Anchor Environmental, L.L.C.
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Memorandum

To: Anne Summers and Marcel Hermans – Port of Portland

From: Ben Hung and John Verduin, PE – Anchor Environmental, L.L.C.

CC: Krista Koehl – Port of Portland; Tom Schadt, Todd Thornburg, and Elizabeth Appy – Anchor Environmental, L.L.C.; Mike Palermo – Palermo Consulting, Inc.; Mark Lewis and Pete Townsend – Newfields

Date: July 5, 2007

Re: Response to Comments on the June 7, 2007 Borrow Source Analytical Results- Port of Portland—Terminal 4 Early Action

This memorandum presents the responses to agency comments (*comments are in italics*) on the Borrow Source Analytical Results provided to the EPA on June 7, 2007.

1. *Please provide these results with a brief memo indicating conformance/deviations from the approved SAP.*

   Field activities related to sample collection and handling were completed in accordance with the sampling and analysis plan.

2. *Please add TEC values and relevant background concentrations (where applicable) to the table of results and provide any discussion necessary to interpret the table.*

   A revised results table is attached to this memorandum. Footnotes are provided to aid in the interpretation of the table.

3. *Please explain why detection limits for some compounds (including cadmium, mercury, selenium, silver, etc.) are greater than proposed in the SAP.*

   The numbers listed next to the "U"-flagged results are the reporting limits (actual sample quantitation limits). The reporting limits for the four compounds mentioned above are the same as specified in the SAP.

4. *EPA concurs the Texada material is not acceptable for use as berm fill.*

   The Port agrees that the Texada material *that was characterized* is not acceptable for use as berm fill.

5. *EPA notes that the Morse and Scarsella materials are vastly different in grain size distribution. Please provide the gradation curves and address the implications of the differences in terms of the berm design (including geotechnical/siesmic) and berm construction. Please evaluate (through filter calculations) whether the Scarcella material would need an additional filter layer between the training dikes and the berm fill to prevent loss of berm fill material through the training dikes.*

   The grain size distribution curves are provided as an attachment to this memorandum. The remainder of the comment refers to design related questions that will be evaluated in future engineering analysis.

6. *Please discuss the estimated hydraulic conductivity of each material and note whether the hydraulic analyses for berm/weir flow would need to be revised based on the use of either material.*

   The estimated hydraulic conductivity for the Scarcella material is 180 feet per day. The estimated hydraulic conductivity for the Morse material is 350 feet per day. The hydraulic analysis that has been performed is based on a proposed range of 30 to 450 feet per day with and average of 280 feet per day. Therefore, there is no need to revise the hydraulic analysis for berm/weir flow based on the use of either material.

