ALPINE PIPELINE RIVER CROSSINGS
2009 MONITORING REPORT

Submitted to

ConocoPhillips Alaska

ConocoPhillips Alaska, Inc.

Submitted by

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ACRONYMS AND ABBREVIATIONS

Baker – Michael Baker Jr., Inc.

BPMSL – British Petroleum Mean Sea Level

HDD – Horizontal directional drill

LCMF - Kuukpik/LCMF, LLC

NPS – Nominal pipe size

VSM – Vertical support member

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1.0 INTRODUCTION/OBJECTIVES

The Alpine Pipeline System was originally constructed during the winter of 1998/1999. The pipeline crosses three major rivers between the Alpine Development CD1 facility and its tie-in to the Kuparuk Pipeline. These three river crossings include the horizontal directionally drilled (HDD) crossing of the East Channel of the Colville River; and the two aboveground crossings of the Kachemach River and the Miluveach River.

Monitoring of the HDD crossing was first conducted in 2001 (Baker 2002). From 2003 through 2006, annual monitoring of the HDD, Kachemach River, and the Miluveach River crossings was conducted (Baker 2003, 2004, 2005, 2006). Over the course of the previous five years' monitoring events, no significant scour, erosion, or VSM tilt were observed at the Kachemach and Miluveach River crossings. As a result, in the fall of 2006 a five-year monitoring interval was recommended. Therefore, in 2007, monitoring was limited to the HDD crossing (Baker 2007).

The 2008 monitoring, including surveying by Kuukpik/LCMF, LLC (LCMF), was conducted at all three crossing locations (Baker 2008). In 2009, LCMF surveying was conducted only at the HDD crossing location. Visual observations and tilt measurements were conducted at all three locations. It is anticipated that LCMF will continue to provide annual bank erosion survey data for the HDD crossing, and that bank erosion surveying of the Kachemach and Miluveach will occur again in 2013.

Monitoring is conducted to document the condition of the pipelines and channel morphology at each of the river crossings. Monitoring also allows for a comparison between observed conditions and the design criteria, as required by Right-of-Way Lease/Grant Stipulations and the Alpine Surveillance and Monitoring Program. The primary objective is documentation of the state of the pipeline at each crossing, as well each pipeline's affect on the channel.

1.1 MONITORING CRITERIA

The 2009 monitoring event included visual observations at all three crossings, as well as bank erosion surveys at the HDD crossing. Figure 1 illustrates the location of the crossings.

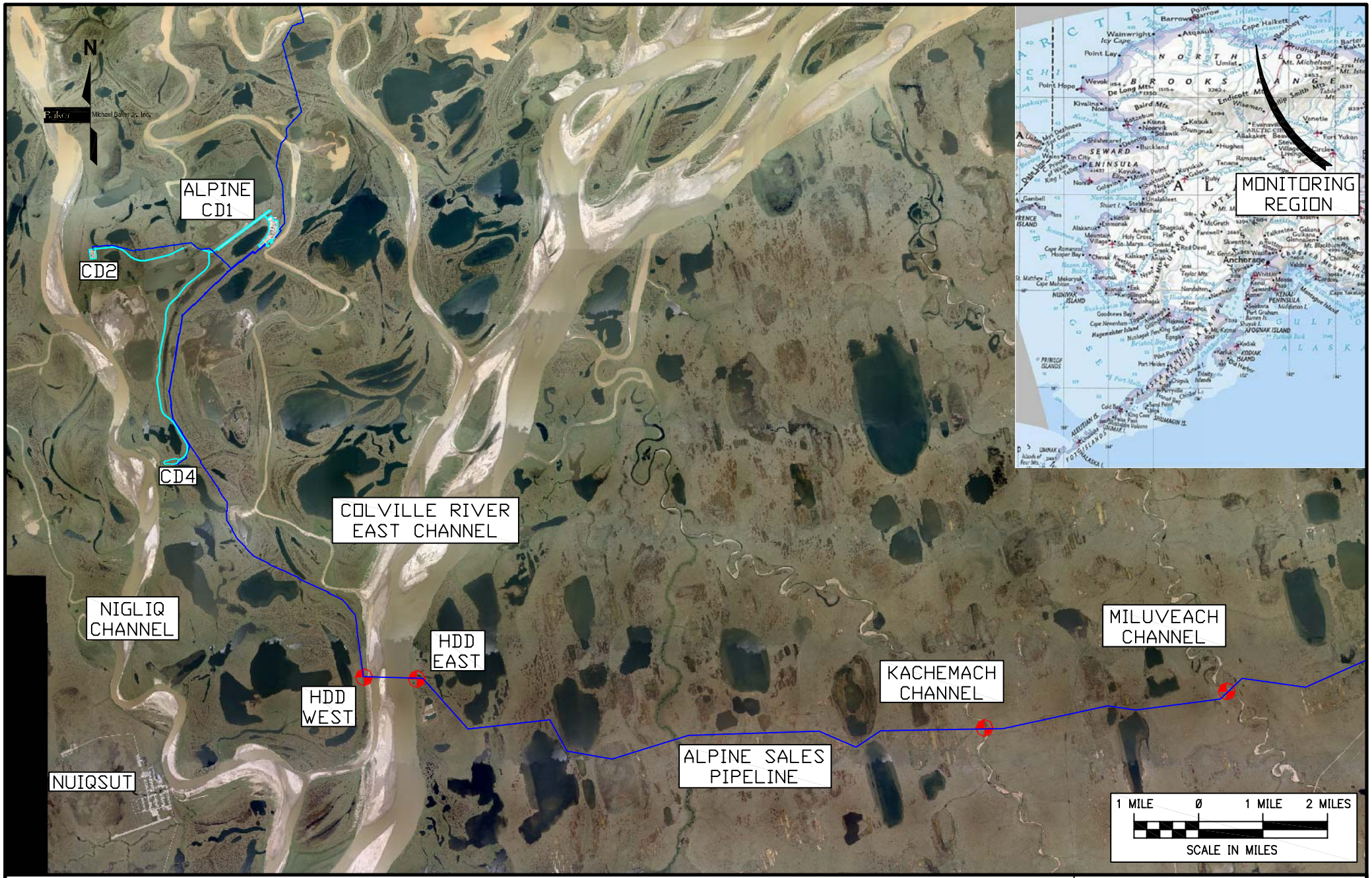
Data collected in 2009 included the following:

- Photographs at each crossing location
- Evaluation of the condition of vertical support member(s) (VSM): tilting, as well as observable settling, scouring, or jacking; particular attention was paid to the following:
    - Miluveach River – VSM Nos. 2047 A/B and 2048 A/B and other VSM within 15 feet of the channel
    - Kachemach River – VSM Nos. 1714 and 1715 A/B and other VSM within 15 feet of the channel

- Evaluation of bank erosion at HDD 50 feet upstream and downstream from the NPS 14 (Nominal Pipe Size 14) crude oil pipeline
- Survey of the top and bottom bank elevations and identification of locations of bank caving at the HDD crossing (LCMF)
- Topographic survey from the Colville River to the HDD east pad to document bank and ground stability
- Measurement of depth and width of scour around VSM in Kachemach and Miluveach River channels
- Observation of localized scour near river crossings

The following physical conditions were specifically evaluated during the site visits:

- Identification of any obstructions, ice dams, new river channels, or changes in flow in the channels
- Evaluation of signs of flooding that threatened a facility or pipeline, or where water cannot be diverted and there was:
    - Evidence of water concentrated longitudinally on or along the pipeline centerline, or
    - Gullying that threatened the buried pipeline at the HDD crossing
- Soil pressure ridges parallel to the pipe axis exceeding one foot in height and 60 feet in length
- Ponding extending over the pipe axis deeper than one foot and more than 100 feet long
- Cracks located within ten feet of the pipeline centerlines at least ten feet long with vertical displacement exceeding six inches, or wider than two inches parallel to the pipe axis and longer than 60 feet
- Depressions occurring longitudinally over pipe axis deeper than one foot and more than 100 feet long
- Pipeline leaks
- Evaluation of the presence or absence of erosion of the HDD facility gravel pads
- Evaluation of evidence of any settlement and jacking of the HDD building foundation movement by surveying



ConocoPhillips Alaska, Inc.

DATE:	8/28/2009	PROJECT:	117009 ALPINE PIPELINE
DRAWN:	EJK	FILE:	FIGURE 1
CHECKED:	JMS	SCALE:	AS SHOWN

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2009

ALPINE PIPELINE MONITORING SITES

FIGURE 1

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2.0 METHODS

Observations and photographs were collected from the three river crossing locations during the 2009 spring breakup. On August 6, 2009, Baker personnel made visual observations and took measurements at each of the river crossings. At that time, channels were clear of ice and snow allowing full access to both the channels and pipelines. Visual observations at the HDD crossing began from the points of pipeline casing entry into the ground, and extended to the riverbanks. Observations at the Kachemach and Miluveach Rivers were conducted to within 15 feet outside the active channel banks on each side. The observations extended upstream and downstream several hundred feet on both banks. In addition to visual observations, both aerial and ground photographs were taken and are provided in Appendix A. The observations and measurements were then compared to established design criteria.

2.1 BANK EROSION

LCMF surveyed the local topography at the HDD crossing in July and August 2009. LCMF incorporated the data into figures and provided a tabulation of historical migration since 2001 for each bank. This is available in Appendix B for HDD West and Appendix C for HDD East. Arbitrary scour control points serve as the origin for the baseline stationing, beginning at 100 feet along each bank, and established as a means of comparing annual measurements. The HDD West top of bank setback allows for 105 feet of bank erosion and the HDD East top of bank setback allows for 115 feet of bank erosion (Baker 1997). Design setbacks for the Kachemach River allow for 25 feet of bank migration on either bank, while setbacks for the Miluveach River allow for 35 feet of bank migration on either bank (Baker 1999). Setbacks were based on a 30-year design life.

2.2 VSM TILT, SETTLEMENT, AND JACKING

Tilt of VSM adjacent to the river crossings were measured using a plumb bob and tape measure. Tilt was measured perpendicular to the oil pipeline (north/south) and parallel to the pipeline (east/west). Tilt of each VSM was documented by measuring the horizontal distance from plumb in feet per vertical foot (ft/ft). The VSM axis was considered plumb if the tilt was measured to be less than or equal to 0.00125 ft/ft. If tilt was measurable, the direction of tilt was also recorded (N, S, E, or W). Approximate conversions between ft/ft and in/ft are provided in Table 2.1.

TABLE 2.1 VSM TILT UNIT CONVERSION

ft/ft	in/ft
<0.00125	<1/64
0.00250	1/32
0.00500	***1/16***
0.00750	3/32
0.01000	1/8
0.01250	5/32
0.01750	27/128

The 1999 Alpine VSM installation specification states that "the plumb of each VSM shall vary no more than +/- 0.5% (1/16 inch per 12 inches) in any direction" (ARCO 1999). The 2004 CPAI North Slope VSM specification states that "the slope of any support beam in the direction parallel to the pipeline centerline shall not exceed 1/2 inch (0.042 feet) in ten feet (0.004 ft/ft or 1/16 inch per foot)" (CPAI 2004). Based on these VSM specifications and for comparison purposes, the plumb (tilt) tolerance was accepted to be 0.005 ft/ft (1/16 in/ft). Bold values in Table 2.1 indicate the VSM tilt tolerance for the purpose of this study.

2.3 VSM Scour

Streambed scour was evaluated using visual methods at each in-stream VSM in the Miluveach and Kachemach Rivers. As presented in the Mechanical Analysis of Aboveground Pipeline and Aboveground River Crossings (Baker 1999), the VSM within the floodplain of the Kachemach and Miluveach River crossings were designed to withstand both local pier scour and channel scour during a 200-year flood. Scour limits for VSM located in the floodplain and in the active channel are shown in Table 2.2. These values include both local pier scour as well as anticipated channel scour.

TABLE 2.2 VSM DESIGN SCOUR LIMITS

River	Minimum Scour Hole Elevations (feet – BPMSL)	
	Floodplain	Main Channel
Kachemach	9.5	6.9
Miluveach	36.7	35.1

2.4 Foundation Settlement and Jacking (HDD West)

LCMF surveyed the elevation of the HDD building foundation piles (bottom of pile cap) and developed tabulations of historic elevations for each pile, available in Appendix B. Data presented in the 2008 monitoring report (Baker 2008) reflected an adjustment to the vertical datum at HDD West of -0.35 feet, which was made to reflect actual elevations based on differential levels carried by LCMF from CD1 (Alpine) in August of 2007. According to LCMF, this adjustment was eliminated to avoid confusion about elevation values. Therefore, the values for each pile cap as presented in Appendix B reflect the original datum.

2.5 Polygon Trough Subsidence (HDD East)

A polygon trough located between the Colville River and the HDD East gravel pad was also monitored for subsidence. Historic profiles and tabulated elevations of selected cross sections over the length of the trough are presented in Appendix C.

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3.0 RESULTS

3.1 HDD WEST BANK

The west bank of the Colville River HDD crossing was evaluated by visual observation, review of ground and aerial photography (Photo A.1 through Photo A.6; Appendix A), as well as both field and topographic surveys. The 2009 Colville River breakup floodwaters did not overtop the west bank of the channel. No significant erosion was evident along the west bank. Deposition of sand along the toe of the bank did occur. A debris line was noted approximately 20 feet east of the bottom toe of the bank, between the toe of the bank and edge of water. This debris was likely deposited well after peak stage, as water did reach the west bank during the breakup observations.

3.1.1 BANK EROSION (HDD WEST)

The greatest bank erosion observed between the 2008 and 2009 monitoring events was 2.0 feet, occurring at Station 0+20, approximately 230 feet upstream (south) of the oil pipeline centerline, as identified on the LCMF topographic survey. The oil pipeline centerline is located at Station 2+50 on the topographic survey (Appendix B).

