8. Construction shall occur during times of low to no flow.
9. Dewatering will be necessary when working at or below the water levels in the surrounding area.
10. Labor assumed to be at Title 36 wage rates.
11. No crushed aggregate surfacing is required for road surfacing.
12. Alternative 1A work will be performed upon completion of Site 2 work by the same Contractor.

Table 7: Capital Cost Summary

Alternative	Capital Cost	Useful Life
1A. Remove Crossing and Salvage Useable Materials	$203,000	N/A
1B. Do Nothing	0	N/A
2A. New Bridge Crossing, Elevate Above Ordinary High Water	3,423,000	30 years
2B. New Culverts, Minor Elevation Change	3,216,000	30 years
2C. Do Nothing	406,000	N/A
3A. Armor Existing Culverts, No Elevation Change	1,502,000	15 years
3B. Install New Circular Culverts, Elevate Roadway 3 Feet	3,352,000	30 years
3C. Install New Arched Culvert, Elevate Roadway 4.5 Feet	3,932,000	30 years
3D. Do Nothing	0	N/A

6.2 Operation and Maintenance Costs

Operation and maintenance (O&M) costs are expected to include minor riprap restoration annually from ice floes; except after extreme flood events which may cause significant damage. O&M costs can be minimized by keeping embankments sloped and low profile to minimize hydraulic impacts and restoration costs.

7.0 FINDINGS

1. All three sites are in the flood plain of the Colville River and are subject to overtopping and ice jamming.

2. Little flood information exists for Nuiqsut and the Corps of Engineers has not established a flood datum for Nuiqsut.

3. A flood study and stream monitoring is needed to determine flood recurrence intervals and flood elevations.

4. Debris lines near Site 2 suggest seasonal floodwaters and ice floes overtop the bridge by approximately 2 feet annually and by approximately 8.5 feet during extreme flood events.

5. The Site 3 overtops annually but requires only minor sandbag repair after the high water recedes.

6. Debris lines near Site 3 suggest that the roadway overtops by approximately 4.5 feet during extreme high water events.

8.0 RECOMMENDATIONS

1. Conduct a flood study and stream monitoring study to determine flood recurrence intervals and flood elevations.

2. Conduct a geotechnical investigation to determine engineering and thermal properties of soils at the sites to allow for proper design.

3. At the Lower Stream Crossing (Site 1), remove the crossing after the Site 2 crossing is restored: **Alternative 1A – Remove Crossing and Salvage Useable Materials.**

4. At the Upper Stream Crossing (Site 2), remove the existing bridge and install three 120-inch culverts: **Alternative 2B – New Culverts, Minor Elevation Change.**

5. At the Tributary Stream Crossing (Site 3), install three new 72-inch culverts to provide all-season access to the water source lake: **Alternative 3B – Install New Circular Culverts, Elevate Roadway 3 Feet.**

9.0 REFERENCES

1. A Policy on Geometric Design of Highways and Streets, (PGDHS or "Green Book") AASHTO, 2011.

2. Alaska Highway Drainage Manual, Alaska DOT&PF. June 13, 2006.

3. Baker. 2013 Colville River Delta Spring Breakup Monitoring & Hydrologic Assessment.

4. Big R Bridge. Standard 4 ¼" Steel Deck 30' to 80' x 14' or 16' Single Lane Bridge – Bridge Detail, December 7, 2015.

5. "Bridges & Structures." Revisions to the National Bridge Inspection Standards (NBIS). N.p., n.d. Web. 07 Dec. 2015.

6. Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400). American Association of State Highway and Transportation Officials (AASHTO), 2001.

7. Green, Ken. NSB CIPM Project Administrator, Personal communication regarding material source stockpile, December 2015.Nukapigak, Thomas. Nuiqsut Public Works Superintendent, Personal Communication, August and November 2015.

8. Roadside Design Guide. AASHTO, 2011.

9. "Village of Nuiqsut | ICAS." ICAS. Web. 16 Sept. 2015.

APPENDIX A

COST ESTIMATE

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 1A - Remove Crossing and Salvage Useable Materials

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	1 L.S.	Temp Erosion and Pollution Control	20,000.00	20,000
2	1 L.S.	Remove 2-48" CMPs	25,000.00	25,000
3	1 L.S.	Remove 5-7 18"-24" Burried Steel Pipes	25,000.00	25,000
4	1 L.S.	Reshaping and Bank Stabilization	45,000.00	45,000
5	1 L.S.	Salvagable Material	15,000.00	15,000
		Subtotal Construction		$130,000

Land Acquisition		0
City Administration	@ 5%	6,500
Design	@ 12%	15,600
Construction Management	@ 15%	19,500
Project Contingency	@ 15%	19,500
3 Years Inflation	@ 3%	12,100
Subtotal		$203,200

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 1B - Do Nothing

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE

Subtotal Construction		$0
Land Acquisition		0
City Administration	@ 5%	0
Design	@ 12%	0
Construction Management	@ 15%	0
Project Contingency	@ 15%	0
1 Years Inflation	@ 3%	0
Subtotal		$0

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 2A - New Bridge Crossing, Elevate Above Ordinary High Water

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	1 L.S.	Mobilization/Demobilization	286,000.00	286,000
2	1 L.S.	Temp Erosion and Pollution Control	75,000.00	75,000
3	1 L.S.	Construction Surveying	90,000.00	90,000
4	1 L.S.	Remove Piling, Abutments, and Superstrucure	75,000.00	75,000
5	1 L.S.	Modular Bridge (FOB Seattle)	54,600.00	54,600
6	1 L.S.	Modular Bridge Assembly	20,000.00	20,000
7	17 Tons	Barging of Bridge Structure (SEA to PUD)	1,000.00	17,000
8	332,000 Lbs.	HP14x117 Piling, Grade 50 (2840l.f.)	1.00	332,000
9	20 Days	Install H Piles	18,000.00	360,000
10	9,000 Lbs.	Pile Caps, Backwall, and Bearing Plates	1.00	9,000
11	2,700 B.F.	8x8 PT Timber	2.00	5,400
12	432 L.F.	Tie Back Anchors	50.00	21,600
13	12 Each	Deadmen	10,000.00	120,000
14	290 C.Y.	Excavation	50.00	14,500
15	3,960 C.Y.	Gravel Fill	50.00	198,000
16	1,500 S.Y.	Geotextile Fabric	5.00	7,500
17	1,000 C.Y.	Rip Rap	375.00	375,000
18	13 Loads	Trucking (Anc. to Nui.)	10,000.00	130,000
		Subtotal Construction		$2,190,600

Land Acquisition		0
City Administration	@ 5%	109,500
Design	@ 12%	262,900
Construction Management	@ 15%	328,600
Project Contingency	@ 15%	328,600
3 Years Inflation	@ 3%	203,100
Subtotal		$3,423,300

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 2B - New Culverts, Minor Elevation Change