Borrow Source Analytical Results

Parameter	TEC	DEQ Default Inorganic Background Concentrations	Morse		Scarcella		Texada	
Conventionals								
Total organic carbon (%)	NS	--	**0.051**		**0.072**		**0.861**	
Total solids (%)	NS	--	**98.4**		**99.7**		**99.6**	
Moisture (%)	NS	--	**6.02**		**4.42**		**6.21**	
Grain Size (%)								
Gravel	NS	--	**55.3**		0.6	U	29.5	U
Sand, Coarse	NS	--	**19**		**1.2**		**19.3**	
Sand, Medium	NS	--	**15**		**48.9**		**23.3**	
Sand, Fine	NS	--	**5.2**		**49**		**12.1**	
Silt, Very Coarse	NS	--	**5.5**		**0.2**		**15.9**	
Metals (mg/kg)								
Arsenic	9.79	7.9	**0.5**		**1.1**		**29.6**	
Cadmium	0.99	<0.5	0.2	U	0.2	U	0.2	U
Chromium	43.4	30	**6.8**		**4.1**		**8.8**	
Copper	31.6	2	**10.8**		**9.5**		**189**	
Iron	NS	--	**39,600**		**11,800**		**26,600**	
Lead	35.8	2	**2**		**1.3**		**3**	
Mercury	0.18	0.2	0.05	U	0.05	U	**0.06**	
Nickel	22.7	20	**2.7**		**6.2**		**9**	
Selenium	NS	0.4	0.5	U	0.5	U	**0.8**	
Silver	NS	0.4	0.2	U	0.2	U	**0.2**	
Zinc	121	53	**47**		**27**		**45**	
PCBs (ug/kg)								
Aroclor 1016	NS	--	3.8	U	3.9	U	3.8	U
Aroclor 1221	NS	--	3.8	U	3.9	U	3.8	U
Aroclor 1232	NS	--	3.8	U	3.9	U	3.8	U
Aroclor 1242	NS	--	3.8	U	3.9	U	3.8	U
Aroclor 1248	NS	--	3.8	U	3.9	U	3.8	U
Aroclor 1254	NS	--	3.8	U	3.9	U	3.8	U
Aroclor 1260	NS	--	3.8	U	3.9	U	3.8	U
Aroclor 1262	NS	--	3.8	U	3.9	U	3.8	U
Aroclor 1268	NS	--	3.8	U	3.9	U	3.8	U
Pesticides (ug/kg)								
2,4'-DDD	NS	--	2	U	2	U	1.9	U
2,4'-DDE	NS	--	2	U	2	U	1.9	U
2,4'-DDT	NS	--	2	U	2	U	1.9	U
4,4'-DDD	4.88	--	2	U	2	U	1.9	U
4,4'-DDE	3.16	--	2	U	2	U	1.9	U
4,4'-DDT	4.16	--	2	U	2	U	1.9	U
Aldrin	NS	--	0.98	U	0.99	U	0.96	U
alpha-BHC	NS	--	0.98	U	0.99	U	0.96	U
alpha-Chlordane	NS	--	0.98	U	0.99	U	0.96	U
beta-BHC	NS	--	0.98	U	0.99	U	0.96	U
beta-Chlordane	NS	--	0.98	U	0.99	U	0.96	U
Camphechlor	NS	--	98	U	99	U	96	U
cis-Nonachlor	NS	--	2	U	2	U	1.9	U

Borrow Source Analytical Results

Parameter	TEC	DEQ Default Inorganic Background Concentrations	Morse		Scarcella		Texada	
delta-BHC	NS	--	0.98	U	0.99	U	0.96	U
Dieldrin	1.9	--	2	U	2	U	1.9	U
Endosulfan I	NS	--	0.98	U	0.99	U	0.96	U
Endosulfan II	NS	--	2	U	2	U	1.9	U
Endosulfan Sulfate	NS	--	2	U	2	U	1.9	U
Endrin	2.22	--	2	U	2	U	1.9	U
Endrin aldehyde	NS	--	2	U	2	U	1.9	U
Endrin ketone	NS	--	2	U	2	U	1.9	U
gamma-BHC (Lindane)	2.37	--	0.98	U	0.99	U	0.96	U
Heptachlor	NS	--	0.98	U	0.99	U	0.96	U
Heptachlor Epoxide	2.47	--	0.98	U	0.99	U	0.96	U
Hexachlorobenzene	NS	--	0.98	U	0.99	U	0.96	U
Hexachlorobutadiene	NS	--	0.98	U	0.99	U	0.96	U
Methoxychlor	NS	--	9.8	U	9.9	U	9.6	U
Oxychlordane	NS	--	2	U	2	U	1.9	U
trans-Nonachlor	NS	--	2	U	2	U	1.9	U
SVOC (ug/kg)								
1-Methylnaphthalene	NS	--	4.8	UJ	5	UJ	**4.8**	**J**
2-Methylnaphthalene	NS	--	4.8	U	5	U	**4.8**	**J**
Acenaphthene	NS	--	4.8	U	5	U	4.8	UJ
Acenaphthylene	NS	--	4.8	U	5	U	4.8	UJ
Anthracene	57.2	--	4.8	U	5	U	4.8	UJ
Benzo(a)anthracene	108	--	4.8	U	5	U	4.8	UJ
Benzo(a)pyrene	150	--	4.8	U	5	U	4.8	UJ
Benzo(b)fluoranthene	NS	--	4.8	U	5	U	4.8	UJ
Benzo(g,h,i)perylene	NS	--	4.8	U	5	U	4.8	UJ
Benzo(k)fluoranthene	NS	--	4.8	UJ	5	UJ	4.8	UJ
bis(2-Ethylhexyl)phthalate	NS	--	22	U	12	U	**11**	**J**
Butylbenzylphthalate	NS	--	4.8	U	5	U	4.8	UJ
Chrysene	166	--	4.8	UJ	5	UJ	4.8	UJ
Dibenzo(a,h)anthracene	33	--	4.8	UJ	5	UJ	4.8	UJ
Dibenzofuran	NS	--	4.8	U	5	U	4.8	UJ
Diethylphthalate	NS	--	**10**		5	U	**6.2**	**J**
Dimethylphthalate	NS	--	4.8	U	5	U	4.8	UJ
Di-n-butylphthalate	NS	--	**12**		**5**		30	UJ
Di-n-octylphthalate	NS	--	4.8	U	5	U	4.8	UJ
Fluoranthene	423	--	4.8	U	5	U	4.8	UJ
Fluorene	77.4	--	4.8	U	5	U	4.8	UJ
Hexachlorobenzene	NS	--	0.98	U	0.99	U	0.96	U
Indeno(1,2,3-cd)pyrene	NS	--	4.8	UJ	5	UJ	4.8	UJ
Phenanthrene	204	--	4.8	UJ	5	UJ	4.8	UJ
Pyrene	195	--	4.8	U	5	U	4.8	UJ
TPH (mg/kg)								
Motor Oil	NS	--	**17**		12	U	**13**	
TPH - Diesel Range	NS	--	5.1	U	6.1	U	5	U
VOC (ug/kg)								