A maximum erosion of 18.7 feet, between April 2002 and August 2009, was measured along the top of bank at Station 3+70, located 120 feet north of the oil pipeline centerline (STA 2+50). This erosion value is unchanged from 2008. This value yields a maximum average rate of 2.6 feet/year at this location over the monitoring period. The average rate of erosion for 2009 along the 440-foot top of bank was measured to be 0.14 feet/year. This is less than the observed historic average rate of 0.46 feet/year, and less than the estimated maximum erosion rate used for design of 2.3 feet/year (Baker 1997). A summary of the LCMF surveying results for the HDD West Bank crossing is presented in Appendix B.

In 1997 Baker established a scour control point at the centerline of the NPS 14 oil pipeline, as shown on HDD Bank Monitoring HDD Site-West, as provided in Appendix B. Comparing the location of the 1997 scour control point to the 2009 LCMF survey data, approximately 9.0 feet of bank erosion has occurred over the 12 year period since 1997 (0.75 feet/year). This rate equals approximately 9% of the design setback of 105 feet. The west bank erosion has not yet reached the 50% design setback. If at some point in the future the bank "migrates 50% of the design setback, erosion rates or possible mitigation measures will be evaluated" (Baker 1999).

Based on visual observations, there does not appear to be any significant bank erosion. Flow direction is largely unchanged. The pipelines appear to be in good condition with no leaks.

Several "pits" were noted in the gravel pads near the buildings at HDD West. These are shown in Photo A.5 and Photo A.6 in Appendix A. All three pits are located west of the large propane tanks, and generally east of the two CP Module buildings. The origin of these pits is not known.

Pit #1 is the northernmost pit, located north of both CP Module buildings, but south of the 2-inch diesel line. This pit is 5 ½′ x 8 ½′ x 3 ½′ deep.

Pit #2 is located between the two CP Module buildings, south of Pit #1 but west of Pit #3. Pit #2 is approximately 6′ diameter x 2′ deep.

Pit #3 lies south of Pit #1, and almost directly east of Pit #2. Pit #3 is 5′ x 7′x 1 ½′ deep.

3.1.2 VSM TILT (HDD WEST)

The VSM directly adjacent to the HDD West pad and crossing were found to be adequately supporting the pipeline based on observations and measurements. All six VSM were found to be generally plumb as well. The maximum tilt was measured to be 0.0059 ft/ft for VSM 748N. Although this value exceeds the tolerance of 0.005 ft/ft (1/16 inch per foot), it is within the accuracy of the survey method utilized. The accuracy of the method employed is ±0.001 ft/ft. A summary of the HDD West Bank VSM tilt survey results is presented in Table 3.1.

Table 3.2 illustrates the change in tilt measurements collected between the 2008 and 2009 monitoring events.

Italicized tilt measurement values in Table 3.1 indicate VSM tilt exceeded the project tolerance of 0.005 ft/ft, but not by more than the accuracy of the survey method of 0.001 ft/ft.

TABLE 3.1 HDD WEST VSM TILT MEASUREMENT RESULTS (2009)

VSM Number	Tilt Measurement Orientation (ft/ft)		Comment
	North/South	East/West	
783	0.0034 S	0.0034 E	
784N (784A)	*0.0059 N*	< 0.00125	N/S: exceeded project tolerance; not survey accuracy
784S (784B)	< 0.00125	0.0041 W	
788	0.002 N	< 0.00125	
789N (789A)	0.0039 N	0.0019 W	
789S (789B)	0.0047 N	0.0018 W	

TABLE 3.2 HDD WEST VSM CHANGE IN TILT FROM 2008 TO 2009

VSM Number	Change in Tilt Measurement Orientation (ft/ft)	
	North/South	East/West
783	0.0054 S	0.0044 E
784N (784A)	0.0029 N	0.0048 E
784S (784B)	0.0046 S	0.0021 W
788	0.0020 N	< 0.00125
789N (789A)	< 0.00125	< 0.00125
789S (789B)	< 0.00125	0.0058 W

3.1.3 Foundation Pile Cap Survey (HDD West)

LCMF has conducted a pile cap elevation survey annually since 2004. Based on the surveys, no single pile cap has experienced a cumulative change of more than 0.015 feet of movement vertically over the span of five years. A summary of the LCMF surveying results for the HDD West Bank crossing is presented in Appendix B.

3.1.4 Summary

Since the 2008 monitoring event, the HDD West bank crossing eroded at an average rate of 0.14 ft/yr. This rate is less than both the long-term historic (0.5 ft/yr) and design erosion rates (2.3 ft/yr) over the 7-year study period. The observed erosion of the west bank, as measured at the NPS 14 oil centerline, represents approximately 9% of the 105-foot design setback, while the pipeline crossing has operated for approximately 10 years or 30% of the original 30-year design life.

Five of the HDD west pad VSM (783; 784S; 788; 789N; 789S) were within the project tolerances of less than or equal to 0.005 ft/ft (1/16 in/ft). The tilt of VSM 784N was measured to be 0.0059W ft/ft which exceeded the project tolerance of 0.005 ft/ft by less than the accuracy of the survey method (0.001 ft/ft).

Based on visual observations, measurements, and survey results, there appeared to be no settling, or jacking of VSM or foundation piles. The HDD west bank gravel pad is largely free from erosion, although three large pits are present on the pad. The origin of the pits is not known. The pipelines appeared to be in good, stable condition with no leaks. No ponding, cracks, depressions, or pressure ridges were evident over the pipeline axis.

3.2 HDD East Bank

The east bank of the Colville River HDD crossing was also evaluated by visual observation, review of ground and aerial photography (Photo A.7 through Photo A.14 in Appendix A), as well as both field and topographic surveys. The 2009 Colville River breakup floodwaters did not overtop the east bank of the channel.

3.2.1 Bank Erosion (HDD East)

The greatest bank erosion observed between the 2008 and 2009 monitoring events was 2.9 feet occurring at Station 0+25, 255 feet south of the approximate NPS 14 oil pipeline centerline (STA 2+80).

Between August 2001 and August 2009, a maximum erosion of 33.2 feet at the top of bank was measured at Station 4+15. This location is approximately 135 feet north of the oil pipeline centerline (STA 2+80). This value yields a maximum average erosion rate of 4.2 feet/year over the 8-year monitoring period at this location. The average rate of erosion for the 2008-2009 period, as measured along the entire 450-foot top of bank, is approximately 0.02 feet/year. This value averages both erosion and deposition. This is less than both the observed long-term historical average erosion rate of 1.4 feet/year, and the estimated maximum design erosion rate of 2.5 feet/year (Baker 1997). A summary of the LCMF surveying results for the HDD East Bank crossing is presented in Appendix C.

Approximately 9.2 feet of bank erosion near the oil pipeline centerline (STA 2+88) has occurred since 1997 (an average of 0.8 feet/year) based on a comparison of 2009 survey data and the 1997 scour control point shown on the figure HDD Bank Erosion Topo/Monitoring HDD Site-East, as provided in Appendix C. As of 2009, the observed bank erosion of 9.2 feet equals 8% of the 115-foot design setback. The east bank erosion has not yet reached the 50% design setback. If at some point in the future the bank "migrates 50% of the design setback, erosion rates or possible mitigation measures will be evaluated" (Baker 1999).

Visually, some erosion and sloughing has occurred along the east bank, with exposed sandbags and Styrofoam evident. It is our understanding that the sandbags and Styrofoam were placed in the bank to combat further erosion. The date of that placement is not known. As noted during the field visit, some large shrubs have fallen down the embankment into the channel. (Photo A.9 and Photo A.10 in Appendix A).

3.2.2 Polygon Trough Subsidence (HDD East)

In addition to bank erosion surveys, subsidence monitoring has been conducted by LCMF at eight cross sections (Cross Section A through Cross Section H) of the polygon trough since 2001. The cumulative subsidence at cross sections A, B, C, F, G and H is less than 2.0 feet. Maximum cumulative subsidence at cross section D is 2.5 feet. The maximum incremental change at cross section D was a drop of 1.9 feet since 2008. The maximum cumulative

subsidence at cross section E is 3.1 feet. The maximum incremental change at cross section E was a drop of 0.9 feet since 2008. These cross sections, as well as tabular results, are provided in Appendix C. (Photo A.11 through Photo A.13 in Appendix A).

3.2.3 VSM TILT

The VSM directly adjacent to the HDD East pad and crossing were found to be adequately supporting the pipelines based on observations and measurements. All five of the VSM were found to be generally plumb. The maximum tilt was measured to be 0.0043S and 0.0043 W (ft/ft) both for VSM 885. These values are within the project tolerance of less than or equal to 0.005 ft/ft (1/16 in/ft). A summary of the HDD East Bank VSM tilt survey results is presented in Table 3.3. Table 3.4 presents the difference in tilt measurements collected during the 2008 and 2009 monitoring events.

TABLE 3.3 HDD EAST VSM TILT MEASUREMENT RESULTS (2009)

VSM Number	Tilt Measurement Orientation (ft/ft)	
	North/South	East/West
883	< 0.00125	< 0.00125
884	< 0.00125	< 0.00125
885	0.0043 S	0.0043 W
889	0.0023 N	0.0023 E
890	0.0024 S	0.0020 E

TABLE 3.4 HDD EAST VSM CHANGE IN TILT FROM 2008 TO 2009

VSM Number	Change in Tilt Measurement Orientation (ft/ft)	
	North/South	East/West
883	< 0.00125	0.0027 E
884	0.0018 N	< 0.00125
885	< 0.00125	0.0013 W
889	< 0.00125	< 0.00125
890	0.0026 N	< 0.00125

3.2.4 SUMMARY

Since the 2008 monitoring event, the HDD East bank crossing eroded at an average rate of 0.02 ft/yr. The eight year average erosion rate of 1.35 feet/year is less than the design erosion rate of 2.5 feet/year (Baker 1997). The observed erosion of the east bank at the NPS 14 oil centerline represents approximately 8% of the 115-foot design setback, while the pipeline crossing has operated for approximately 30% of the original 30-year design life.

All five of the VSM at HDD East Pad were within the project tolerances for tilt, measuring less than or equal to 0.005 ft/ft (1/16 inch per foot).

Based on visual observations, measurements, and field survey results, there did not appear to be any settling or jacking of VSM. The HDD East Bank gravel pad is free from erosion and the pipelines appeared to be in good, stable condition with no leaks. No ponding, cracks, depressions, or pressure ridges were evident over the pipeline axis. A polygon trough does pass over the seawater casing axis, however, features of the trough do not meet or exceed the allowable physical conditions listed in section 1.1 Monitoring Criteria, relative to the pipeline axis.

3.3 KACHEMACH RIVER

The Kachemach River crossing was evaluated by visual observation, review of ground and aerial photography (Photo A.15 through Photo A.22; Appendix A), and field surveys**.** At the time of the field visit, flow was observed within and across the gravel channel bottom at a depth of generally less than three feet. Based on visual observation, flow from the 2009 breakup was confined to the east bank of the main channel, reaching between VSM 1714 and 1714A on the west bank of the channel. VSM 1714A is currently located within the channel, while VSM 1714 is located approximately 30 feet west of the edge of water. VSM 1714 and VSM 1714A are separated by approximately 30 feet.

3.3.1 BANK EROSION

Based on visual observations, no bank erosion was evident at the crossing nor immediately upstream or downstream from the pipelines.

3.3.2 VSM TILT

The VSM located within the vicinity of the Kachemach River were adequately supporting the pipelines based on visual observations. Four of the six VSM were found to be generally plumb, within the project tolerance of less than or equal to 0.005 ft/ft (1/16 in/ft) based on measured tilt, or within the accuracy of the survey method utilized. The accuracy of the method employed is ±0.001 ft/ft.

The other two VSM, 1714A and 1715C (both reportedly abandoned), exceeded the 0.005 ft/ft ±0.001 ft/ft project tolerance based on field measurements. The maximum measured tilt was 0.143 ft/ft E, measured at VSM 1715C. Maximum tilt at VSM 1714A was 0.141 E. Both of these tilt measurements, exceeding the combined project tolerance (including survey accuracy), were tilting in the east direction.

The reportedly abandoned VSM 1715C was measured to have the greatest change in tilt since 2008, a change of 0.0303 ft/ft to the west. Of the VSM that are not abandoned, VSM 1716 was measured to have the greatest change in tilt, a change of 0.0103 to the west. However, this

VSM did not exceed project tolerance for tilt in 2009. A summary of the 2009 Kachemach River VSM tilt survey results are presented in Table 3.5. Table 3.6 presents the difference in tilt measurements collected during the 2008 and 2009 monitoring events.

Bold and italicized tilt measurement orientation values in Table 3.5 indicate VSM tilt exceeded the project tolerance of 0.005 ft/ft by more than the accuracy of the survey method of 0.001 ft/ft. Italicized tilt measurement orientation values in Table 3.5 indicate VSM tilt exceeded the project tolerance of 0.005 ft/ft but not by more than the accuracy of the survey method of ±0.001 ft/ft.

TABLE 3.5 KACHEMACH RIVER VSM TILT MEASUREMENT RESULTS (2009)

VSM Number	Tilt Measurement Orientation (ft/ft)		Comments
	North/South	East/West	
1713	Greater than 15' from channel		
1714	*0.0051 N*	0.0048 E	
1714A (Abandoned)	0.0043 S	***0.0141 E***	E/W: exceeded project tolerance & survey accuracy
1715A	< 0.00125	< 0.00125	
1715B	0.0023 N	0.0025 W	
1715C (Abandoned)	< 0.00125	***0.0143 E***	E/W: exceeded project tolerance & survey accuracy
1716	*0.0055 S*	0.0043 W	
1717	Greater than 15' from channel		

TABLE 3.6 KACHEMACH RIVER VSM CHANGE IN TILT FROM 2008 TO 2009

VSM Number	Change in Tilt Measurement Orientation (ft/ft)	
	North/South	East/West
1713	Greater than 15' from channel	
1714	< 0.00125	0.0078 E
1714A (Abandoned)	0.0027 N	< 0.00125
1715A	< 0.00125	0.0030 E
1715B	< 0.00125	< 0.00125
1715C (Abandoned)	0.0022 N	0.0303 W
1716	0.0016 N	0.0103 W
1717	Greater than 15' from channel	

3.3.3 VSM Scour

Visual observations and measurements were collected to evaluate pier scour for those VSM located within the active Kachemach River channel. No excessive scour was observed at the base of any VSM located within the channel or floodplain. The design scour limit for the main channel of the Kachemach River is 6.9 feet BPMSL; however, no topographic survey was conducted this monitoring cycle. Table 3.7 illustrates the field scour measurements.

