APPENDIX I

Potentiometric Groundwater Surface Maps and Groundwater Velocity Calculations

- Regional Aquifer

Aspect consulting
earth+water

King County
Department of
Natural Resources and Parks
Solid Waste Division

April 30, 2010

Mr. Sendy Jimenez
King County Solid Waste Division
King Street Center
201 South Jackson Street, Suite 701
Seattle, Washington 98104-3855

Re: Contract Number: E00065E07 K
Potentiometric Groundwater Surface Mapping and
Groundwater Velocity Calculation
1st Quarter 2010 Data Collected January 4, 2010
Cedar Hills Landfill
King County, Washington
Project No. 070074-007-03

Dear Mr. Jimenez:

Aspect Consulting, LLC submits this letter report on groundwater conditions during the 1st Quarter of 2010 for the Regional Aquifer beneath the Cedar Hills Landfill (landfill), in accordance with King County Department of Natural Resources, Solid Waste Division (KCSWD) Contract Number E00065E07 K. KCSWD personnel measured groundwater elevations at the landfill on January 4, 2010. These measurements were received by Aspect Consulting on February 23, 2010 and were used to:

1. Evaluate the potentiometric groundwater surface elevation;
2. Determine the groundwater flow direction and horizontal gradient; and
3. Calculate the groundwater velocity of the Regional Aquifer.

There have been no significant changes in the interpreted groundwater conditions since the previous report submitted for the 4th Quarter of 2009 monitoring event.

Groundwater Elevation Data

KCSWD measured groundwater levels at 43 wells completed in the Regional Aquifer, as defined in *Cedar Hills Regional Landfill Hydrogeologic Report*, March 1999, prepared by CH2M Hill/Udaloy Environmental Services. Monitoring wells MW-86 and WS-ATC-1 were not measured. Table 1 lists the well names, locations, reference point elevations, measured groundwater levels, and calculated groundwater elevations at these wells. Wells not significantly affected by vertical hydraulic gradients were used for potentiometric surface mapping purposes. A total of 26 wells completed within 10 feet of the water table were selected. Figure 1 shows well locations, groundwater elevations at the 26 selected wells, groundwater potentiometric surface contours, and interpreted groundwater flow direction in the Regional Aquifer for the January 4, 2010 measurement event.

Groundwater potentiometric surface contours for the Regional Aquifer were calculated using the same methodology developed for the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements,* October 2007, prepared by Aspect Consulting. The contouring methodology includes triangulation using linear interpolation and three passes of a 3x3 Gaussian filter. The 350-foot contour was adjusted slightly to better honor the water level data and reduce contouring "edge effects".

Direction of Groundwater Flow

Groundwater elevations from measurements made on January 4, 2010 indicate that groundwater in the Regional Aquifer generally flowed north beneath the southern and central portions of the landfill (Figure 1). At the northern end of the landfill, groundwater generally flowed east/northeast.

Groundwater Velocity

Horizontal groundwater velocity was calculated using the following formula:

$$v = \frac{1}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

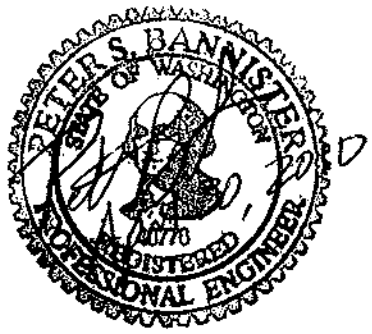
where:
v = Groundwater velocity [L/t]
K = Hydraulic conductivity [L/t]
$\Delta H/\Delta L$ = Hydraulic gradient [L/L]
n_{eff} = Effective porosity [dimensionless]

Horizontal groundwater velocity was calculated for the southern, central, and northern portions of the Regional Aquifer, based on spatial differences in aquifer parameters and hydraulic gradients. The southern portion of the Regional Aquifer has a lower hydraulic conductivity than the central and northern portions, as reported in *Cedar Hills Regional Aquifer Hydraulic Parameter Testing Report*, May 2003, prepared by CH2M Hill/Udaloy Environmental Services. The hydraulic conductivity values for the central and northern areas were based on the range presented in the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements,* October 2007, prepared by Aspect Consulting. The hydraulic gradient was greatest under the southern portion of the landfill and smallest under the northern portion. Table 2 presents a summary of the hydraulic parameters used to calculate a groundwater velocity from the 1st Quarter 2010 data. On January 4, 2010, average horizontal groundwater velocity within the Regional Aquifer ranged from 0.014 feet per day (ft/day) under the southern portion of the landfill to 2.1 ft/day under the central portion of the landfill.

Thank you for the opportunity to provide hydrogeologic consulting services to the King County Solid Waste Division. Please call Peter at (206) 780-7728 or Erick at (206) 780-7715, if you have any questions.

Sincerely,

Aspect consulting, LLC



Erick William Miller

4-30-10

Peter S. Bannister, PE
Senior Project Engineer
pbannister@aspectconsulting.com

Erick W. Miller, LHG
Senior Associate Hydrogeologist
emiller@aspectconsulting.com

Attachments: Table 1: Measured Groundwater Elevations – 1st Quarter 2010
Table 2: Groundwater Velocity Calculations – 1st Quarter 2010
Figure 1: Groundwater Potentiometric Surface Map – 1st Quarter 2010

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Table 1: Measured Groundwater Elevations - 1st Quarter 2010

