

# **Nanushuk Development Project**

USACE Permit Application Figure Set  
(Sheets 1-53)

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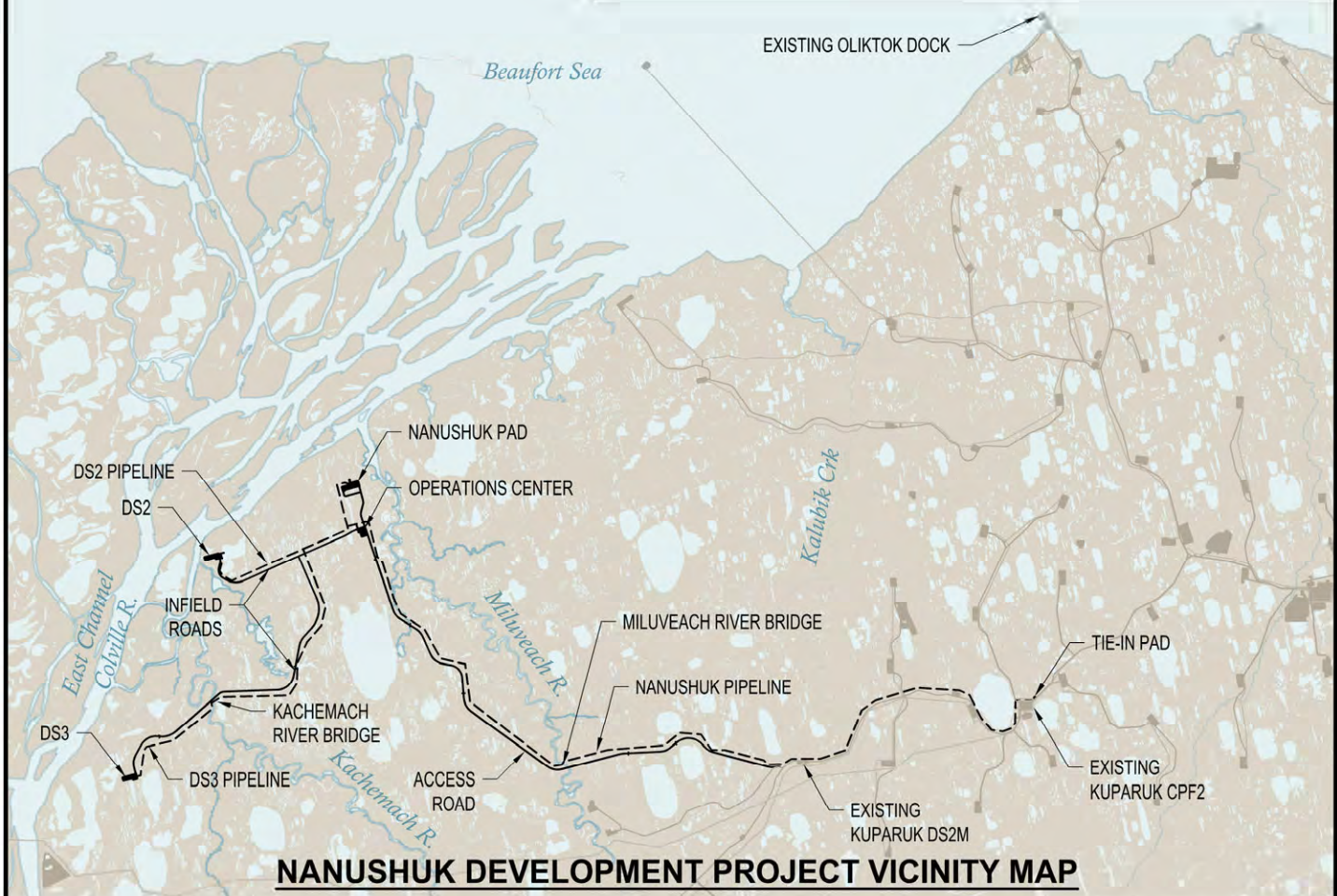
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## LEGEND



0 2 4 6 MI

- PROPOSED GRAVEL ROAD
- - - PROPOSED PIPELINE
- PROPOSED PAD
- EXISTING PAD/FACILITY
- EXISTING ROAD
- EXISTING PIPELINE