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	1 L.S.	Mobilization/Demobilization	268,000.00	268,000
2	1 L.S.	Temp Erosion and Pollution Control	50,000.00	50,000
3	1 L.S.	Construction Surveying	90,000.00	90,000
4	1 L.S.	Remove Piling, Abutments, and Superstrucure	75,000.00	75,000
5	195 L.F.	3 - 120" Φ CMP	1,800.00	351,000
6	6 Each	End Section	4,000.00	24,000
7	55,000 Lbs.	Sheet Piling (1550 S.f.)	1.00	55,000
8	15 Days	Install Sheet Piling	18,000.00	270,000
9	500 Lbs.	8"x4"x9/16" Rolled Angle H.D.G.	6.00	3,000
10	72 L.F.	Tieback Anchors	50.00	3,600
11	4 Each	Deadmen	7,500.00	30,000
12	19,500 B.F.	4" Rigid Insulation	12.00	234,000
13	610 C.Y.	Excavation	50.00	30,500
14	1,600 C.Y.	Gravel Fill	50.00	80,000
15	1,030 C.Y.	Riprap	375.00	386,250
16	1,500 S.Y.	Geotextile Fabric	5.00	7,500
17	10 Loads	Trucking (Anc. to Nui.)	10,000.00	100,000
		Subtotal Construction		$2,057,850

Land Acquisition		0
City Administration	@ 5%	102,900
Design	@ 12%	246,900
Construction Management	@ 15%	308,700
Project Contingency	@ 15%	308,700
3 Years Inflation	@ 3%	190,800
Subtotal		$3,215,850

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 2C - Do Nothing (Remove Bridge)

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	1 L.S.	Mobilization/Demobilization	40,000.00	40,000
2	1 L.S.	Temp Erosion and Pollution Control	75,000.00	75,000
3	1 L.S.	Remove Piling, Abutments, and Superstrucure	75,000.00	75,000
4	1 L.S.	Reshaping and Bank Stabilization	50,000.00	50,000
		Subtotal Construction		$240,000

Land Acquisition		0
City Administration	@ 5%	12,000
Design	@ 15%	36,000
Construction Management	@ 20%	48,000
Project Contingency	@ 20%	48,000
3 Years Inflation	@ 3%	22,300
Subtotal		$406,300

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 3A - Armor Existing Culverts, No Elevation Change

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	1 L.S.	Mobilization/Demobilization	250,000.00	250,000
2	1 L.S.	Temp Erosion and Pollution Control	50,000.00	50,000
3	1 L.S.	Slope Grading	85,000.00	85,000
4	1,425 C.Y.	Riprap	375.00	534,400
5	2,420 S.Y.	Geotextile Fabric	5.00	12,100
		Subtotal Construction		$931,500

Land Acquisition		0
City Administration	@ 5%	46,600
Design	@ 12%	111,800
Construction Management	@ 15%	139,700
Project Contingency	@ 20%	186,300
3 Years Inflation	@ 3%	86,400
Subtotal		$1,502,300

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 3B - Install New Circular Culverts, Elevate Roadway 3 Feet

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	1 L.S.	Mobilization/Demobilization	280,000.00	280,000
2	1 L.S.	Temp Erosion and Pollution Control	50,000.00	50,000
3	1 L.S.	Construction Surveying	90,000.00	90,000
4	1 L.S.	Remove Old Culverts	25,000.00	25,000
5	195 L.F.	72" CMP	1,200.00	234,000
6	6 Each	End Sections	3,000.00	18,000
7	34,000 Lbs.	Sheet Piling (1000 S.f)	1.00	34,000
8	15 Days	Install Sheet Piling	18,000.00	270,000
9	500 Lbs.	8"x4"x9/16" Rolled Angle H.D.G.	6.00	3,000
10	72 L.F.	Tieback Anchors	50.00	3,600
11	4 Each	Deadmen	7,500.00	30,000
12	12,400 B.F.	4" Rigid Insulation	12.00	148,800
13	1,280 C.Y.	Excavation	50.00	64,000
14	2,740 C.Y.	Gravel Fill	50.00	137,000
15	1,735 C.Y.	Riprap	375.00	650,625
16	1,390 S.Y.	Geotextile Fabric	5.00	6,950
17	10 Loads	Trucking (Anc. to Nui.)	10,000.00	100,000
		Subtotal Construction		$2,144,975

Land Acquisition		0
City Administration	@ 5%	107,200
Design	@ 12%	257,400
Construction Management	@ 15%	321,700
Project Contingency	@ 15%	321,700
3 Years Inflation	@ 3%	198,900
Subtotal		$3,351,875

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 3C - Install New Arched Culvert, Elevate Roadway 4.5 Feet

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	1 L.S.	Mobilization/Demobilization	328,000.00	328,000
2	1 L.S.	Temp Erosion and Pollution Control	50,000.00	50,000
3	1 L.S.	Construction Surveying	90,000.00	90,000
4	1 L.S.	Remove Old Culverts	25,000.00	25,000
5	72 L.F.	100-inch x 154-inch Pipe Arch Culvert	1,800.00	129,600
6	2 Each	End Sections	4,000.00	8,000
7	40,000 Lbs.	Sheet Piling (1130 S.F.)	1.00	40,000
8	15 Days	Install Sheet Piling	18,000.00	270,000
9	1,000 Lbs.	8"x4"x9/16" Rolled Angle H.D.G.	3.00	3,000
10	72 L.F.	Tieback Anchors	50.00	3,600
11	4 Each	Deadmen	7,500.00	30,000
12	30,800 B.F.	4" Rigid Insulation	12.00	369,600
13	1,500 C.Y.	Excavation	50.00	75,000
14	3,300 C.Y.	Gravel Fill	50.00	165,000
15	2,190 C.Y.	Riprap	375.00	821,250
16	1,660 S.Y.	Geotextile Fabric	5.00	8,300
17	10 Loads	Trucking (Anc. to Nui.)	10,000.00	100,000
		Subtotal Construction		$2,516,350

Land Acquisition		0
City Administration	@ 5%	125,800
Design	@ 12%	302,000
Construction Management	@ 15%	377,500
Project Contingency	@ 15%	377,500
3 Years Inflation	@ 3%	233,300
Subtotal		$3,932,450

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

Alternative 3D - Do Nothing

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE

Subtotal Construction		$0
Land Acquisition		0
City Administration	@ 5%	0
Design	@ 12%	0
Construction Management	@ 15%	0
Project Contingency	@ 15%	0
1 Years Inflation	@ 3%	0
Subtotal		$0

