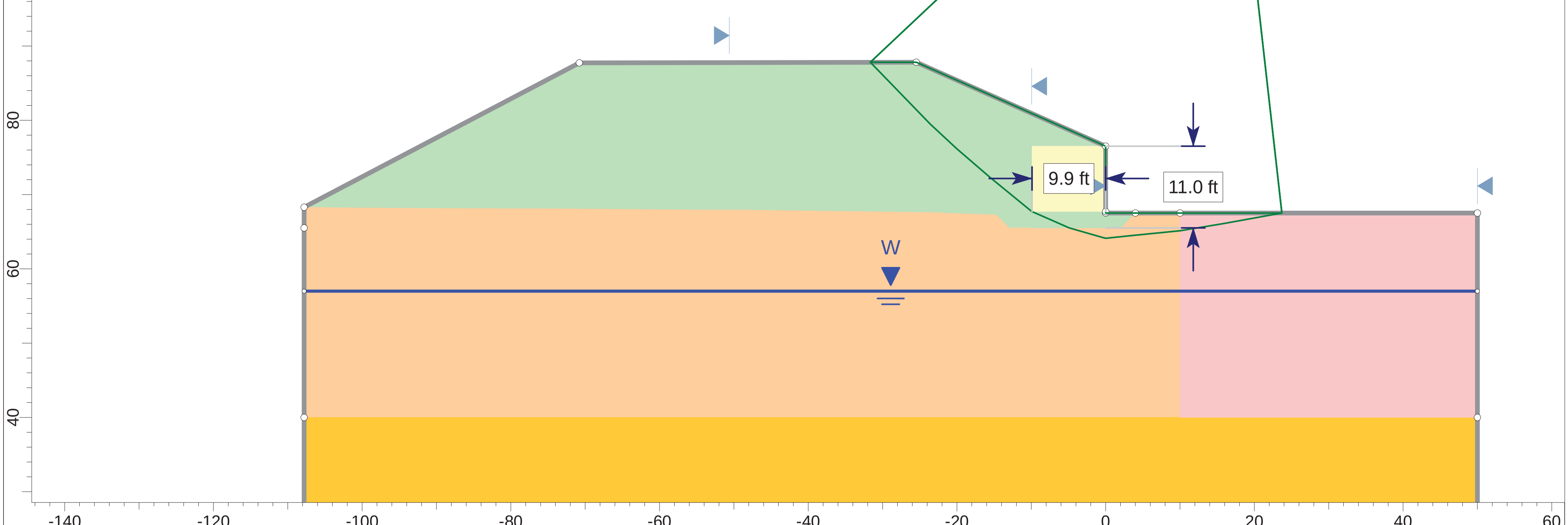
Circular Surface - Wall 2 (STA. 30+50)

Project No. 10-069.200

Figure No. C-23

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Improved Soil		120	Mohr-Coulomb	0	34	Water Surface
Foundation Soil 1		120	Mohr-Coulomb	0	36	Water Surface
Foundation Soil 2		115	Mohr-Coulomb	0	30	Water Surface

Method: spencer
Factor of Safety: 1.15
Axis Location: 16.317, 133.007
Left Slip Surface Endpoint: -31.648, 87.817
Right Slip Surface Endpoint: 23.689, 67.521



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

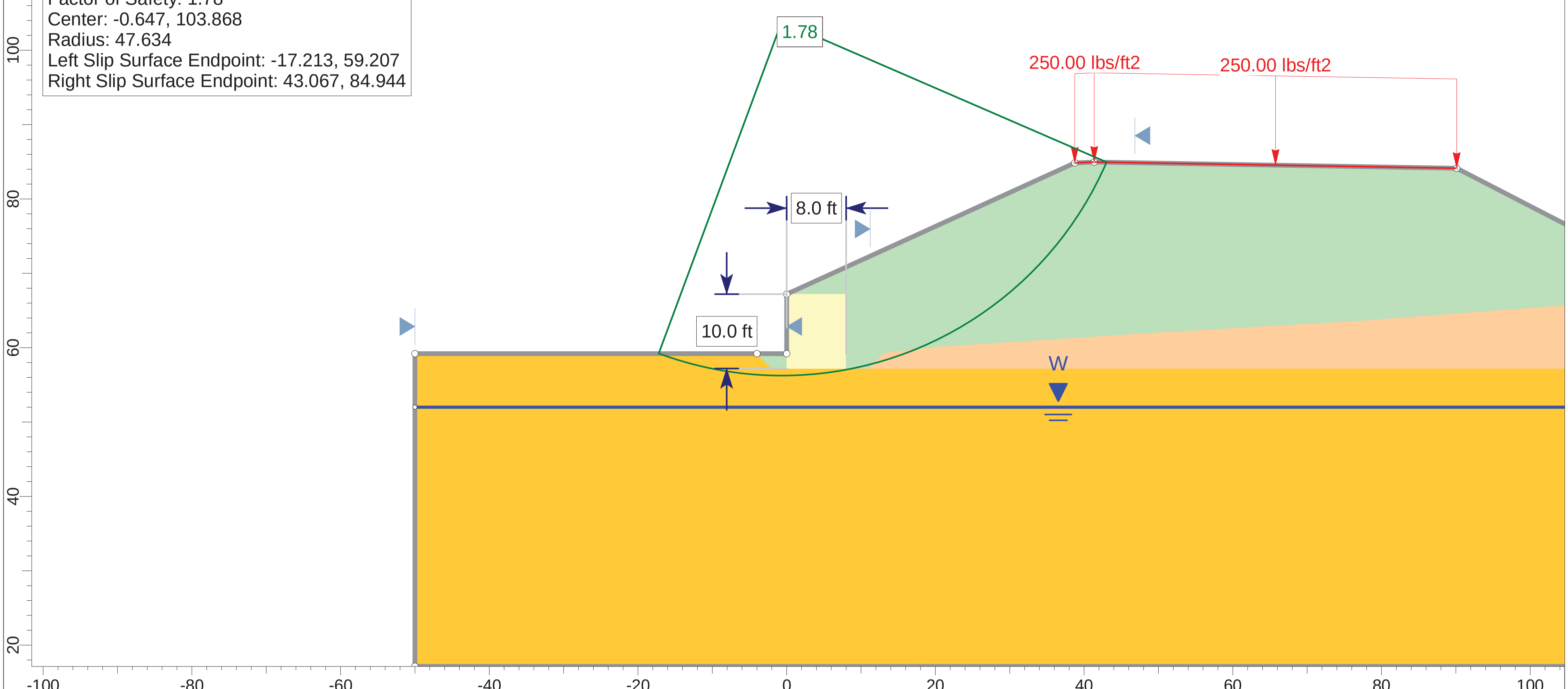
Non-Circular Surface - Wall 2 (STA. 30+50)

Project No. 10-069.200

Figure No. C-24

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.78
Center: -0.647, 103.868
Radius: 47.634
Left Slip Surface Endpoint: -17.213, 59.207
Right Slip Surface Endpoint: 43.067, 84.944



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

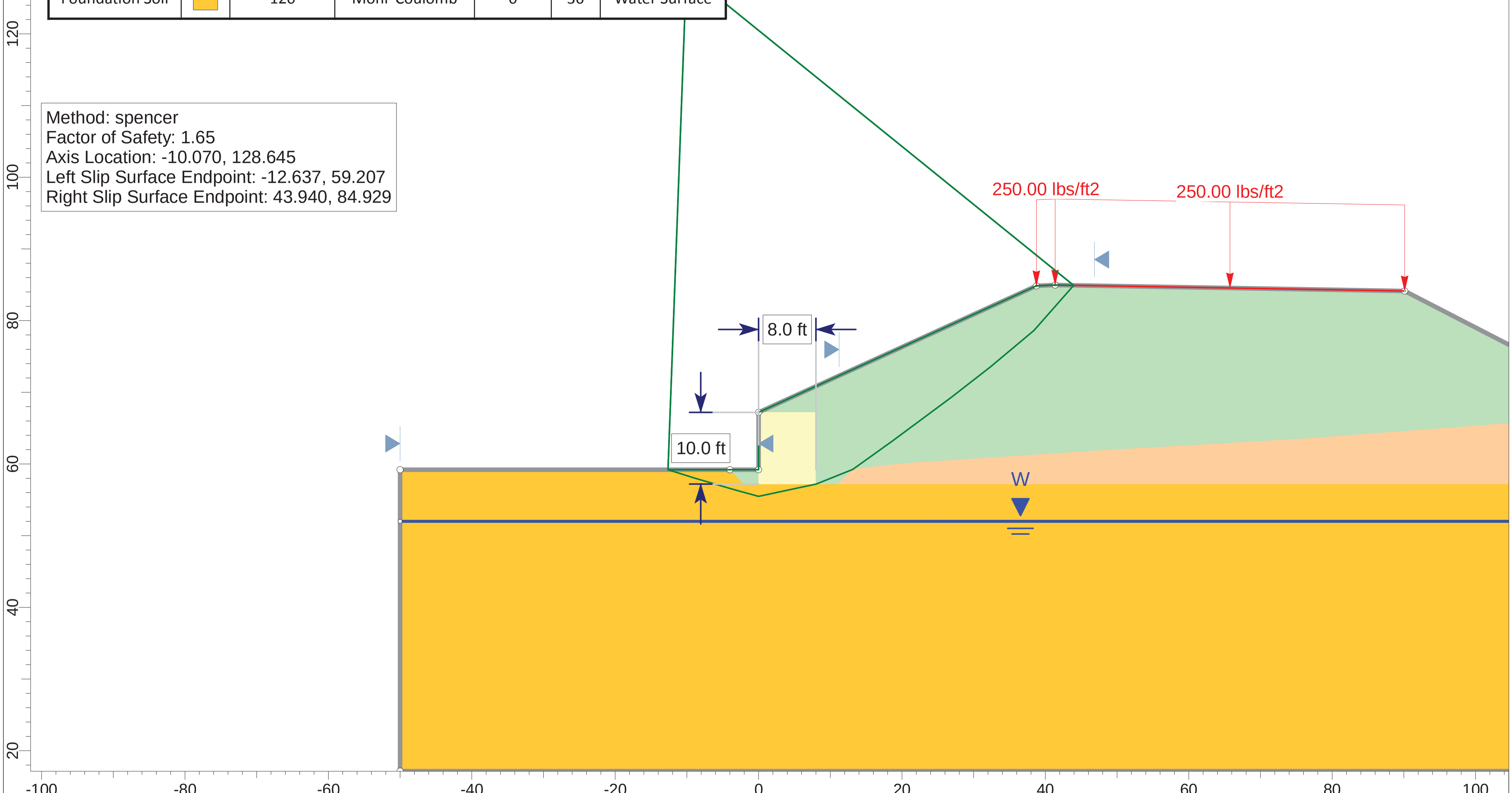
Static Global Stability Analysis

Circular Surface - Wall 3 (STA. 20+50)

Project No.	Figure No.
10-069.200	C-25

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.65
Axis Location: -10.070, 128.645
Left Slip Surface Endpoint: -12.637, 59.207
Right Slip Surface Endpoint: 43.940, 84.929



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

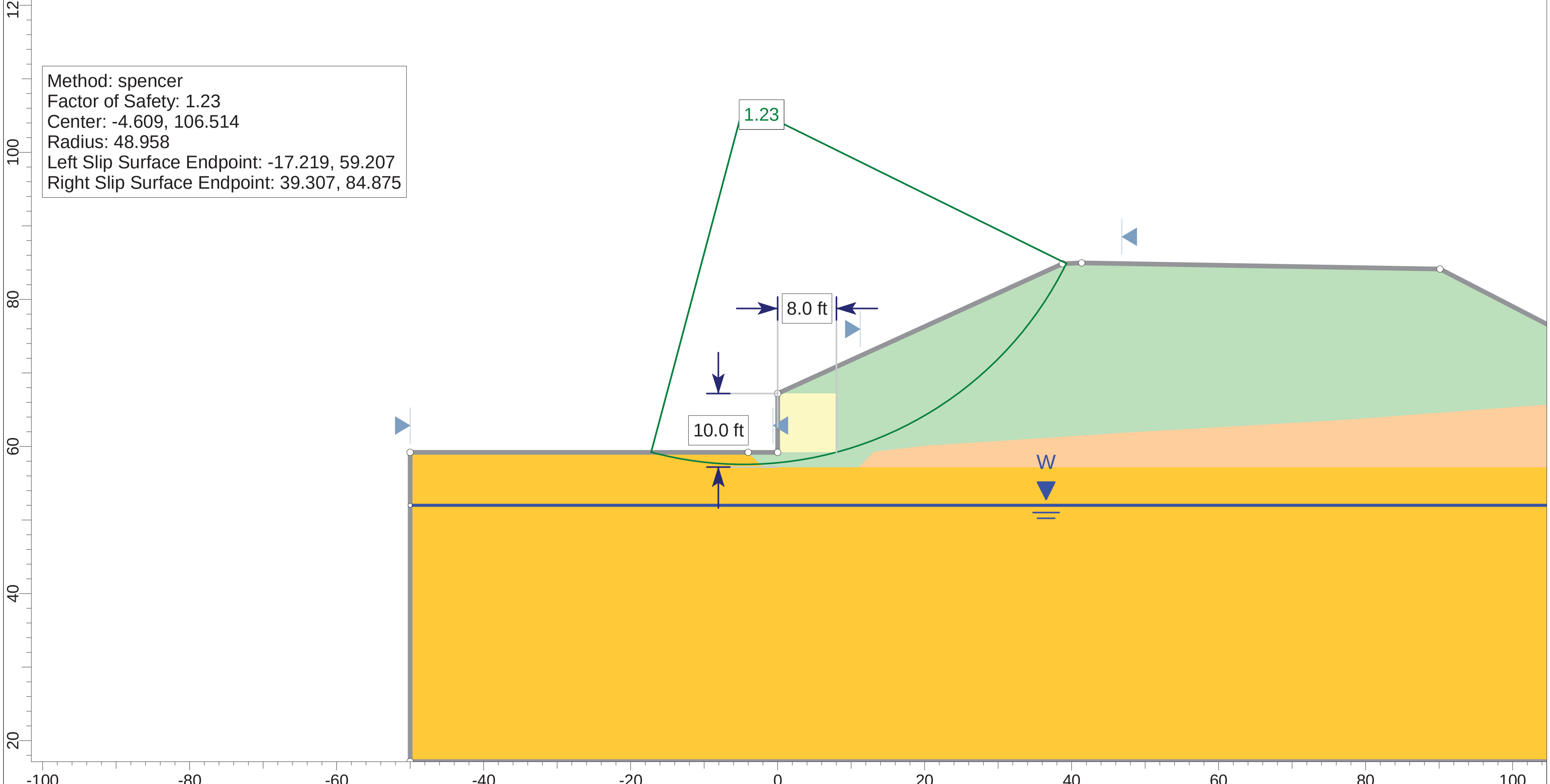
Non-Circular Surface - Wall 3 (STA. 20+50)