DATUM: NAVD88, NAD83 ASP Zone 4

APPLICANT: Armstrong Energy, LLC

ACTIVITY: Road, Pad and Pipeline Construction

ADDRESS: 510 L Street, Suite 310  
Anchorage, Alaska 99501

REFERENCE: POA-2015-025

PROJECT: Nanushuk Development

WATERWAY: Miluveach River

LOCATION: T11N R5,6,7,8,9E  
T12N R6E, T13N R9E  
Umiat Meridian

COUNTY: North Slope Borough  
STATE: Alaska

SHEET **1** of **53**  
6-16-17



## LEGEND

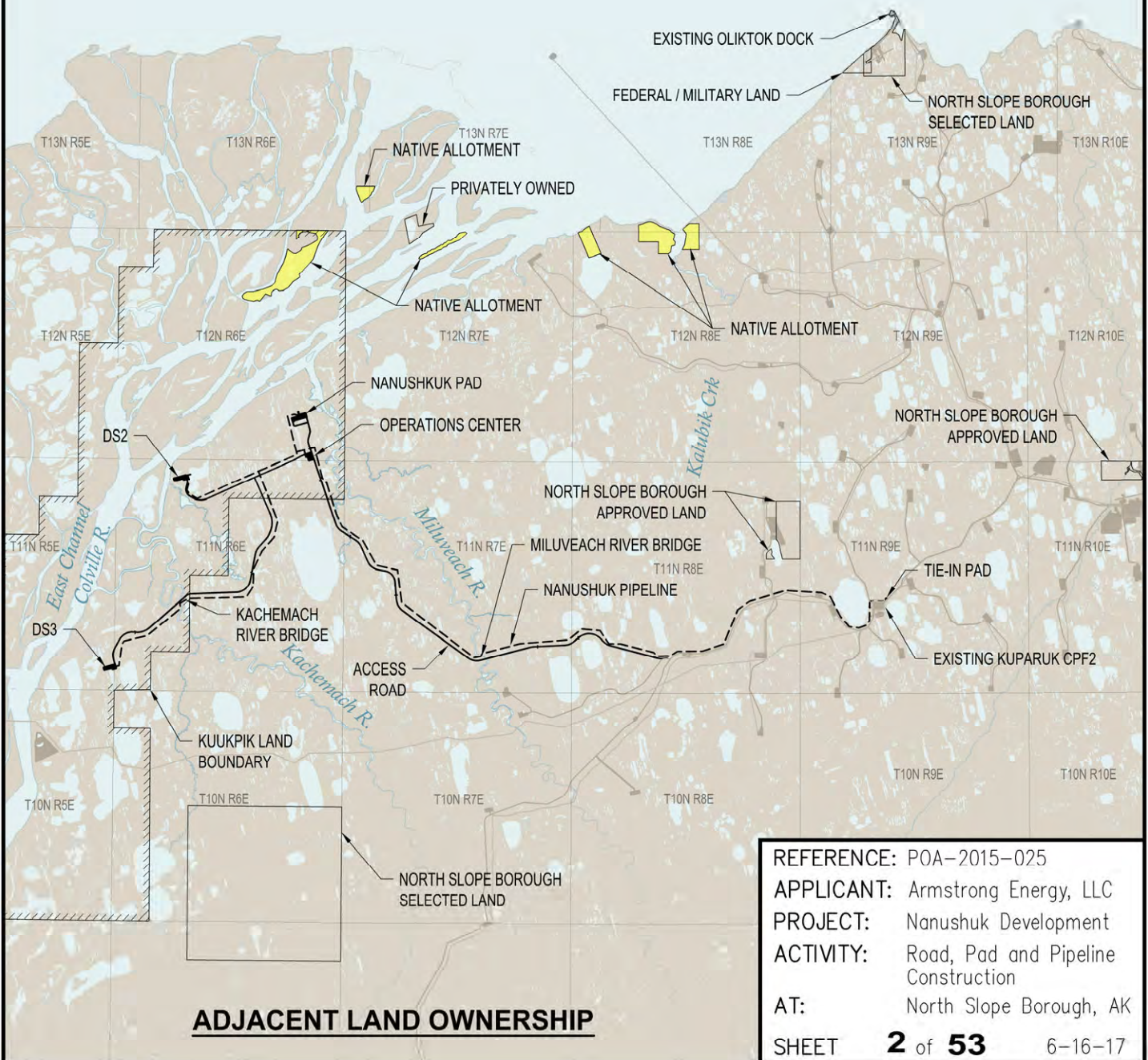


- PROPOSED GRAVEL ROAD
- - - PROPOSED PIPELINE
- PROPOSED PAD
- EXISTING PAD/FACILITY
- EXISTING ROAD
- EXISTING PIPELINE
- NATIVE ALLOTMENT
- /// KUKUPIK LANDS BOUNDARY

0 2 4 6 MI

### NOTE:

LAND NOT SPECIFICALLY LABELED  
IS STATE OF ALASKA LAND.



REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **2** of **53** 6-16-17



## **ADJACENT LAND OWNERSHIP CONTACT INFORMATION**

KUUKPIK VILLAGE CORPORATION  
P.O. BOX 89187  
NUIQSUT, AK 99789  
(907) 480-6220  
ATTN: JOE NUKAPIGAK

ARCTIC SLOPE REGIONAL CORPORATION  
P.O. BOX 129  
BARROW, AK 99723  
ATTN: REX A. ROCK SR.

STATE OF ALASKA DEPARTMENT OF NATURAL RESOURCES DIVISION OF MINING, LAND & WATER  
3700 AIRPORT WAY  
FAIRBANKS, AK 99709  
ATTN: JEANNE PROULX

REFERENCE: POA-2015-025  
APPLICANT: Armstrong Energy, LLC  
PROJECT: Nanushuk Development  
ACTIVITY: Road, Pad and Pipeline  
Construction  
AT: North Slope Borough, AK  
SHEET **3** of **53** 6-16-17

## LEGEND



- PROPOSED GRAVEL ROAD
- - - PROPOSED PIPELINE
- PROPOSED PAD
- EXISTING PAD/FACILITY
- EXISTING ROAD
- EXISTING PIPELINE

0 2 4 6 MI

OLIKTOK DOCK SCREEDING AREA  
LAT: N70° 30' 41.414"  
LONG: W149° 51' 54.183"