Borrow Source Analytical Results

Parameter	TEC	DEQ Default Inorganic Background Concentrations	Morse		Scarcella		Texada	
1,1,1,2-Tetrachloroethane	NS	--	1	U	1.1	U	1	U
1,1,1-Trichloroethane	NS	--	1	U	1.1	U	1	U
1,1,2,2-Tetrachloroethane	NS	--	1	U	1.1	U	1	U
1,1,2-Trichloroethane	NS	--	1	U	1.1	U	1	U
1,1,2-Trichlorotrifluoroethane	NS	--	2.1	U	2.2	U	2.1	U
1,1-Dichloroethane	NS	--	1	U	1.1	U	1	U
1,1-Dichloroethene	NS	--	1	U	1.1	U	1	U
1,1-Dichloropropene	NS	--	1	U	1.1	U	1	U
1,2,3-Trichlorobenzene	NS	--	5.2	U	5.4	U	5.3	U
1,2,3-Trichloropropane	NS	--	2.1	U	2.2	U	2.1	U
1,2,4-Trichlorobenzene	NS	--	5.2	U	5.4	U	5.3	U
1,2,4-Trimethylbenzene	NS	--	1	U	1.1	U	1	U
1,2-Dibromo-3-chloropropane	NS	--	5.2	U	5.4	U	5.3	U
1,2-Dibromoethane	NS	--	1	U	1.1	U	1	U
1,2-Dichlorobenzene	NS	--	1	U	1.1	U	1	U
1,2-Dichloroethane	NS	--	1	U	1.1	U	1	U
1,2-Dichloropropane	NS	--	1	U	1.1	U	1	U
1,3,5-Trimethylbenzene	NS	--	1	U	1.1	U	1	U
1,3-Dichlorobenzene	NS	--	1	U	1.1	U	1	U
1,3-Dichloropropane	NS	--	1	U	1.1	U	1	U
1,4-Dichlorobenzene	NS	--	1	U	1.1	U	1	U
2,2-Dichloropropane	NS	--	1	U	1.1	U	1	U
2-Butanone (MEK)	NS	--	5.2	U	5.4	U	5.3	U
2-Chloroethylvinylether	NS	--	5.2	U	5.4	U	5.3	U
2-Chlorotoluene	NS	--	1	U	1.1	U	1	U
2-Hexanone	NS	--	5.2	U	5.4	U	5.3	U
4-Chlorotoluene	NS	--	1	U	1.1	U	1	U
4-Isopropyltoluene	NS	--	1	U	1.1	U	1	U
4-Methyl-2-pentanone (MIBK)	NS	--	5.2	U	5.4	U	5.3	U
Acetone	NS	--	7.6	U	6.9	U	6.9	U
Acrolein	NS	--	52	U	54	U	53	U
Acrylonitrile	NS	--	5.2	U	5.4	U	5.3	U
Benzene	NS	--	1	U	1.1	U	1	UJ
Bromobenzene	NS	--	1	U	1.1	U	1	U
Bromodichloromethane	NS	--	1	U	1.1	U	1	U
Bromoethane	NS	--	2.1	U	2.2	U	2.1	U
Bromoform	NS	--	1	U	1.1	U	1	U
Bromomethane	NS	--	1	U	1.1	U	1	U
Carbon disulfide	NS	--	1	U	1.1	U	1	U
Carbon tetrachloride	NS	--	1	U	1.1	U	1	U
Chlorobenzene	NS	--	1	U	1.1	U	1	U
Chloroethane	NS	--	1	U	1.1	U	1	U
Chloroform	NS	--	1	U	1.1	U	1	U
Chloromethane	NS	--	1	U	1.1	U	1	U
cis-1,2-Dichloroethene	NS	--	1	U	1.1	U	1	U
cis-1,3-Dichloropropene	NS	--	1	U	1.1	U	1	U