Project No. **10-069.200**

Figure No. **C-26**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.23
Center: -4.609, 106.514
Radius: 48.958
Left Slip Surface Endpoint: -17.219, 59.207
Right Slip Surface Endpoint: 39.307, 84.875



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

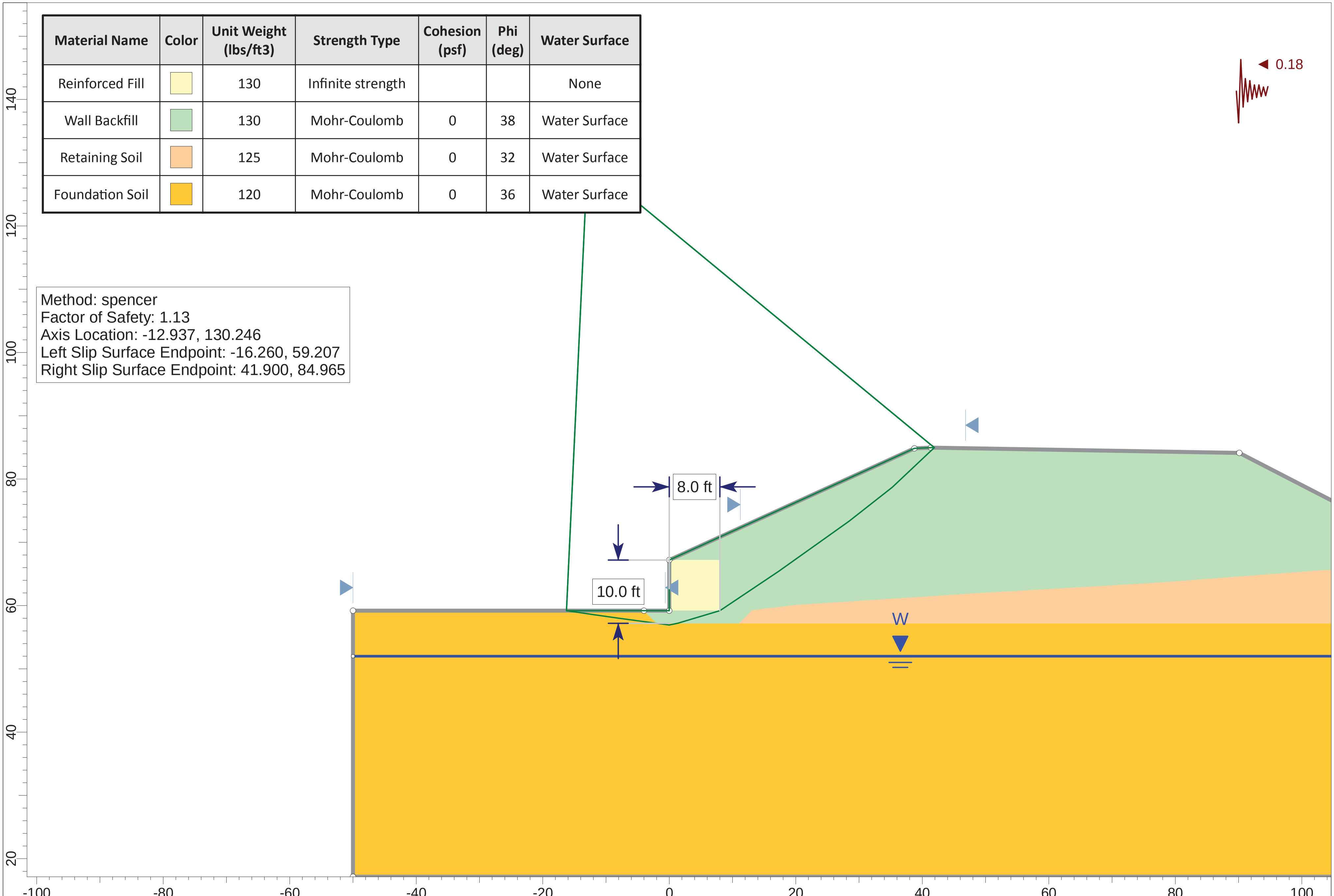
Pseudo-Static Compound Stability Analysis

Circular Surface - Wall 3 (STA. 20+50)

Project No.	Figure No.
10-069.200	C-27

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.13
Axis Location: -12.937, 130.246
Left Slip Surface Endpoint: -16.260, 59.207
Right Slip Surface Endpoint: 41.900, 84.965



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

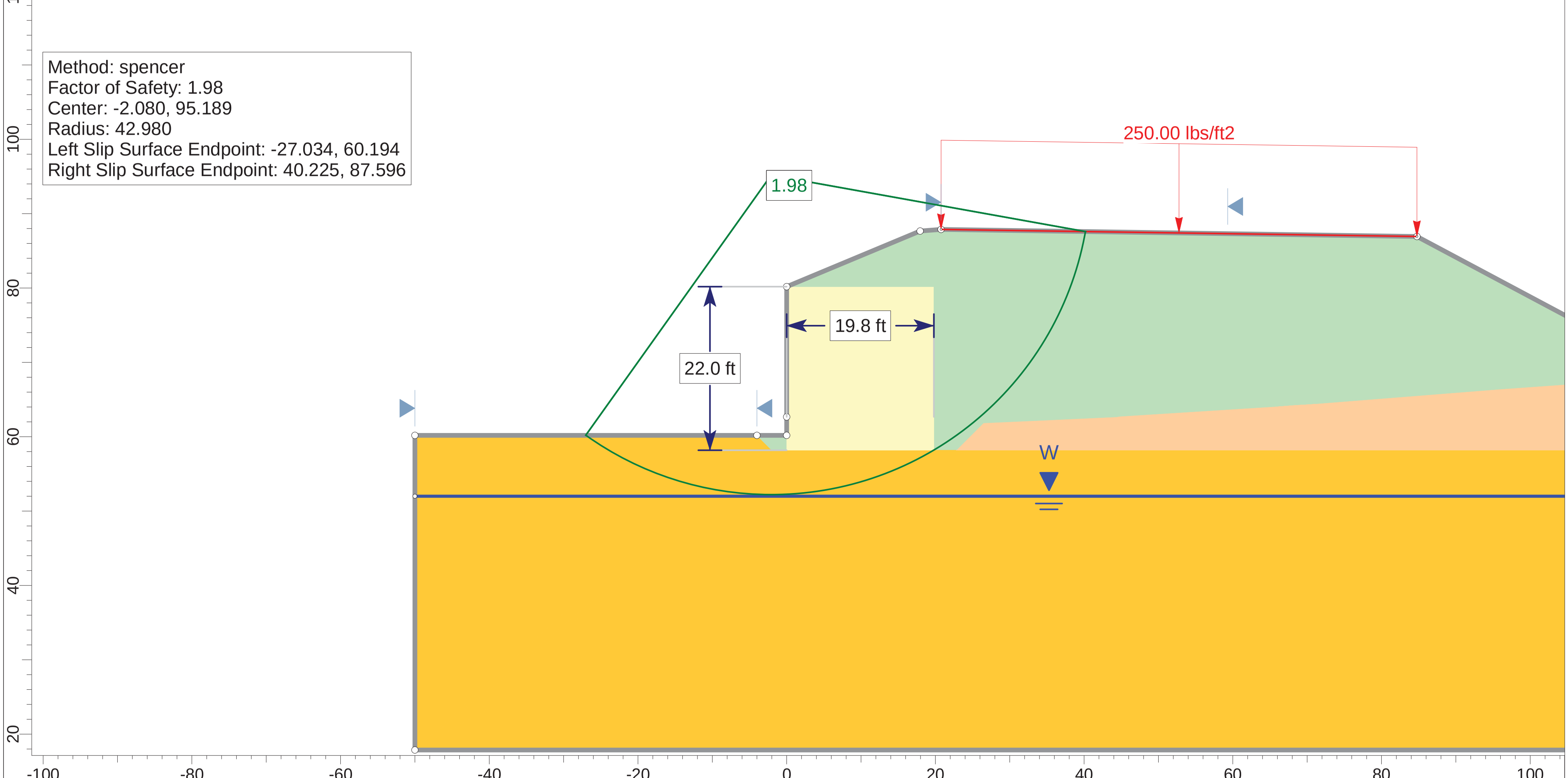
Non-Circular Surface - Wall 3 (STA. 20+50)

Project No. 10-069.200

Figure No. C-28

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.98
Center: -2.080, 95.189
Radius: 42.980
Left Slip Surface Endpoint: -27.034, 60.194
Right Slip Surface Endpoint: 40.225, 87.596



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

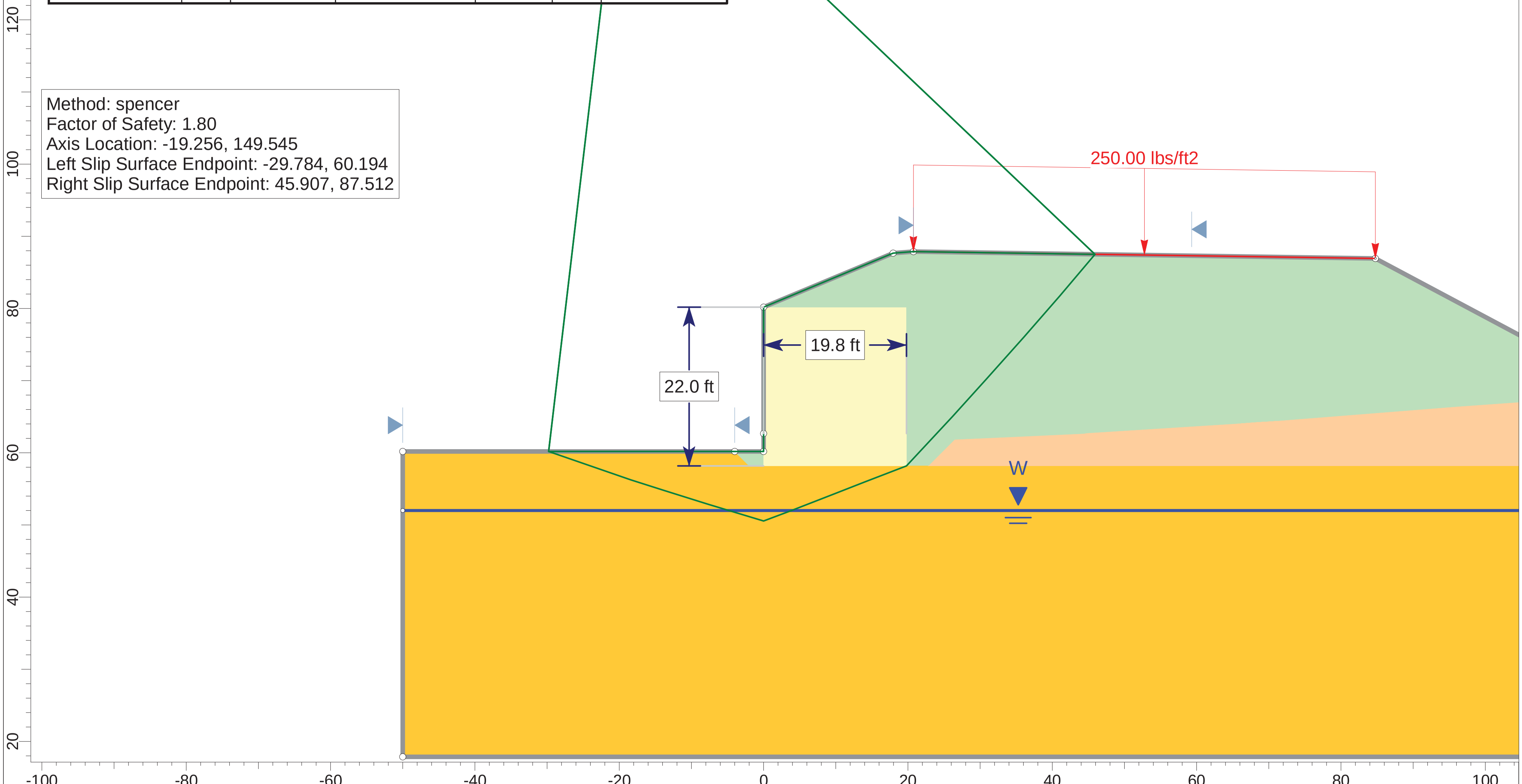
Static Global Stability Analysis

Circular Surface - Wall 3 (STA. 21+00)