Cedar Hills Landfill - King County, Washington

	Well Name	Northing	Easting	Reference Point Elevation (ft MSL)	Measured Depth to Groundwater (ft)	Groundwater Elevation (ft MSL)
Wells Completed Within 10 Feet Of The Water Table	MW-60	167873	1701154	567.15	230.48	336.67
	MW-64	168772	1701980	596.55	267.61	328.94
	MW-66	174250	1699750	531.28	240.52	290.76
	MW-67	172611	1701777	516.43	223.65	292.78
	MW-68	170609	1701917	647.07	334.84	312.23
	MW-69	172400	1698062	653.69	359.10	294.59
	MW-70	168700	1698413	530.57	207.93	322.64
	MW-72	170988	1698230	671.87	364.54	307.33
	MW-73	174996	1698955	485.70	192.95	292.75
	MW-74	173814	1700387	531.26	242.50	288.76
	MW-76	167193	1700376	491.71	136.77	354.94
	MW-77	169000	1700008	552.67	229.80	322.87
	MW-78	169028	1698882	537.35	215.30	322.05
	MW-80	172965	1701310	530.41	241.72	288.69
	MW-81	172114	1702569	493.66	186.47	307.19
	MW-82	167725	1699554	474.85	125.45	349.40
	MW-83	167212	1697940	496.81	145.03	351.78
	MW-84	173895	1698603	530.80	238.24	292.56
	MW-85	173695	1701829	531.76	248.49	283.27
	MW-86	174918	1701331	536.04	Not measured	Not measured
	MW-87	173494	1700670	537.31	250.72	286.59
	MW-88	174303	1701808	513.68	228.35	285.33
	MW-93	169851	1702259	632.15	311.60	320.55
	MW-94	167210	1698674	495.51	141.38	354.13
	MW-95	169427	1697265	571.54	253.94	317.60
	MW-100	169610	1700792	620.32	300.84	319.48
	MW-106	173462	1702537	475.47	193.15	282.32
Wells Completed More Than 10 Feet Below The Water Table	MW-21	173876	1697902	420.66	127.37	293.29
	MW-22	173088	1701844	517.09	234.87	282.22
	MW-24	167768	1699582	475.99	147.63	328.36
	MW-43	174327	1701274	547.06	265.37	281.69
	MW-54	168436	1702154	580.43	281.52	298.91
	MW-56	167215	1698981	480.33	126.58	353.75
	MW-57	167202	1699993	456.64	102.80	353.84
	MW-58A	167207	1699007	479.27	151.21	328.06
	MW-59	167193	1699984	457.13	125.88	331.25
	MW-65	167147	1701602	545.83	211.32	334.51
	MW-75	173432	1701060	532.40	248.03	284.37
	MW-89	174319	1701800	512.82	233.89	278.93
	MW-90	174301	1702203	502.22	223.70	278.52
	MW-91	173424	1701023	532.02	249.31	282.71
	MW-99	172099	1702556	493.64	203.19	290.45
	WS-ATC-1	169823	1702269	625.51	Not measured	Not measured
	NPW-1	171139	1701907	646.33	335.58	310.75
	NPW-3	170663	1701923	645.81	333.95	311.86

Notes:

1. Water level measurements made January 4, 2010 by KCSWD personnel.
2. Elevations in feet above mean sea level (ft MSL).

King County

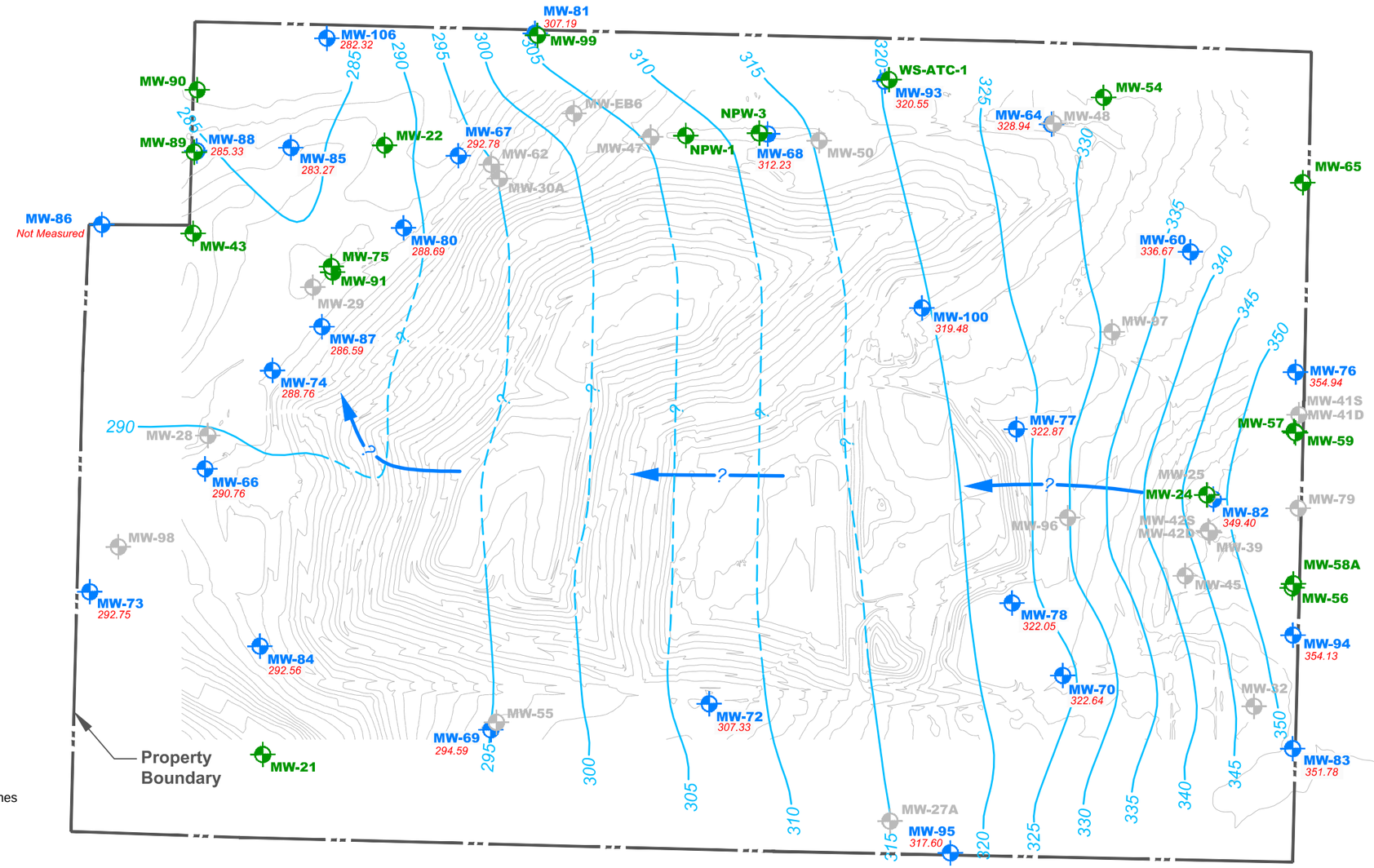
Table 2: Groundwater Velocity Calculations - 1st Quarter 2010

Cedar Hills Landfill - King County, Washington

Regional Aquifer Zone beneath the Landfill	Horizontal Hydraulic Conductivity			Horizontal Hydraulic Gradient	Effective Porosity	Horizontal Groundwater Velocity	Direction of Flow
	Range	(cm/s)	(ft/d)	(ft/ft)	(%)	(ft/d)	
Southern	Minimum	6.4E-06	0.018	0.020	26	0.0014	North
	Maximum	6.4E-04	1.8	0.020	26	0.14	
	Mean	6.4E-05	0.18	0.020	26	0.014	
Central	Minimum	2.1E-03	6	0.0085	24	0.21	North
	Maximum	4.2E-02	120	0.0085	24	4.2	
	Mean	2.1E-02	60	0.0085	24	2.1	
Northern	Minimum	2.1E-03	6	0.0061	24	0.151	East-Northeast
	Maximum	4.2E-02	120	0.0061	24	3.0	
	Mean	2.1E-02	60	0.0061	24	1.5	

Notes:

1. Horizontal hydraulic conductivity values for the southern portion of the regional aquifer from *Cedar Hills Regional Aquifer Hydraulic Parameter Testing Report* , May 2003, CH2M Hill/Udaloy Environmental Services. Mean hydraulic conductivity values are the geometric mean of the high and low values.
2. Horizontal hydraulic conductivity values for coarser-grained soils for the central and northern portion of the regional aquifer from Table 4.4 *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements* , October 2007, prepared by Aspect Consulting.
3. Hydraulic gradients measured from the potentiometric surface map shown on Figure 1.
4. Effective porosity values from Table 4.3-4 *Cedar Hills Regional Landfill Hydrogeologic Report* , March 1999, CH2M Hill/Udaloy Environmental Services.