TABLE 3.7 KACHEMACH RIVER VSM SCOUR

VSM	Location Description	Depth of Scour, ft	Notes
1713	Grassy bank incline	No scour hole	Greater than 90 feet from edge of water
1714	Grassy floodplain	2.2 feet below existing ground	Approximately 30 feet from edge of water
1714A	Channel	1.4 ft below water surface	Abandoned VSM
1715A	Channel	No scour hole	Approximately 2.5 foot diameter scour casing
1715B	Channel	No scour hole	Approximately 2.5 foot diameter scour casing
1715C	Grassy floodplain	1.4 feet below existing ground	Abandoned VSM; Approximately 2.5 feet from edge of water
1716	Grassy floodplain	1.0 feet below existing ground	Approximately 30 feet from edge of water
1717	Grassy Floodplain	1.5 feet below existing ground	Approximately 95 feet from edge of water.
1718	Grassy Floodplain	1.7 feet below existing ground	Approximately 160 feet from edge of water
1719	Grassy bank incline	No scour hole	Approximately 225 feet from edge of water

3.3.4 Summary

The tilt of VSM 1714A and 1715C both exceed the project tolerance (including survey accuracy). Both of these are reportedly abandoned VSM. Although VSM 1713 is not located within the active channel, and therefore not reported in Table 3.5, this VSM also exceeds the project tolerance with tilt of 0.0055 S and 0.0062 E. Of VSM that are not reported to be abandoned, VSM 1716 exhibited the largest change in tilt, with a change of 0.0103 ft/ft W. VSM 1716 remains within the project tolerance.

Based on visual observations, there is no significant bank erosion or channel scour at the VSM crossing. The VSM have no apparent visual effect on the channel at the crossing location. The pipelines appear to be in good condition with no observed leaks.

3.4 MILUVEACH RIVER

The Miluveach River crossing was evaluated by visual observation, review of ground and aerial photography (Photo A.23 through Photo A.31; Appendix A), and field surveys. At the time of the field visit, flow was observed to be confined to the east side of the channel, approximately 4.5 feet in width, and 0.1 foot deep. Based on visual observation, flow from the 2009 breakup was confined to the main channel and did not appear to have reached the overbank regions adjacent to the river crossing.

3.4.1 BANK EROSION

Based on visual observations, no bank erosion was evident at the crossing nor immediately upstream or downstream from the pipelines.

3.4.2 VSM TILT

The VSM located within the vicinity of the Miluveach River were adequately supporting the pipelines based on visual observations. One of the four VSM, 2048N was found to be generally plumb, within the project tolerance of less than or equal to 0.005 ft/ft (1/16 in/ft) based on measured tilt. The other three VSM, 2047N, 2047S, and 2048S, exceeded the 0.005 ft/ft ±0.001 ft/ft project tolerance based on field measurements.

A summary of the Miluveach River VSM tilt survey results is presented in Table 3.8. Table 3.9 presents the difference in tilt measurements collected during the 2008 and 2009 monitoring events. The maximum measured tilt was 0.096 ft/ft E, measured at VSM 2048S.

Bold italicized tilt measurement orientation values in Table 3.8 indicate VSM tilt exceeded the project tolerance of 0.005 ft/ft by more than the accuracy of the survey method of ±0.001 ft/ft. Italicized tilt measurement orientation values in Table 3.8 indicate VSM tilt exceeded the project tolerance of 0.005 ft/ft but not by more than the accuracy of the survey method of ±0.001 ft/ft.

TABLE 3.8 MILUVEACH RIVER VSM TILT MEASUREMENT RESULTS (2009)

VSM Number	Tilt Measurement Orientation (ft/ft)		Comment
	North/South	East/West	
2046	Greater than 15' from channel		
2047N (A)	***0.0069 S***	0.0013 W	N/S: exceeded project tolerance & survey accuracy
2047S (B)	***0.0065 N***	< 0.00125	N/S: exceeded project tolerance & survey accuracy
2048N (A)	0.0023 N	0.0027 W	
2048S (B)	0.0043 S	***0.0096 E***	E/W: exceeded project tolerance & survey accuracy
2049	Greater than 15' from channel		

TABLE 3.9 MILUVEACH RIVER VSM TILT CHANGE IN TILT FROM 2008 TO 2009

VSM Number	Change in Tilt Measurement Orientation (ft/ft)	
	North/South	East/West
2046	Greater than 15' from channel	
2047N (A)	0.0139 S	< 0.00125
2047S (B)	0.0105 N	0.0015 W
2048N (A)	0.0013 N	0.0024 E
2048S (B)	0.0017 N	0.0045 W
2049	Greater than 15' from channel	

3.4.3 VSM SCOUR

Visual observations and measurements were collected to evaluate pier scour for those VSM located within the active Miluveach River channel. No excessive scour was observed at the base of any VSM located within the channel or floodplain. The design scour limit for the main channel of the Miluveach River is 35.1 feet BPMSL; however, no topographic survey was conducted this monitoring cycle. Table 3.10 illustrates the field scour measurements.

TABLE 3.10 MILUVEACH RIVER VSM SCOUR

VSM	Location Description	Depth of Scour Hole, ft	Notes
2046	Grassy bank above floodplain	No scour hole	Outside channel floodplain
2047N (A)	Dry Gravel Channel Bed	Shallow, local scour	Dry, 3 ft diameter scour hole
2047S (B)	Dry Gravel Channel Bed	Shallow, local scour	Dry, 2 ft diameter scour hole
2048N (A)	Dry Gravel Channel Bed	0.45 ft below water surface	Ponded water in scour hole, 3 ft diameter scour hole
2048S (B)	Dry Gravel Channel Bed	0.95 ft below water surface	Ponded water in scour hole, 8 ft diameter scour hole
2049	Grassy bank above floodplain	No scour hole	Outside channel floodplain

3.4.4 SUMMARY

The tilt of VSM 2047N, 2047S, and 2048S all exceed the project tolerance, including survey accuracy. All three of these VSM were approaching values exceeding the project tolerance in 2008.

Based on visual observations, there is no significant bank erosion or channel scour at the VSM crossing. The VSM have no apparent visual effect on the channel at the crossing location. The pipelines appear to be in good condition with no observed leaks.

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4.0 CONCLUSIONS

No significant erosion or scour occurred at any of the Alpine Pipeline System river crossing sites during the 2009 spring breakup. Floodwaters did not overtop any banks during the 2009 spring breakup. The condition of the VSM and pipelines was determined to be stable despite VSM tilt measurements being outside of the project tolerance at the Kachemach River and Miluveach River crossings. At the east and west bank HDD crossing sites, continuing natural erosion along the banks was noted to be within design estimates and is not negatively impacting the safe operation of the pipeline. No signs of pressure ridges, depressions, ponding, or cracking were evident.

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5.0 REFERENCES

ARCO Alaska, Inc. (ARCO). 1999. Vertical Support Member and Module Pile Installation Specification. SPC-CE-AP-10001. February 1999.

ConocoPhillips Alaska (CPAI). 2004. Vertical Support Member and Module Pile Installation Specification. SPC-CE-NS-80002. May 2004.

Michael Baker, Jr., Inc. (Baker). 2008. Alpine Pipeline River Crossings 2008 Monitoring Report. Prepared for ConocoPhillips Alaska. 114133-MBJ-RPT-001. October 2008.

—— 2007. Alpine Pipeline HDD Crossing 2007 Monitoring Report. Prepared for ConocoPhillips Alaska. 111620-MBJ-RPT-001. October 2007.

—— 2006. Alpine Pipeline River Crossings 2006 Monitoring Report. Prepared for ConocoPhillips Alaska. 108710-MBJ-RPT-001. October 2006.

—— 2005. 2005 Alpine Pipeline River Crossing Monitoring. Prepared for ConocoPhillips Alaska. 105758-MBJ-001. October 2005.

—— 2004. 2004 Alpine Pipeline River Crossing Monitoring. Prepared for ConocoPhillips Alaska. 103654-MBJ-001. October 2004.

—— 2003. 2003 Alpine Pipeline River Crossing Monitoring. Prepared for ConocoPhillips Alaska. 101376-MBJ-001. July 2003.

—— 2002. HDD Transition Zones Civil Surveillance Trip Report – 2001. Prepared for Phillips Alaska Inc. 25114-217-MBJ-001. January 2002.

—— 1999. Mechanical Analysis of Aboveground Pipeline & Aboveground River Crossings. Prepared for ARCO Alaska Inc. 23100-MBJ-RP-001. May 1999.

—— 1997. Alpine Development. Colville River Crossing Design Report. Prepared for ARCO Alaska. Rev. 4. 2003. Prepared for Arco Alaska Inc. 23100-MBJ-RP-003. June 1997.

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Appendix A Photographs

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PHOTO A.1 HDD WEST, MAY 18, 2009. HDD WEST SIX DAYS BEFORE PEAK STAGE, LOOKING EAST.

PHOTO A.2 HDD WEST, AUGUST 6, 2009. AERIAL VIEW OF HDD WEST FACILITIES.

PHOTO A.3 HDD WEST, AUGUST 6, 2009. WEST BANK, LOOKING NORTHWEST.

PHOTO A.4 HDD WEST, AUGUST 6, 2009. WEST BANK, LOOKING SOUTHWEST.

PHOTO A.5 HDD WEST, AUGUST 6, 2009. VIEW OF PITS IN GRAVEL PAD BETWEEN CP MODULE BUILDINGS.

PHOTO A.6 HDD WEST, AUGUST 6, 2009. VIEW OF PIT IN GRAVEL PAD NEAR PROPANE TANKS.

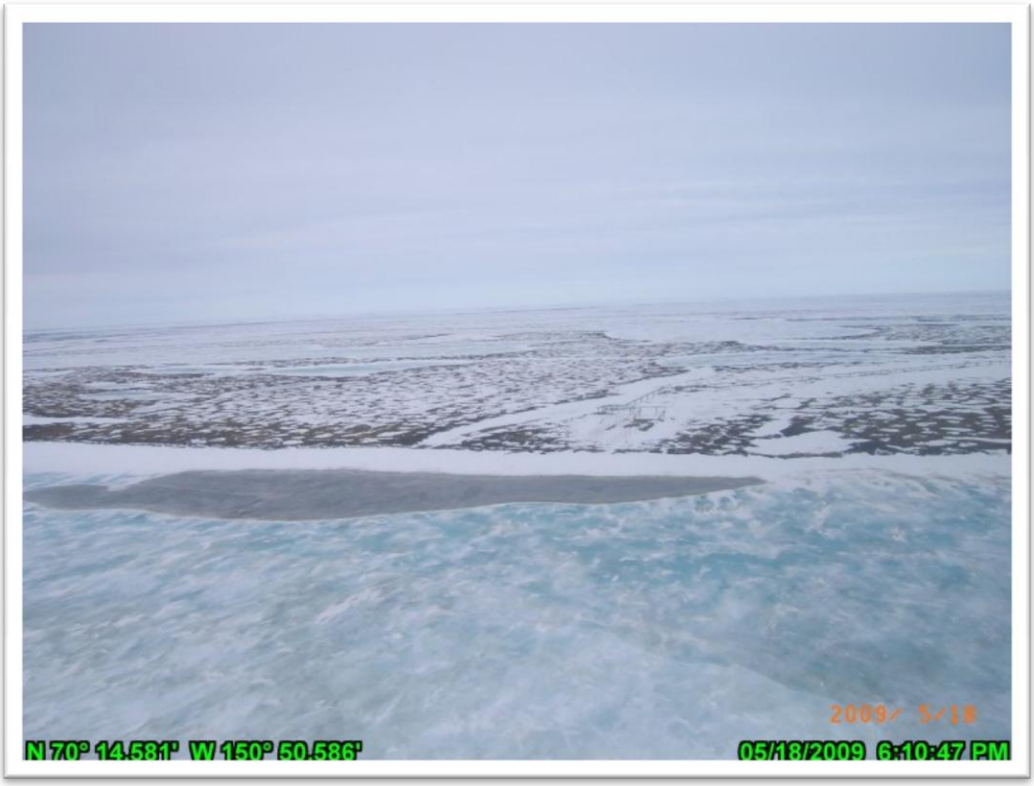

PHOTO A.7 HDD EAST, MAY 18, 2009. VIEW OF HDD EAST FACILITIES SIX DAYS BEFORE PEAK STAGE.

PHOTO A.8 HDD EAST, AUGUST 6, 2009. AERIAL VIEW OF HDD EAST, LOOKING EAST.

PHOTO A.9 HDD EAST, AUGUST 6, 2009. VIEW OF EAST BANK FROM CHANNEL.