Project No.	Figure No.
10-069.200	C-29

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.80
Axis Location: -19.256, 149.545
Left Slip Surface Endpoint: -29.784, 60.194
Right Slip Surface Endpoint: 45.907, 87.512



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

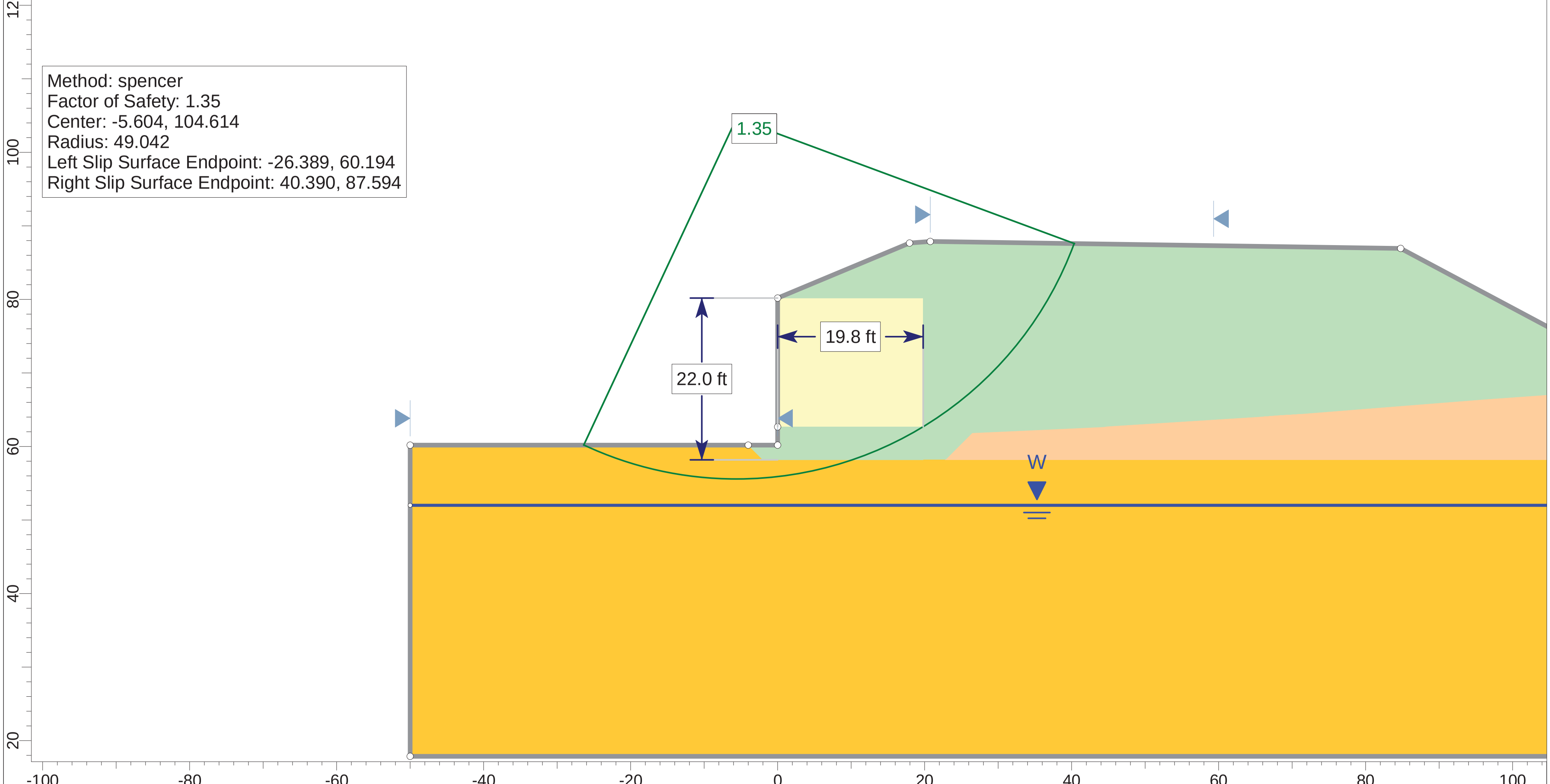
Static Global Stability Analysis

Non-Circular Surface - Wall 3 (STA. 21+00)

Project No.	Figure No.
10-069.200	C-30

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.35
Center: -5.604, 104.614
Radius: 49.042
Left Slip Surface Endpoint: -26.389, 60.194
Right Slip Surface Endpoint: 40.390, 87.594



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

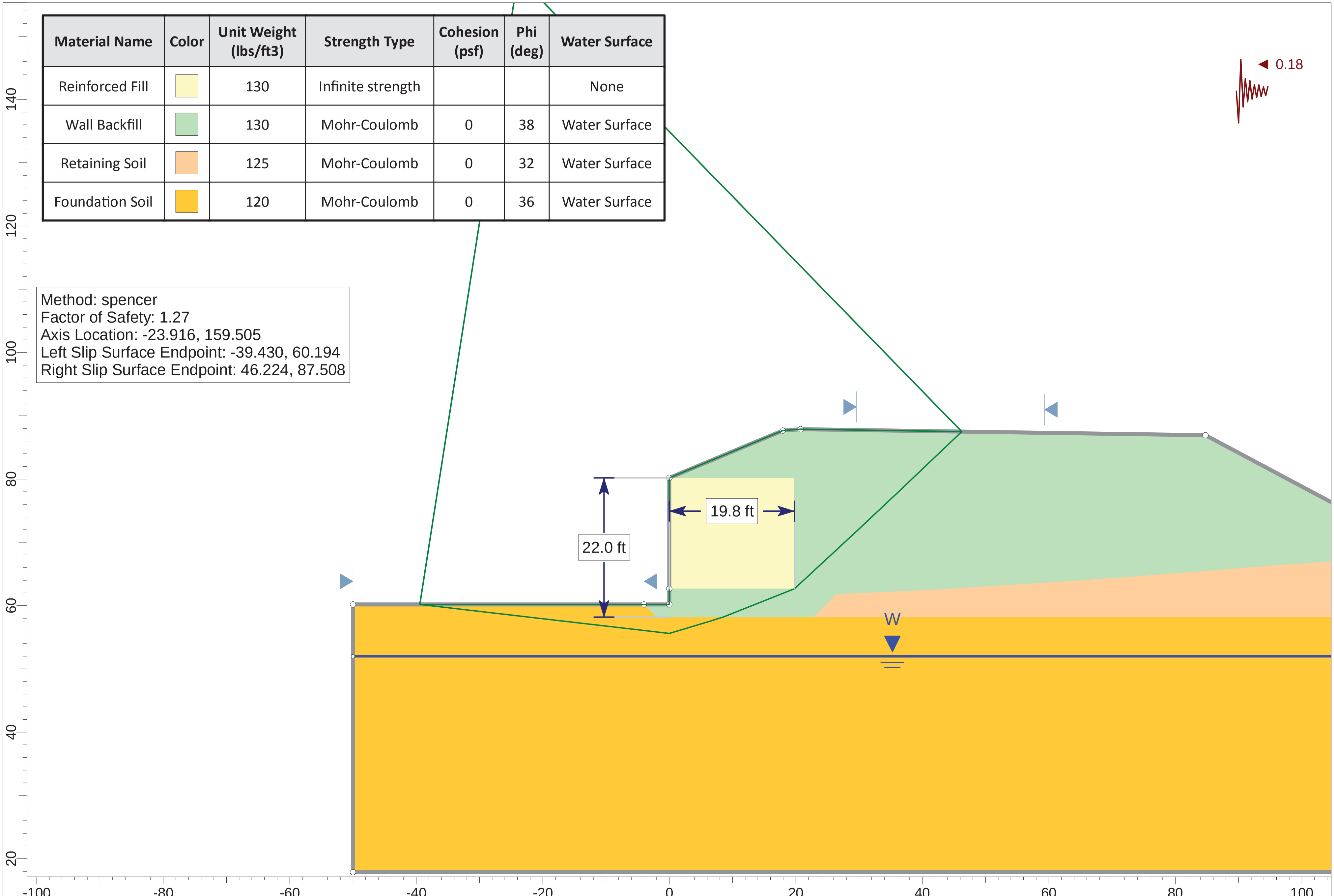
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis
Circular Surface - Wall 3 (STA. 21+00)

Project No. **10-069.200**
Figure No. **C-31**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.27
Axis Location: -23.916, 159.505
Left Slip Surface Endpoint: -39.430, 60.194
Right Slip Surface Endpoint: 46.224, 87.508



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

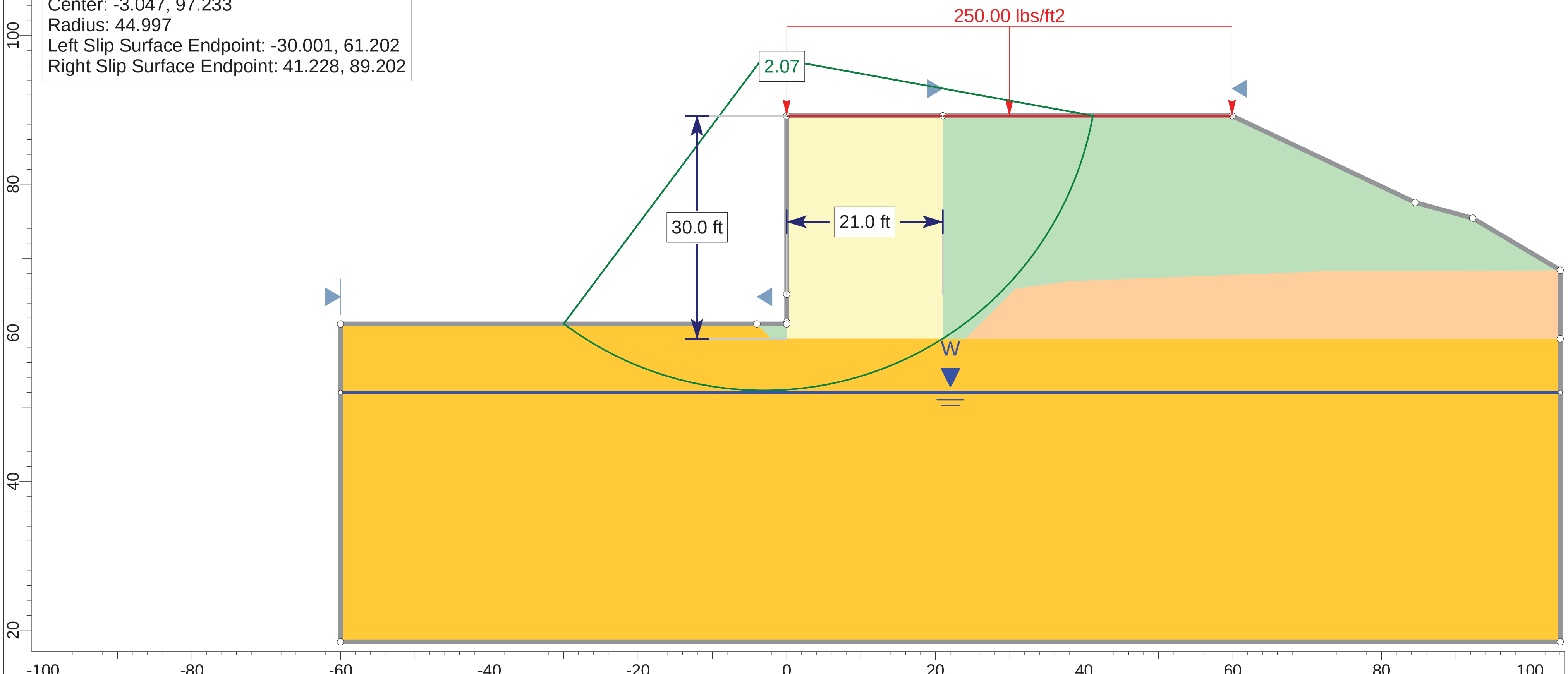
Non-Circular Surface - Wall 3 (STA. 21+00)

Project No. **10-069.200**

Figure No. **C-32**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 2.07
Center: -3.047, 97.233
Radius: 44.997
Left Slip Surface Endpoint: -30.001, 61.202
Right Slip Surface Endpoint: 41.228, 89.202