Legend

- **MW-X** *XXX.XX* — Well completed in Regional Aquifer within 10 feet of the water table
- **MW-X** — Wells completed in Regional Aquifer more than 10 ft below water table
- MW-X — Wells screened in discontinuous Perched Zones
- 300 — Regional Aquifer Groundwater Elevation Contour *(feet MSL)*. Dashed where inferred from sparse data.
- ← ? — Inferred Horizontal Groundwater Flow Path

Notes:

1. Groundwater measurements made on January 4, 2010
2. Only wells completed in the Regional Aquifer within 10 feet of the water table were used for contouring

N

0 800 1600

Feet

Base Map provided by HDR Engineering, Inc.

King County

Aspect consulting
earth+water
www.aspectconsulting.com
a limited liability company

Groundwater Potentiometric Surface Map
1st Quarter 2010 - Regional Aquifer
Cedar Hills Landfill
King County, Washington

DATE: March 2010	PROJECT NO. 070074
DESIGNED BY: PSB	
DRAWN BY: PMB	FIGURE NO. 1
REVISED BY: -	

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Aspect CONSULTING

King County
Department of
Natural Resources and Parks
Solid Waste Division

July 20, 2010

Mr. Sendy Jimenez
King County Solid Waste Division
King Street Center
201 South Jackson Street, Suite 701
Seattle, Washington 98104-3855

Re: Contract Number: E00065E07 K
Potentiometric Groundwater Surface Mapping and
Groundwater Velocity Calculation
2nd Quarter 2010 Data Collected April 1, 2010
Cedar Hills Landfill
King County, Washington
Project No. 070074-007-03

Dear Mr. Jimenez:

Aspect Consulting, LLC submits this letter report on groundwater conditions during the 2nd Quarter of 2010 for the Regional Aquifer beneath the Cedar Hills Landfill (landfill), in accordance with King County Department of Natural Resources, Solid Waste Division (KCSWD) Contract Number E00065E07 K. KCSWD personnel measured groundwater elevations at the landfill on April 1, 2010. These measurements were received by Aspect Consulting on July 2, 2010 and were used to:

1. Evaluate the potentiometric groundwater surface elevation;
2. Determine the groundwater flow direction and horizontal gradient; and
3. Calculate the groundwater velocity of the Regional Aquifer.

There have been no significant changes in the interpreted groundwater conditions since the previous report submitted for the 1st Quarter of 2010 monitoring event.

Groundwater Elevation Data

KCSWD measured groundwater levels at 44 wells completed in the Regional Aquifer, as defined in *Cedar Hills Regional Landfill Hydrogeologic Report*, March 1999, prepared by CH2M Hill/Udaloy Environmental Services. Monitoring well WS-ATC-1 was not measured. Table 1 lists the well names, locations, reference point elevations, measured groundwater levels, and calculated groundwater elevations at these wells. Wells not significantly affected by vertical hydraulic gradients were used for potentiometric surface mapping purposes. A total of 27 wells completed within 10 feet of the water table were selected. Figure 1 shows well locations, groundwater elevations at the 27 selected wells, groundwater potentiometric surface contours, and interpreted groundwater flow direction in the Regional Aquifer for the April 1, 2010 measurement event.

Groundwater potentiometric surface contours for the Regional Aquifer were calculated using the same methodology developed for the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements*, October 2007, prepared by Aspect Consulting. The contouring methodology includes triangulation using linear interpolation and three passes of a 3x3 Gaussian filter. The 355-foot contour was adjusted to better honor the water level data and reduce contouring "edge effects".

Direction of Groundwater Flow

Groundwater elevations from measurements made on April 1, 2010 indicate that groundwater in the Regional Aquifer generally flowed north beneath the southern and central portions of the landfill (Figure 1). At the northern end of the landfill, groundwater generally flowed east/northeast.

Groundwater Velocity

Horizontal groundwater velocity was calculated using the following formula:

$$v = \frac{1}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

where:
v = Groundwater velocity [L/t]
K = Hydraulic conductivity [L/t]
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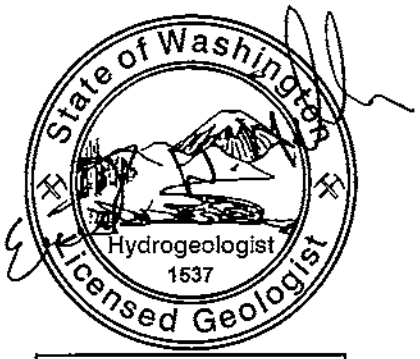
n_{eff} = Effective porosity [dimensionless]

Horizontal groundwater velocity was calculated for the southern, central, and northern portions of the Regional Aquifer, based on spatial differences in aquifer parameters and hydraulic gradients. The southern portion of the Regional Aquifer has a lower hydraulic conductivity than the central and northern portions, as reported in *Cedar Hills Regional Aquifer Hydraulic Parameter Testing Report*, May 2003, prepared by CH2M Hill/Udaloy Environmental Services. The hydraulic conductivity values for the central and northern areas were based on the range presented in the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements*, October 2007, prepared by Aspect Consulting. The hydraulic gradient was greatest under the southern portion of the landfill and smallest under the northern portion. Table 2 presents a summary of the hydraulic parameters used to calculate a groundwater velocity from the 2nd Quarter 2010 data. On April 1, 2010, average horizontal groundwater velocity within the Regional Aquifer ranged from 0.015 feet per day (ft/day) under the southern portion of the landfill to 2.1 ft/day under the central portion of the landfill.

Thank you for the opportunity to provide hydrogeologic consulting services to the King County Solid Waste Division. Please call Peter at (206) 780-7728 or Erick at (206) 780-7715, if you have any questions.