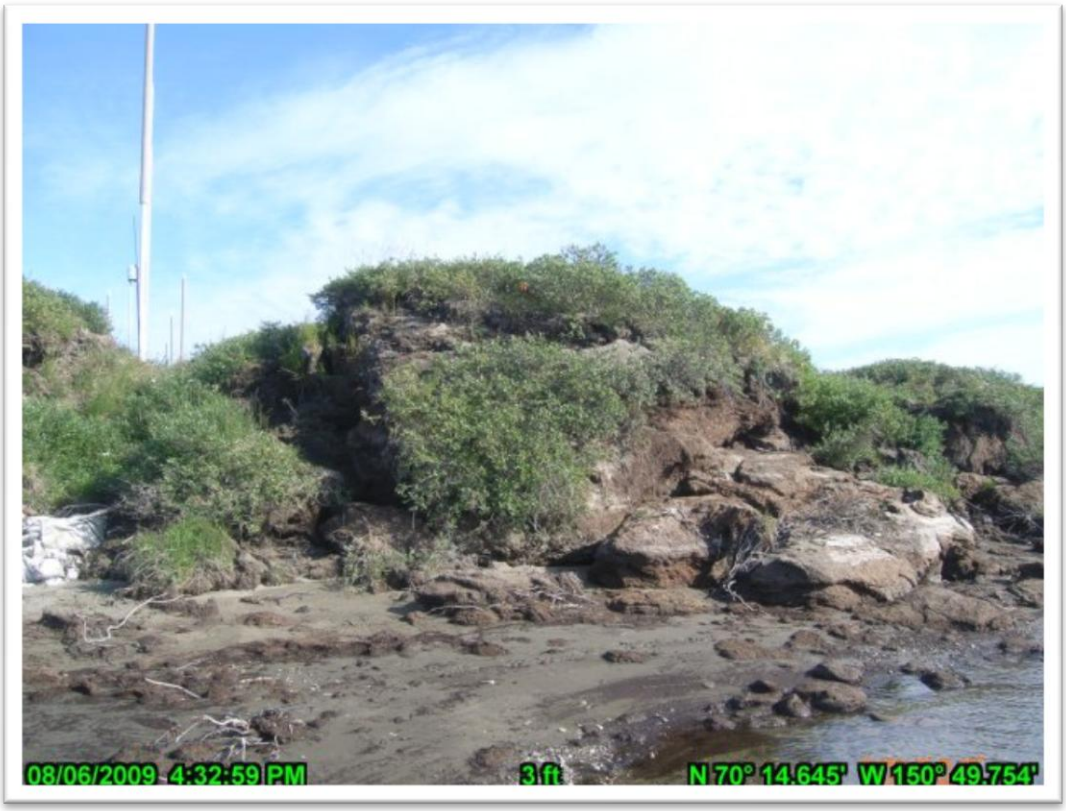

PHOTO A.10 HDD EAST, AUGUST 6, 2009. VIEW OF EAST BANK FROM CHANNEL, LOOKING SOUTHEAST.

PHOTO A.11 HDD EAST, AUGUST 6, 2009. VIEW OF TROUGH FROM EAST BANK, LOOKING EAST TOWARD PIPELINE.

PHOTO A.12 HDD EAST, AUGUST 6, 2009. VIEW OF TROUGH, LOOKING SOUTHWEST.

PHOTO A.13 HDD EAST, AUGUST 6, 2009. VIEW OF TROUGH, LOOKING SOUTHWEST.

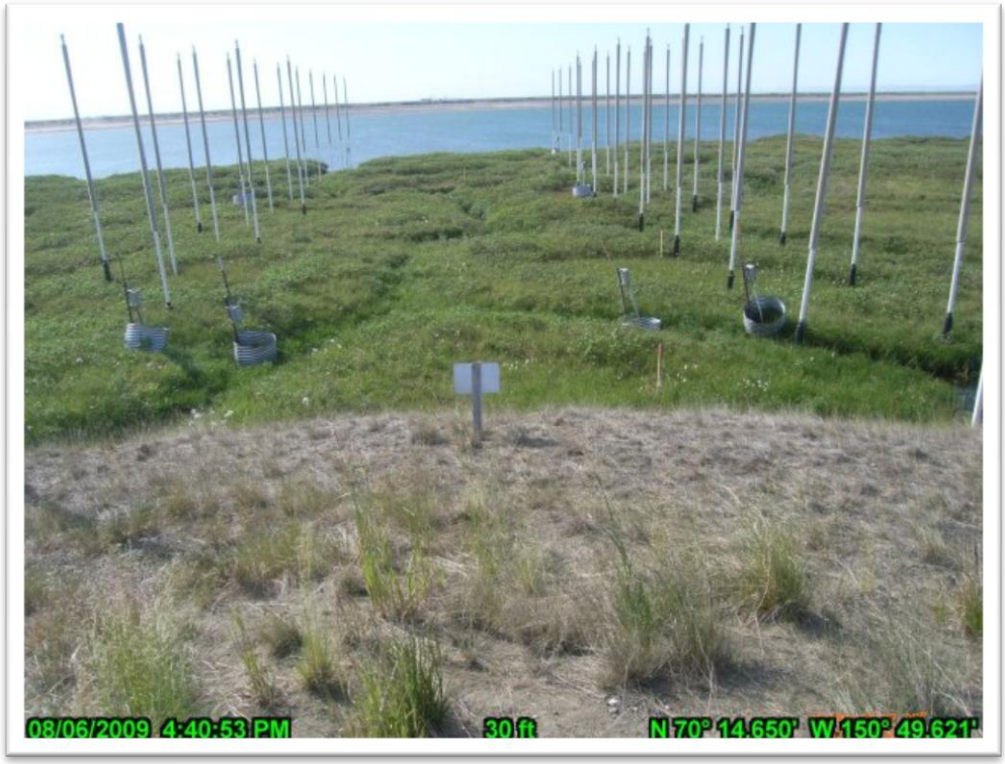

PHOTO A.14 HDD EAST, AUGUST 6, 2009. VIEW FROM EAST THROUGH THERMOSIPHONS, LOOKING WEST.

PHOTO A.15 KACHEMACH RIVER CROSSING, MAY 31, 2009.

PHOTO A.16 KACHEMACH RIVER CROSSING, AUGUST 6, 2009. AERIAL VIEW LOOKING NORTH.

PHOTO A.17 KACHEMACH RIVER CROSSING, AUGUST 6, 2009. FROM WEST BANK, LOOKING EAST.

PHOTO A.18 KACHEMACH RIVER CROSSING, AUGUST 6, 2009. CHANNEL LOOKING SOUTH.

PHOTO A.19 KACHEMACH RIVER CROSSING, AUGUST 6, 2009. CHANNEL, LOOKING NORTH.

PHOTO A.20 KACHEMACH RIVER CROSSING, AUGUST 6, 2009. EAST BANK, LOOKING NORTHWEST.

PHOTO A.21 KACHEMACH RIVER CROSSING, AUGUST 6, 2009. EAST BANK, LOOKING WEST.

PHOTO A.22 KACHEMACH RIVER CROSSING, AUGUST 6, 2009. EAST BANK LOOKING SOUTH.

PHOTO A.23 MILUVEACH RIVER CROSSING, MAY 31, 2009. PIPE BRIDGE AT MILUVEACH RIVER CROSSING DURING SPRING BREAKUP.

PHOTO A.24 MILUVEACH RIVER CROSSING, AUGUST 6, 2009. AERIAL VIEW OF CROSSING, LOOKING SOUTHWEST.

PHOTO A.25 MILUVEACH RIVER CROSSING, AUGUST 6, 2009. AERIAL VIEW OF CROSSING, LOOKING SOUTH.

PHOTO A.26 MILUVEACH RIVER CROSSING, AUGUST 6, 2009. IN CHANNEL LOOKING SOUTH.

PHOTO A.27 MILUVEACH RIVER CROSSING, AUGUST 6, 2009. VIEW OF VSM SCOUR HOLE.

PHOTO A.28 MILUVEACH RIVER CROSSING, AUGUST 6, 2009. FROM WEST BANK LOOKING SOUTHEAST.

PHOTO A.29 MILUVEACH RIVER CROSSING, AUGUST 6, 2009. VIEW OF EAST BANK LOOKING SOUTHEAST.

PHOTO A.30 MILUVEACH RIVER CROSSING, AUGUST 6, 2009. VIEW OF CHANNEL FROM CROSSING LOCATION, LOOKING NORTH.

PHOTO A.31 MILUVEACH RIVER CROSSING, AUGUST 6, 2009. VIEW OF WEST BANK FROM EAST BANK, LOOKING WEST-NORTHWEST.

Appendix B HDD West

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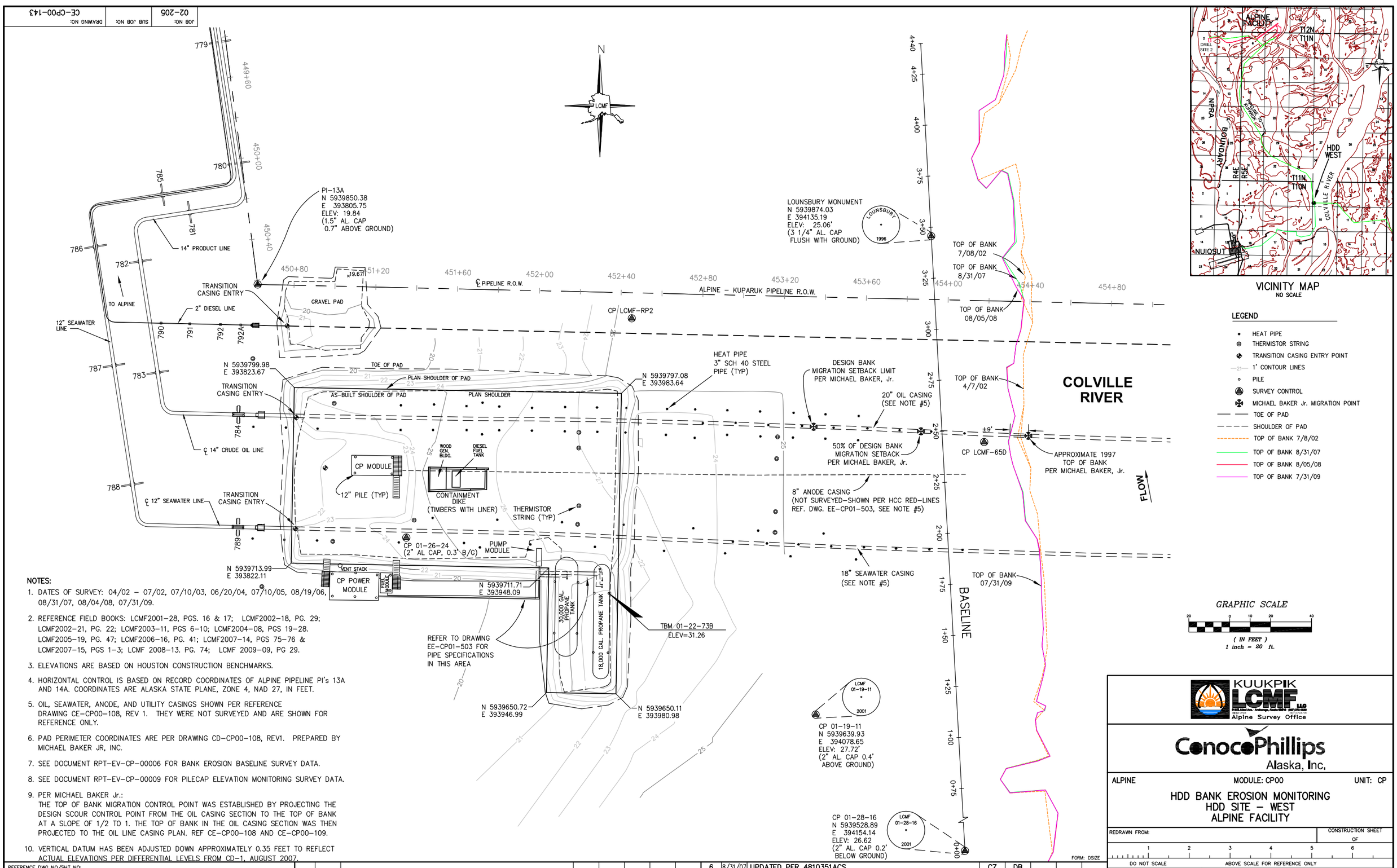
JOB NO:	SUB JOB NO:	DRAWING NO:
02-205		CE-CP00-143



NOTES:

1. DATES OF SURVEY: 04/02 – 07/02, 07/10/03, 06/20/04, 07/10/05, 08/19/06, 08/31/07, 08/04/08, 07/31/09.
2. REFERENCE FIELD BOOKS: LCMF2001-28, PGS. 16 & 17; LCMF2002-18, PG. 29; LCMF2002-21, PG. 22; LCMF2003-11, PGS 6-10; LCMF2004-08, PGS 19-28. LCMF2005-19, PG. 47; LCMF2006-16, PG. 41; LCMF2007-14, PGS 75-76 & LCMF2007-15, PGS 1-3; LCMF 2008-13. PG. 74; LCMF 2009-09, PG 29.
3. ELEVATIONS ARE BASED ON HOUSTON CONSTRUCTION BENCHMARKS.
4. HORIZONTAL CONTROL IS BASED ON RECORD COORDINATES OF ALPINE PIPELINE PI's 13A AND 14A. COORDINATES ARE ALASKA STATE PLANE, ZONE 4, NAD 27, IN FEET.
5. OIL, SEAWATER, ANODE, AND UTILITY CASINGS SHOWN PER REFERENCE DRAWING CE-CP00-108, REV 1. THEY WERE NOT SURVEYED AND ARE SHOWN FOR REFERENCE ONLY.
6. PAD PERIMETER COORDINATES ARE PER DRAWING CD-CP00-108, REV1. PREPARED BY MICHAEL BAKER JR, INC.
7. SEE DOCUMENT RPT-EV-CP-00006 FOR BANK EROSION BASELINE SURVEY DATA.
8. SEE DOCUMENT RPT-EV-CP-00009 FOR PILECAP ELEVATION MONITORING SURVEY DATA.
9. PER MICHAEL BAKER Jr.:
   THE TOP OF BANK MIGRATION CONTROL POINT WAS ESTABLISHED BY PROJECTING THE DESIGN SCOUR CONTROL POINT FROM THE OIL CASING SECTION TO THE TOP OF BANK AT A SLOPE OF 1/2 TO 1. THE TOP OF BANK IN THE OIL CASING SECTION WAS THEN PROJECTED TO THE OIL LINE CASING PLAN. REF CE-CP00-108 AND CE-CP00-109.
10. VERTICAL DATUM HAS BEEN ADJUSTED DOWN APPROXIMATELY 0.35 FEET TO REFLECT ACTUAL ELEVATIONS PER DIFFERENTIAL LEVELS FROM CD-1, AUGUST 2007.

FORM: DSIZE

KUUKPIK LCMF LLC
Alpine Survey Office

ConocoPhillips Alaska, Inc.