PanGEO INCORPORATED

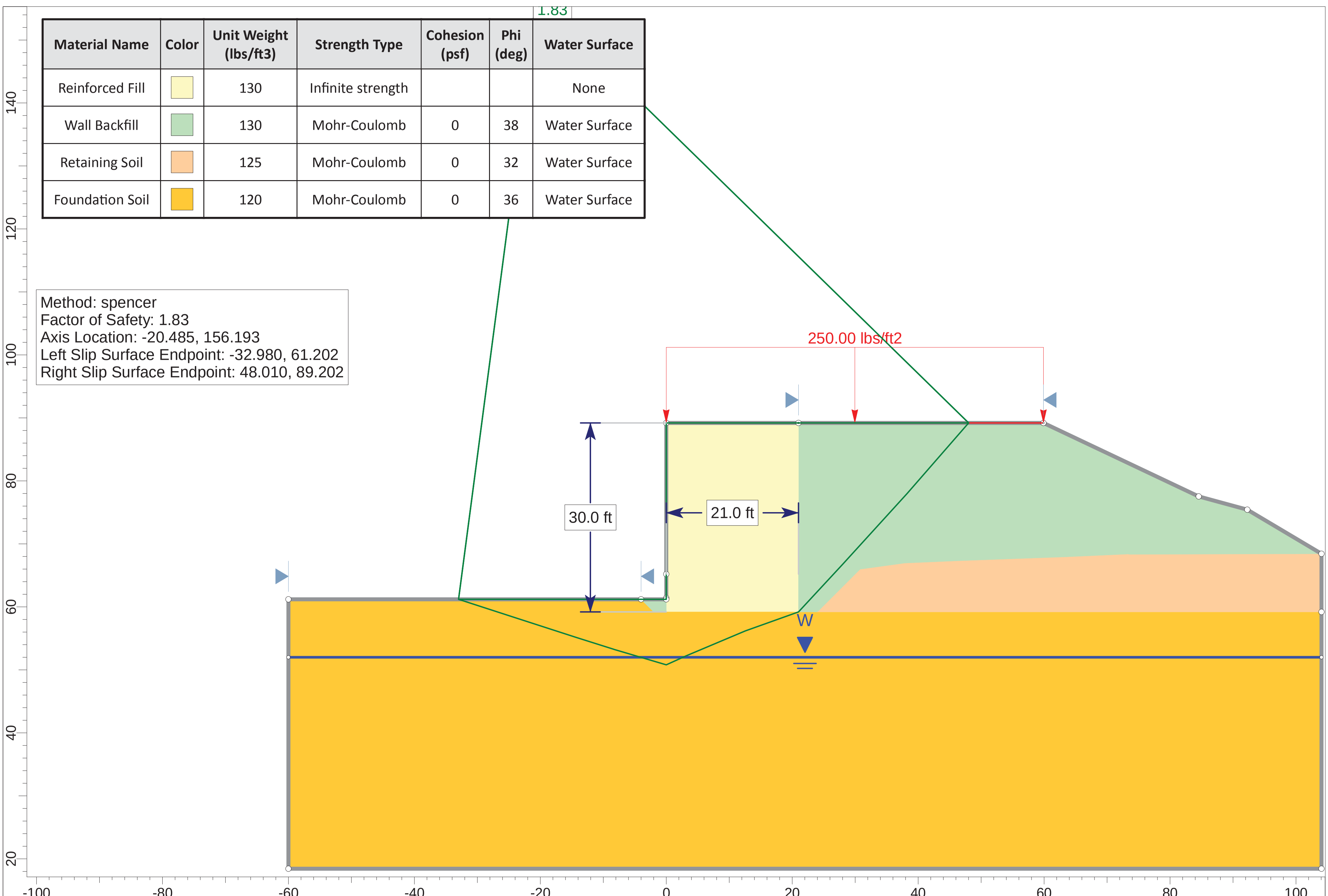
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

Circular Surface - Wall 3 (STA. 21+34)

Project No.	Figure No.
10-069.200	C-33



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.83
Axis Location: -20.485, 156.193
Left Slip Surface Endpoint: -32.980, 61.202
Right Slip Surface Endpoint: 48.010, 89.202

PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

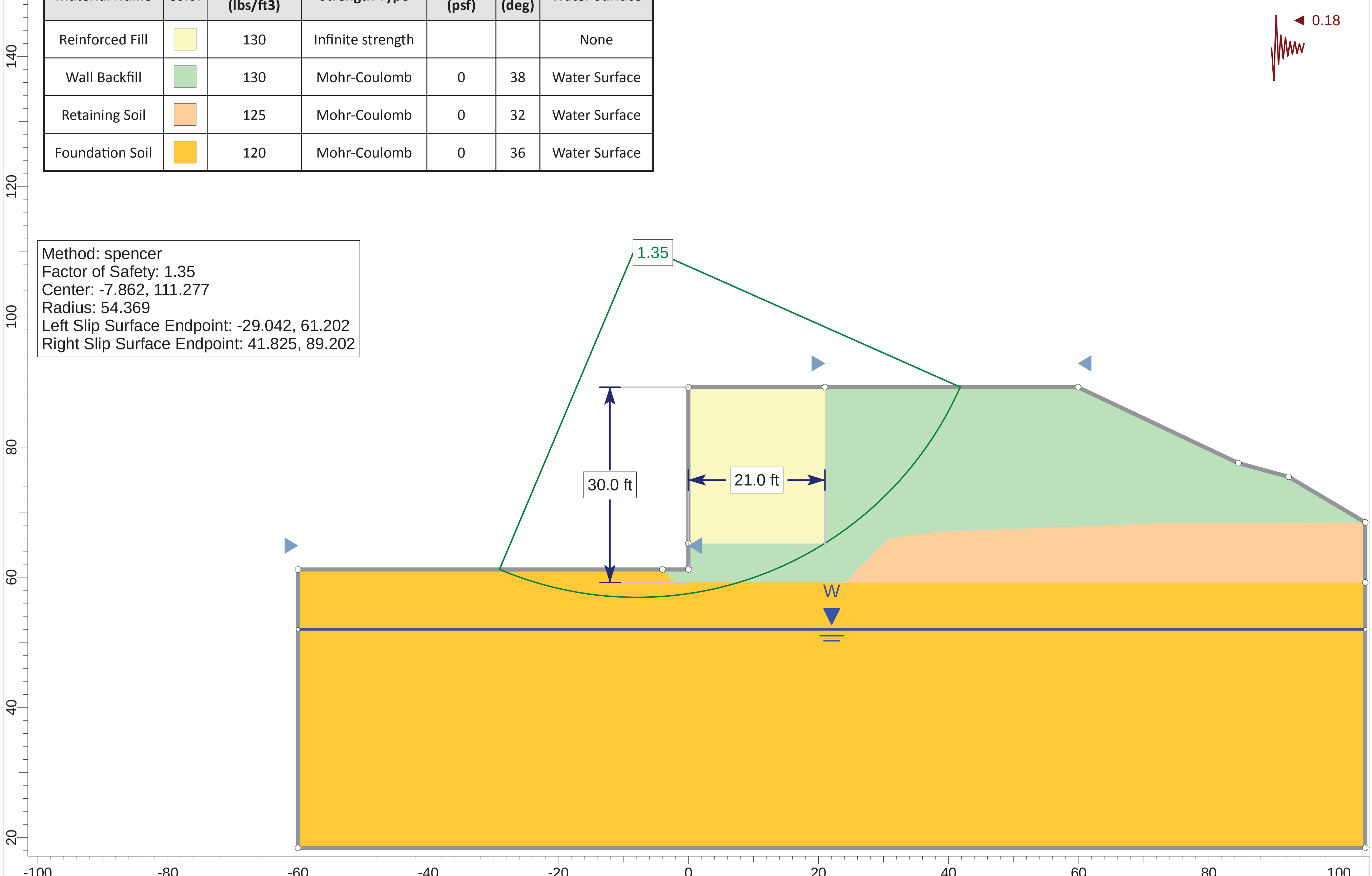
Non-Circular Surface - Wall 3 (STA. 21+34)

Project No. **10-069.200**

Figure No. **C-34**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.35
Center: -7.862, 111.277
Radius: 54.369
Left Slip Surface Endpoint: -29.042, 61.202
Right Slip Surface Endpoint: 41.825, 89.202



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

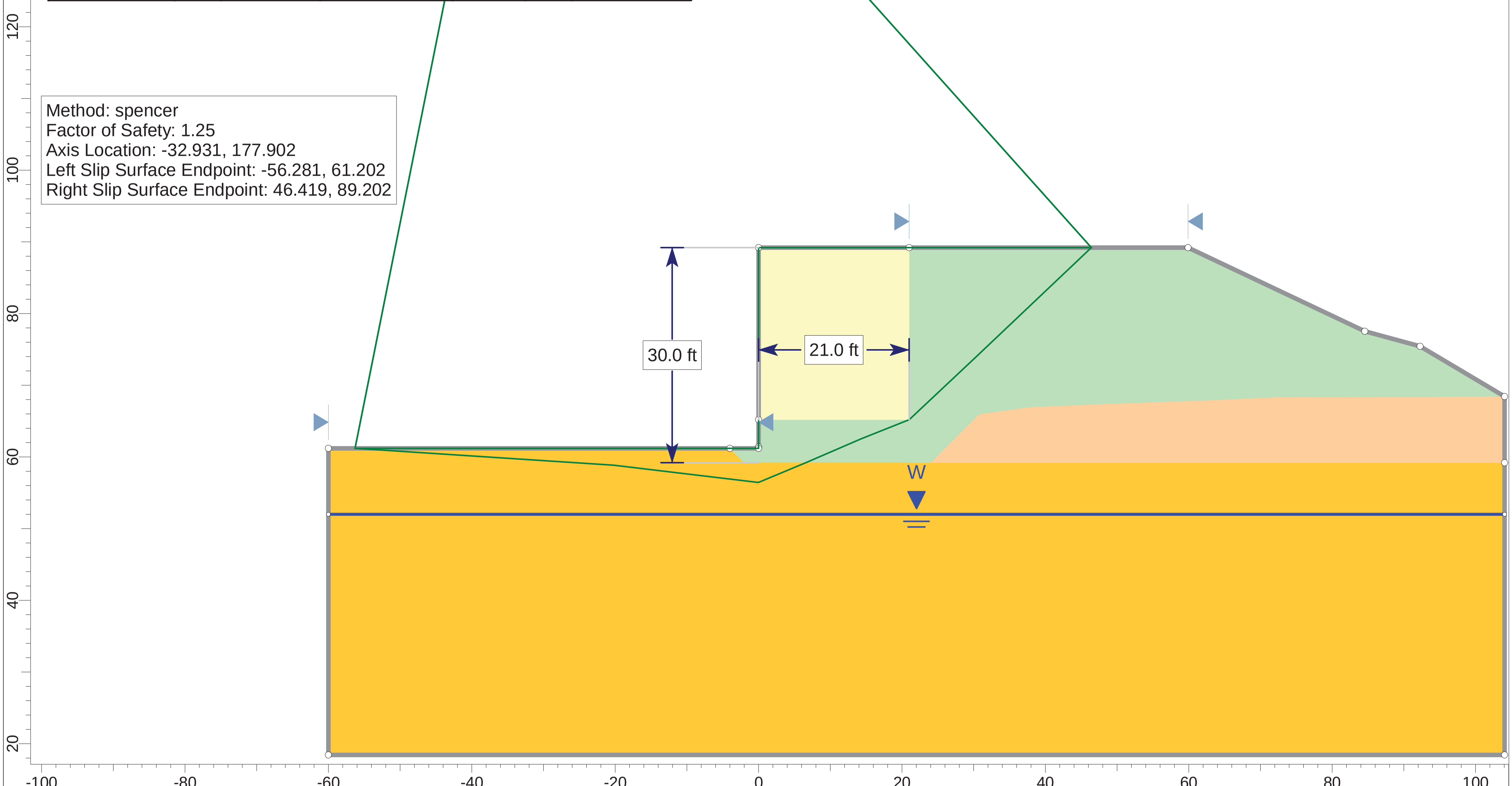
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

Circular Surface - Wall 3 (STA. 21+34)