Sincerely,

Aspect consulting, LLC



Erick William Miller
7-20-10

Peter S. Bannister, PE
Senior Project Engineer
pbannister@aspectconsulting.com

Erick W. Miller, LHG
Senior Associate Hydrogeologist
emiller@aspectconsulting.com

Attachments: Table 1: Measured Groundwater Elevations – 2nd Quarter 2010
Table 2: Groundwater Velocity Calculations – 2nd Quarter 2010
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Table 1: Measured Groundwater Elevations - 2nd Quarter 2010

Cedar Hills Landfill - King County, Washington

	Well Name	Northing	Easting	Reference Point Elevation (ft MSL)	Measured Depth to Groundwater (ft)	Groundwater Elevation (ft MSL)
Wells Completed Within 10 Feet Of The Water Table	MW-60	167873	1701154	567.15	228.93	338.22
	MW-64	168772	1701980	596.55	267.13	329.42
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	MW-56	167215	1698981	480.33	125.02	355.31
	MW-57	167202	1699993	456.64	101.06	355.58
	MW-58A	167207	1699007	479.27	150.58	328.69
	MW-59	167193	1699984	457.13	125.03	332.10
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	MW-75	173432	1701060	532.40	247.75	284.65
	MW-89	174319	1701800	512.82	233.43	279.39
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	NPW-3	170663	1701923	645.81	334.12	311.69

Notes:

1. Water level measurements made April 1, 2010 by KCSWD personnel.
2. Elevations in feet above mean sea level (ft MSL).

King County

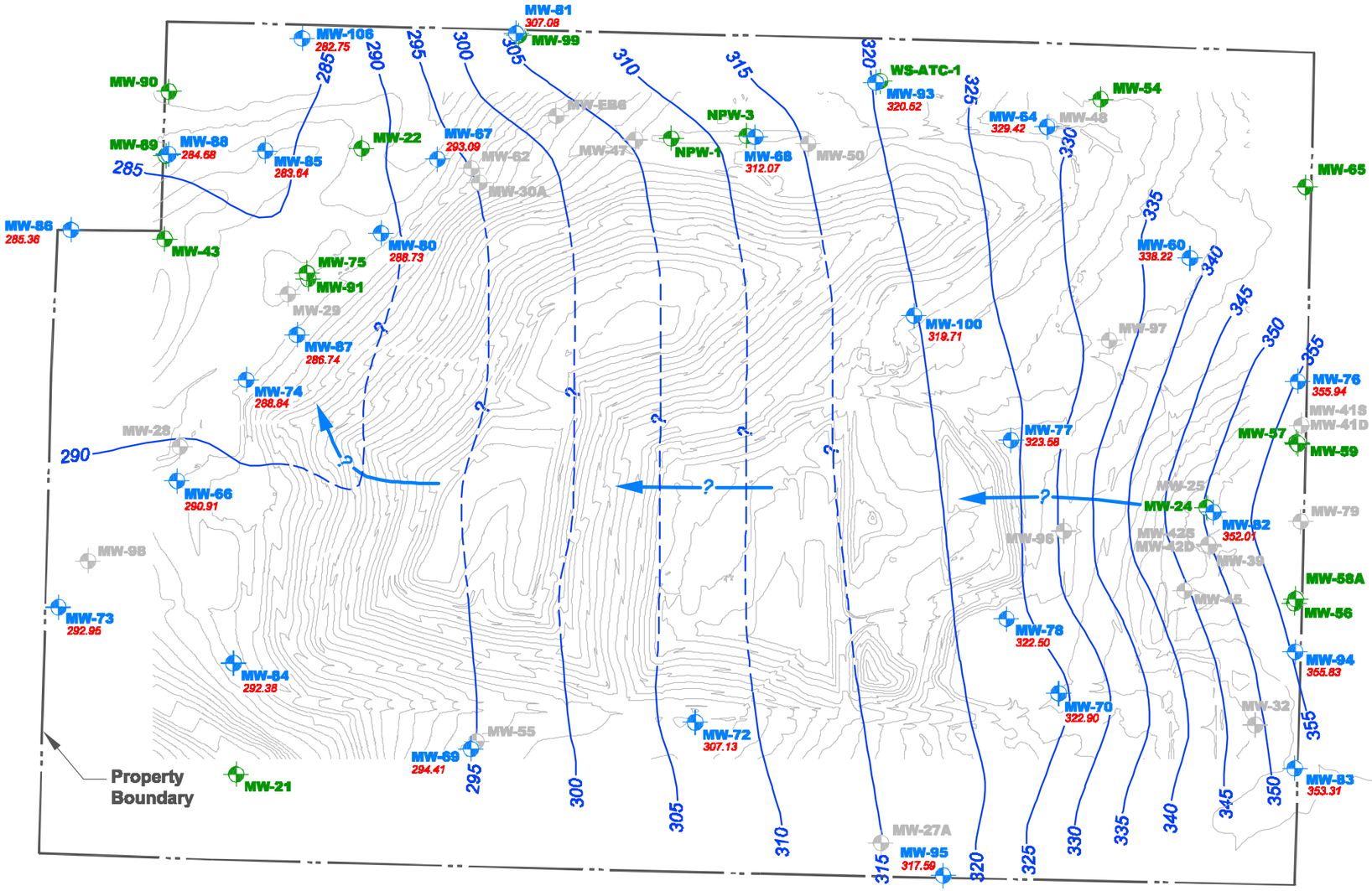
Table 2: Groundwater Velocity Calculations - 2nd Quarter 2010

Cedar Hills Landfill - King County, Washington

Regional Aquifer Zone beneath the Landfill	Horizontal Hydraulic Conductivity			Horizontal Hydraulic Gradient	Effective Porosity	Horizontal Groundwater Velocity	Direction of Flow
	Range	(cm/s)	(ft/d)	(ft/ft)	(%)	(ft/d)	
Southern	Minimum	6.4E-06	0.018	0.021	26	0.0015	North
	Maximum	6.4E-04	1.8	0.021	26	0.15	
	Mean	6.4E-05	0.18	0.021	26	0.015	
Central	Minimum	2.1E-03	6	0.0086	24	0.21	North
	Maximum	4.2E-02	120	0.0086	24	4.3	
	Mean	2.1E-02	60	0.0086	24	2.1	
Northern	Minimum	2.1E-03	6	0.0045	24	0.111	East-Northeast
	Maximum	4.2E-02	120	0.0045	24	2.2	
	Mean	2.1E-02	60	0.0045	24	1.1	

Notes:

1. Horizontal hydraulic conductivity values for the southern portion of the regional aquifer from *Cedar Hills Regional Aquifer Hydraulic Parameter Testing Report* , May 2003, CH2M Hill/Udaloy Environmental Services. Mean hydraulic conductivity values are the geometric mean of the high and low values.
2. Horizontal hydraulic conductivity values for coarser-grained soils for the central and northern portion of the regional aquifer from Table 4.4 *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements* , October 2007, prepared by Aspect Consulting.
3. Hydraulic gradients measured from the potentiometric surface map shown on Figure 1.
4. Effective porosity values from Table 4.3-4 *Cedar Hills Regional Landfill Hydrogeologic Report* , March 1999, CH2M Hill/Udaloy Environmental Services.



Legend

- **MW-X** XXX.XX — Well completed in Regional Aquifer within 10 feet of the water table
- **MW-X** — Wells completed in Regional Aquifer more than 10 ft below water table
- **MW-X** — Wells screened in discontinuous Perched Zones
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- ← ? — Inferred Horizontal Groundwater Flow Path

Notes:

1. Groundwater measurements made on April 01, 2010
2. Only wells completed in the Regional Aquifer within 10 feet of the water table were used for contouring

N

0 800 1600

Feet

Base Map provided by HDR Engineering, Inc.