Nuiqsut Repair Bridge Crossing PAR

2/10/2016

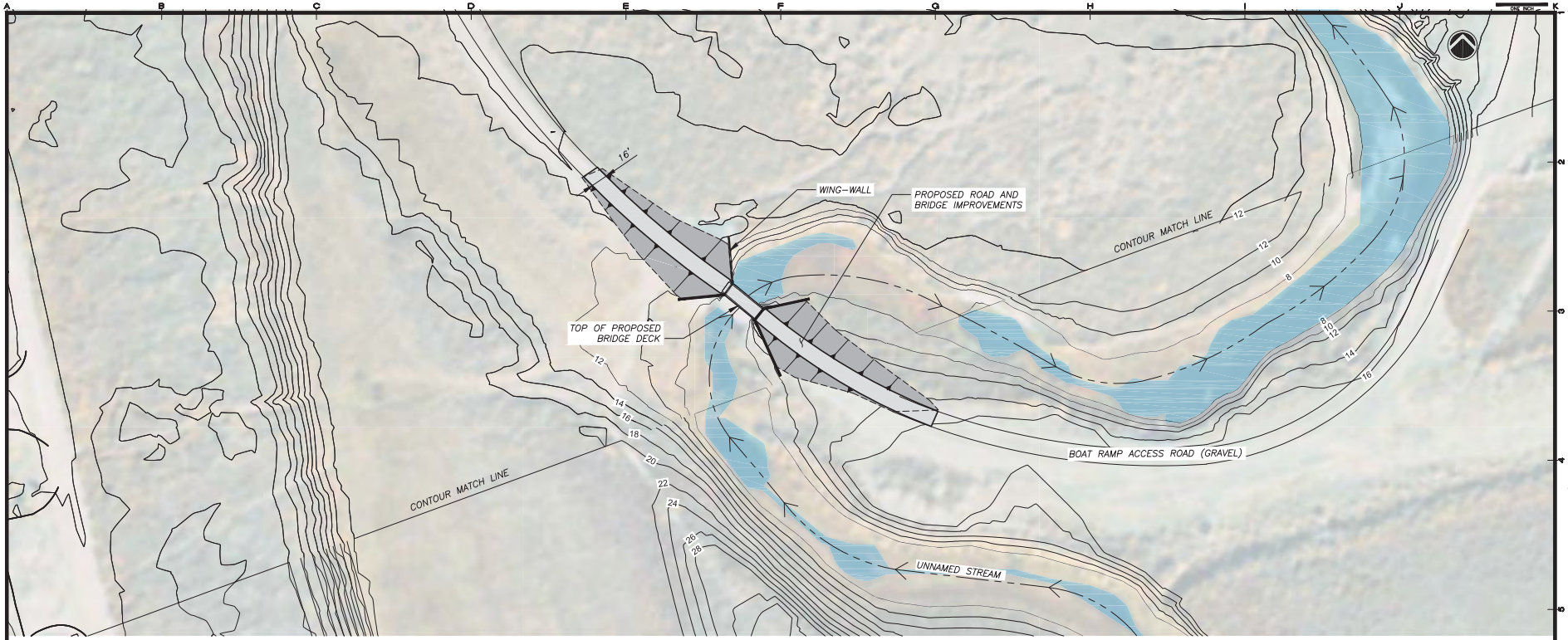
Elevate Bridge at Site 2 Above Extreme High Water - See Section 2.10.1 pg 18

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	1 L.S.	Mobilization/Demobilization	2,300,000.00	2,300,000
2	92,800 C.Y.	Gravel Fill	50.00	4,640,000
3	28,824 C.Y.	Riprap	375.00	10,809,000
4	42,000 S.Y.	Geotextile Fabric	5.00	210,000

Subtotal Construction		$17,959,000
Land Acquisition		0
City Administration	@ 5%	898,000
Design	@ 12%	2,155,100
Construction Management	@ 15%	2,693,900
Project Contingency	@ 15%	2,693,900
1 Years Inflation	@ 3%	538,800
Subtotal		$26,938,700

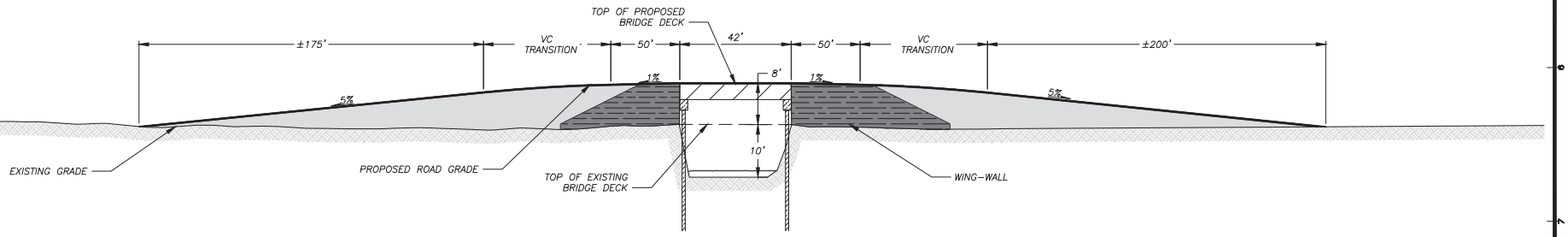
APPENDIX B

CONCEPT DRAWINGS FOR UPPER STREAM CROSSING (SITE 2)



1 / 2A.1 SCALE: 1"=50'

SITE 2-ALTERNATIVE 2A PLAN



2 / 2A.1 SCALE: N.T.S

SITE 2-ALTERNATIVE 2A SECTION

REVISIONS

MARK	DATE	DESCRIPTION
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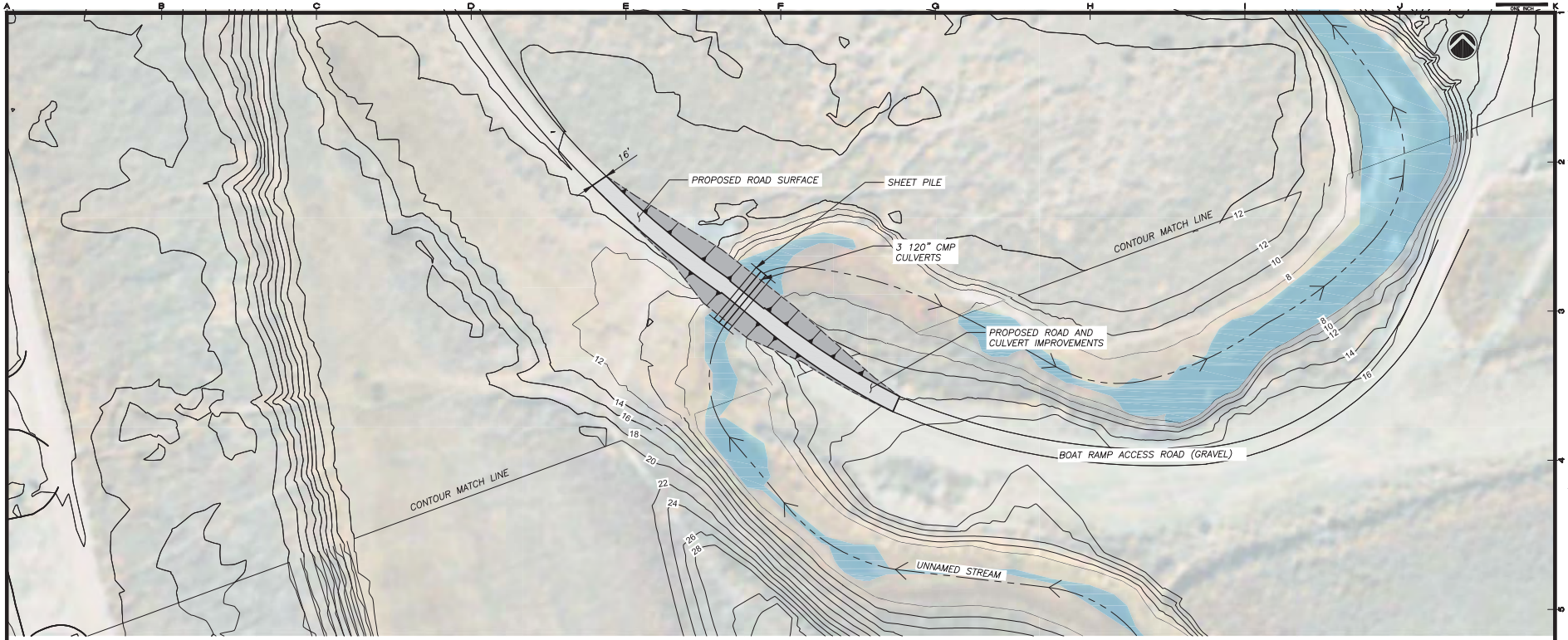
NUIQSUT, ALASKA