Project No.	Figure No.
10-069.200	C-35

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

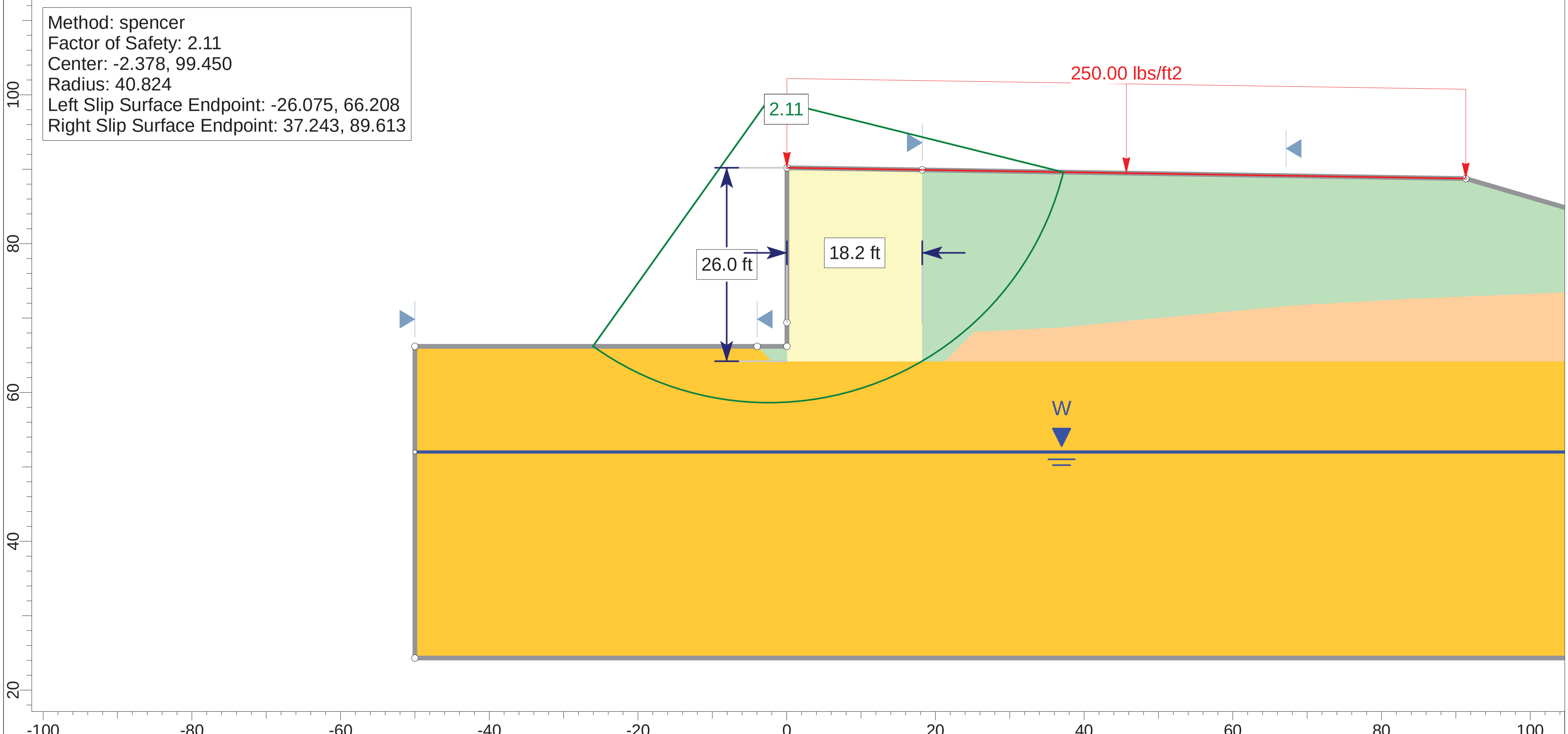
Pseudo-Static Compound Stability Analysis

Non-Circular Surface - Wall 3 (STA. 21+34)

Project No.	Figure No.
10-069.200	C-36

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 2.11
Center: -2.378, 99.450
Radius: 40.824
Left Slip Surface Endpoint: -26.075, 66.208
Right Slip Surface Endpoint: 37.243, 89.613



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

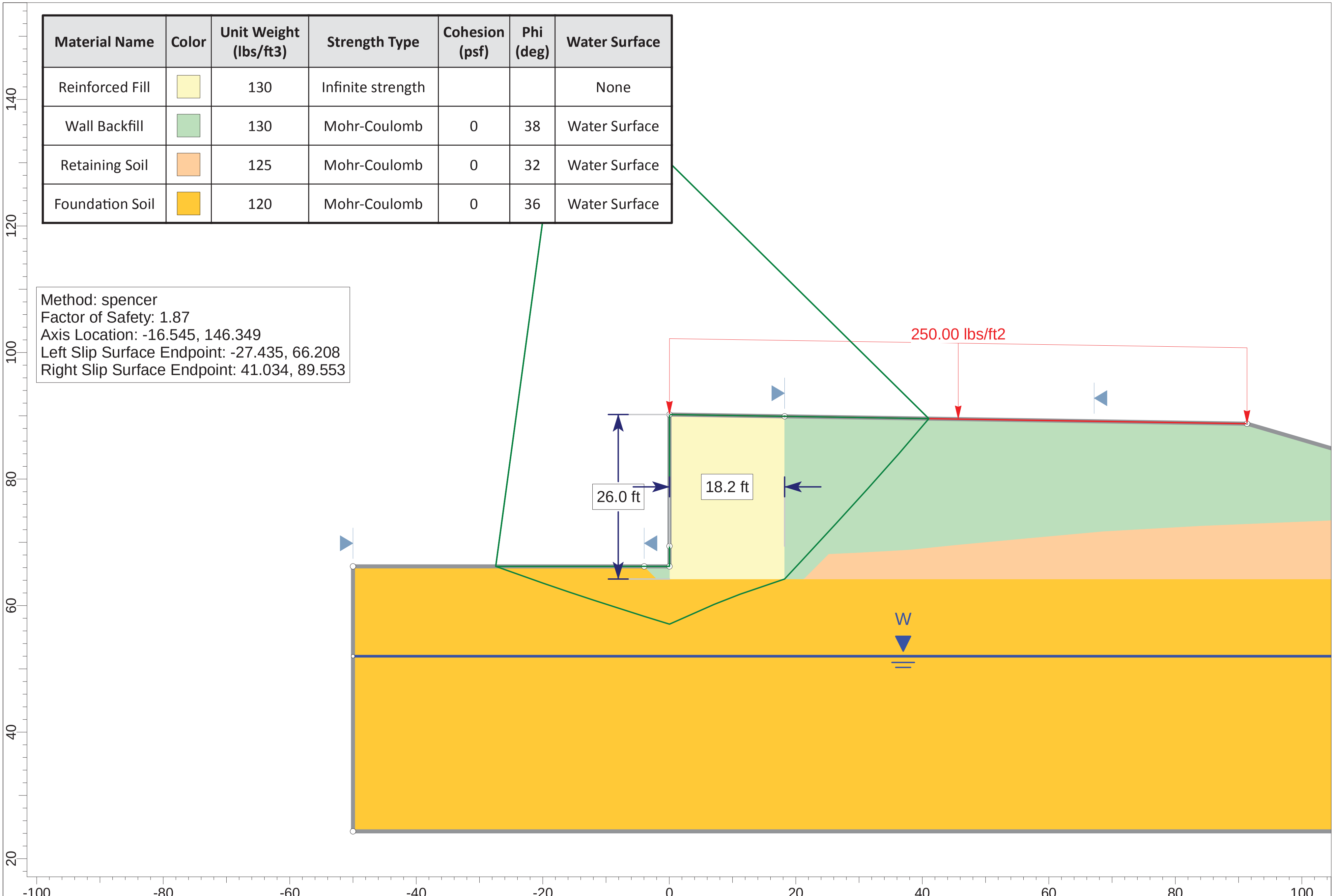
Circular Surface - Wall 4 (STA. 40+00)

Project No. 10-069.200

Figure No. C-37

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.87
Axis Location: -16.545, 146.349
Left Slip Surface Endpoint: -27.435, 66.208
Right Slip Surface Endpoint: 41.034, 89.553



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

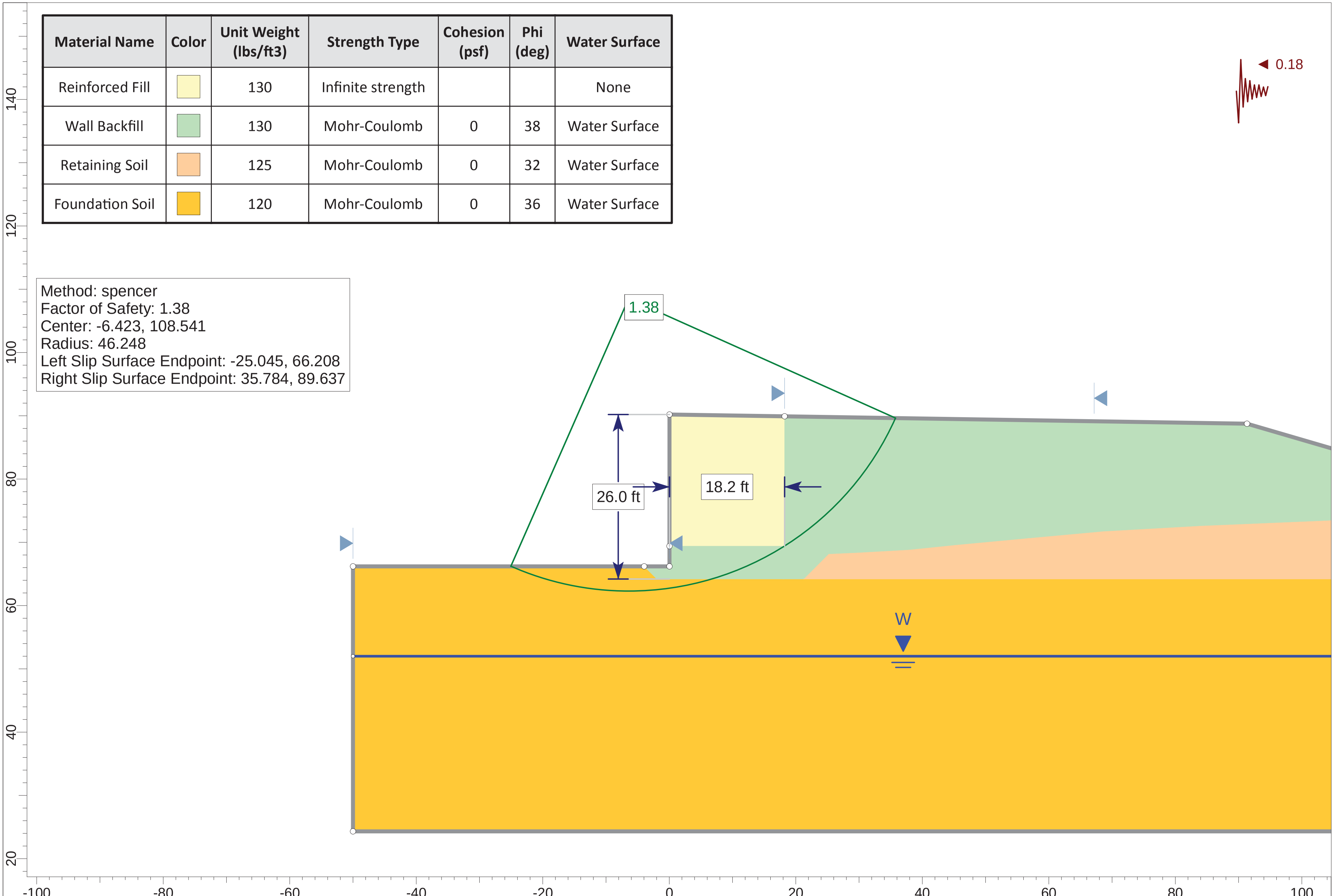
Non-Circular Surface - Wall 4 (STA. 40+00)

Project No. 10-069.200

Figure No. C-38

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.38
Center: -6.423, 108.541
Radius: 46.248
Left Slip Surface Endpoint: -25.045, 66.208
Right Slip Surface Endpoint: 35.784, 89.637



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

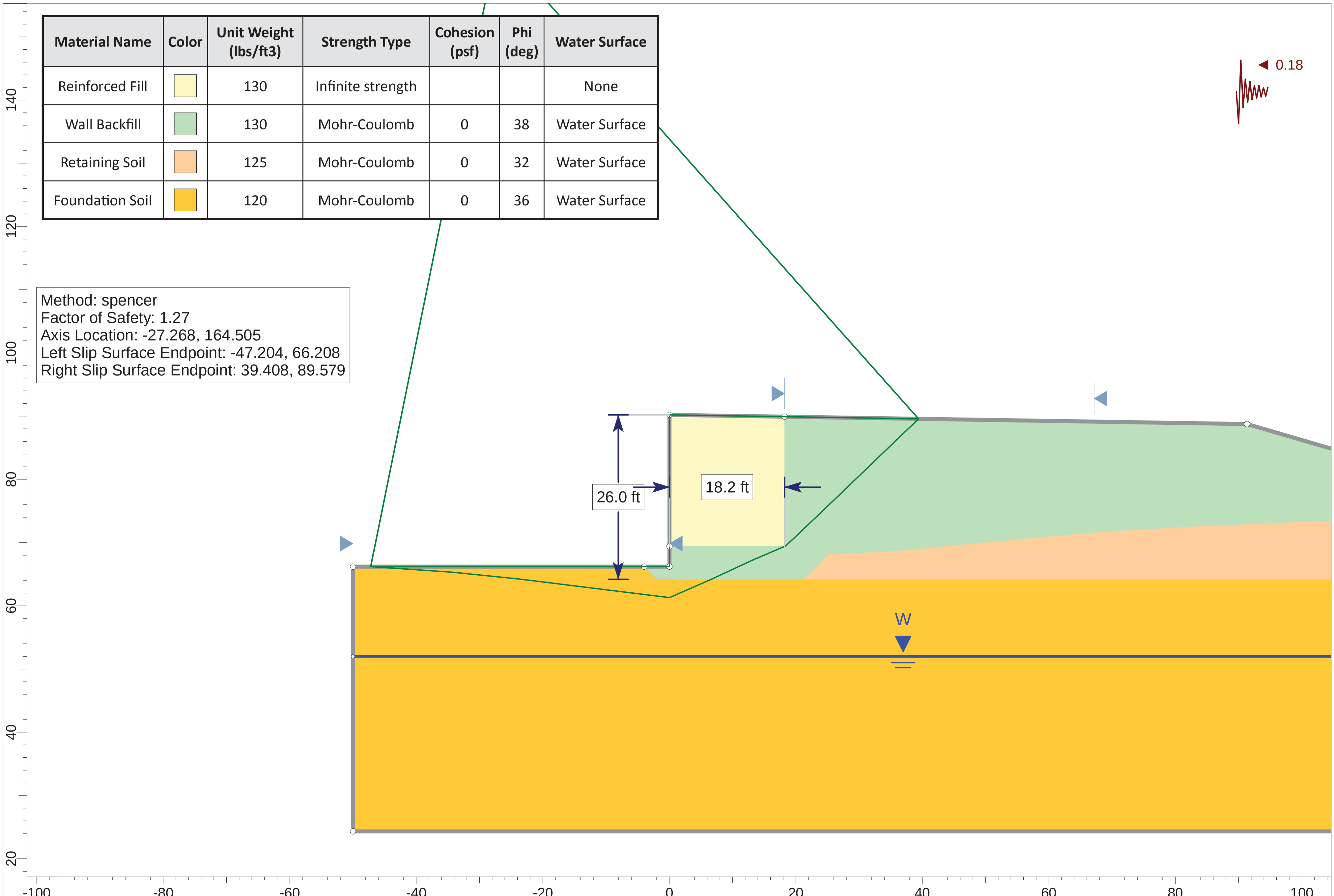
I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis
Circular Surface - Wall 4 (STA. 40+00)