## PROJECT OVERVIEW

REFERENCE: POA-2015-025

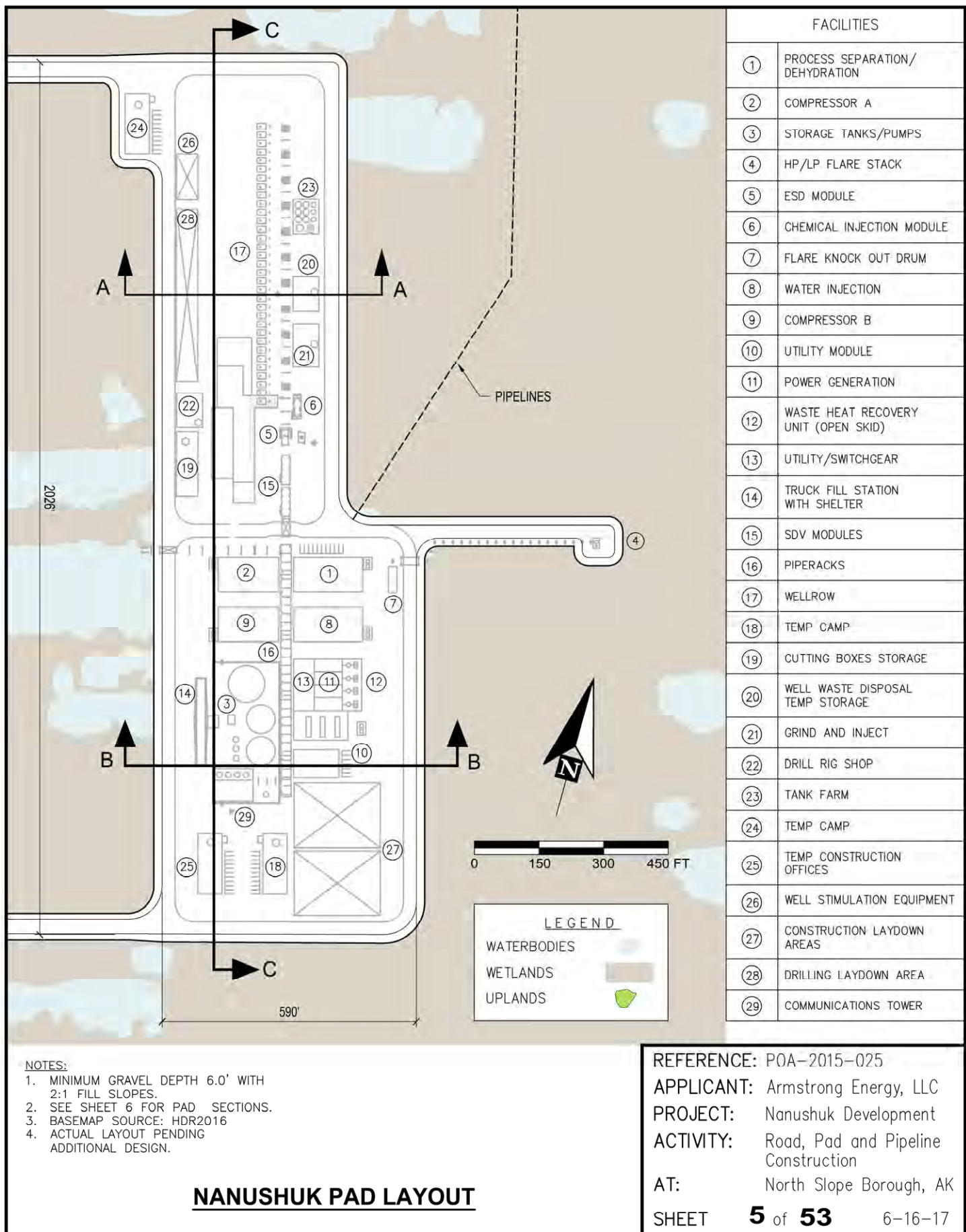
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