SHEET TITLE
SITE 2-
ALTERNATIVE 2A

SHEET
2A.1

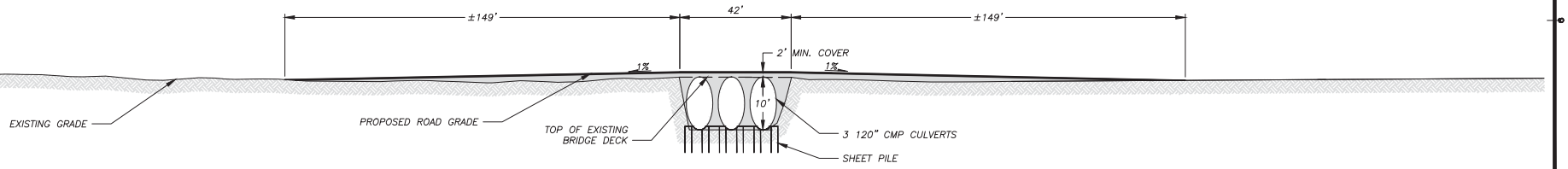
DRAWN BY	CHECKED BY
WJB	AJB

DATED: 12-17-15
SCALE: 1"=50'
JOB NUMBER: 15-031



1 / 2A.1 SITE 2-ALTERNATIVE 2B PLAN

SCALE: 1"=50'



2 / 2A.1 SITE 2-ALTERNATIVE 2B SECTION

SCALE: N.T.S

REVISIONS

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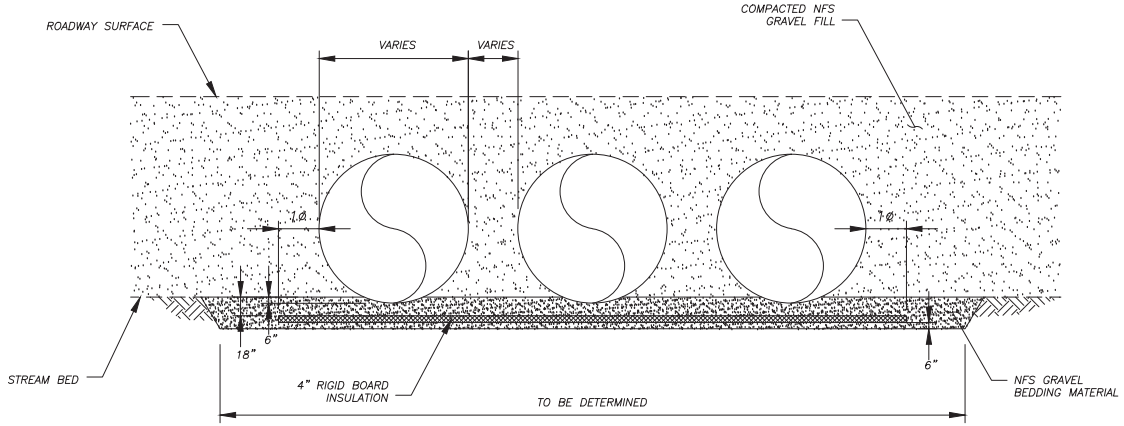
SHEET TITLE: SITE 2- ALTERNATIVE 2B

SHEET: 2B.1

DRAWN BY	CHECKED BY
WJB	AJB
DATED: 12-17-15	SCALE: 1"=50'

JOB NUMBER: 15-031



1 2B/3B.2 **TYPICAL CULVERT DETAIL**
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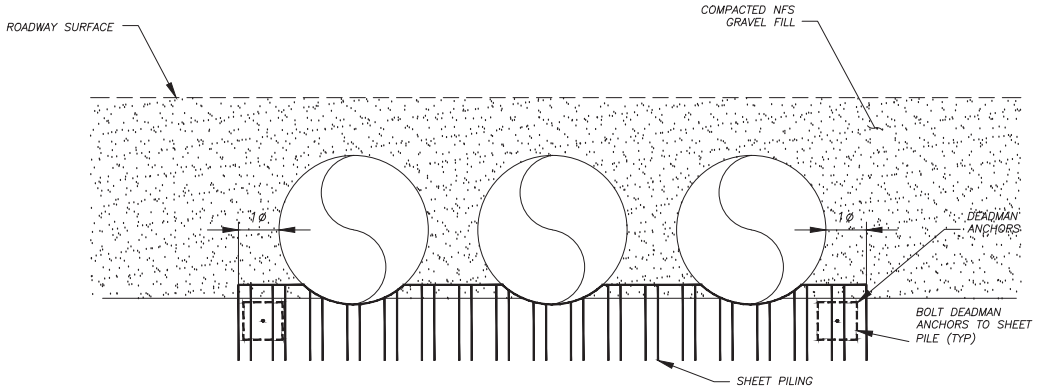

2 2B/3B.2 **TYPICAL SHEET PILE DETAIL**
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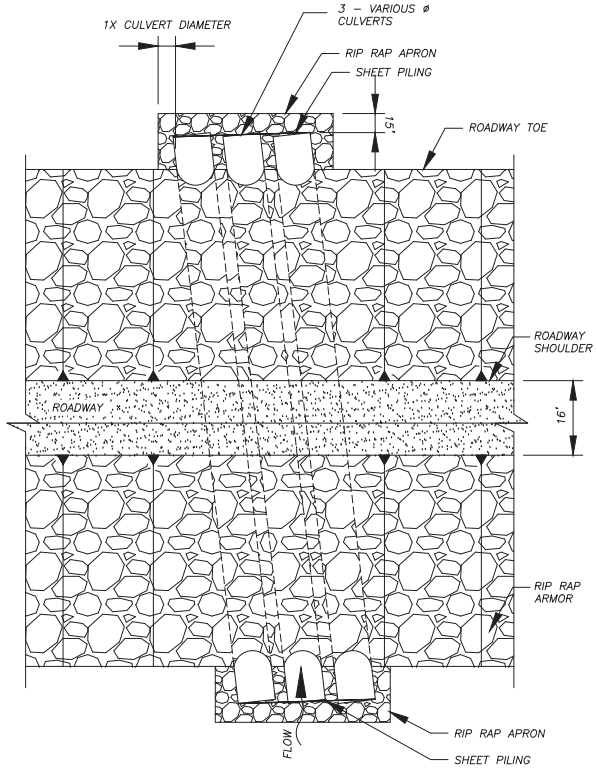