Project No.	Figure No.
10-069.200	C-39

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.27
Axis Location: -27.268, 164.505
Left Slip Surface Endpoint: -47.204, 66.208
Right Slip Surface Endpoint: 39.408, 89.579



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

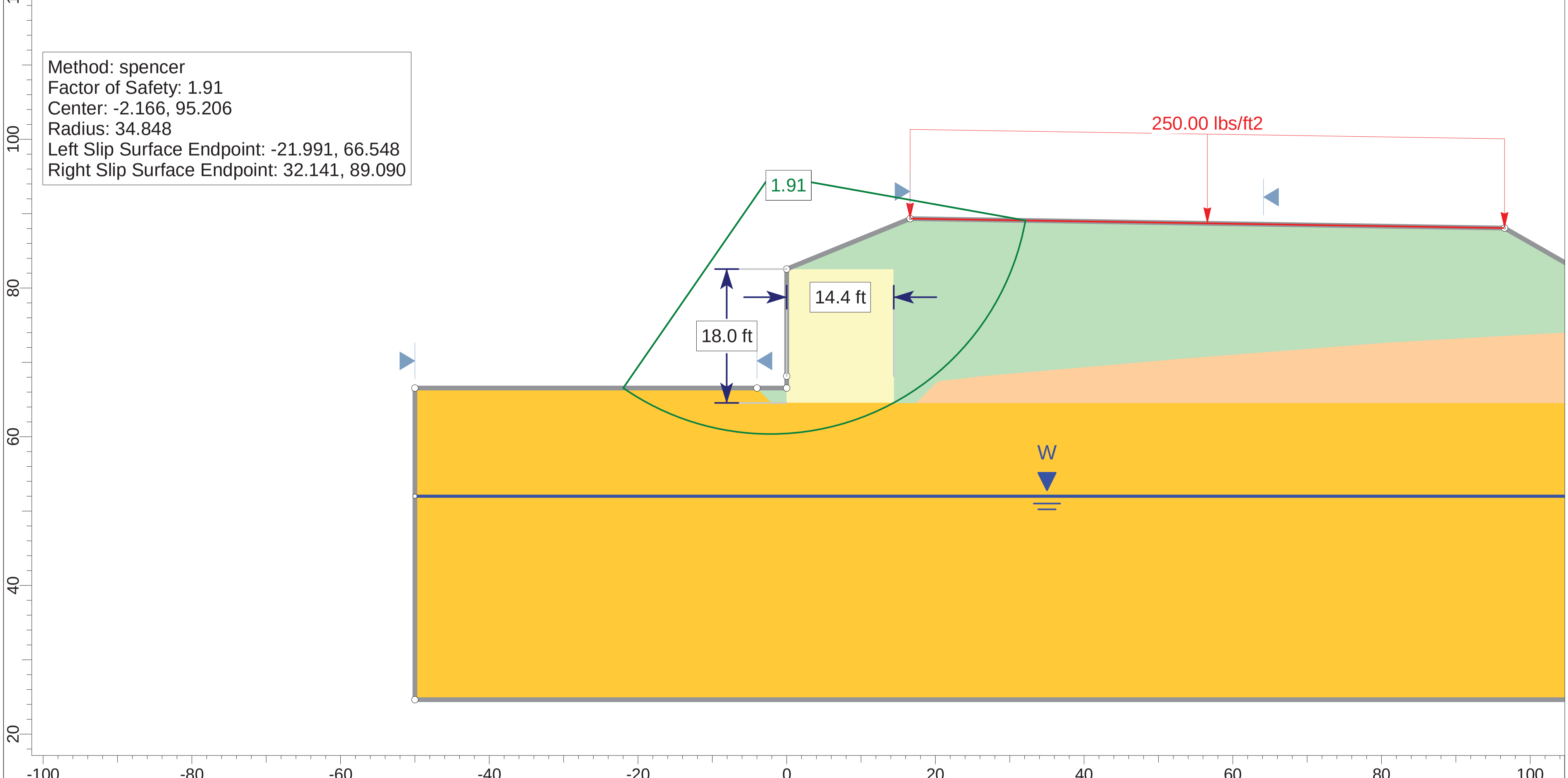
Non-Circular Surface - Wall 4 (STA. 40+00)

Project No. 10-069.200

Figure No. C-40

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.91
Center: -2.166, 95.206
Radius: 34.848
Left Slip Surface Endpoint: -21.991, 66.548
Right Slip Surface Endpoint: 32.141, 89.090



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

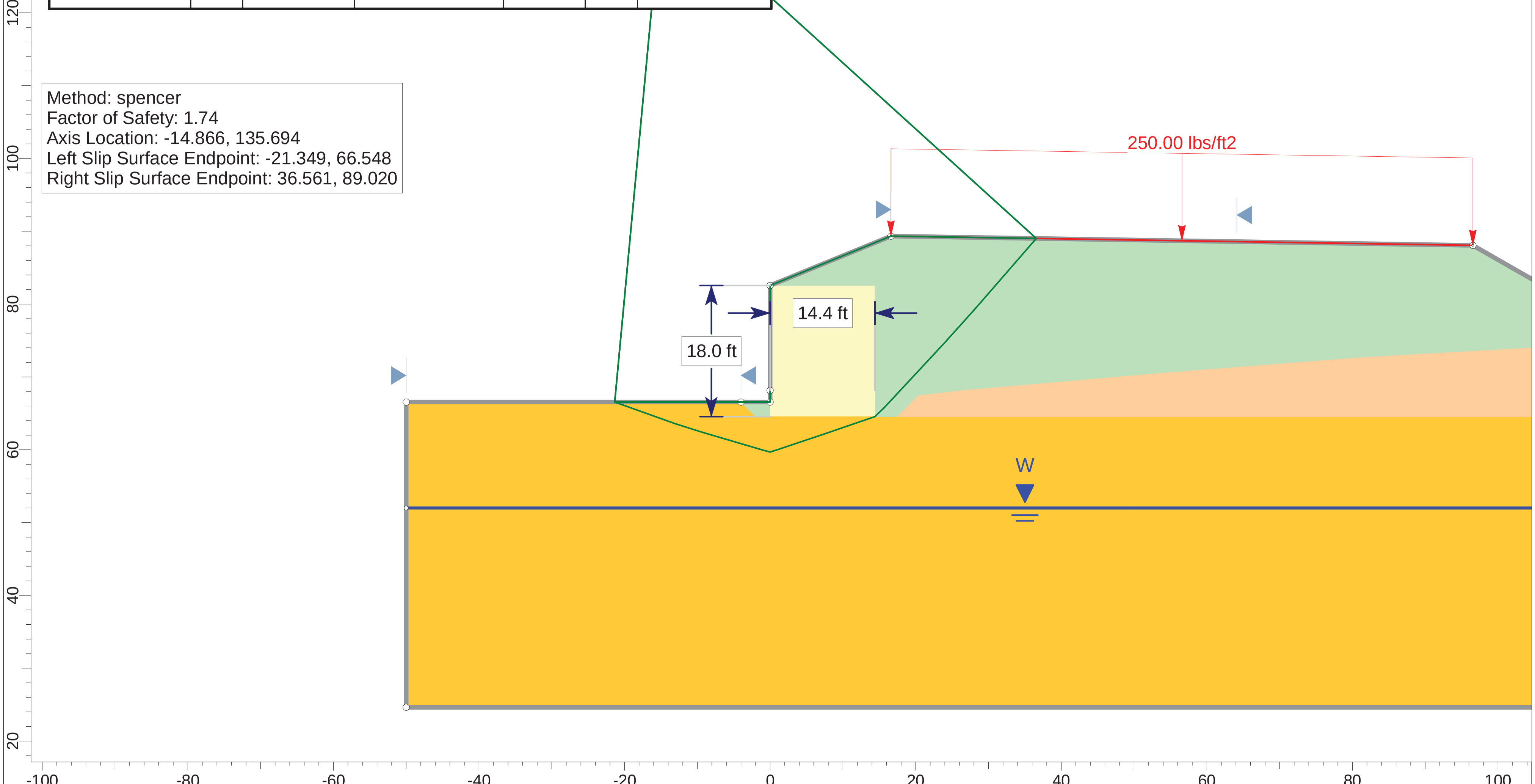
Static Global Stability Analysis

Circular Surface - Wall 4 (STA. 40+25)

Project No.	Figure No.
10-069.200	C-41

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.74
Axis Location: -14.866, 135.694
Left Slip Surface Endpoint: -21.349, 66.548
Right Slip Surface Endpoint: 36.561, 89.020



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Static Global Stability Analysis

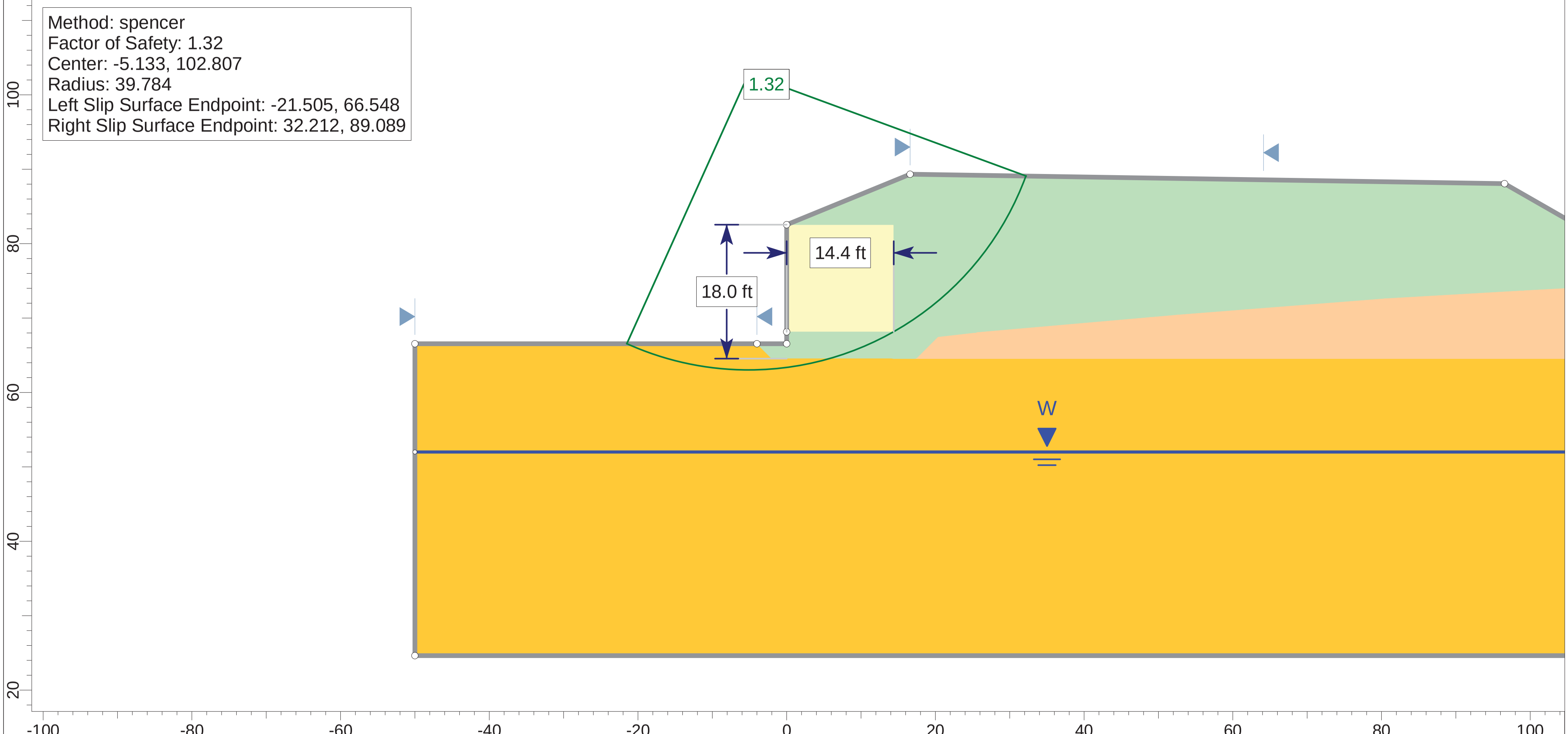
Non-Circular Surface - Wall 4 (STA. 40+25)