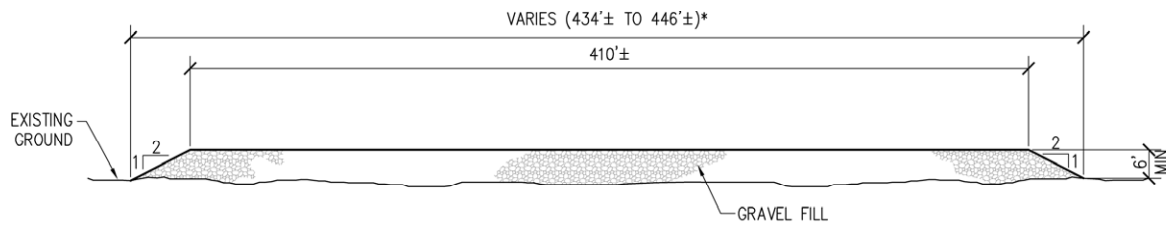
AT: North Slope Borough, AK

SHEET **4** of **53** 6-16-17



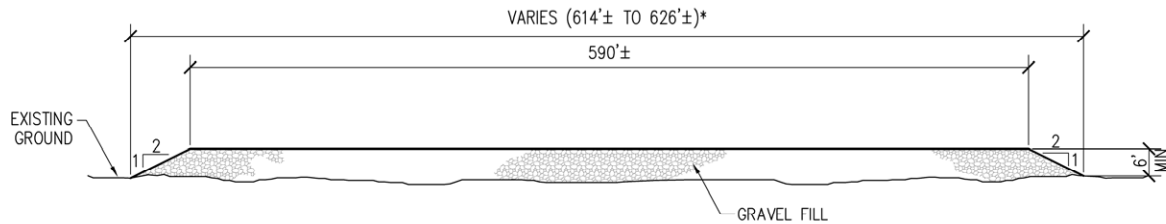
**NANUSHUK PAD LAYOUT**





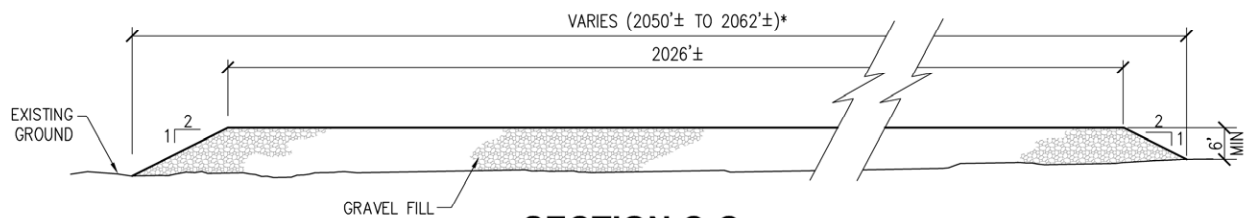
### **SECTION A-A**

NTS



### **SECTION B-B**

NTS



### **SECTION C-C**

NTS

**\*NOTE:**  
MAX TOE TO TOE DIMENSIONS ARE  
ESTIMATED. ACTUAL DIMENSIONS WILL  
VARY BASED UPON SITE CONDITIONS.

## **NANUSHUK PAD SECTIONS**

REFERENCE: POA-2015-025

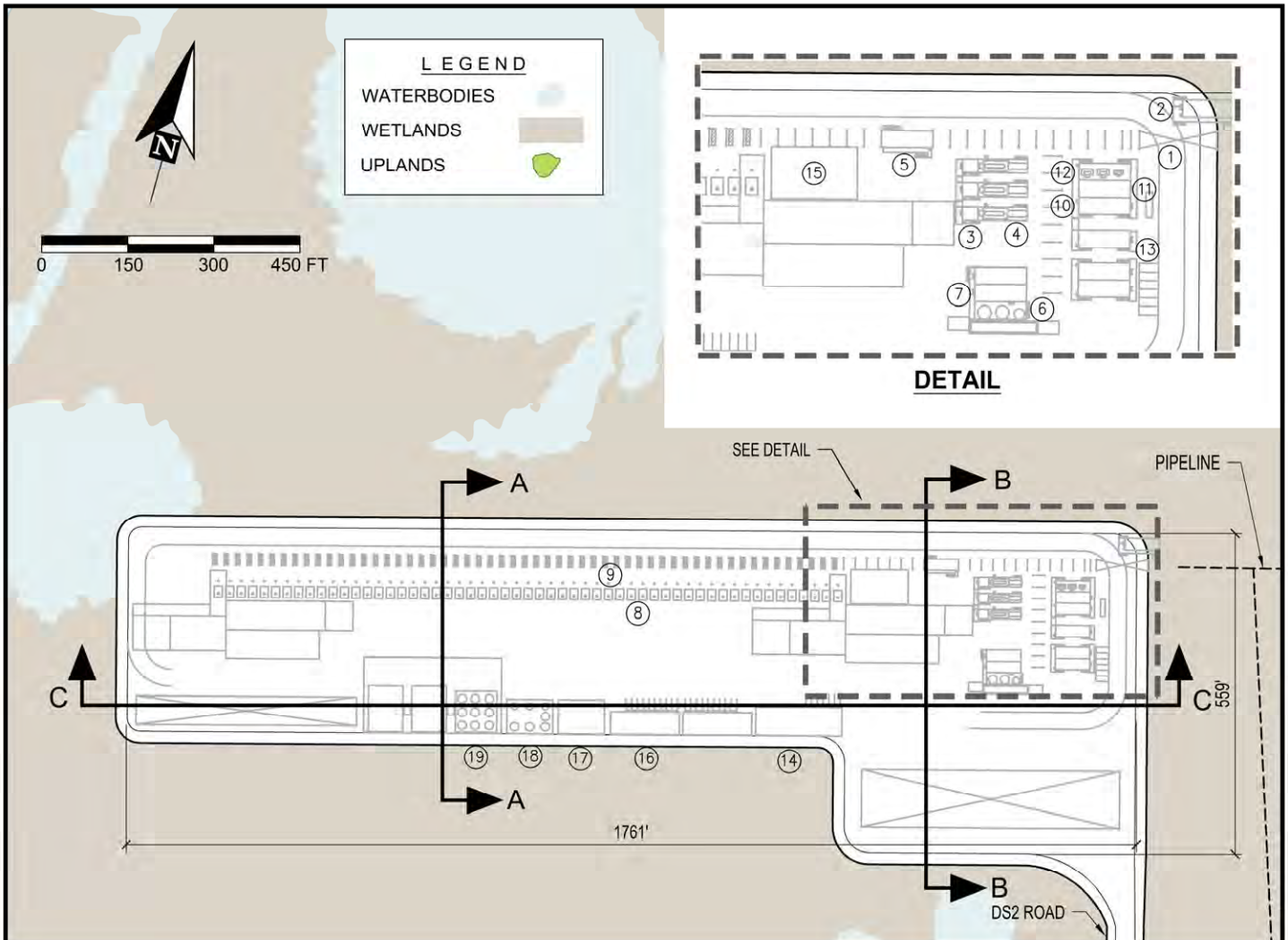
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline  
Construction

AT: North Slope Borough, AK

SHEET **6** of **53** 6-16-17



### PLAN

FACILITIES					
(1)	PIPE BRIDGE	(8)	WELL SHELTER/SKID MANIFOLD	(15)	GRIND & INJECT SKID
(2)	PIGGING MODULE	(9)	PIPERACK/ACCESS PLATFORM	(16)	TEMPORARY CAMP
(3)	FUEL GAS CONDITIONING (5)	(10)	REIM MODULE	(17)	DRILL RIG SHOP
(4)	PRODUCTION HEATER MODULE (5)	(11)	SWITCHGEAR	(18)	TANK FARM
(5)	ESD MODULE	(12)	DRILL RIG POWER/TRANSFORMER	(19)	WELL STIMULATION EQUIPMENT
(6)	CHEMICAL/DIESEL STORAGE TANKS	(13)	COMMUNICATION TOWER		
(7)	CHEMICAL INJECTION/PUMPS MODULE	(14)	COLD STORAGE/EMERGENCY RESPONSE		

#### NOTES:

1. MINIMUM GRAVEL DEPTH 6.0' WITH 2:1 FILL SLOPES.
2. SEE SHEET 8 FOR PAD SECTIONS.
3. BASEMAP SOURCE: HDR2016
4. ACTUAL LAYOUT PENDING ADDITIONAL DESIGN.