Borrow Source Analytical Results

Parameter	TEC	DEQ Default Inorganic Background Concentrations	Morse		Scarcella		Texada	
Dibromochloromethane	NS	--	1	U	1.1	U	1	U
Dibromomethane	NS	--	1	U	1.1	U	1	U
Dichloromethane	NS	--	2.2	U	2.9	U	2.1	U
Dichlorodifluoromethane	NS	--	1	U	1.1	U	1	U
Ethylbenzene	NS	--	1	U	1.1	U	1	U
Hexachlorobutadiene	NS	--	0.98	U	0.99	U	0.96	U
Iodomethane	NS	--	1	U	1.1	U	1	U
m,p-Xylenes	NS	--	1	U	1.1	U	1	U
Naphthalene	176	--	4.8	U	5	U	4.8	UJ
n-Butylbenzene	NS	--	1	U	1.1	U	1	U
n-Propylbenzene	NS	--	1	U	1.1	U	1	U
o-Xylene	NS	--	1	U	1.1	U	1	U
sec-Butylbenzene	NS	--	1	U	1.1	U	1	U
Styrene	NS	--	1	U	1.1	U	1	U
tert-Butylbenzene	NS	--	1	U	1.1	U	1	U
Tetrachloroethene	NS	--	1	U	1.1	U	1	U
Toluene	NS	--	1	U	1.1	U	1	U
trans-1,2-Dichloroethene	NS	--	1	U	1.1	U	1	U
trans-1,3-Dichloropropene	NS	--	1	U	1.1	U	1	U
trans-1,4-Dichloro-2-butene	NS	--	5.2	U	5.4	U	5.3	U
Trichloroethene	NS	--	1	U	1.1	U	1	U
Trichlorofluoromethane	NS	--	1	U	1.1	U	1	U
Vinyl Acetate	NS	--	5.2	U	5.4	U	5.3	U
Vinyl chloride	NS	--	1	U	1.1	U	1	U

NS = No screening level.

U = Analyte was not detected above the reported sample quantitation limit.

J = Analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

UJ = Analyte was not detected above the reported sample quantitation limit. The reported quanititation limit is approximate.

Detected concentration greater than TEC

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Client: Anchor Environmental, LLC	Project No.: KW76
Client Project: Quarry Samples 050332-01	

Case Narrative

1. Two samples were received on April 28, 2007 and submitted for grain size distribution according to ASTM D422.
2. The samples were mostly sand and gravel and did not contain enough fines to run a hydrometer test.
3. The data is provided in summary tables and plots.
4. There were no other noted anomalies in this project.

Approved by: Taylor McKenzie Date: 5/8/07
Title: Lead Technician

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Anchor Environmental, LLC
Quarry Samples 050332-01

Percent Finer Than Indicated Size, By ASTM D422

Sample ID	Moisture Content (%)	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200
Scarcella 01	0.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.4	98.2	90.5	49.3	4.6	0.6	0.2
Morse 01	0.7	100.0	100.0	100.0	100.0	92.8	74.1	65.0	44.8	25.8	15.0	10.8	8.7	7.2	5.5