Project No. 10-069.200

Figure No. C-42

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.32
Center: -5.133, 102.807
Radius: 39.784
Left Slip Surface Endpoint: -21.505, 66.548
Right Slip Surface Endpoint: 32.212, 89.089



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

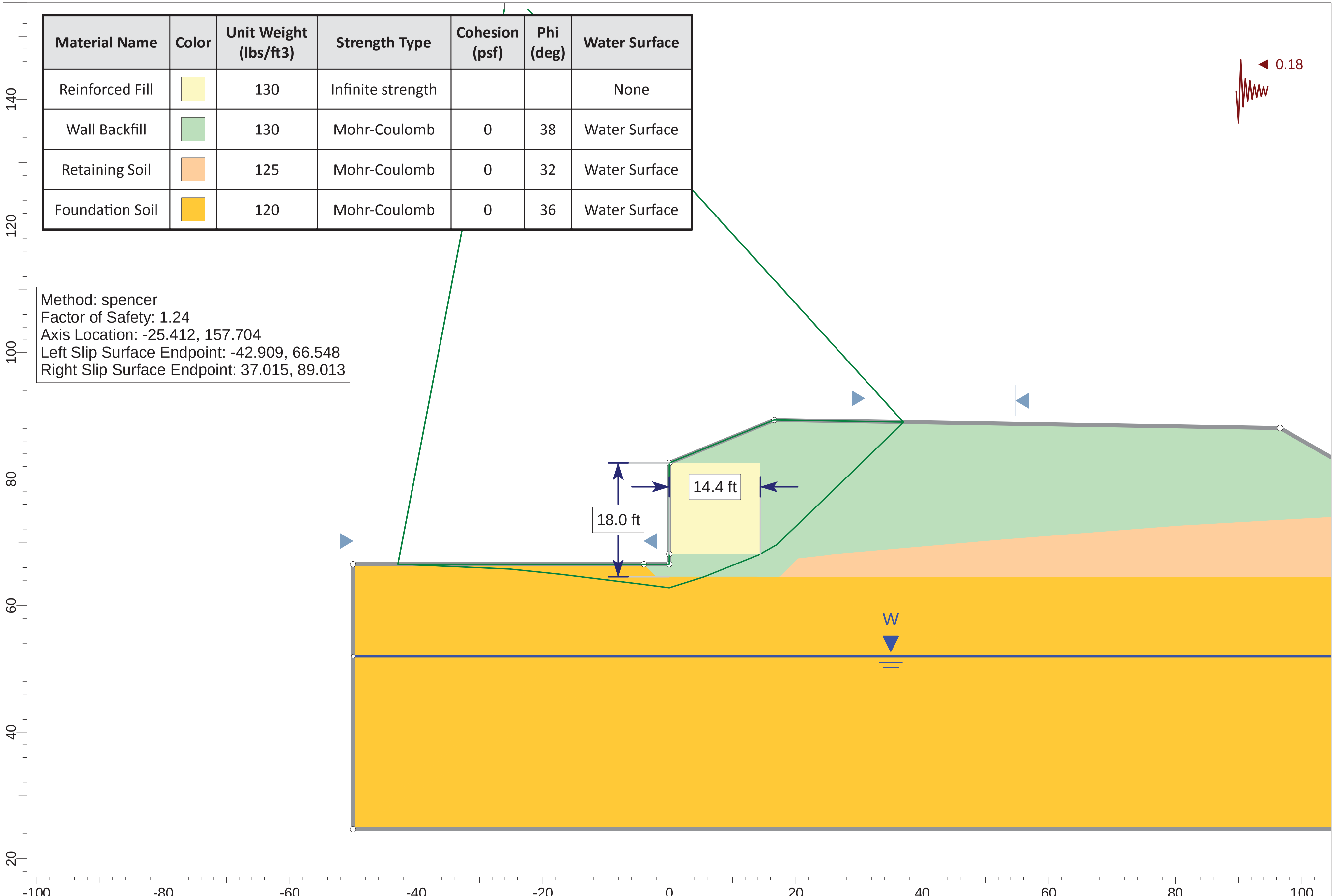
Pseudo-Static Compound Stability Analysis
Circular Surface - Wall 4 (STA. 40+25)

Project No. 10-069.200

Figure No. C-43

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.24
Axis Location: -25.412, 157.704
Left Slip Surface Endpoint: -42.909, 66.548
Right Slip Surface Endpoint: 37.015, 89.013



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

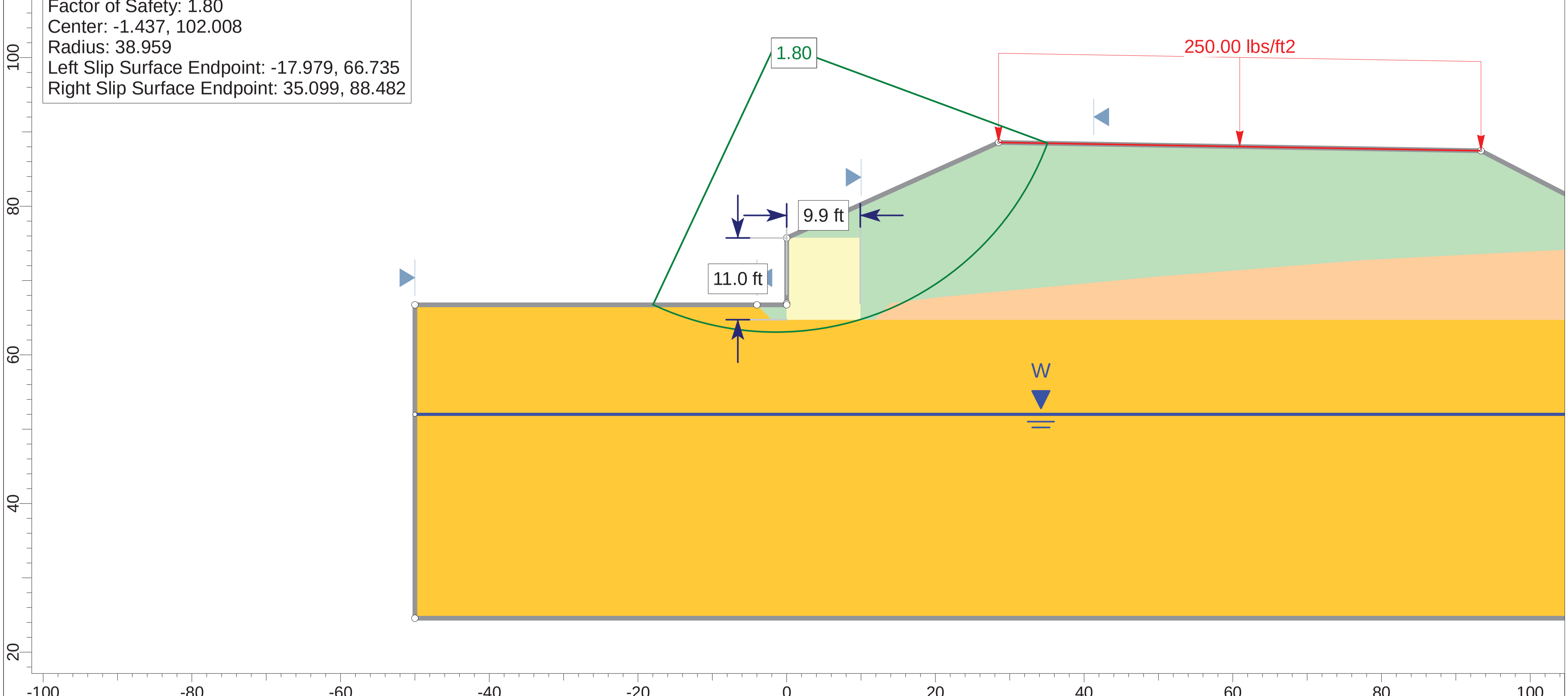
Non-Circular Surface - Wall 4 (STA. 40+25)

Project No. 10-069.200

Figure No. C-44

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.80
Center: -1.437, 102.008
Radius: 38.959
Left Slip Surface Endpoint: -17.979, 66.735
Right Slip Surface Endpoint: 35.099, 88.482



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

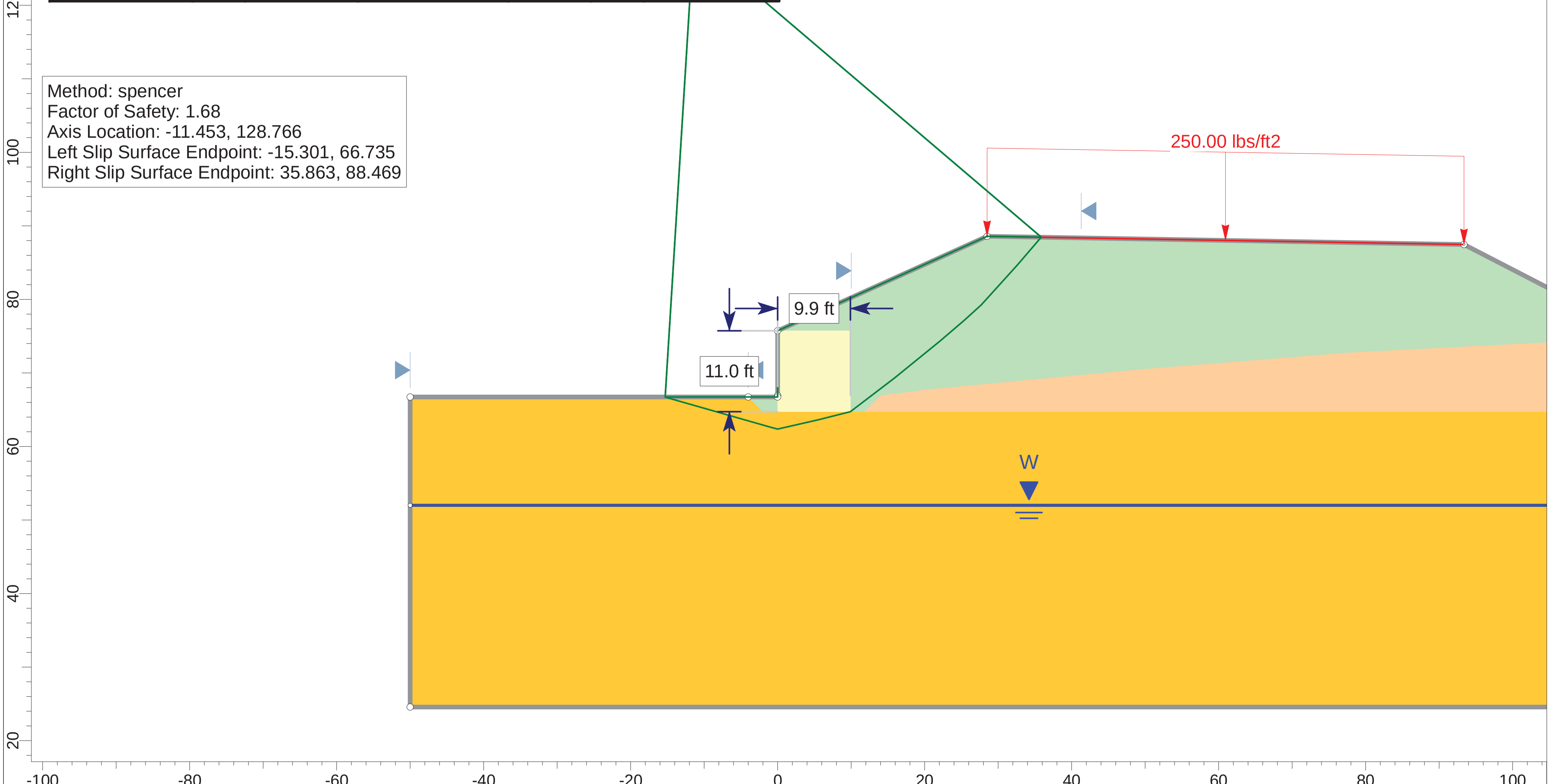
Static Global Stability Analysis

Circular Surface - Wall 4 (STA. 40+50)