ALPINE | MODULE: CP00 | UNIT: CP

HDD BANK EROSION MONITORING
HDD SITE – WEST
ALPINE FACILITY

REDRAWN FROM: | CONSTRUCTION SHEET OF

DO NOT SCALE — ABOVE SCALE FOR REFERENCE ONLY

DATE:	DRAWN: CZ	DESIGN:	ECM NO: 1870227ACS
11/5/02	CHECKED: JZ		CC NO:
SCALE: 1"=20'	APPROVAL: ML		CADD FILE NO. 01-12-05-1WEST
JOB NO: 02-205 SUB JOB NO:	DRAWING NO: CE-CP00-143		PART: 1 OF 1 REV: 8

REFERENCE DWG NO/SHT NO:

REV	DATE	REVISIONS	BY	CHK	JOB ENGR	PROJ ENGR	CUST APP
8	7/31/09	UPDATED PER 6370813ACS	AG	DB			
7	8/7/08	UPDATED PER 5538034ACS	CZ	GD			
6	8/31/07	UPDATED PER 4810351ACS	CZ	DB			
5	8/21/06	UPDATED PER 4116808ACS	AG	GD			
4	7/10/05	UPDATED PER 3391755ACS	CZ	DB			
3	6/25/04	UPDATED PER 2390460ACS	CZ	BD			
2	11/15/03	ISSUED PER 2094387ACS	GD	JZ			
1	11/5/02	ISSUED PER 1870227ACS	CZ	JZ			

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Pile Cap Designation	Pile Cap Monitor - Bottom of Pile Cap Locations - HDD West See Drawing CE-CP00-143 Rev 8 for Survey Baseline Location						Description
	6/20/2004	8/4/2005	8/19/2006	8/31/2007	8/7/2008	8/3/2009	Date
W-01 NE Cor	26.389	26.389	26.391	26.398	26.397	26.401	Bottom of Pile Cap (In Feet)
W-02 NE Cor	26.391	26.390	26.390	26.400	26.397	26.403	Bottom of Pile Cap (In Feet)
W-03 NE Cor	26.391	26.391	26.394	26.400	26.398	26.403	Bottom of Pile Cap (In Feet)
W-04 NE Cor	26.389	26.388	26.390	26.394	26.394	26.396	Bottom of Pile Cap (In Feet)
W-05 NE Cor	26.383	26.378	26.386	26.390	26.389	26.393	Bottom of Pile Cap (In Feet)
W-06 NE Cor	26.395	26.391	26.394	26.400	26.397	26.401	Bottom of Pile Cap (In Feet)
W-07 NE Cor	26.397	26.393	26.402	26.406	26.404	26.408	Bottom of Pile Cap (In Feet)
W-08 NE Cor	26.403	26.401	26.404	26.408	26.406	26.412	Bottom of Pile Cap (In Feet)
W-09 NE Cor	31.291	31.294	31.292	31.290	31.292	31.294	Bottom of Pile Cap (In Feet)
W-10 NE Cor	31.266	31.261	31.261	31.264	31.263	31.263	Bottom of Pile Cap (In Feet)
W-11 NE Cor	31.299	31.300	31.288	31.294	31.299	31.304	Bottom of Pile Cap (In Feet)
W-12 NE Cor	31.301	31.301	31.298	31.294	31.297	31.298	Bottom of Pile Cap (In Feet)
W-13 NE Cor	27.377	27.373	27.383	27.393	27.389	27.391	Bottom of Pile Cap (In Feet)
W-14 NE Cor	27.428	27.423	27.433	27.439	27.442	27.442	Bottom of Pile Cap (In Feet)
W-15 NE Cor	27.413	27.407	27.407	27.425	27.428	27.425	Bottom of Pile Cap (In Feet)
W-16 NE Cor	27.389	27.385	27.392	27.416	27.400	27.404	Bottom of Pile Cap (In Feet)
W-17 NE Cor	28.940	28.947	28.944	28.940	28.945	28.946	Bottom of Pile Cap (In Feet)
W-18 NE Cor	28.965	28.972	28.968	28.965	28.970	28.969	Bottom of Pile Cap (In Feet)
W-19 NE Cor	28.959	28.962	28.960	28.956	28.958	28.958	Bottom of Pile Cap (In Feet)
W-20 NE Cor	28.964	28.965	28.965	28.965	28.966	28.964	Bottom of Pile Cap (In Feet)

Note: Survey completed on 6/20/2004 was used to compute Incremental/Cumulative Change. Positive numbers indicate subsidence.
All Pile Caps are 0.083' Thick. Add Cap thickness to shown elevations for Top of Pile Cap Elevations

Baseline Station	Streambank Monitor - Top of Bank Locations									Description
	See Drawing CE-CP00-143 Rev 8 for Survey Baseline Location									
	4/7/2002	7/8/2002	7/10/2003	6/20/2004	7/10/2005	8/19/2006	8/31/2007	8/5/2008	7/31/2009	Date
0+00	39.5	39.5	39.5	39.5	39.3	39.3	39.3	39.3	39.4	Baseline Offset (In Feet)
0+05	39.3	39.3	39.3	39.3	37.6	37.6	37.6	37.6	37.7	Baseline Offset (In Feet)
0+10	39.4	39.4	39.4	39.4	38.5	38.5	38.5	38.5	38.7	Baseline Offset (In Feet)
0+20	45.8	45.8	45.8	45.8	41.9	41.9	41.9	41.9	39.9	Baseline Offset (In Feet)
0+25	41.5	41.5	41.5	41.5	39.1	39.1	39.1	39.1	37.6	Baseline Offset (In Feet)
0+30	37.7	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.8	Baseline Offset (In Feet)
0+40	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	42.2	Baseline Offset (In Feet)
0+50	42.0	42.0	42.0	42.0	42.0	42.0	44.5	44.5	44.5	Baseline Offset (In Feet)
0+60	41.4	41.4	41.4	41.4	41.4	41.4	46.4	46.4	46.3	Baseline Offset (In Feet)
0+70	40.7	40.7	40.7	40.7	40.7	40.7	41.9	41.9	41.9	Baseline Offset (In Feet)
0+75	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.3	Baseline Offset (In Feet)
0+80	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	Baseline Offset (In Feet)
0+85	29.0	29.0	29.0	29.0	29.0	29.0	29.7	29.7	30.3	Baseline Offset (In Feet)
0+90	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	43.3	Baseline Offset (In Feet)
1+00	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.9	Baseline Offset (In Feet)
1+05	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.8	Baseline Offset (In Feet)
1+10	41.4	41.4	41.4	41.4	39.2	39.2	39.2	39.2	39.2	Baseline Offset (In Feet)
1+15	38.2	38.2	38.2	38.2	38.2	38.2	39.9	39.9	39.9	Baseline Offset (In Feet)
1+20	39.4	39.4	39.4	39.4	39.4	39.4	40.4	40.4	40.4	Baseline Offset (In Feet)
1+25	41.4	41.4	41.4	41.4	41.4	41.4	41.4	41.4	42.1	Baseline Offset (In Feet)
1+30	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.5	Baseline Offset (In Feet)
1+35	44.2	44.2	44.2	44.2	43.8	43.8	43.8	43.8	44.1	Baseline Offset (In Feet)
1+40	45.3	45.3	45.3	45.3	43.4	43.4	43.4	43.4	43.4	Baseline Offset (In Feet)
1+45	45.7	45.7	45.7	45.7	43.4	43.4	43.4	43.4	43.4	Baseline Offset (In Feet)
1+50	45.7	45.7	45.7	45.7	43.9	43.9	43.9	43.9	44.1	Baseline Offset (In Feet)
1+60	45.8	45.8	45.8	44.9	44.2	44.3	44.3	44.3	44.2	Baseline Offset (In Feet)
1+65	45.9	45.9	45.9	45.0	44.3	44.4	44.4	44.4	44.2	Baseline Offset (In Feet)
1+75	45.9	45.9	45.9	45.9	44.4	44.4	44.4	44.4	44.4	Baseline Offset (In Feet)
1+90	45.0	45.0	44.1	44.1	44.1	44.1	44.1	44.1	44.2	Baseline Offset (In Feet)
2+00	44.7	44.7	41.8	41.8	41.1	40.4	40.4	40.4	40.6	Baseline Offset (In Feet)
2+05	44.6	44.6	40.4	40.4	39.7	38.4	38.4	38.4	38.3	Baseline Offset (In Feet)
2+10	43.7	43.7	40.4	40.2	40.2	38.3	38.3	38.3	38.1	Baseline Offset (In Feet)
2+20	41.5	41.5	41.5	40.6	40.6	37.5	37.5	37.5	37.2	Baseline Offset (In Feet)
2+25	42.0	42.0	42.0	40.7	40.7	35.9	35.9	35.9	35.7	Baseline Offset (In Feet)
2+30	42.4	42.3	42.2	40.9	40.9	34.2	34.2	34.2	34.2	Baseline Offset (In Feet)
2+35	41.0	40.4	40.4	40.4	40.4	33.1	33.1	33.1	33.1	Baseline Offset (In Feet)
2+45	38.3	36.8	36.8	36.8	36.8	32.7	32.7	32.7	32.7	Baseline Offset (In Feet)
2+50	39.0	38.1	37.8	37.5	37.1	34.3	34.3	34.3	34.3	Baseline Offset (In Feet)
2+55	39.9	39.3	38.2	38.2	37.4	35.9	35.9	35.9	35.9	Baseline Offset (In Feet)
2+60	40.7	40.7	40.7	40.7	38.3	35.1	35.1	35.1	35.2	Baseline Offset (In Feet)
2+65	40.9	40.9	40.9	40.6	39.2	34.1	34.1	34.1	34.2	Baseline Offset (In Feet)
2+70	41.1	41.1	41.1	40.3	40.3	33.3	33.3	33.3	33.4	Baseline Offset (In Feet)
2+75	41.3	41.3	41.3	39.9	39.9	33.3	33.3	33.3	33.3	Baseline Offset (In Feet)
2+80	41.5	41.5	41.5	39.4	39.4	34.6	34.6	34.6	34.2	Baseline Offset (In Feet)
2+85	41.7	41.7	41.7	39.6	39.6	37.8	37.8	37.8	37.6	Baseline Offset (In Feet)
2+90	43.5	43.5	41.5	40.8	40.8	38.5	38.5	38.5	38.5	Baseline Offset (In Feet)
3+00	47.0	47.0	46.1	46.1	44.8	41.6	41.6	41.6	41.6	Baseline Offset (In Feet)
3+10	47.1	43.6	43.6	43.6	43.6	43.2	43.2	43.2	43.2	Baseline Offset (In Feet)
3+15	47.4	42.9	42.9	42.9	42.3	42.9	42.9	42.0	42.0	Baseline Offset (In Feet)
3+25	47.3	44.6	44.6	44.4	42.3	38.9	38.9	37.4	37.4	Baseline Offset (In Feet)
3+30	45.4	44.0	44.0	43.2	42.7	36.2	36.2	35.4	35.4	Baseline Offset (In Feet)
3+35	43.4	43.4	43.4	43.4	42.0	36.4	36.4	35.8	35.8	Baseline Offset (In Feet)
3+40	44.8	44.8	44.0	44.0	41.3	41.1	41.1	40.1	40.1	Baseline Offset (In Feet)
3+45	45.2	45.2	44.2	44.2	42.8	41.5	41.5	40.7	40.7	Baseline Offset (In Feet)
3+50	44.9	44.9	44.2	44.2	42.3	41.4	41.4	40.8	40.8	Baseline Offset (In Feet)
3+60	44.1	44.1	44.1	44.1	43.4	41.4	41.4	41.4	41.0	Baseline Offset (In Feet)
3+70	44.7	44.7	42.8	41.8	41.0	26.0	26.0	26.0	26.0	Baseline Offset (In Feet)
3+75	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	Baseline Offset (In Feet)
3+85	23.1	23.1	23.1	23.1	23.1	23.0	23.0	23.0	23.1	Baseline Offset (In Feet)
4+00	28.4	28.4	28.4	28.4	26.5	26.5	26.5	26.5	26.4	Baseline Offset (In Feet)
4+10	37.4	37.1	37.1	37.1	33.0	33.0	33.0	33.0	34.0	Baseline Offset (In Feet)
4+25	45.9	42.2	42.2	42.2	40.4	40.3	40.2	40.0	40.0	Baseline Offset (In Feet)
4+30	47.3	43.2	43.2	42.1	41.2	41.1	41.1	40.5	40.5	Baseline Offset (In Feet)
4+35	48.8	43.1	43.1	41.9	41.9	41.8	41.8	41.1	41.1	Baseline Offset (In Feet)
4+40	50.9	42.5	42.5	42.1	42.1	42.1	42.1	42.1	41.9	Baseline Offset (In Feet)

*****Note:** Survey completed on 4/7/02 was used for baseline data to compute Incremental/Cumulative Change. Negative numbers indicate erosion.