3 2B/3B.2 **CULVERT LAYOUT PLAN**
SCALE: N.T.S

REVISIONS		
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SHEET TITLE
DETAILS

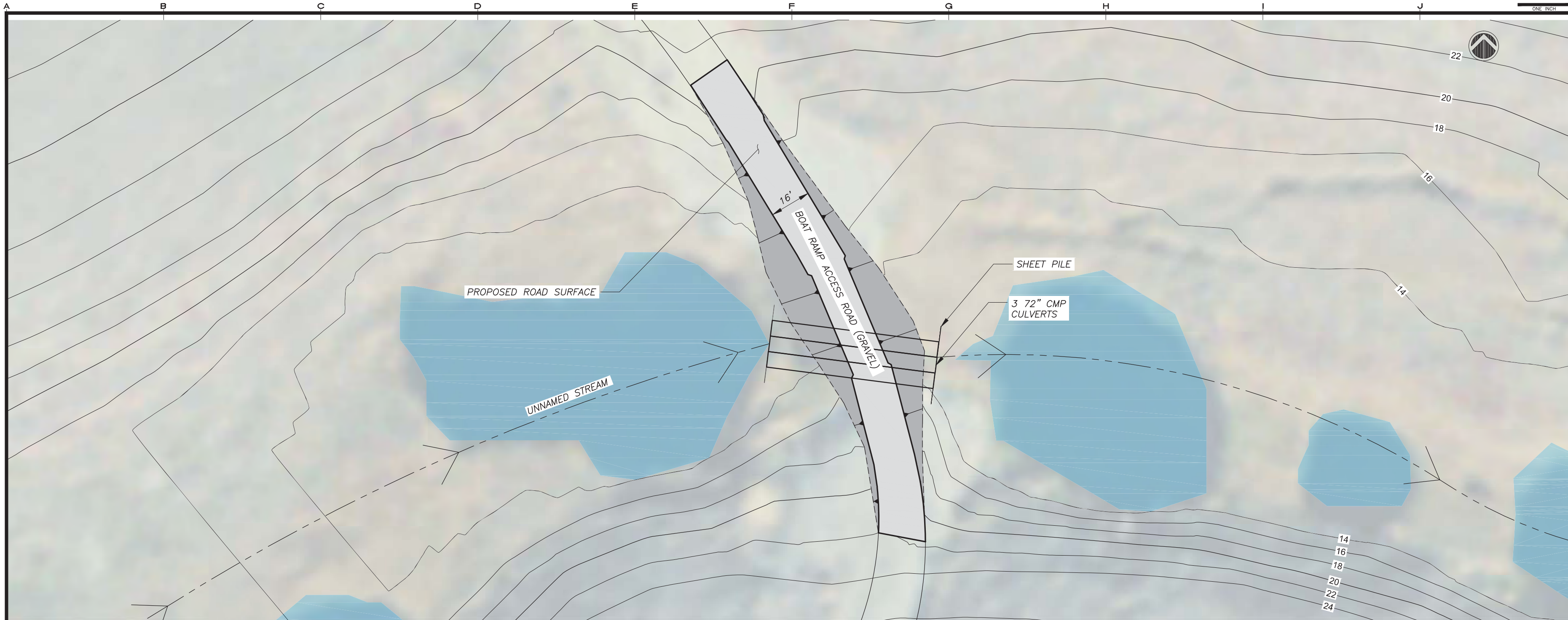
SHEET
2B.2/3B.2

DRAWN BY	CHECKED BY
WJB	AJB
DATED	SCALE
12-17-15	1"=20'

JOB NUMBER
15-031

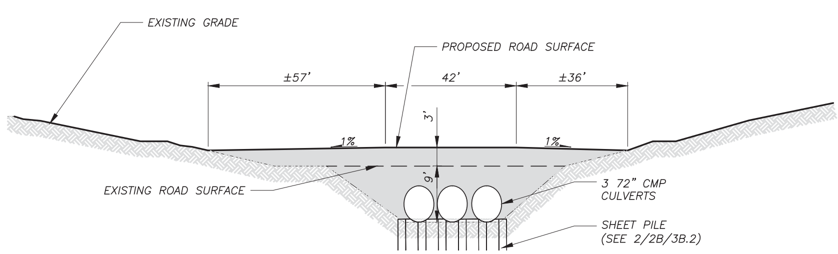
APPENDIX C

CONCEPT DRAWINGS FOR TRIBUTARY STREAM CROSSING (SITE 3)



SITE 3-ALTERNATIVE 3B PLAN

1 / 3B.1 SCALE: 1"=20'



SITE 3-ALTERNATIVE 3B SECTION

2 / 3B.1 SCALE: N.T.S

REVISIONS		
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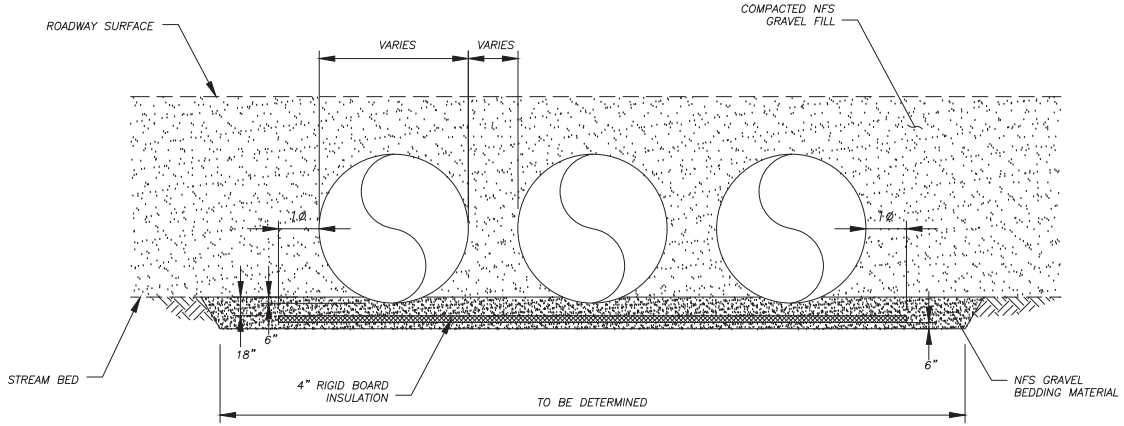
NUIQSUT, ALASKA