### DS2 LAYOUT

REFERENCE: POA-2015-025

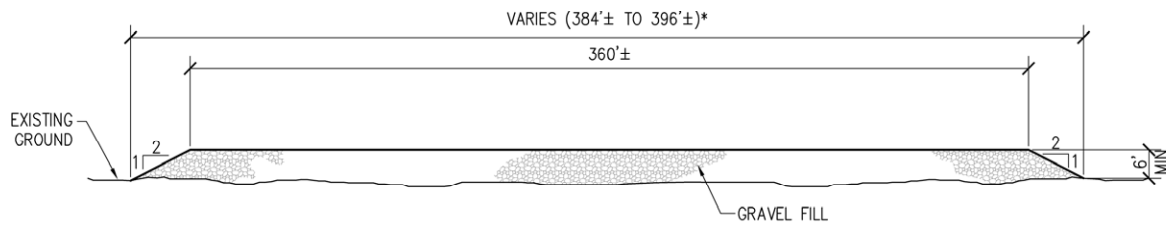
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

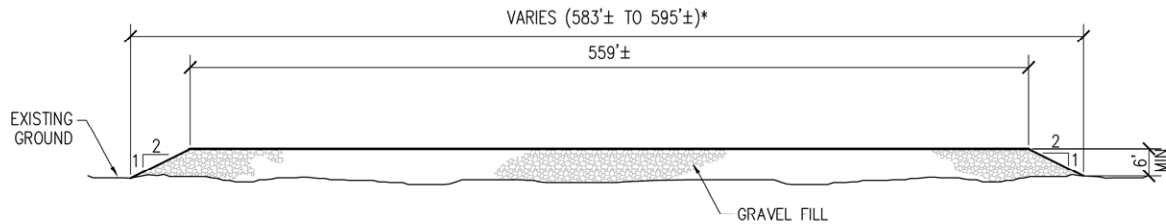
AT: North Slope Borough, AK

SHEET **7** of **53** 6-16-17



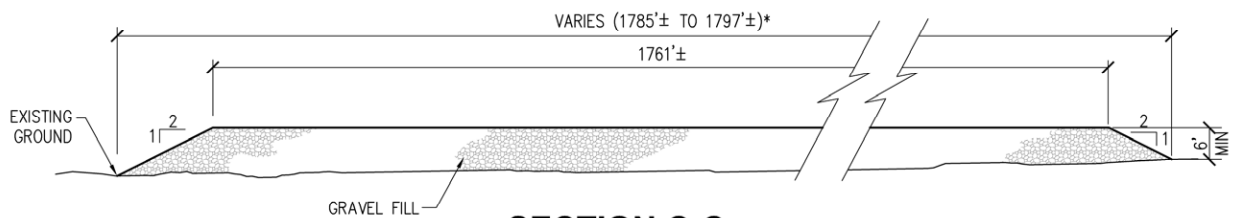
### **SECTION A-A**

NTS



### **SECTION B-B**

NTS



### **SECTION C-C**

NTS

**\*NOTE:**  
MAX TOE TO TOE DIMENSIONS ARE  
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## **DS2 PAD SECTIONS**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

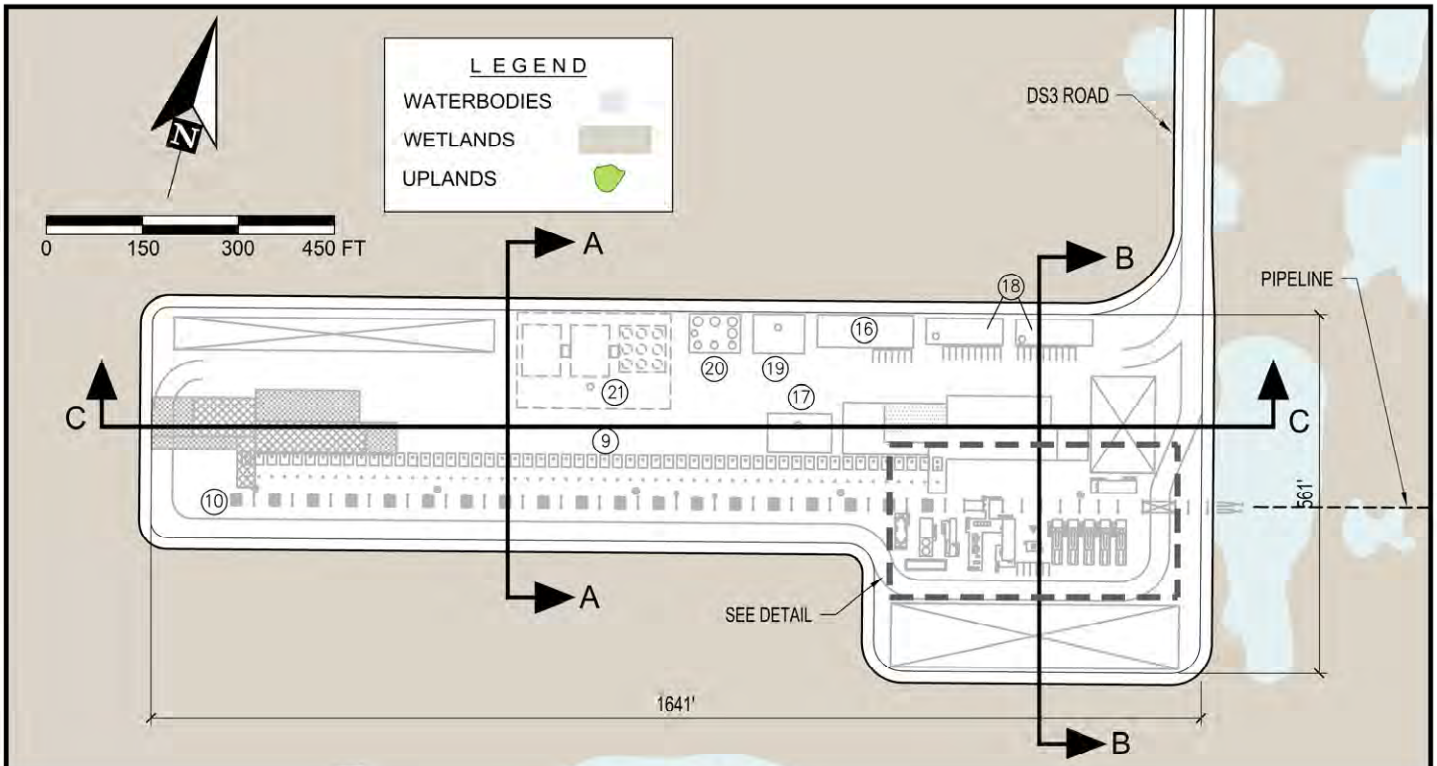
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline  
Construction