King County

Aspect consulting earth+water
www.aspectconsulting.com
a limited liability company

Groundwater Potentiometric Surface Map 2nd Quarter 2010 - Regional Aquifer

Cedar Hills Landfill

King County, Washington

DATE: July 2010	PROJECT NO. 070074
DESIGNED BY: PSB	
DRAWN BY: PMB	FIGURE NO. 1
REVISED BY: -	

Q:\King County\070074 King County Landfill P_Maps\2010-07 Cedar Hills-Q2\CH_2010Q2_RA_v2004.dwg

Aspect CONSULTING

King County
Department of
Natural Resources and Parks
Solid Waste Division

September 23, 2010

Mr. Sendy Jimenez
King County Solid Waste Division
King Street Center
201 South Jackson Street, Suite 701
Seattle, Washington 98104-3855

Re: Contract Number: E00065E07 K
Potentiometric Groundwater Surface Mapping and Groundwater Velocity Calculation
3rd Quarter 2010 Data Collected July 1, 2010
Cedar Hills Landfill
King County, Washington
Project No. 070074-007-03

Dear Mr. Jimenez:

Aspect Consulting, LLC submits this letter report on groundwater conditions during the 3rd Quarter of 2010 for the Regional Aquifer beneath the Cedar Hills Landfill (landfill), in accordance with King County Department of Natural Resources, Solid Waste Division (KCSWD) Contract Number E00065E07 K. KCSWD personnel measured groundwater elevations at the landfill on July 1, 2010. These measurements were received by Aspect Consulting on August 30, 2010 and were used to:

1. Evaluate the potentiometric groundwater surface elevation;
2. Determine the groundwater flow direction and horizontal gradient; and
3. Calculate the groundwater velocity of the Regional Aquifer.

There have been no significant changes in the interpreted groundwater conditions since the previous report submitted for the 2nd Quarter of 2010 monitoring event.

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Direction of Groundwater Flow

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Groundwater Velocity

Horizontal groundwater velocity was calculated using the following formula:

$$v = \frac{1}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

where:
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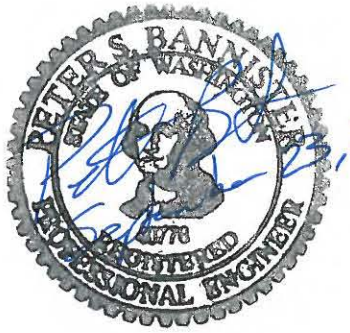
K = Hydraulic conductivity [L/t]
$\Delta H/\Delta L$ = Hydraulic gradient [L/L]
n_{eff} = Effective porosity [dimensionless]

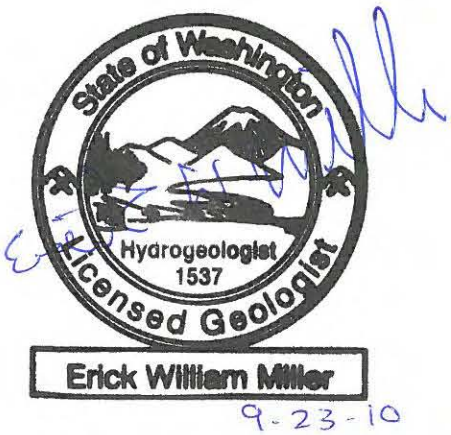
Horizontal groundwater velocity was calculated for the southern, central, and northern portions of the Regional Aquifer, based on spatial differences in aquifer parameters and hydraulic gradients. The southern portion of the Regional Aquifer has a lower hydraulic conductivity than the central and northern portions, as reported Table 4.3-2 of the *Cedar Hills Regional Landfill Site-Wide Hydrogeologic Report,* May 2004, prepared by CH2M Hill/Udaloy Environmental Services. The hydraulic conductivity values for the central and northern areas were based on the range presented in Table 4.4 of the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements,* October 2007, prepared by Aspect Consulting. The hydraulic gradient was greatest under the southern portion of the landfill and smallest under the northern portion. Table 2 presents a summary of the hydraulic parameters used to calculate a groundwater velocity from the 3rd Quarter 2010 data. On July 1, 2010, average horizontal groundwater velocity within the Regional Aquifer ranged from 0.015 feet per day (ft/day) under the southern portion of the landfill to 2.2 ft/day under the central portion of the landfill.

Thank you for the opportunity to provide hydrogeologic consulting services to the King County Solid Waste Division. Please call Peter at (206) 780-7728 or Erick at (206) 780-7715, if you have any questions.

Sincerely,

Aspect consulting, LLC





Peter S. Bannister, PE
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Erick W. Miller, LHG
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emiller@aspectconsulting.com

Attachments: Table 1: Measured Groundwater Elevations – 3rd Quarter 2010
Table 2: Groundwater Velocity Calculations – 3rd Quarter 2010
Figure 1: Groundwater Potentiometric Surface Map – 3rd Quarter 2010

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Table 1: Measured Groundwater Elevations - 3rd Quarter 2010

Cedar Hills Landfill - King County, Washington

	Well Name	Northing	Easting	Reference Point Elevation (ft MSL)	Measured Depth to Groundwater (ft)	Groundwater Elevation (ft MSL)
Wells Completed Within 10 Feet Of The Water Table	MW-60	167873	1701154	567.15	228.12	339.03
	MW-64	168772	1701980	596.55	265.72	330.83
	MW-66	174250	1699750	531.28	239.82	291.46
	MW-67	172611	1701777	516.43	222.90	293.53
	MW-68	170609	1701917	647.07	335.18	311.89
	MW-69	172400	1698062	653.69	358.92	294.77
	MW-70	168700	1698413	530.57	207.21	323.36
	MW-72	170988	1698230	671.87	364.92	306.95
	MW-73	174996	1698955	485.70	192.23	293.47
	MW-74	173814	1700387	531.26	241.91	289.35
	MW-76	167193	1700376	491.71	134.02	357.69
	MW-77	169000	1700008	552.67	228.78	323.89
	MW-78	169028	1698882	537.35	214.88	322.47
	MW-80	172965	1701310	530.41	241.17	289.24
	MW-81	172114	1702569	493.66	186.24	307.42
	MW-82	167725	1699554	474.85	121.33	353.52
	MW-83	167212	1697940	496.81	142.59	354.22
	MW-84	173895	1698603	530.80	237.77	293.03
	MW-85	173695	1701829	531.76	247.42	284.34
	MW-86	174918	1701331	536.04	250.27	285.77
	MW-87	173494	1700670	537.31	250.05	287.26
	MW-88	174303	1701808	513.68	228.42	285.26
	MW-93	169851	1702259	632.15	311.39	320.76
	MW-94	167210	1698674	495.51	138.23	357.28
	MW-95	169427	1697265	571.54	253.67	317.87
	MW-100	169610	1700792	620.32	300.36	319.96
	MW-106	173462	1702537	475.47	192.01	283.46
Wells Completed More Than 10 Feet Below The Water Table	MW-21	173876	1697902	420.66	126.96	293.70
	MW-22	173088	1701844	517.09	233.96	283.13
	MW-24	167768	1699582	475.99	146.27	329.72
	MW-43	174327	1701274	547.06	264.42	282.64
	MW-54	168436	1702154	580.43	279.78	300.65
	MW-56	167215	1698981	480.33	123.67	356.66
	MW-57	167202	1699993	456.64	99.41	357.23
	MW-58A	167207	1699007	479.27	150.07	329.20
	MW-59	167193	1699984	457.13	124.38	332.75
	MW-65	167147	1701602	545.83	210.00	335.83
	MW-75	173432	1701060	532.40	247.16	285.24
	MW-89	174319	1701800	512.82	232.87	279.95
	MW-90	174301	1702203	502.22	222.29	279.93
	MW-91	173424	1701023	532.02	248.43	283.59
	MW-99	172099	1702556	493.64	202.30	291.34
	NPW-1	171139	1701907	646.33	335.56	310.77
	NPW-3	170663	1701923	645.81	334.14	311.67