Appendix C HDD East

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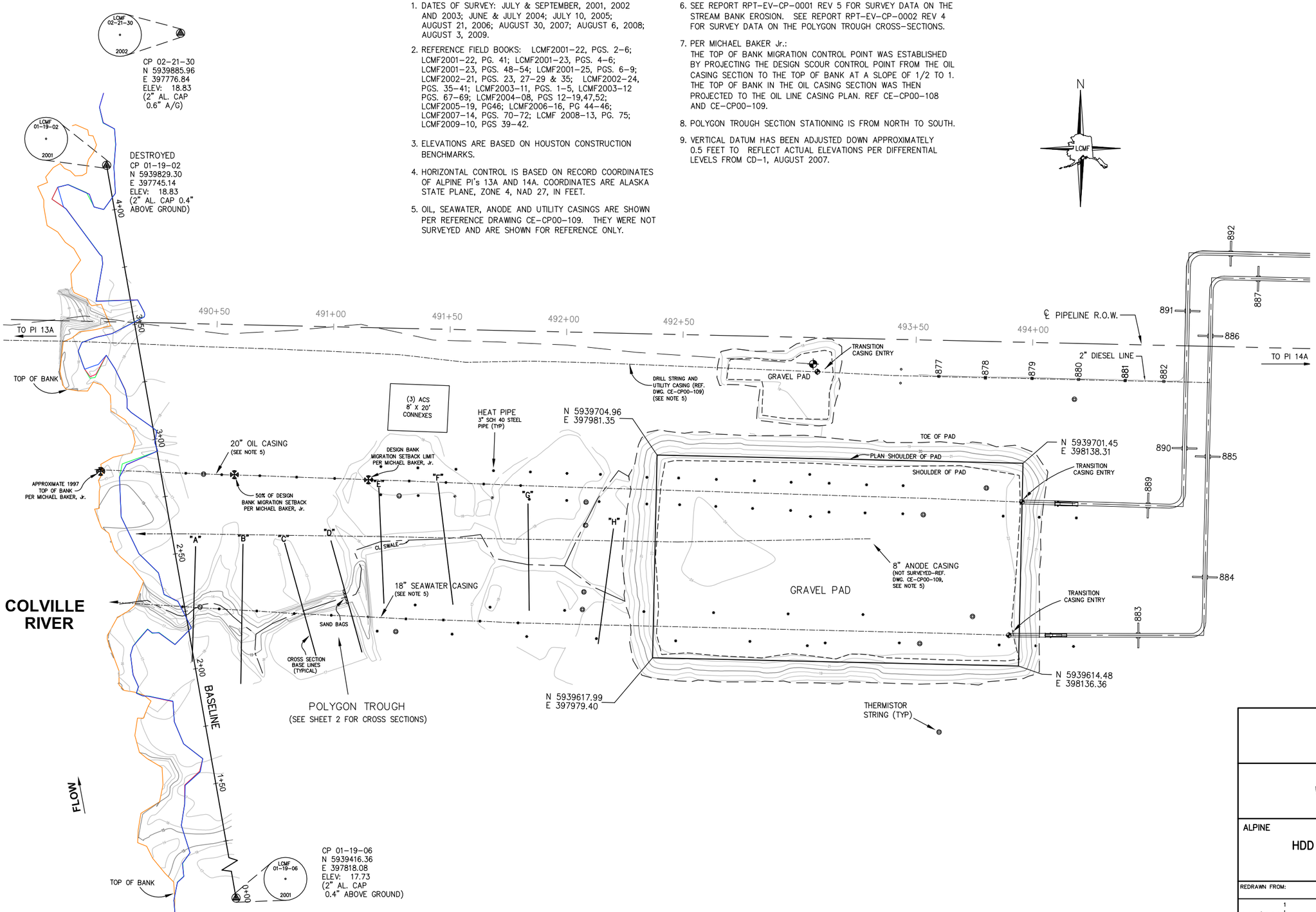
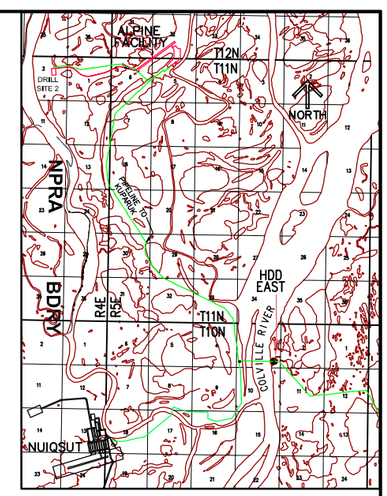
JOB NO:	SUB JOB NO:	DRAWING NO:
02-205		CE-CP00-134

NOTES:

1. DATES OF SURVEY: JULY & SEPTEMBER, 2001, 2002 AND 2003; JUNE & JULY 2004; JULY 10, 2005; AUGUST 21, 2006; AUGUST 30, 2007; AUGUST 6, 2008; AUGUST 3, 2009.
2. REFERENCE FIELD BOOKS: LCMF2001-22, PGS. 2-6; LCMF2001-22, PG. 41; LCMF2001-23, PGS. 4-6; LCMF2001-23, PGS. 48-54; LCMF2001-25, PGS. 6-9; LCMF2002-21, PGS. 23, 27-29 & 35; LCMF2002-24, PGS. 35-41; LCMF2003-11, PGS. 1-5, LCMF2003-12 PGS. 67-69; LCMF2004-08, PGS 12-19,47,52; LCMF2005-19, PG46; LCMF2006-16, PG 44-46; LCMF2007-14, PGS. 70-72; LCMF 2008-13, PG. 75; LCMF2009-10, PGS 39-42.
3. ELEVATIONS ARE BASED ON HOUSTON CONSTRUCTION BENCHMARKS.
4. HORIZONTAL CONTROL IS BASED ON RECORD COORDINATES OF ALPINE PI's 13A AND 14A. COORDINATES ARE ALASKA STATE PLANE, ZONE 4, NAD 27, IN FEET.
5. OIL, SEAWATER, ANODE AND UTILITY CASINGS ARE SHOWN PER REFERENCE DRAWING CE-CP00-109. THEY WERE NOT SURVEYED AND ARE SHOWN FOR REFERENCE ONLY.
6. SEE REPORT RPT-EV-CP-0001 REV 5 FOR SURVEY DATA ON THE STREAM BANK EROSION. SEE REPORT RPT-EV-CP-0002 REV 4 FOR SURVEY DATA ON THE POLYGON TROUGH CROSS-SECTIONS.
7. PER MICHAEL BAKER Jr.: THE TOP OF BANK MIGRATION CONTROL POINT WAS ESTABLISHED BY PROJECTING THE DESIGN SCOUR CONTROL POINT FROM THE OIL CASING SECTION TO THE TOP OF BANK AT A SLOPE OF 1/2 TO 1. THE TOP OF BANK IN THE OIL CASING SECTION WAS THEN PROJECTED TO THE OIL LINE CASING PLAN. REF CE-CP00-108 AND CE-CP00-109.
8. POLYGON TROUGH SECTION STATIONING IS FROM NORTH TO SOUTH.
9. VERTICAL DATUM HAS BEEN ADJUSTED DOWN APPROXIMATELY 0.5 FEET TO REFLECT ACTUAL ELEVATIONS PER DIFFERENTIAL LEVELS FROM CD-1, AUGUST 2007.





VICINITY MAP
NO SCALE

LEGEND

- HEAT PIPE
- THERMISTOR STRING
- TRANSITION CASING ENTRY POINT
- 1' CONTOUR LINES
- PILE
- SURVEY CONTROL
- MICHAEL BAKER Jr. MIGRATION POINT
- TOP OF BANK 9/8/01
- TOP OF BANK 8/30/07
- TOP OF BANK 8/6/08
- TOP OF BANK 8/3/09

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 inch = 20 ft.

KUUKPIK LCMF LLC
Alpine Survey Office

ConocoPhillips Alaska, Inc.

ALPINE | MODULE: CP00 | UNIT: CP

HDD BANK EROSION TOPO/MONITORING
HDD SITE - EAST
ALPINE FACILITY

REDRAWN FROM: | CONSTRUCTION SHEET OF

1 2 3 4 5 6
DO NOT SCALE — ABOVE SCALE FOR REFERENCE ONLY

DATE: 7/31/01	DRAWN: GD/CZ	DESIGN:	ECM NO: A01007ACS
SCALE: 1"=20'	CHECKED: JZ		CC NO:
JOB NO: 02-205	SUB JOB NO:	APPROVAL: CD	CADD FILE NO. 01-12-05-1EAST
		DRAWING NO: CE-CP00-134	PART: 1 OF 2 REV: 8

REFERENCE DWG NO/SHT NO:
CE-CP00-109
PD-CP00-130 SHEET 1

REV	DATE	REVISIONS	BY	CHK	JOB ENGR	PROJ ENGR	CUST APP
8	8/5/09	UPDATED PER 6370813ACS	AG	GD			
7	8/6/08	UPDATED PER 5538034ACS	CZ	GD			
6	8/30/07	UPDATED PER 4810351ACS	CZ	DB			
5	8/25/06	UPDATED PER 4116808ACS	AG	DB			
4	7/11/05	UPDATED PER 3391755ACS	CZ	GD			
3	6/27/04	ISSUED PER 2390460ACS	CZ	BD			
2	12/31/03	ISSUED PER 2094387ACS-ADDED SHEET 2 AND 2003 DATA	GD/CZ	JZ			C/K
1	11/1/02	ISSUED PER 1870227ACS	CZ	JZ			TM
0	7/31/01	ISSUED PER A01007ACS	RLW	JZ			CD

FORM: DSIZE

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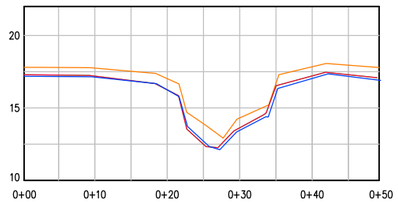
JOB NO:	SUB JOB NO:	DRAWING NO:
02-205		CE-CP00-134

CROSS SECTIONS, POLYGON TROUGH

HORIZONTAL SCALE = 1"=10' VERTICAL SCALE = 1"=5'

"A"



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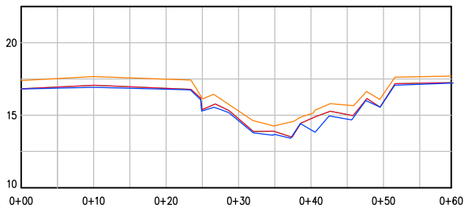
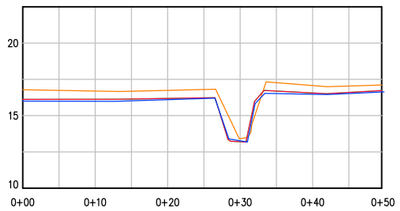


"C"



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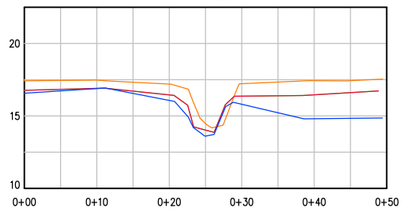
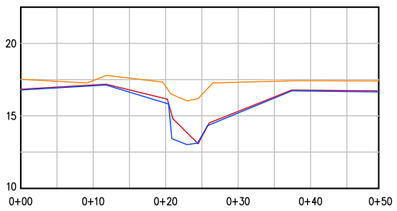
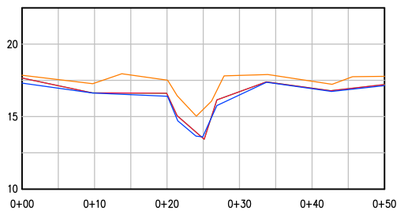


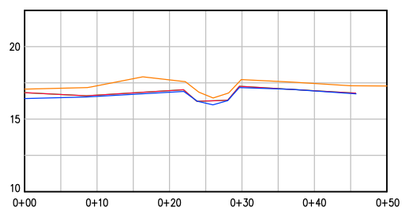
"E"



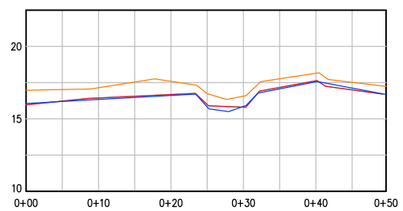
"F"



"G"



"H"

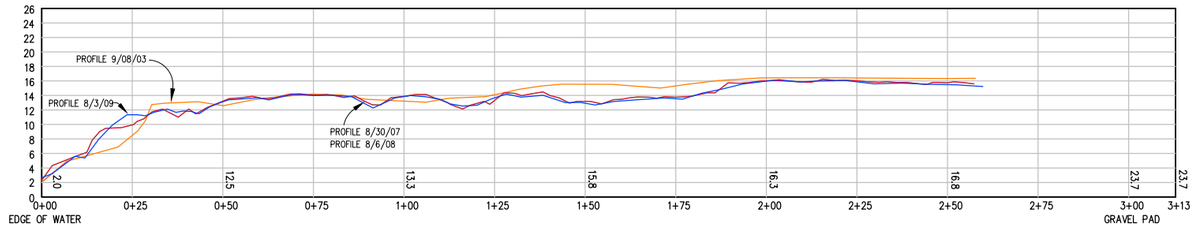


LEGEND

- CROSS SECTION 9/8/03
- CROSS SECTION 8/30/07
- CROSS SECTION 8/06/08
- CROSS SECTION 8/03/09

CENTERLINE PROFILE, POLYGON TROUGH

HORIZONTAL SCALE = 1"=20' VERTICAL SCALE = 1"=10'



FORM: DSIZE

REFERENCE DWG NO/SHT NO:
CE-CP00-109
PD-CP00-130 SHEET 1

REV	DATE	REVISIONS	BY	CHK	JOB ENGR	PROJ ENGR	CUST APP
7	8/6/09	UPDATED PER 6370813ACS	AG	GD			
6	8/6/08	UPDATED PER 5538034ACS	CZ	GD			
5	8/30/07	UPDATED PER 4810351ACS	CZ	DB			
4	8/25/06	UPDATED PER 4116808ACS	AG	DB			
3	7/28/05	UPDATED PER 3391755ACS	CZ	GD			
2	7/9/04	ISSUED PER 2390460ACS	AG	GD			
1	12/31/03	ISSUED PER 2094387ACS	GD	JZ			C/K

KUUKPIK LCMF LLC
Alpine Survey Office

ConocoPhillips Alaska, Inc.