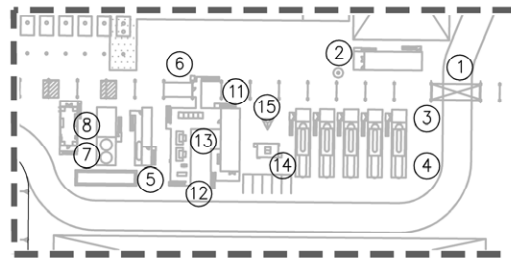
AT: North Slope Borough, AK

SHEET **8** of **53** 6-16-17





**PLAN**



**DETAIL**

FACILITIES					
(1)	PIPE BRIDGE	(8)	CHEMICAL INJECTION/PUMPS MODULE	(15)	COMMUNICATION TOWER
(2)	PIGGING MODULE	(9)	WELL SHELTER/SKID MANIFOLD	(16)	COLD STORAGE/EMERGENCY RESPONSE
(3)	FUEL GAS CONDITIONING (5)	(10)	PIPERACK/ACCESS PLATFORM	(17)	GRIND & INJECT SKID
(4)	PRODUCTION HEATER MODULE (5)	(11)	REIM MODULE	(18)	TEMPORARY CAMP
(5)	TEST SEPARATOR MODULE	(12)	ELECTRICAL TRANSF/DIESEL GENERATOR	(19)	DRILL RIG SHOP
(6)	ESD MODULE	(13)	SWITCHGEAR	(20)	TANK FARM
(7)	CHEMICAL/DIESEL STORAGE TANKS	(14)	DRILL RIG POWER/TRANSFORMER	(21)	WELL STIMULATION EQUIPMENT

**NOTES:**

1. MINIMUM GRAVEL DEPTH 6.0' WITH 2:1 FILL SLOPES.
2. SEE SHEET 10 FOR PAD SECTIONS.
3. BASEMAP SOURCE: HDR2016
4. ACTUAL LAYOUT PENDING ADDITIONAL DESIGN.

**DS3 LAYOUT**

REFERENCE: POA-2015-025

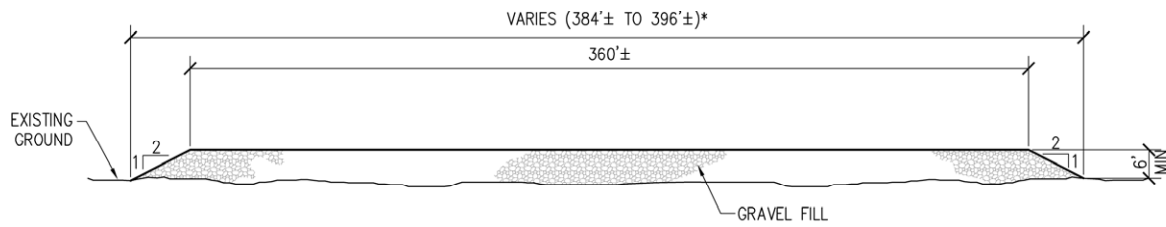
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