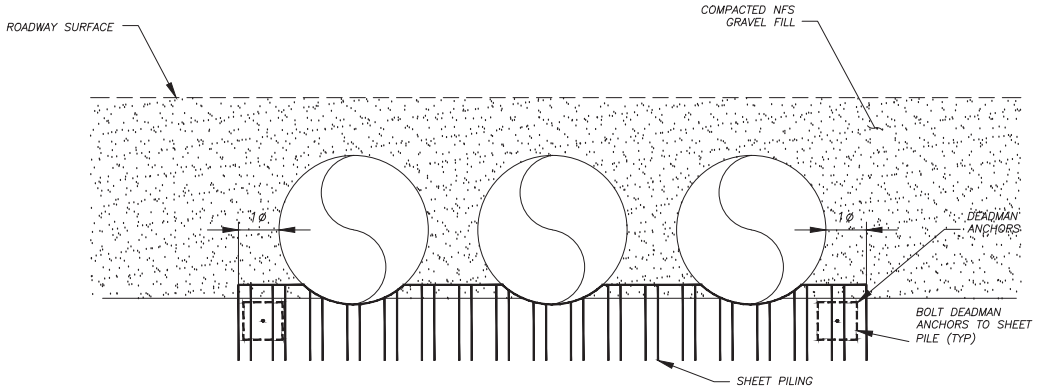
SHEET TITLE: SITE 3– ALTERNATIVE 3B

SHEET: 3B.1

DRAWN BY: WJB | CHECKED BY: AJB
DATE: 12–17–15 | SCALE: 1"=20'
JOB NUMBER: 15–031



1 2B/3B.2 **TYPICAL CULVERT DETAIL**
SCALE: N.T.S



2 2B/3B.2 **TYPICAL SHEET PILE DETAIL**
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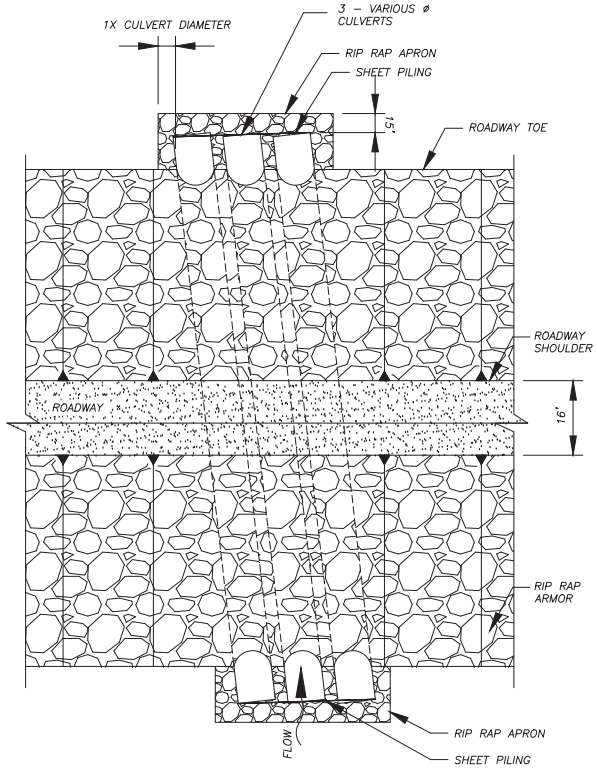

3 2B/3B.2 **CULVERT LAYOUT PLAN**
SCALE: N.T.S

REVISIONS		
MARK	DATE	DESCRIPTION
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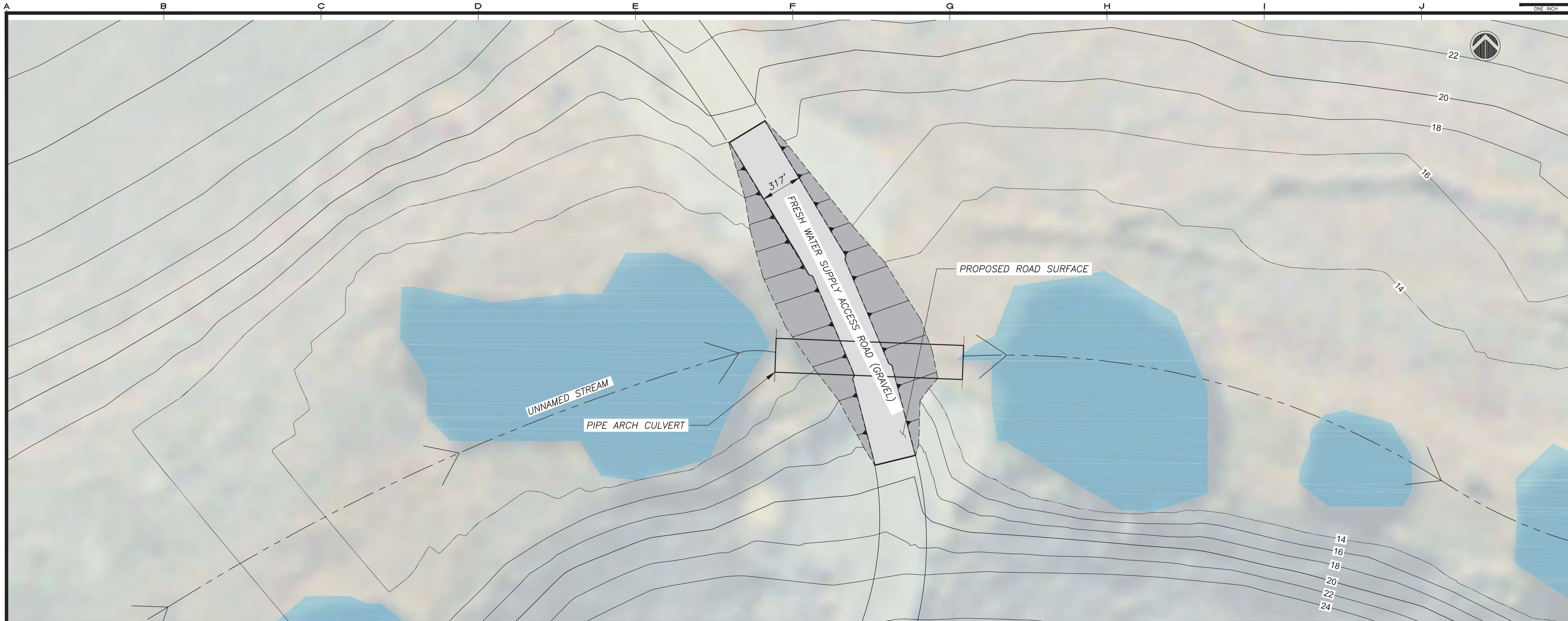
NUIQSUT, ALASKA

SHEET TITLE
DETAILS

SHEET
2B.2/3B.2

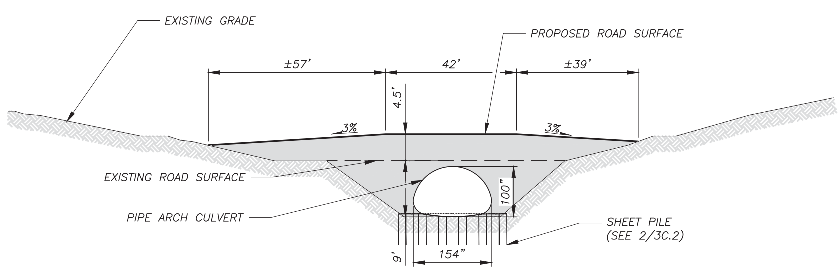
DRAWN BY	CHECKED BY
WJB	AJB
DATED	SCALE
12-17-15	1"=20'