ALPINE MODULE: CP00 UNIT: CP

HDD BANK EROSION TOPO/MONITORING
HDD SITE – EAST
ALPINE FACILITY

REDRAWN FROM: CONSTRUCTION SHEET OF

1 2 3 4 5 6

DO NOT SCALE ABOVE SCALE FOR REFERENCE ONLY

DATE: 12/31/03	DRAWN: GD/CZ	DESIGN:	ECM NO: 2094387ACS
SCALE: 1"=20'	CHECKED: JZ		CC NO:
	APPROVAL: COLEGROVE/KANADY		CADD FILE NO. 01-12-05-1EAST
JOB NO: 02-205 SUB JOB NO:	DRAWING NO: CE-CP00-134		PART: 2 OF 2 REV: 7

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Baseline Station	Streambank Monitor - Top of Bank Locations See Drawing CE-CP00-134 Rev 3 for Survey Baseline Stations												Description
	9/8/2001	7/8/2002	9/12/2002	7/9/2003	9/8/2003	6/19/2004	6/19/2004	7/10/2005	8/21/2006	8/30/2007	8/6/2008	8/3/2009	Date
0+10	N/A	N/A	-25.3	-25.3	-25.3	-25.3	-25.3	-25.3	-25.3	-25.3	-25.3	-25.6	Baseline Offset (In Feet)
0+20	N/A	N/A	-32.1	-30.9	-30.9	-30.9	-30.9	-30.9	-30.9	-30.9	-30.9	-31.0	Baseline Offset (In Feet)
0+25	N/A	N/A	-38.2	-38.2	-38.2	-38.2	-38.2	-37.0	-37.0	-37.0	-37.0	-34.1	Baseline Offset (In Feet)
0+30	N/A	N/A	-41.1	-41.1	-41.1	-41.1	-41.1	-36.9	-36.9	-36.9	-36.9	-34.3	Baseline Offset (In Feet)
0+40	N/A	N/A	-37.7	-37.7	-37.7	-37.7	-37.7	-36.5	-35.1	-35.1	-35.1	-34.8	Baseline Offset (In Feet)
0+50	N/A	N/A	-30.3	-30.3	-30.3	-30.3	-30.3	-30.3	-30.3	-30.3	-30.3	-30.3	Baseline Offset (In Feet)
0+60	N/A	N/A	-28.0	-27.9	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5	Baseline Offset (In Feet)
0+65	N/A	N/A	-39.8	-39.8	-23.9	-23.9	-23.9	-23.4	-23.4	-23.4	-23.4	-23.4	Baseline Offset (In Feet)
0+70	-31.2	-31.5	-27.7	-27.7	-20.0	-20.0	-20.0	-16.2	-16.2	-16.2	-16.2	-16.2	Baseline Offset (In Feet)
0+75	-27.1	-27.0	-27.2	-27.6	-21.1	-21.0	-21.0	-18.0	-18.0	-18.0	-18.0	-18.0	Baseline Offset (In Feet)
0+80	-26.5	-26.5	-27.5	-27.5	-22.4	-22.4	-22.4	-22.4	-22.4	-22.4	-22.4	-22.4	Baseline Offset (In Feet)
0+90	-29.2	-29.2	-29.2	-29.2	-29.2	-27.8	-27.8	-27.8	-27.2	-27.2	-27.2	-27.2	Baseline Offset (In Feet)
1+00	-26.8	-26.7	-26.7	-26.7	-26.7	-26.7	-26.7	-26.7	-26.7	-26.7	-26.7	-26.7	Baseline Offset (In Feet)
1+10	-25.4	-25.6	-25.6	-25.6	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	Baseline Offset (In Feet)
1+15	-27.6	-27.6	-24.5	-24.5	-20.8	-20.8	-20.8	-20.2	-20.2	-20.2	-20.2	-20.2	Baseline Offset (In Feet)
1+20	-30.5	-22.1	-22.6	-22.6	-21.4	-21.4	-21.4	-18.2	-18.2	-18.2	-18.2	-18.8	Baseline Offset (In Feet)
1+25	-32.8	-22.5	-23.0	-22.9	-18.1	-18.1	-18.1	-16.4	-16.4	-16.4	-16.4	-16.4	Baseline Offset (In Feet)
1+30	-36.1	-27.7	-28.0	-27.9	-17.3	-17.3	-17.3	-17.0	-17.0	-17.0	-17.0	-17.0	Baseline Offset (In Feet)
1+40	-34.9	-21.3	-20.6	-20.6	-17.1	-17.1	-17.1	-15.8	-15.8	-15.8	-15.8	-16.0	Baseline Offset (In Feet)
1+45	-28.8	18.6	-16.5	-16.5	-16.1	-16.1	-16.1	-14.3	-14.3	-14.3	-14.3	-14.3	Baseline Offset (In Feet)
1+50	-23.8	-20.7	-15.6	-15.6	-13.8	-13.8	-13.8	-13.4	-13.4	-13.4	-13.4	-13.4	Baseline Offset (In Feet)
1+55	-22.2	-21.8	-14.5	-14.5	-11.5	-11.5	-11.5	-7.1	-7.1	-7.1	-7.1	-7.5	Baseline Offset (In Feet)
1+60	-21.6	-21.4	-15.1	-14.9	-9.0	-9.0	-9.0	-4.2	-4.2	-4.2	-4.2	-4.2	Baseline Offset (In Feet)
1+65	-26.5	-25.8	-24.9	-24.6	-11.4	-9.7	-9.7	-6.9	-6.9	-6.9	-6.9	-6.9	Baseline Offset (In Feet)
1+70	-30.1	-29.6	-29.7	-29.7	-15.7	-13.0	-13.0	-10.8	-10.8	-10.8	-10.8	-10.8	Baseline Offset (In Feet)
1+75	-30.5	-30.0	-29.6	-29.6	-16.1	-14.4	-14.4	-12.0	-12.0	-12.0	-12.0	-12.0	Baseline Offset (In Feet)
1+80	-29.4	-30.2	-24.6	-22.1	-13.9	-13.9	-13.9	-12.8	-12.8	-12.8	-12.8	-12.8	Baseline Offset (In Feet)
1+85	-24.5	-24.5	-20.5	-17.0	-12.7	-12.7	-12.7	-12.3	-12.3	-12.3	-12.3	-12.3	Baseline Offset (In Feet)
1+90	-21.5	-21.6	-21.9	-19.5	-16.9	-16.9	-16.9	-16.9	-16.9	-16.9	-16.9	-16.9	Baseline Offset (In Feet)
1+95	-28.5	-27.7	-27.7	-27.7	-27.7	-27.7	-27.7	-27.7	-26.3	-26.3	-26.3	-26.3	Baseline Offset (In Feet)
2+00	-33.4	-33.7	-27.8	-27.8	-27.8	-27.8	-27.8	-27.8	-26.4	-26.4	-26.4	-26.4	Baseline Offset (In Feet)
2+05	-32.6	-32.5	-27.3	-27.3	-27.3	-27.3	-27.3	-27.3	-26.8	-26.8	-26.8	-26.8	Baseline Offset (In Feet)
2+10	-33.5	-29.1	-26.0	-26.0	-26.0	-26.0	-26.0	-26.0	-26.0	-26.0	-26.0	-26.5	Baseline Offset (In Feet)
2+15	-34.5	-28.8	-23.2	-23.2	-23.2	-23.2	-23.2	-23.2	-23.2	-23.2	-23.7	-23.7	Baseline Offset (In Feet)
2+20	-34.9	-32.0	-21.0	-21.0	-21.0	-20.4	-20.4	-17.4	-17.3	-17.3	-17.3	-18.2	Baseline Offset (In Feet)
2+25	-31.2	-31.1	-18.4	-18.4	-8.0	-5.2	-5.2	-5.2	-5.2	-1.0	-1.0	-1.0	Baseline Offset (In Feet)
2+30	-23.2	-19.7	-13.7	-13.7	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.8	Baseline Offset (In Feet)
2+35	-18.8	-11.7	-8.9	-7.0	-7.0	-7.1	-7.1	-7.1	-7.1	-7.1	-7.1	-7.9	Baseline Offset (In Feet)
2+40	-15.9	-12.0	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3	-8.2	-8.2	Baseline Offset (In Feet)
2+50	-21.0	-20.7	-14.7	-14.6	-14.6	-14.6	-14.6	-14.6	-13.6	-13.3	-13.3	-13.3	Baseline Offset (In Feet)
2+60	-26.0	-25.9	-20.5	-20.6	-20.6	-20.5	-20.5	-19.8	-17.7	-17.7	-17.7	-17.4	Baseline Offset (In Feet)
2+70	-30.0	-30.6	-25.5	-25.4	-20.8	-20.8	-20.8	-20.8	-20.6	-20.0	-20.0	-20.0	Baseline Offset (In Feet)
2+75	-30.7	-31.2	-26.1	-26.0	-20.9	-20.9	-20.9	-20.8	-19.7	-19.7	-19.7	-19.4	Baseline Offset (In Feet)
2+85	-26.8	-26.8	-22.8	-22.8	-22.8	-22.8	-22.8	-20.4	-17.9	-17.9	-17.9	-17.9	Baseline Offset (In Feet)
2+90	-24.5	-24.5	-21.4	-21.4	-21.4	-21.3	-21.3	-21.3	-17.3	-16.5	-15.1	-15.1	Baseline Offset (In Feet)
3+00	-8.7	-9.0	-9.0	-8.9	-6.0	-6.0	-6.0	0.3	0.3	0.3	0.3	0.3	Baseline Offset (In Feet)
3+10	-11.0	-11.4	-11.4	-11.4	-11.4	-11.4	-11.4	-6.9	-5.2	-5.2	-5.2	-5.0	Baseline Offset (In Feet)
3+15	-16.2	-16.1	-16.0	-15.9	-15.9	-15.9	-15.9	-10.5	-9.6	-9.6	-9.6	-9.6	Baseline Offset (In Feet)
3+20	-15.8	-15.9	-11.9	-11.9	-11.9	-11.8	-11.8	-11.8	-8.9	-8.9	-8.9	-8.9	Baseline Offset (In Feet)
3+25	-17.3	-16.6	-11.4	-11.1	-11.1	-11.1	-11.1	-10.3	-9.5	-9.5	-9.5	-9.5	Baseline Offset (In Feet)
3+30	-35.0	-35.4	-23.4	-13.9	-11.5	-11.5	-11.5	-11.2	-11.2	-11.2	-11.2	-11.2	Baseline Offset (In Feet)
3+35	-35.0	-35.0	-23.8	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-24.6	Baseline Offset (In Feet)
3+40	-33.9	-33.9	-25.4	-25.4	-25.4	-25.4	-25.4	-25.4	-25.4	-25.4	-25.4	-25.4	Baseline Offset (In Feet)
3+45	-32.4	-32.5	-27.3	-27.4	-27.4	-26.4	-26.4	-24.1	-24.1	-24.1	-24.1	-24.6	Baseline Offset (In Feet)
3+52	-10.4	-10.1	-9.9	-8.4	-8.4	-8.4	-8.4	-8.4	2.4	2.4	2.4	3.1	Baseline Offset (In Feet)
3+60	-12.4	-11.5	-11.3	-11.2	-11.2	-10.8	-10.8	-10.8	3.0	3.0	3.0	3.0	Baseline Offset (In Feet)
3+65	-18.9	-18.7	-18.7	-18.7	-18.7	-18.4	-18.4	-18.4	-3.3	-13.8	-13.8	-13.8	Baseline Offset (In Feet)
3+70	-23.8	-24.2	-24.0	-24.0	-24.0	-24.1	-24.1	-21.2	-9.6	-11.9	-11.9	-11.9	Baseline Offset (In Feet)
3+75	-23.3	-23.3	-20.2	-20.2	-20.2	-20.2	-20.2	-19.3	-11.3	-10.1	-10.1	-10.1	Baseline Offset (In Feet)
3+80	-19.3	-19.7	-12.9	-12.9	-12.9	-11.6	-11.6	-11.6	-9.0	-9.0	-9.0	-9.0	Baseline Offset (In Feet)
3+85	-19.5	-19.3	-13.2	-12.3	-12.3	-12.0	-12.0	-12.0	-11.1	-11.1	-11.1	-11.1	Baseline Offset (In Feet)
3+95	-25.9	-26.3	-22.4	-22.4	-22.4	-21.9	-21.9	-21.9	-16.1	-16.1	-16.1	-16.1	Baseline Offset (In Feet)
4+00	-29.7	-30.2	-21.2	-21.2	-21.2	-21.9	-21.9	-21.9	-18.6	-18.6	-18.6	-18.6	Baseline Offset (In Feet)
4+05	-29.4	-29.9	-19.5	-19.5	-19.5	-19.5	-19.5	-19.5	-21.7	-21.7	-21.7	-21.3	Baseline Offset (In Feet)
4+15	-30.6	-27.3	2.7	2.6	2.6	2.6	2.6	2.6	2.7	2.7	2.5	2.5	Baseline Offset (In Feet)
4+25	-5.4	-1.0	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.7	Baseline Offset (In Feet)
4+35	-5.4	-0.7	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.9	Baseline Offset (In Feet)
4+45	N/A	-5.1	1.3	1.2	1.2	1.9	1.9	1.9	1.9	1.9	1.9	1.6	Baseline Offset (In Feet)
4+50	N/A	-6.3	1.9	1.8	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	Baseline Offset (In Feet)

*****Note:** Field Survey dated 8/7/01 was used for baseline data to compute Incremental/Cumulative Change. Negative numbers indicate erosion.