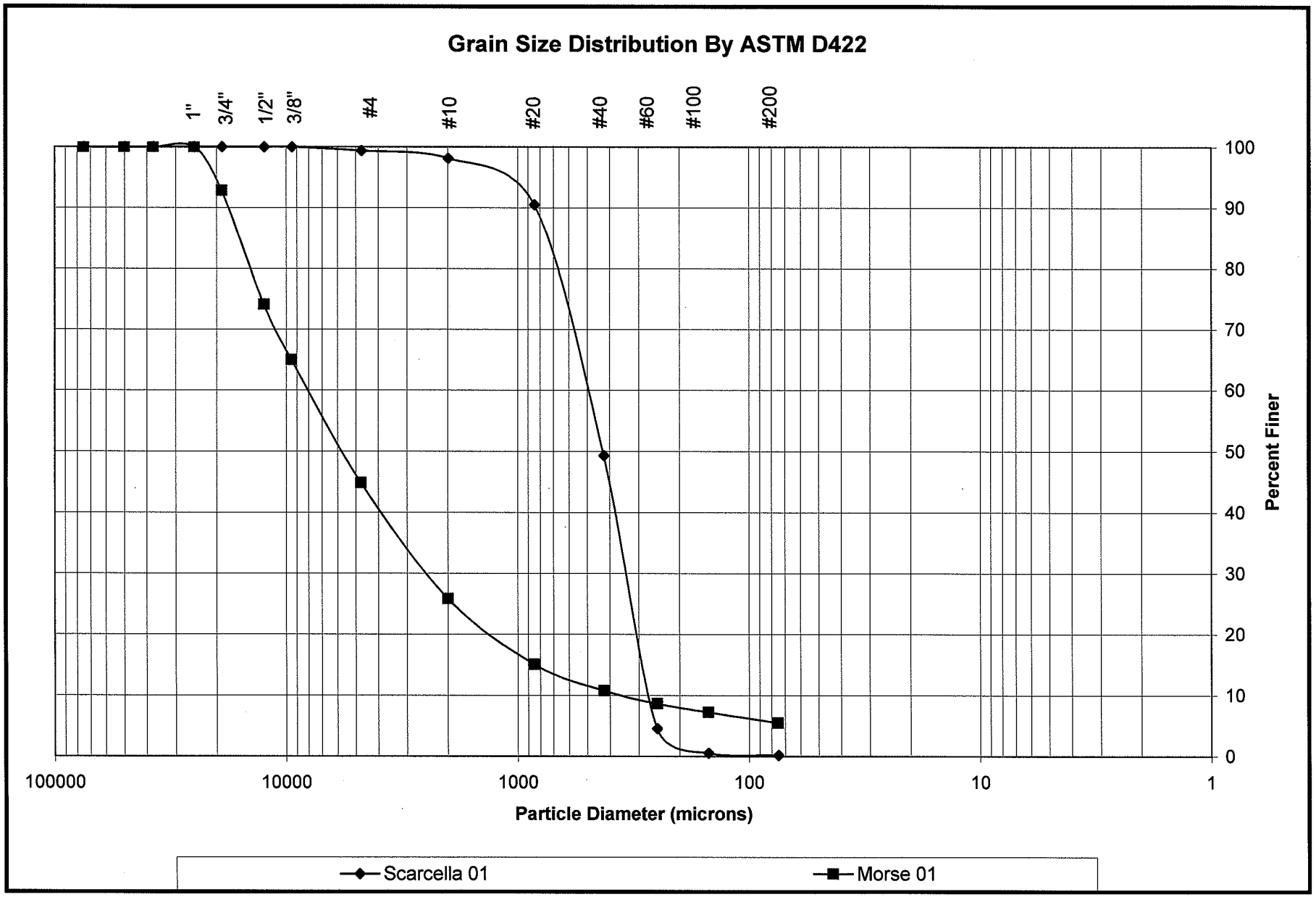
KW76

Anchor Environmental, LLC
Quarry Samples 050332-01

Percent Retained in Each Size Fraction, By ASTM D422

Sieve Size (microns)	3-2"	2-1.5"	1.5-1"	1-3/4"	3/4-1/2"	1/2-3/8"	3/8-#4	4750-2000	2000-850	850-425	425-250	250-150	150-75	<75
Scarcella 01	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.2	7.7	41.2	44.7	4.0	0.3	0.2
Morse 01	0.0	0.0	0.0	7.2	18.7	9.1	20.1	19.0	10.8	4.2	2.1	1.4	1.7	5.5

KW76


Grain Size Distribution By ASTM D422
1"
3/4"
1/2"
3/8"
#4
#10
#20
#40
#60
#100
#200
100
90
80
70
60
50
40
30
20
10
0
Percent Finer
100000
10000
1000
100
10
1
Particle Diameter (microns)
Scarcella 01
Morse 01