JOB NUMBER
15-031



SITE 3-ALTERNATIVE 3C PLAN

1 / 3C.1 SCALE: 1"=20'



SITE 3-ALTERNATIVE 3C SECTION

2 / 3C.1 SCALE: N.T.S

REVISIONS

MARK	DATE	DESCRIPTION
1		
2		
3		
4		
5		

NOT FOR CONSTRUCTION

HATTENBURG DILLEY & LINNELL
Engineering Consultants
- ENGINEERING
- SURVEYING
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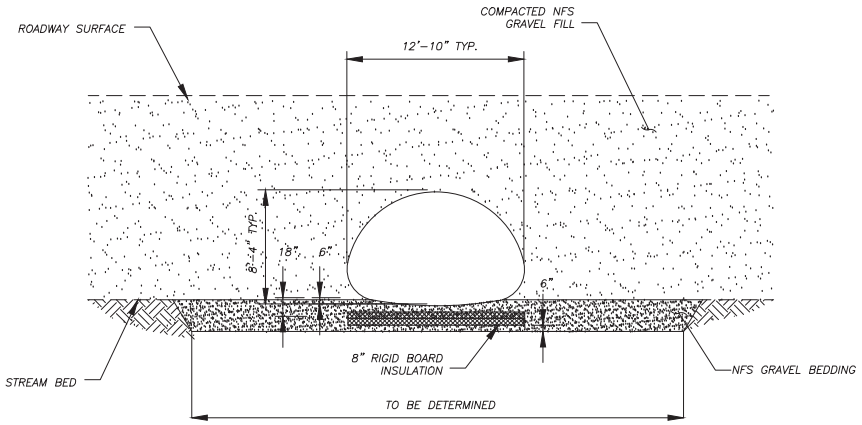
BRIDGE CORSSINGS
NORTH SLOPE BOROUGH
NUIQSUT, ALASKA

SHEET TITLE: SITE 3- ALTERNATIVE 3C

SHEET: 3C.1

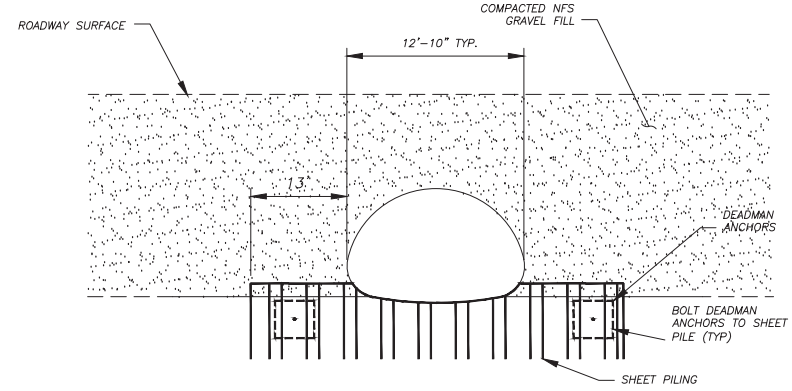
DRAWN BY: WJB | CHECKED BY: AJB
DATE: 12-17-15 | SCALE: 1"=20'
JOB NUMBER: 15-031

H:\Jobs\15-031 North Slope Borough PARs 2015 Term (NSB)\02 – NUI Bridge Crossing Repairs\CAD\DRAWINGS\BRIDGE CROSSINGS alternate, 1=1, 12/17/15 at 11:33 by WJB
LAYOUT: 3C.1



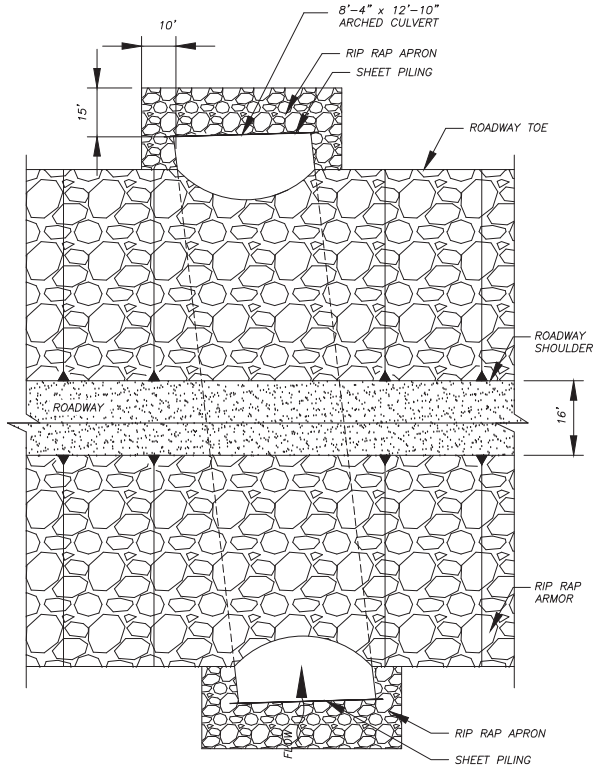
1 3C.2 **TYPICAL PIPE ARCH CULVERT DETAIL**

SCALE: N.T.S



2 3C.2 **TYPICAL PIPE ARCH SHEET PILE DETAIL**

SCALE: N.T.S



3 1.1 **PIPE ARCH CULVERT LAYOUT PLAN**

SCALE: N.T.S

REVISIONS		
MARK	DATE	DESCRIPTION
1		
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BRIDGE CORSSINGS

NORTH SLOPE BOROUGH

NUIQSUT, ALASKA

SHEET TITLE: DETAILS

SHEET: 3C.2

DRAWN BY	CHECKED BY
WJB	AJB

DATED: 12-17-15 SCALED: 1"=20'

JOB NUMBER: 15-031

APPENDIX D

HDL SITE INSPECTION REPORT

HATTENBURG DILLEY & LINNELL
Engineering Consultants

MEMORANDUM

DATE: September 8, 2015

TO: Jack Frantz, North Slope Borough Project Administrator

FROM: Adam Bruscher, Project Engineer

RE: August 20-21, NSB PAR Bridge Crossing Repair - Nuiqsut Site Inspection

CIVIL ENGINEERING

GEOTECHNICAL ENGINEERING

TRANSPORTATION ENGINEERING

ENVIRONMENTAL SERVICES

PLANNING

SURVEYING

CONSTRUCTION ADMINSTRATION

MATERIAL TESTING

RIGHT-OF-WAY SERVICES

On Thursday August 20, 2015, I departed Anchorage with Scott Hattenburg and Kyle Albert of Hattenburg Dilley & Linnell via Alaska Airlines at 7:35 AM and arrived in Prudhoe Bay at 9:17 AM. We departed Prudhoe Bay at 1:30 PM via Ravn Alaska and arrived in Nuiqsut at 1:50 PM. Upon arriving in Nuiqsut we were greeted by Kuukpik Hotel staff and transported to Kuukpikmiut Subsistence Oversight Panel Inc. for our vehicle rental. Upon obtaining the vehicle rental we checked into our rooms at the Kuukpik Hotel.