Notes:

1. Water level measurements made July 1, 2010 by KCSWD personnel.
2. Elevations in feet above mean sea level (ft MSL).

King County

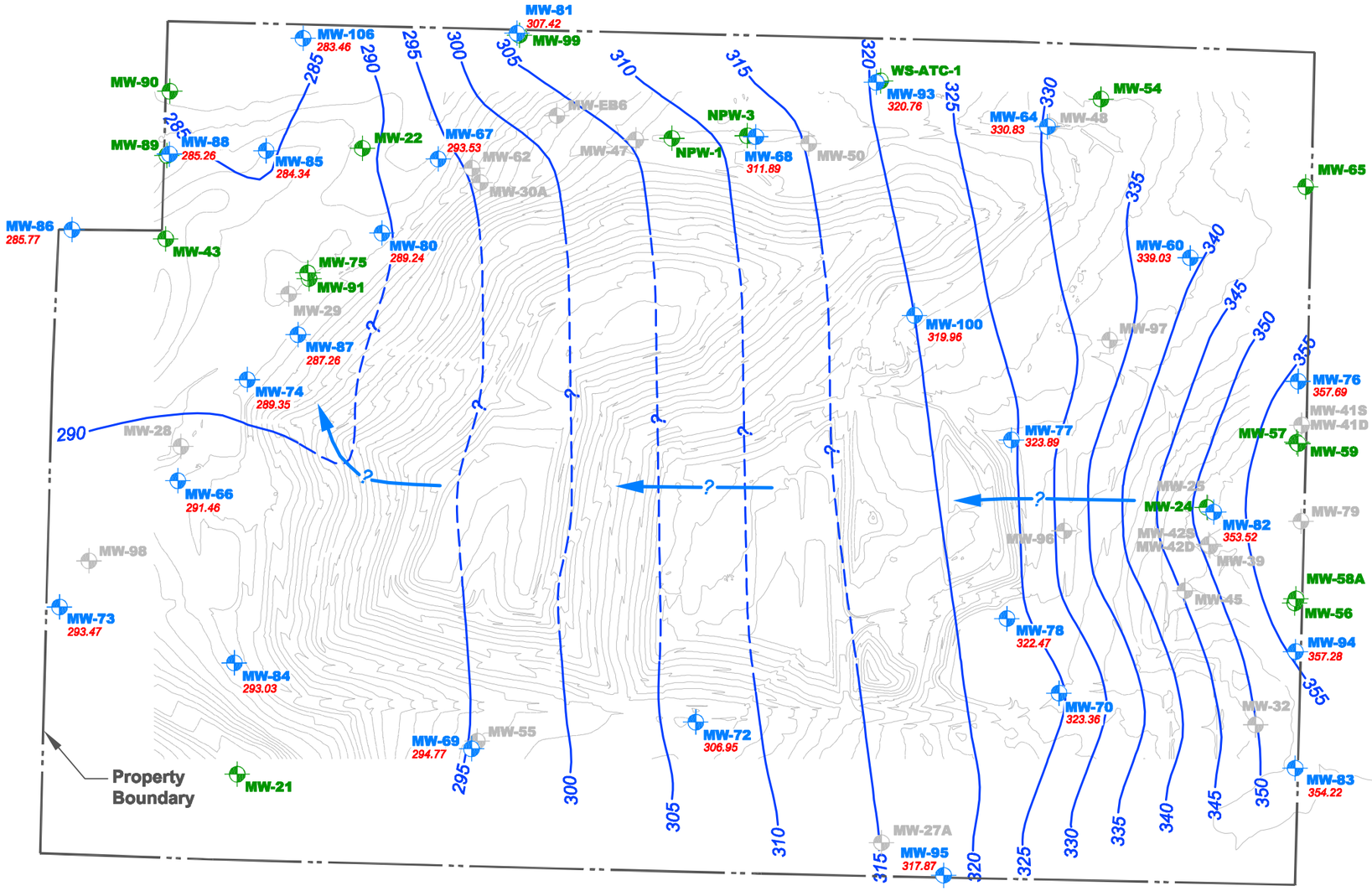
Table 2: Groundwater Velocity Calculations - 3rd Quarter 2010

Cedar Hills Landfill - King County, Washington

Regional Aquifer Zone beneath the Landfill	Horizontal Hydraulic Conductivity			Horizontal Hydraulic Gradient	Effective Porosity	Horizontal Groundwater Velocity	Direction of Flow
	Range	(cm/s)	(ft/d)	(ft/ft)	(%)	(ft/d)	
Southern	Minimum	6.4E-06	0.018	0.022	26	0.0015	North
	Maximum	6.4E-04	1.8	0.022	26	0.15	
	Mean	6.4E-05	0.18	0.022	26	0.015	
Central	Minimum	2.1E-03	6	0.0087	24	0.22	North
	Maximum	4.2E-02	120	0.0087	24	4.3	
	Mean	2.1E-02	60	0.0087	24	2.2	
Northern	Minimum	2.1E-03	6	0.0044	24	0.110	East-Northeast
	Maximum	4.2E-02	120	0.0044	24	2.2	
	Mean	2.1E-02	60	0.0044	24	1.1	

Notes:

1. Horizontal hydraulic conductivity values for the southern portion of the regional aquifer from Table 4.3-2 of the *Cedar Hills Regional Landfill Site-Wide Hydrogeologic Report* , May 2004, CH2M Hill/Udaloy Environmental Services. Mean hydraulic conductivity values are the geometric mean of the high and low values.
2. Horizontal hydraulic conductivity values for coarser-grained soils for the central and northern portion of the regional aquifer from Table 4.4 of the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements* , October 2007, prepared by Aspect Consulting.
3. Hydraulic gradients measured from the potentiometric surface map shown on Figure 1.
4. Effective porosity values from Table 4.3-4 *Cedar Hills Regional Landfill Hydrogeologic Report* , March 1999, CH2M Hill/Udaloy Environmental Services.