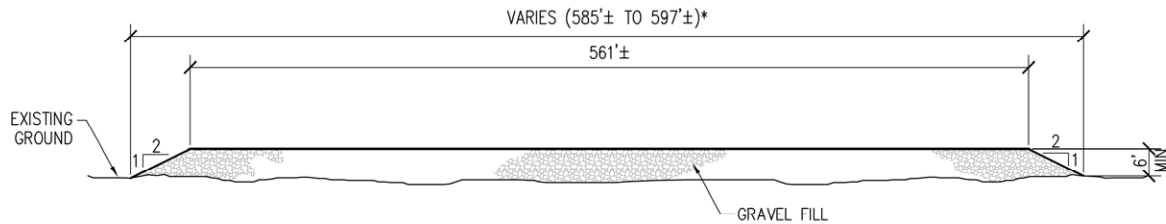
AT: North Slope Borough, AK

SHEET **9** of **53** 6-16-17



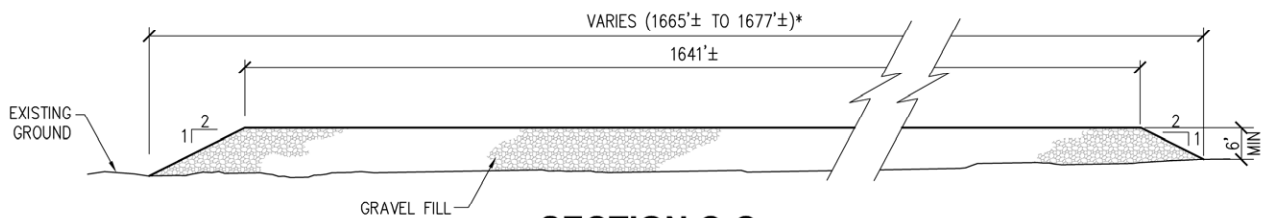
### **SECTION A-A**

NTS



### **SECTION B-B**

NTS



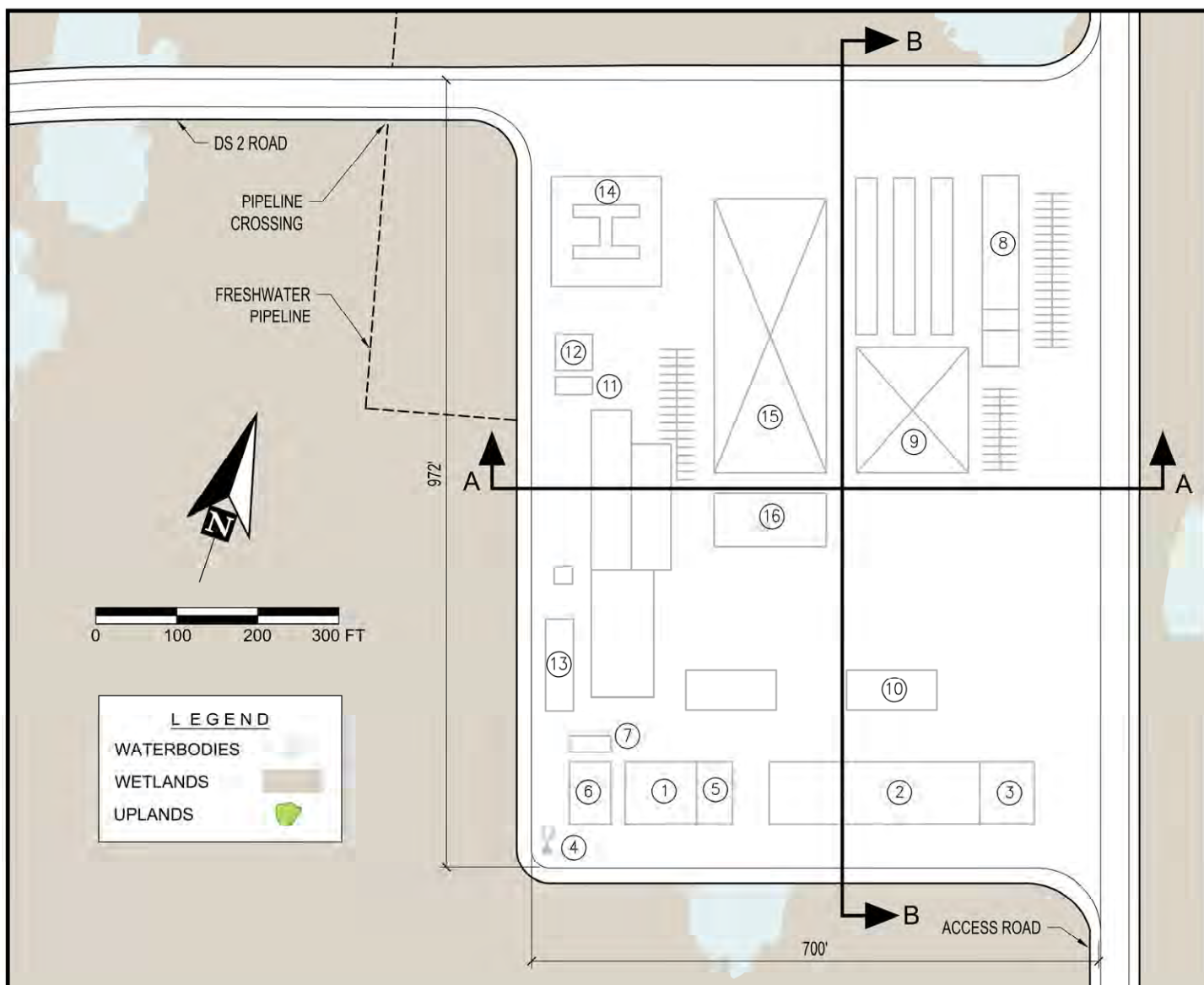
### **SECTION C-C**

NTS

**\*NOTE:**  
MAX TOE TO TOE DIMENSIONS ARE  
ESTIMATED. ACTUAL DIMENSIONS WILL  
VARY BASED UPON SITE CONDITIONS.

## **DS3 PAD SECTIONS**

REFERENCE: POA-2015-025  
APPLICANT: Armstrong Energy, LLC  
PROJECT: Nanushuk Development  
ACTIVITY: Road, Pad and Pipeline  
Construction  
AT: North Slope Borough, AK  
SHEET **10** of **53** 6-16-17



FACILITIES			
①	POWER GENERATION/SWITCHGEAR (2)	⑨	OFFICE/WAREHOUSE & MAINTENANCE
②	POTABLE WATER TANKS & WASTEWATER TREATMENT TANKS	⑩	COLD STORAGE
③	FINE WATER MIST TANK	⑪	POTABLE WATER STORAGE
④	COMMUNICATION TOWER	⑫	RAW WATER STORAGE
⑤	SWITCHGEAR SKID	⑬	FINE WATER MIST FIREWATER STORAGE
⑥	STANDBY GENERATORS (3) UNIT	⑭	HELICOPTER PAD
⑦	TRANSFORMERS (6)	⑮	TEMPORARY CONSTRUCTION CAMP/OFFICE
⑧	MAN/OPERATOR CAMP AND CENTRAL CONTROL ROOM	⑯	TEMPORARY DRILLING CAMP

**NOTES:**

1. MINIMUM GRAVEL DEPTH 6.0' WITH 2:1 FILL SLOPES.
2. SEE SHEET 12 FOR PAD SECTIONS.
3. BASEMAP SOURCE: HDR2016
4. ACTUAL LAYOUT PENDING ADDITIONAL DESIGN.