Project No. **10-069.200**

Figure No. **C-45**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

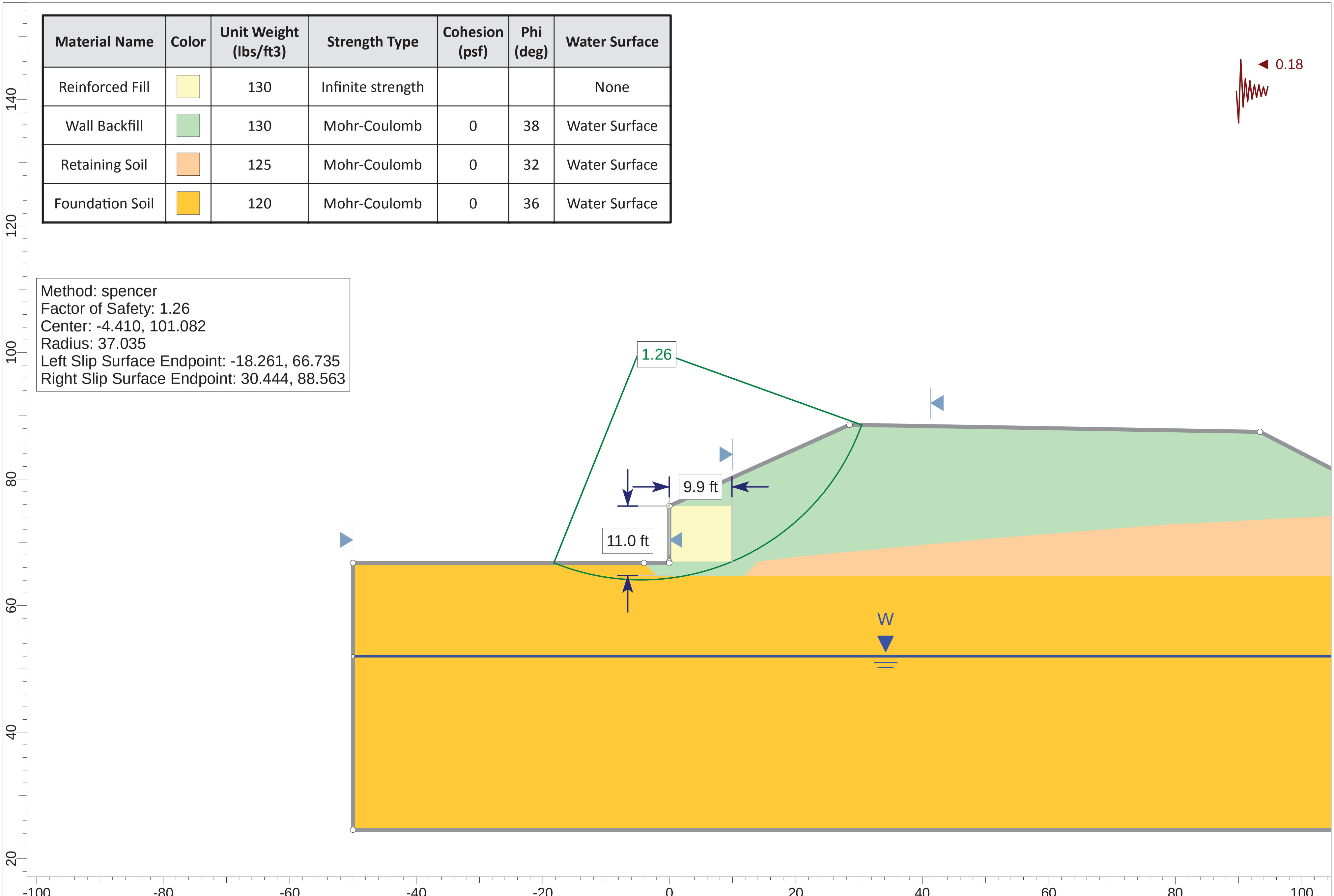
Static Global Stability Analysis

Non-Circular Surface - Wall 4 (STA. 40+50)

Project No.	Figure No.
10-069.200	**C-46**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.26
Center: -4.410, 101.082
Radius: 37.035
Left Slip Surface Endpoint: -18.261, 66.735
Right Slip Surface Endpoint: 30.444, 88.563



PanGEO INCORPORATED

SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis

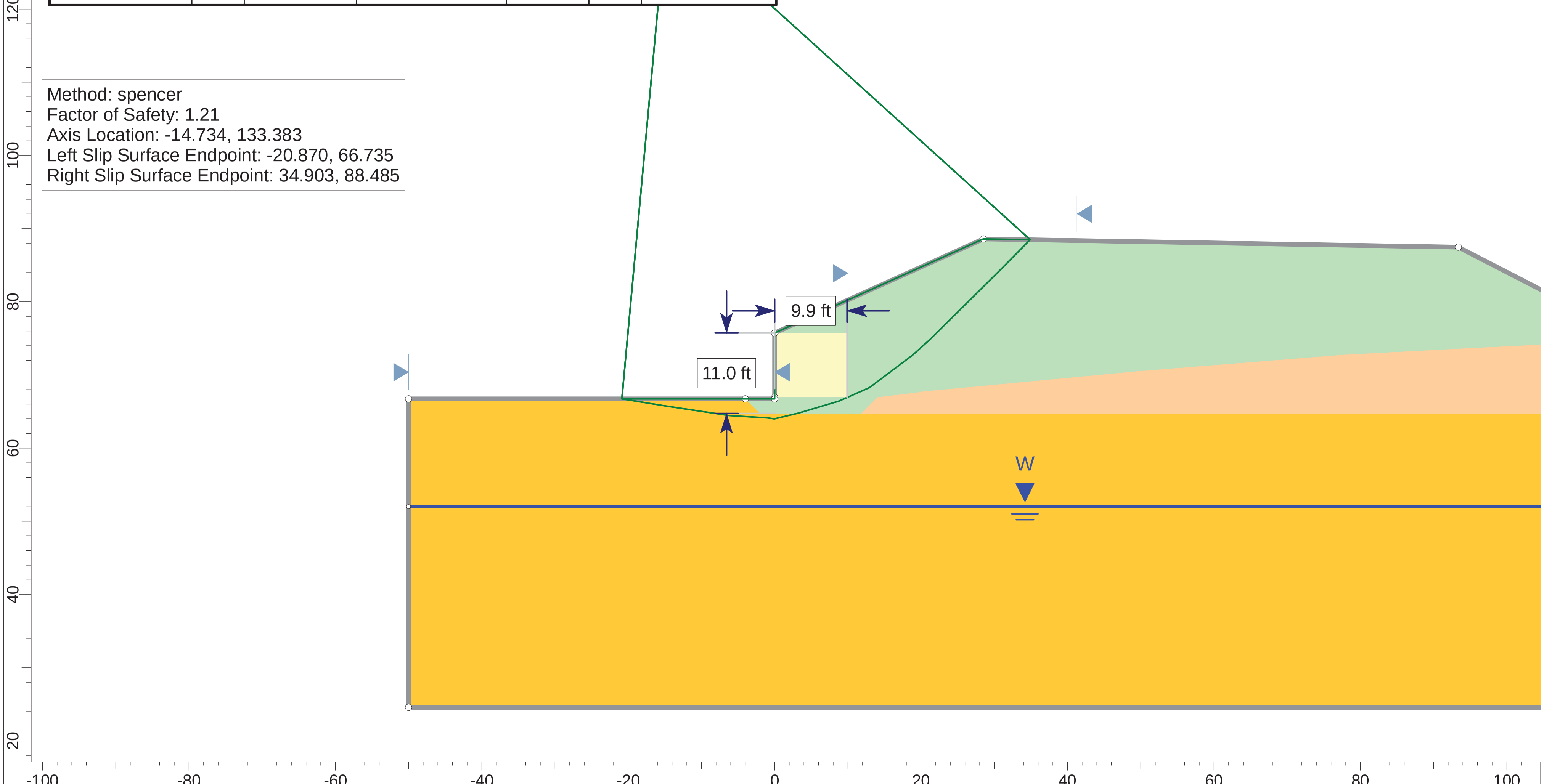
Circular Surface - Wall 4 (STA. 40+50)

Project No. 10-069.200

Figure No. C-47

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Reinforced Fill		130	Infinite strength			None
Wall Backfill		130	Mohr-Coulomb	0	38	Water Surface
Retaining Soil		125	Mohr-Coulomb	0	32	Water Surface
Foundation Soil		120	Mohr-Coulomb	0	36	Water Surface

Method: spencer
Factor of Safety: 1.21
Axis Location: -14.734, 133.383
Left Slip Surface Endpoint: -20.870, 66.735
Right Slip Surface Endpoint: 34.903, 88.485



PanGEO INCORPORATED
SLIDEINTERPRET 6.022

I-5, 116th Street NE Interchange Improvements
The Tulalip Tribes
Snohomish County, Washington

Pseudo-Static Compound Stability Analysis
Non-Circular Surface - Wall 4 (STA. 40+50)

Project No. 10-069.200

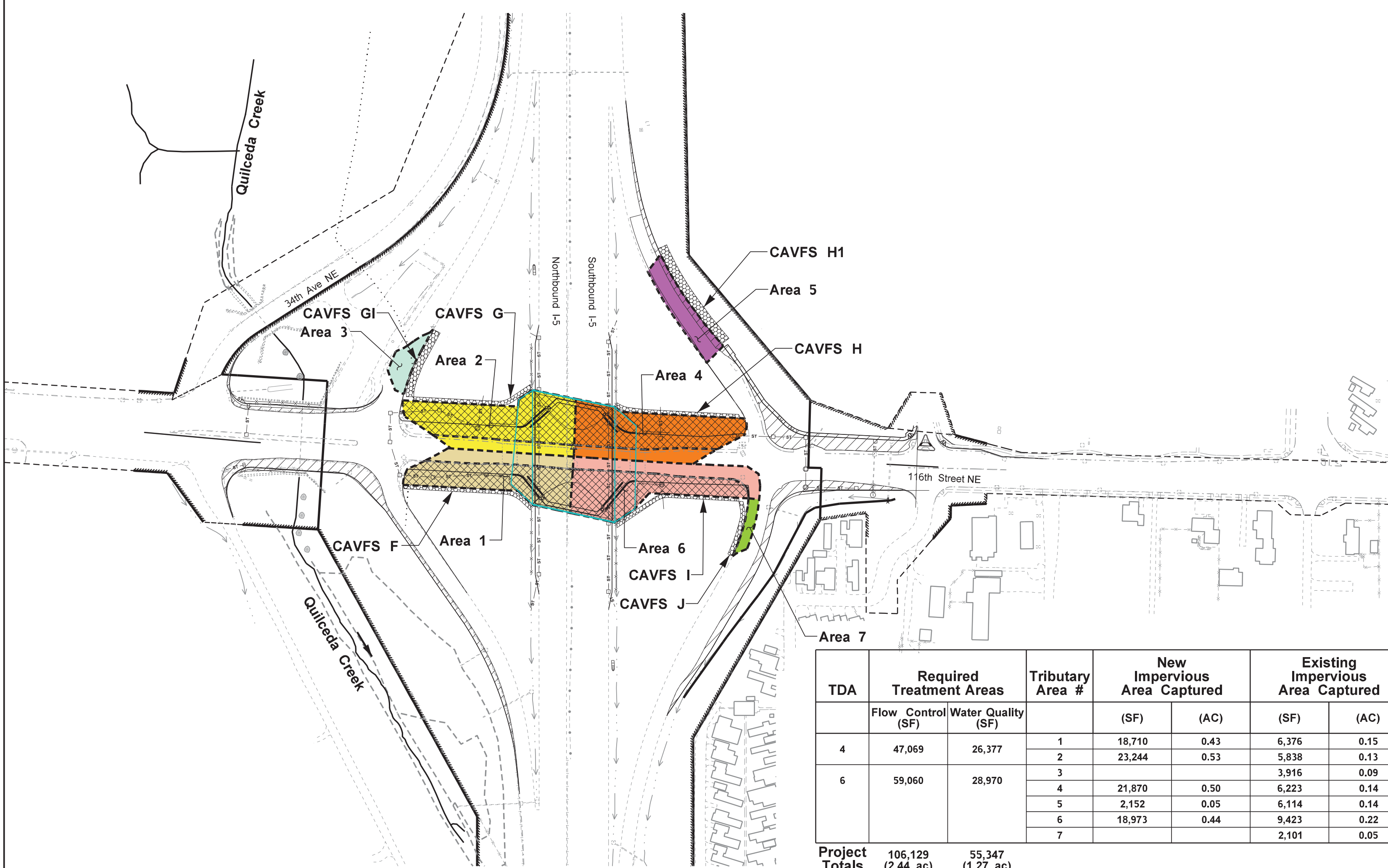
Figure No. C-48

APPENDIX D

PROPOSED STORMWATER MANAGEMENT PLAN

APPENDIX D: PROPOSED STORMWATER MANAGEMENT PLAN

The currently proposed stormwater management plan for the "Bridge Only" portion of the project will consist of seven compost amended vegetated filter strips (CAVFS). The locations and designations of the CAVFS are shown in Figure 5-2 of the final drainage report (Parametrix, 2013). Appendix D contains Figure 5-2 (Parametrix, 2013) for reference.



TDA	Required Treatment Areas		Tributary Area #	New Impervious Area Captured		Existing Impervious Area Captured		Total Impervious Areas Captured	
	Flow Control (SF)	Water Quality (SF)		(SF)	(AC)	(SF)	(AC)	(SF)	(AC)
4	47,069	26,377	1	18,710	0.43	6,376	0.15	25,086	0.58
			2	23,244	0.53	5,838	0.13	29,082	0.67
6	59,060	28,970	3			3,916	0.09	3,916	0.09
			4	21,870	0.50	6,223	0.14	28,093	0.64
			5	2,152	0.05	6,114	0.14	8,266	0.19
			6	18,973	0.44	9,423	0.22	28,396	0.65
			7			2,101	0.05	2,101	0.05
Project Totals	106,129 (2.44 ac)	55,347 (1.27 ac)						124,940	2.87

U:\Bell\Projects\Clients\1598-Tulalip Tribes\554-1598-033-116thPh3\99Svcs\CADD\Figures\SWR_TDAs\Bridge Only\BL1598033_FIG_5-2.dgn
10:56:54 AM
6/14/2013
cushmreb

Parametrix

0 200
SCALE IN FEET

Legend:

- Area Treated
- New Impervious
- Bypass Area
- Area 1 - CAVFS F
- Area 2 - CAVFS G
- Area 3 - CAVFS G1
- Area 4 - CAVFS H
- Area 5 - CAVFS H1
- Area 6 - CAVFS I
- Area 7 - CAVFS J

Figure 5-2
Equivalent Areas