Baseline	Point	Subsidence Monitor - Cross-Section A											Description
Station	Description	See Drawing CE-CP00-134 for Survey Cross-Section Locations											
		9/8/2001	7/9/2002	9/14/2002	7/9/2003	9/8/2003	7/9/2004	7/28/2005	8/21/2006	8/30/2007	8/7/2008	8/3/2009	
0+00	Tundra	18.0	17.8	17.8	17.8	17.8	17.7	17.9	18.0	17.3	17.3	17.2	Elevation (In Feet)
0+09	Tundra	18.0	17.8	17.8	17.8	17.8	17.7	17.8	17.9	17.2	17.3	17.2	Elevation (In Feet)
0+18	Tundra	17.5	17.3	17.5	17.4	17.4	17.2	17.4	17.4	16.7	16.7	16.7	Elevation (In Feet)
0+21	Top Bank	16.7	16.6	16.5	16.8	16.8	16.4	16.6	16.6	15.8	15.9	15.8	Elevation (In Feet)
0+22.5	Gradebreak	15.4	14.9	14.8	14.8	14.8	14.8	14.6	14.4	13.5	13.6	13.7	Elevation (In Feet)
0+25	Toe Bank	13.9	13.6	13.6	13.7	13.7	13.0	13.3	13.0	12.3	12.3	12.3	Elevation (In Feet)
0+27	CL Swale	13.5	13.3	12.5	13.1	13.1	11.7	12.2	12.8	12.3	12.0	12.1	Elevation (In Feet)
0+29	Toe Bank	13.5	13.5	14.2	14.5	14.5	13.9	14.1	14.0	13.4	13.5	13.3	Elevation (In Feet)
0+34	Gradebreak	15.6	15.2	15.2	15.5	15.5	14.8	15.3	15.3	14.6	14.6	14.4	Elevation (In Feet)
0+35	Top Bank	17.6	17.4	17.4	17.4	17.4	17.6	17.2	17.2	16.5	16.5	16.3	Elevation (In Feet)
0+42	Tundra	18.4	18.1	18.1	18.1	18.1	18.0	18.1	18.1	17.5	17.5	17.4	Elevation (In Feet)
0+50	Tundra	18.1	17.9	17.8	17.8	17.8	17.7	17.8	17.8	17.1	17.1	16.9	Elevation (In Feet)

Baseline	Point	Subsidence Monitor - Cross-Section B											Description
Station	Description	See Drawing CE-CP00-134 for Survey Cross-Section Locations											
		9/8/2001	7/9/2002	9/14/2002	7/9/2003	9/8/2003	7/9/2004	7/28/2005	8/21/2006	8/30/2007	8/7/2008	8/3/2009	
0+00	Tundra	17.6	17.2	17.2	17.4	17.4	17.5	17.4	17.5	16.8	16.9	16.8	Elevation (In Feet)
0+10	Tundra	18.0	17.9	17.7	17.7	17.7	17.7	17.7	17.8	17.1	17.1	16.9	Elevation (In Feet)
0+23	Tundra	17.6	17.3	17.3	17.4	17.4	17.3	17.4	17.5	16.8	16.8	16.8	Elevation (In Feet)
0+25	Top of Bank	17.2	17.0	16.0	16.0	16.0	15.9	16.0	16.1	15.4	15.4	15.3	Elevation (In Feet)
0+27	Gradebreak	16.6	16.5	16.5	16.5	16.5	16.4	16.4	16.5	15.8	15.7	15.6	Elevation (In Feet)
0+32	Toe Bank	14.4	14.6	14.1	14.5	14.5	14.5	14.7	14.6	13.9	13.9	13.8	Elevation (In Feet)
0+35	CL Swale	14.3	14.2	13.7	14.2	14.2	14.2	14.6	14.6	13.9	13.9	13.7	Elevation (In Feet)
0+37	Toe Bank	14.2	13.7	13.5	14.4	14.4	13.7	14.4	14.5	13.5	13.8	13.4	Elevation (In Feet)
0+38	Gradebreak	-	15.0	14.9	14.9	14.9	14.9	15.0	15.1	14.4	14.5	14.4	Elevation (In Feet)
0+40	Gradebreak	-	14.2	14.0	15.4	15.4	15.4	15.5	15.5	14.9	14.9	13.8	Elevation (In Feet)
0+42	Gradebreak	16.1	15.6	15.6	15.8	15.8	15.8	15.9	15.9	15.3	15.2	15.0	Elevation (In Feet)
0+49	Gradebreak	16.2	16.2	16.0	16.0	16.0	16.0	16.2	16.2	15.6	15.6	15.6	Elevation (In Feet)
0+52	Top Bank	17.6	17.8	17.6	17.7	17.7	17.6	17.7	17.8	17.2	17.2	17.1	Elevation (In Feet)
0+60	Tundra	17.8	17.6	17.7	17.7	17.7	17.6	17.8	17.9	17.2	16.9	17.2	Elevation (In Feet)

Baseline	Point	Subsidence Monitor - Cross-Section C											Description
Station	Description	See Drawing CE-CP00-134 for Survey Cross-Section Locations											
		9/8/2001	7/9/2002	9/14/2002	7/9/2003	9/8/2003	7/9/2004	7/28/2005	8/21/2006	8/30/2007	8/7/2008	8/3/2009	
0+00	Tundra	16.9	16.9	16.8	16.8	16.8	16.7	16.7	16.8	16.1	16.1	16.0	Elevation (In Feet)
0+13	Tundra	16.7	16.7	16.6	16.7	16.7	16.6	16.7	16.8	16.1	16.2	16.0	Elevation (In Feet)
0+27	Top Bank	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.9	16.2	16.2	16.2	Elevation (In Feet)
0+29	Toe Bank	12.9	12.5	12.4	13.2	13.2	13.5	13.7	13.8	13.2	13.5	13.4	Elevation (In Feet)
0+31	Toe Bank	13.9	13.6	13.4	13.6	13.6	13.5	13.6	13.9	13.2	13.3	13.2	Elevation (In Feet)
0+32	Gradebreak	16.7	16.6	N/A	16.7	16.7	16.6	16.7	16.7	16.0	16.0	15.8	Elevation (In Feet)
0+33	Top Bank	17.5	17.1	17.2	17.2	17.2	17.1	17.1	17.5	16.7	16.7	16.5	Elevation (In Feet)
0+42	Tundra	17.1	17.0	16.9	16.9	16.9	17.0	17.0	17.1	16.5	16.7	16.5	Elevation (In Feet)
0+50	Tundra	17.2	17.1	17.0	17.2	17.2	17.1	17.2	17.3	16.7	16.8	16.6	Elevation (In Feet)

Baseline	Point	Subsidence Monitor - Cross-Section D											Description
Station	Description	See Drawing CE-CP00-134 for Survey Cross-Section Locations											
		9/8/2001	7/9/2002	9/14/2002	7/9/2003	9/8/2003	7/9/2004	7/28/2005	8/21/2006	8/30/2007	8/7/2008	8/3/2009	
0+00	Tundra	17.6	17.6	17.3	17.5	17.5	17.5	17.4	17.5	16.8	16.9	16.6	Elevation (In Feet)
0+10	Tundra	17.9	17.9	17.6	17.6	17.6	17.6	17.6	17.6	16.9	16.9	16.9	Elevation (In Feet)
0+20	Gradebreak	17.6	17.5	16.6	NA	NA	NA	17.2	17.2	16.4	16.5	16.0	Elevation (In Feet)
0+22	Top Bank	16.7	16.8	16.6	16.8	16.8	16.8	16.5	16.5	15.7	15.7	14.9	Elevation (In Feet)
0+24	Toe Bank	14.7	14.8	14.3	14.8	14.8	14.8	13.9	14.9	14.2	14.5	14.2	Elevation (In Feet)
0+25	CL Swale	14.2	14.1	13.7	14.1	14.1	14.1	13.7	14.0	13.4	13.9	13.6	Elevation (In Feet)
0+27	Toe Bank	14.6	14.3	14.0	14.2	14.2	14.2	16.2	16.5	15.8	15.8	15.6	Elevation (In Feet)
0+29	Top Bank	17.4	17.1	16.9	17.1	17.1	17.0	17.0	17.0	16.4	16.5	15.9	Elevation (In Feet)
0+38	Tundra	17.7	17.5	17.3	17.3	17.3	17.2	17.2	17.1	16.4	16.4	14.8	Elevation (In Feet)
0+50	Tundra	17.6	17.5	17.3	16.8	16.8	17.4	17.4	17.4	16.7	16.8	14.9	Elevation (In Feet)

Note: Baseline Stationing Runs from North to South along Cross-Sections.
****Note: Vertical Datum Adjusted Down Approximately 0.5 feet to reflet Actual Elevation per Differential Levels from CD-1, ran August 2007.***

Alpine CP 00
HDD East Site
Subsidence Monitor - Seawater Line

Baseline Station	Point Description	Subsidence Monitor - Cross-Section E							Description
		See Drawing CE-CP00-134 for Survey Cross-Section Locations							
		9/8/2003	7/9/2004	7/28/2005	8/21/2006	8/30/2007	8/7/2008	8/3/2009	
0+00	Tundra	17.5	17.5	17.4	17.5	16.8	16.8	16.8	Elevation (In Feet)
0+9	Tundra	17.3	17.3	17.3	17.8	17.1	N/A	N/A	Elevation (In Feet)
0+12	Gradebreak	17.8	17.8	17.4	17.9	17.2	17.3	17.1	Elevation (In Feet)
0+20	Top Bank	17.3	17.3	17.3	17.3	16.2	15.8	15.8	Elevation (In Feet)
0+21	Toe Bank	16.5	16.5	16.5	16.2	14.8	14.3	13.4	Elevation (In Feet)
0+23	CL Swale	16.0	16.0	16.0	14.7	13.8	13.2	13.0	Elevation (In Feet)
0+24	Toe Bank	16.2	16.4	16.3	14.8	13.1	13.8	13.1	Elevation (In Feet)
0+27	Top Bank	17.3	17.4	17.4	16.3	14.5	14.5	14.3	Elevation (In Feet)
0+38	Tundra	17.4	17.4	17.5	17.5	16.8	16.8	16.7	Elevation (In Feet)
0+49	Tundra	17.4	17.4	17.4	17.4	16.7	16.8	16.7	Elevation (In Feet)

Baseline Station	Point Description	Subsidence Monitor - Cross-Section F							Description
		See Drawing CE-CP00-134 for Survey Cross-Section Locations							
		9/8/2003	7/9/2004	7/28/2005	8/21/2006	8/30/2007	8/7/2008	8/3/2009	
0+00	Tundra	17.9	17.9	18.2	18.3	17.7	17.7	17.3	Elevation (In Feet)
0+10	Tundra	17.3	17.2	17.2	17.3	16.6	16.6	16.6	Elevation (In Feet)
0+14	Gradebreak	18.0	18.0	18.0	18.0	16.6	N/A	N/A	Elevation (In Feet)
0+20	Top Bank	17.5	17.5	17.6	17.6	16.6	16.6	16.4	Elevation (In Feet)
0+21	Toe Bank	16.5	16.3	16.3	16.0	15.1	15.0	14.7	Elevation (In Feet)
0+24	CL Swale	15.0	12.5	15.0	13.8	13.4	13.7	13.7	Elevation (In Feet)
0+26	Toe Bank	16.1	12.5	13.1	13.6	15.2	13.6	15.8	Elevation (In Feet)
0+28	Top Bank	17.8	17.9	17.9	17.3	16.4	16.1	16.2	Elevation (In Feet)
0+34	Gradebreak	17.9	17.9	18.0	18.0	17.4	17.5	17.4	Elevation (In Feet)
0+43	Gradebreak	17.2	17.3	17.2	17.4	16.8	16.8	16.7	Elevation (In Feet)
0+46	Gradebreak	17.8	17.8	17.8	17.6	17.0	N/A	N/A	Elevation (In Feet)
0+52	Tundra	17.8	17.9	17.9	18.0	17.3	17.4	17.3	Elevation (In Feet)

Baseline Station	Point Description	Subsidence Monitor - Cross-Section G							Description
		See Drawing CE-CP00-134 for Survey Cross-Section Locations							
		9/8/2003	7/9/2004	7/28/2005	8/21/2006	8/30/2007	8/7/2008	8/3/2009	
0+00	Tundra	17.1	17.3	17.4	17.5	16.8	16.9	16.4	Elevation (In Feet)
0+09	Tundra	17.2	17.1	17.2	17.3	16.6	16.9	16.5	Elevation (In Feet)
0+16	Gradebreak	17.9	17.9	17.9	17.5	16.8	N/A	N/A	Elevation (In Feet)
0+22	Top Bank	17.6	17.7	17.7	17.8	17.0	17.1	16.9	Elevation (In Feet)
0+24	Toe Bank	16.9	17.0	17.0	17.0	16.2	16.3	16.2	Elevation (In Feet)
0+26	CL Swale	16.5	16.5	16.5	16.5	16.3	16.1	16.0	Elevation (In Feet)
0+28	Toe Bank	16.8	16.7	16.9	16.9	16.3	16.3	16.3	Elevation (In Feet)
0+30	Top Bank	17.7	17.8	17.8	17.9	17.3	17.3	17.2	Elevation (In Feet)
0+37	Tundra	17.6	17.6	17.6	17.7	17.0	17.3	17.1	Elevation (In Feet)
0+46	Tundra	17.3	17.3	17.3	17.4	16.8	16.8	16.7	Elevation (In Feet)

Baseline Station	Point Description	Subsidence Monitor - Cross-Section H							Description
		See Drawing CE-CP00-134 for Survey Cross-Section Locations							
		9/8/2003	7/9/2004	7/28/2005	8/21/2006	8/30/2007	8/7/2008	8/3/2009	
0+00	Tundra	17.0	16.8	16.6	16.7	16.0	16.0	16.1	Elevation (In Feet)
0+09	Tundra	17.1	16.9	16.9	17.0	16.4	16.5	16.3	Elevation (In Feet)
0+18	Gradebreak	17.8	17.8	17.8	17.3	16.6	N/A	N/A	Elevation (In Feet)
0+24	Top Bank	17.3	17.4	17.4	17.5	16.8	16.8	16.7	Elevation (In Feet)
0+25	Toe Bank	16.8	16.4	16.6	16.6	15.9	15.9	15.7	Elevation (In Feet)
0+28	CL Swale	16.3	16.3	16.3	16.3	15.8	15.6	15.5	Elevation (In Feet)
0+30	Toe Bank	16.6	16.6	16.4	16.5	15.8	15.9	15.9	Elevation (In Feet)
0+32	Top Bank	17.6	17.7	17.6	17.6	16.9	17.0	16.8	Elevation (In Feet)
0+40	Gradebreak	18.2	18.2	18.2	18.3	17.6	17.7	17.6	Elevation (In Feet)
0+42	Gradebreak	17.7	17.7	17.8	17.9	17.2	N/A	N/A	Elevation (In Feet)
0+50	Tundra	17.2	17.2	17.3	17.4	16.7	16.7	16.7	Elevation (In Feet)

Note: Baseline Stationing Runs from North to South along Cross-Sections.
****Note: Vertical Datum Adjusted Down Approximately 0.5 feet to reflet Actual Elevation per Differential Levels from CD-1, ran August 2007.***

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