Temperatures were in the low-40°Fs during the day and mid-30°Fs at night. Conditions were overcast during the site visit.

The purpose for the trip was to investigate and gather the field information necessary to prepare a Project Analysis Report (PAR) for the North Slope Borough (Borough) to repair two temporary culvert crossings and one failed bridge crossing (Figure 1). During our visit to Nuiqsut we also completed an as-built survey of the PAPI pads for the Nuiqsut Airport.

Figure 1: project location map

Upon departing the hotel we spoke with Thomas, the Public Works Supervisor for Nuiqsut. He mentioned that extreme high water events occur during the spring ice breakup and the only visible landmark is the gravel pile located 0.7 miles east of the village and a knoll 0.1 miles east of the village (Figure 1). He also informed us that the backwater from the Colville River causes the water level to rise well above the access road, thus annually washing out the lower stream crossing by the boat launch. The tributary stream crossing south of the airport is armored with sandbags and though it overtops annually, it has not washed out.

For the remainder of the day on August 20th we performed a preliminary investigation of the three stream crossings and as a separate project as-built the newly constructed PAPI pads at the airport.

On August 21st we started our field work at the temporary culvert crossing on the boat ramp access road. We gathered measurements on the existing pipes, roadway dimensions. We setup a level and took field measurements on the top of the roadway, top of pipes and water level at the culverts. We collected a cross section of the stream 100 feet upstream of the bridge, recording relative elevations at 10' intervals.

Figure 2: Temporary culvert crossing, Road to the Boat Launch, two 48-inch CMPs

Next we visited the failed bridge location. We noted the condition of the bridge, what failed, and the sizes and dimension of the structural components of the bridge. We setup a level and took relative elevation measurements on the centerline of the bridge deck, the water surface, channel bottom, and centerline of the road 75 feet East and West of the structure. To better understand the channel hydraulics we recorded a reference cross section roughly 250 feet downstream of the bridge.

Figure 3: Failed 42-foot span Bridge, Road to Boat Launch

The last structure we visited was the tributary stream crossing south of the airport on the road to the water source. We gathered data in a similar fashion to the first culvert crossing and noted the dimensions of the existing pipes and roadway widths. A level was used to determine relative heights for the top of the roadway, culverts, and water surface. A reference cross section was collected 100 feet upstream of the crossing. High water debris

lines were located at the edges of the cross-section. The road embankment at this crossing was armored with sandbags that appeared to help protect the structure from erosion.

Figure 4: Temporary culvert crossing – Road to Water Source, three 48-inch diameter CMPs

Upon completing visits to all three structures, we revisited the failed bridge location and investigated surrounding areas to locate the high water debris lines. We found two locations with evidence of debris from high water events. We estimated that the lower of the two debris lines represented a normal high water event due to the large amount of debris in the area. The relative elevation of this debris line was approximately 2 feet higher than the centerline of the bridge deck. We estimated the higher of the debris lines represented an extreme high water event. This debris line was measured to be approximately 8.5 feet higher than the bridge deck.

Figure 5: High water debris line

After documenting the location and relative elevations of the high water lines we gathered our equipment, departed from Nuiqsut at 3:50 PM and arrived in Anchorage at 8:39 PM.

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APPENDIX D
LETTER AGREEMENT BETWEEN CPAI AND NSB

ConocoPhillips
Alaska

Stephen Thatcher
Manager
Western North Slope Development

Post Office Box 100360
Anchorage, Alaska 99510
ATO-1770
Phone 907.263.4464
Stephen.Thatcher@conocophillips.com

March 1, 2018

Harry K. Brower, Jr., Mayor
North Slope Borough
P.O. Box 69
Utqiagvik, Alaska 99723

Re: Nuiqsut Freshwater Lake Road Culvert Replacement

Dear Mayor Brower:

This letter is intended to clarify and document the oral discussions among ConocoPhillips Alaska, Inc., ("CPAI") staff and the North Slope Borough ("NSB") staff about replacing culverts that pass a beaded stream through the road to the Nuiqsut freshwater lake. To confirm that CPAI and NSB share a common understanding of how the proposed project will proceed, we ask that you countersign this letter in the space provided below.

The culvert battery at issue is located about 6,200 feet upstream from the Nigliq Channel and is identified at Site 3 in the NSB's Project Analysis Report (PAR) dated February 10, 2016 and prepared by Hattenburg, Dilley, and Linnell of Anchorage, Alaska. At this location, the gravel road has washed out repeatedly during high water events, resulting in a degraded stream function and fish passage. According to the PAR, this section of roadway overtops during break-up events and the risk of overtopping could be substantially reduced by raising the height of the road and increasing the volume of hydrologic flow beneath it by, for example, replacing the existing culverts with a new flow through design that could be as simple as a larger culvert battery, though detailed engineering would be needed to support final project design. NSB recognizes that an improved stream crossing is desirable.

CPAI has identified improved waterflow at this location as a valuable wetland restoration project that would merit credit as compensatory mitigation under the U.S. Army Corp of Engineers ("USACE") Section 404 permitting program in connection with our GMT2 development. CPAI has had preliminary planning discussions with USACE, Kuukpik Corporation, NSB, and others to develop this project. The next step is to engage an engineering firm to prepare a preliminary design. CPAI is prepared to do this, based on the following key points of mutual agreement:

1. NSB understands that CPAI is proposing to perform a culvert replacement or other project to improve water flow at the road crossing, for the purpose of getting credit from the USACE as compensatory mitigation in connection with a Section 404 permit for the GMT2 project. Implementation of this project depends on getting approvals from USACE and others as necessary to fulfill the purpose of this project.

2. NSB and CPAI expect to enter into good faith discussions in the future with the goal of entering into a binding agreement about project specifications, payment obligations, liabilities, and related issues. The basic proposal is that CPAI would pay for most or all of the project costs, and the NSB would assume ownership, maintenance obligations, and any liability for the new crossing after determining that it meets project specifications. Implementation of the project will depend on reaching timely agreement on the necessary terms and conditions.

3. CPAI plans to engage an engineering firm in March 2018 to prepare a preliminary design and prepare permit application documents. CPAI will bear the full cost of this preliminary design.

4. CPAI also plans to engage an engineering firm to perform hydrology field studies during the summer of 2018 to gather information necessary for final project design. The decision regarding whether or not to execute final project design will be made shortly after receiving the preliminary design and hydrology field studies reports.

5. If CPAI ultimately does not proceed with this project, but the NSB wishes to have the benefit of preliminary design work or summer hydrology studies funded by CPAI, CPAI will allow NSB to purchase the work at cost.

Details on these issues are being discussed primarily by Brad Thomas for CPAI and Bob Shears for NSB.

Please countersign below to confirm that NSB agrees with the basic project structure described in this letter. We will then move forward incrementally to flesh out the full project details, with the goal of ultimately having a concise but comprehensive written agreement between CPAI and NSB.

Yours truly,

Stephen Thatcher

On behalf of NSB, I agree with the key points of understanding set forth above:

3-14-18

Harry K. Brower, Jr., Mayor

Date