Legend

- **MW-X** XXX.XX — Well completed in Regional Aquifer within 10 feet of the water table (water level in feet MSL)
- **MW-X** — Wells completed in Regional Aquifer more than 10 ft below water table
- **MW-X** — Wells screened in discontinuous Perched Zones
- 300 — Regional Aquifer Groundwater Elevation Contour *(feet MSL)*. Dashed where inferred from sparse data.
- ? — Inferred Horizontal Groundwater Flow Path

Notes:

1. Groundwater measurements made on July 1st, 2010.
2. Only wells completed in the Regional Aquifer within 10 feet of the water table were used for contouring.

N

0 800 1600

Feet

Base Map provided by HDR Engineering, Inc.

King County

Aspect CONSULTING

Groundwater Potentiometric Surface Map 3rd Quarter 2010 - Regional Aquifer

Cedar Hills Landfill

King County, Washington

DATE: Sept 2010	PROJECT NO. 070074
DESIGNED BY: PSB	
DRAWN BY: PMB	FIGURE NO. 1
REVISED BY: -	

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Aspect CONSULTING

King County
Department of
Natural Resources and Parks
Solid Waste Division

October 26, 2010

Mr. Sendy Jimenez
King County Solid Waste Division
King Street Center
201 South Jackson Street, Suite 701
Seattle, Washington 98104-3855

Re: Contract Number: E00065E07 K
Potentiometric Groundwater Surface Mapping and
Groundwater Velocity Calculation
4th Quarter 2010 Data Collected October 1, 2010
Cedar Hills Landfill
King County, Washington
Project No. 070074-007-03

Dear Mr. Jimenez:

Aspect Consulting, LLC submits this letter report on groundwater conditions during the 4th Quarter of 2010 for the Regional Aquifer beneath the Cedar Hills Landfill (landfill), in accordance with King County Department of Natural Resources, Solid Waste Division (KCSWD) Contract Number E00065E07 K. KCSWD personnel measured groundwater elevations at the landfill on October 1, 2010. These measurements were received by Aspect Consulting on October 12, 2010 and were used to:

1. Evaluate the potentiometric groundwater surface elevation;
2. Determine the groundwater flow direction and horizontal gradient; and
3. Calculate the groundwater velocity of the Regional Aquifer.

There have been no significant changes in the interpreted groundwater conditions since the previous report submitted for the 3rd Quarter of 2010 monitoring event.

Groundwater Elevation Data

KCSWD measured groundwater levels at 44 wells completed in the Regional Aquifer, as defined in *Cedar Hills Regional Landfill Hydrogeologic Report*, March 1999, prepared by CH2M Hill/Udaloy Environmental Services. Table 1 lists the well names, locations, reference point elevations, measured groundwater levels, and calculated groundwater elevations at these wells. Wells not significantly affected by vertical hydraulic gradients were used for potentiometric surface mapping purposes. A total of 27 wells completed within 10 feet of the water table were selected. Figure 1 shows well locations, groundwater elevations at the 27 selected wells, groundwater potentiometric surface contours, and interpreted groundwater flow direction in the Regional Aquifer for the October 1, 2010 measurement event.

Groundwater potentiometric surface contours for the Regional Aquifer were calculated using the same methodology developed for the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements*, October 2007, prepared by Aspect Consulting. The contouring methodology includes triangulation using linear interpolation and three passes of a 3x3 Gaussian filter.

Direction of Groundwater Flow

Groundwater elevations from measurements made on October 1, 2010 indicate that groundwater in the Regional Aquifer generally flowed north beneath the southern and central portions of the landfill (Figure 1). At the northern end of the landfill, groundwater generally flowed east/northeast.

Groundwater Velocity

Horizontal groundwater velocity was calculated using the following formula:

$$v = \frac{1}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

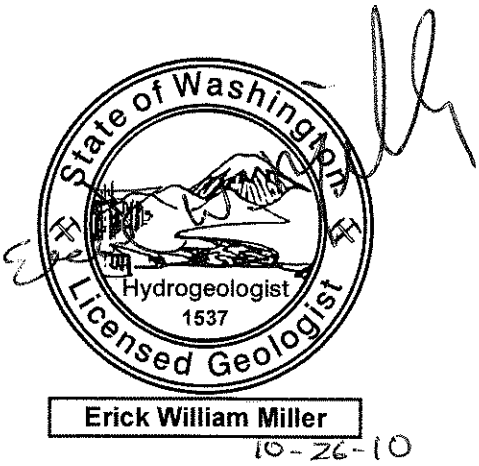
where:
v = Groundwater velocity [L/t]
K = Hydraulic conductivity [L/t]
$\Delta H/\Delta L$ = Hydraulic gradient [L/L]
n_{eff} = Effective porosity [dimensionless]

Horizontal groundwater velocity was calculated for the southern, central, and northern portions of the Regional Aquifer, based on spatial differences in aquifer parameters and hydraulic gradients. The southern portion of the Regional Aquifer has a lower hydraulic conductivity than the central and northern portions, as reported Table 4.3-2 of the *Cedar Hills Regional Landfill Site-Wide Hydrogeologic Report*, May 2004, prepared by CH2M Hill/Udaloy Environmental Services. The hydraulic conductivity values for the central and northern areas were based on the range presented in Table 4.4 of the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements*, October 2007, prepared by Aspect Consulting. The hydraulic gradient was greatest under the southern portion of the landfill and smallest under the northern portion. Table 2 presents a summary of the hydraulic parameters used to calculate a groundwater velocity from the 4th Quarter 2010 data. On October 1, 2010, average horizontal groundwater velocity within the Regional Aquifer ranged from 0.014 feet per day (ft/day) under the southern portion of the landfill to 2.1 ft/day under the central portion of the landfill.

Thank you for the opportunity to provide hydrogeologic consulting services to the King County Solid Waste Division. Please call Peter at (206) 780-7728 or Erick at (206) 780-7715, if you have any questions.

Sincerely,

Aspect consulting, LLC



Peter S. Bannister, PE
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Erick W. Miller, LHG
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Attachments: Table 1: Measured Groundwater Elevations – 4th Quarter 2010
Table 2: Groundwater Velocity Calculations – 4th Quarter 2010
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Table 1: Measured Groundwater Elevations - 4th Quarter 2010

Cedar Hills Landfill - King County, Washington

	Well Name	Northing	Easting	Reference Point Elevation (ft MSL)	Measured Depth to Groundwater (ft)	Groundwater Elevation (ft MSL)
Wells Completed Within 10 Feet Of The Water Table	MW-60	167873	1701154	567.15	229.13	338.02
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	MW-24	167768	1699582	475.99	147.10	328.89
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	NPW-1	171139	1701907	646.33	334.41	311.92
	NPW-3	170663	1701923	645.81	333.75	312.06

Notes:

1. Water level measurements made October 1, 2010 by KCSWD personnel.
2. Elevations in feet above mean sea level (ft MSL).

King County

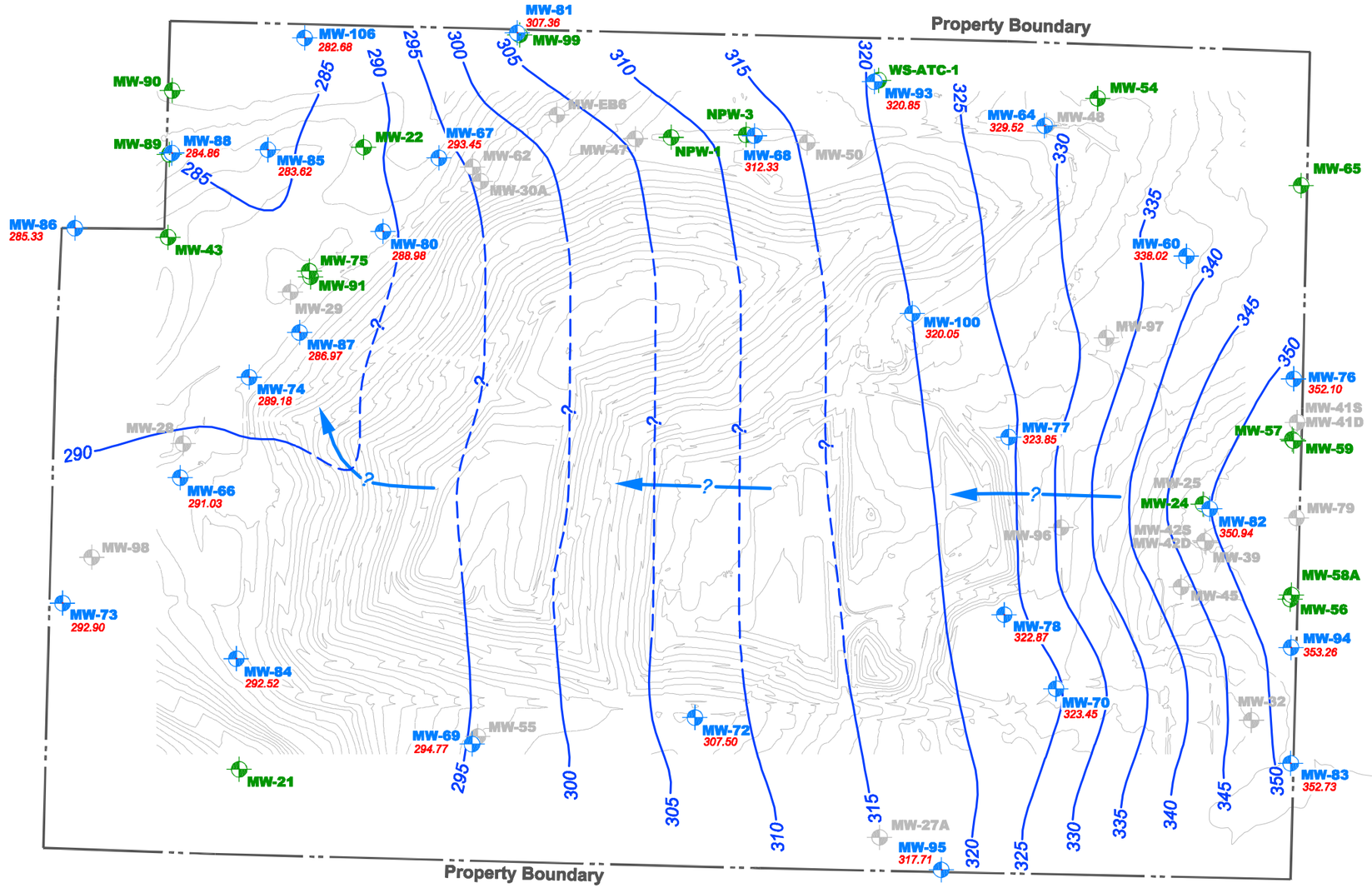
Table 2: Groundwater Velocity Calculations - 4th Quarter 2010

Cedar Hills Landfill - King County, Washington

Regional Aquifer Zone beneath the Landfill	Horizontal Hydraulic Conductivity			Horizontal Hydraulic Gradient	Effective Porosity	Horizontal Groundwater Velocity	Direction of Flow
	Range	(cm/s)	(ft/d)	(ft/ft)	(%)	(ft/d)	
Southern	Minimum	6.4E-06	0.018	0.020	26	0.0014	North
	Maximum	6.4E-04	1.8	0.020	26	0.14	
	Mean	6.4E-05	0.18	0.020	26	0.014	
Central	Minimum	2.1E-03	6	0.0085	24	0.21	North
	Maximum	4.2E-02	120	0.0085	24	4.3	
	Mean	2.1E-02	60	0.0085	24	2.1	
Northern	Minimum	2.1E-03	6	0.0047	24	0.116	East-Northeast
	Maximum	4.2E-02	120	0.0047	24	2.3	
	Mean	2.1E-02	60	0.0047	24	1.2	

Notes:

1. Horizontal hydraulic conductivity values for the southern portion of the regional aquifer from Table 4.3-2 of the *Cedar Hills Regional Landfill Site-Wide Hydrogeologic Report* , May 2004, CH2M Hill/Udaloy Environmental Services. Mean hydraulic conductivity values are the geometric mean of the high and low values.
2. Horizontal hydraulic conductivity values for coarser-grained soils for the central and northern portion of the regional aquifer from Table 4.4 of the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements* , October 2007, prepared by Aspect Consulting.
3. Hydraulic gradients measured from the potentiometric surface map shown on Figure 1.
4. Effective porosity values from Table 4.3-4 *Cedar Hills Regional Landfill Hydrogeologic Report* , March 1999, CH2M Hill/Udaloy Environmental Services.



Legend

- **MW-73** 292.90 — Well completed in Regional Aquifer within 10 feet of the water table (water level in feet MSL)
- **MW-21** — Wells completed in Regional Aquifer more than 10 ft below water table
- **MW-98** — Wells screened in discontinuous Perched Zones
- 300 — Regional Aquifer Groundwater Elevation Contour *(feet MSL)*. Dashed where inferred from sparse data.
- ? — Inferred Horizontal Groundwater Flow Path

Notes:

1. Groundwater measurements made on October 1, 2010.
2. Only wells completed in the Regional Aquifer within 10 feet of the water table were used for contouring.

N

0 800 1600

Feet

Base Map provided by HDR Engineering, Inc.

King County

Aspect CONSULTING

Groundwater Potentiometric Surface Map
4th Quarter 2010 - Regional Aquifer
Cedar Hills Landfill
King County, Washington

DATE: Oct 2010	*PROJECT NO.* 070074
DESIGNED BY: PSB	
DRAWN BY: PMB	*FIGURE NO.* 1
REVISED BY: -	

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