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

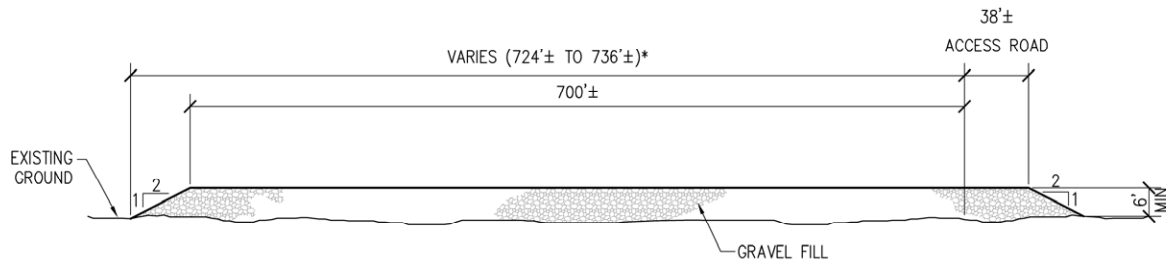
ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **11** of **53** 6-16-17

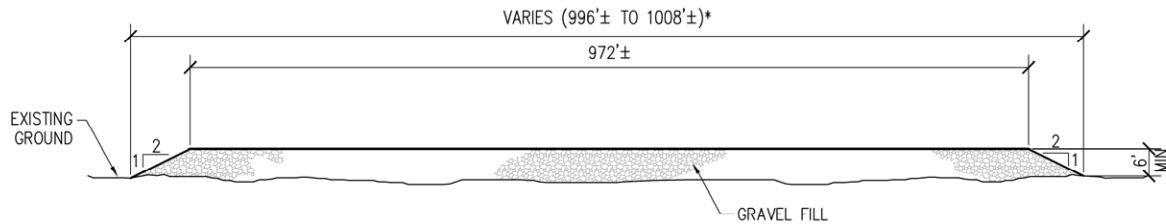
**OPERATIONS CENTER LAYOUT**





### **SECTION A-A**

NTS



### **SECTION B-B**

NTS

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ESTIMATED. ACTUAL DIMENSIONS WILL  
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## **OPERATIONS CENTER PAD SECTIONS**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

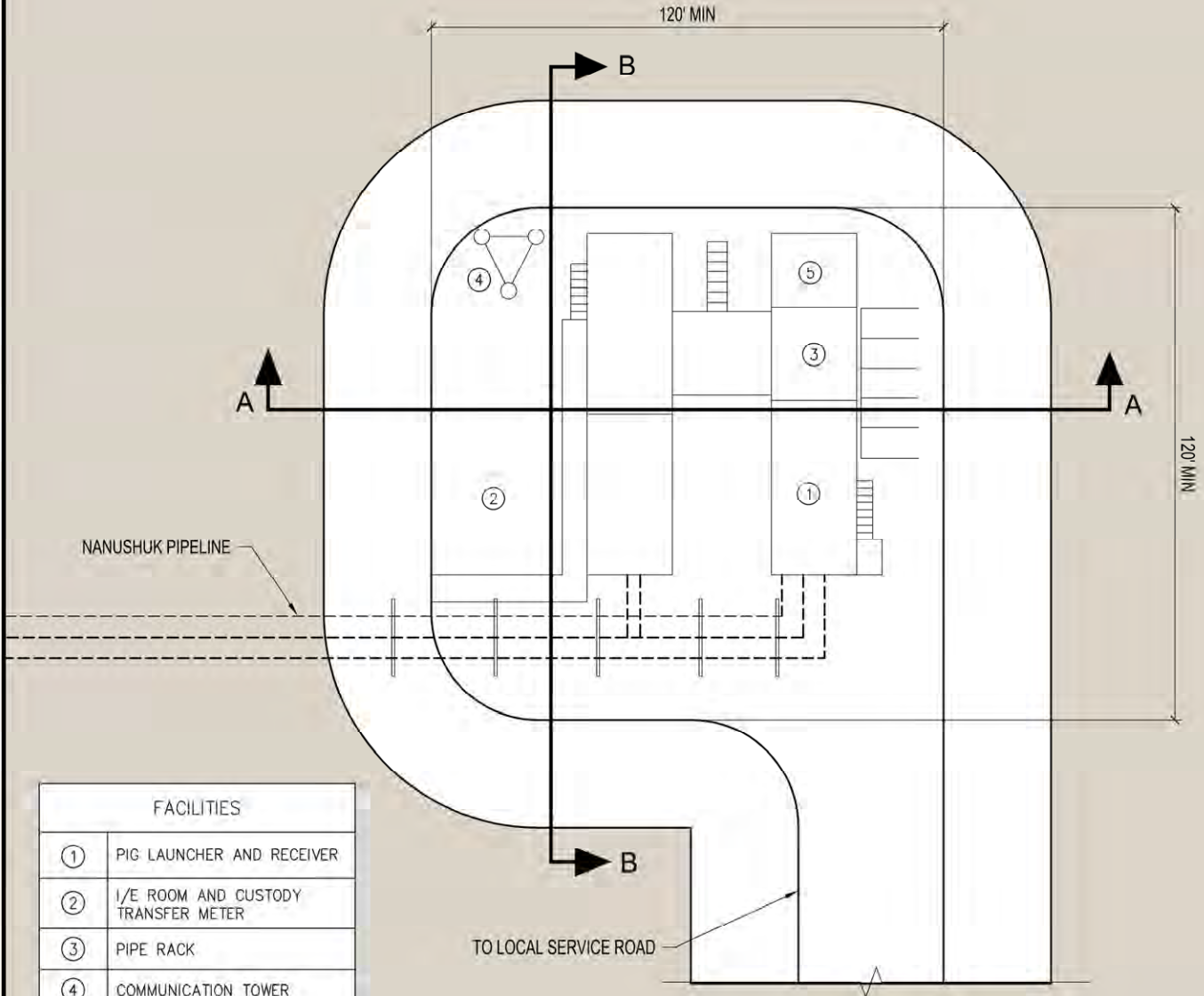
ACTIVITY: Road, Pad and Pipeline  
Construction

AT: North Slope Borough, AK

SHEET **12** of **53** 6-16-17



LEGEND	
WATERBODIES	
WETLANDS	
UPLANDS	



FACILITIES	
①	PIG LAUNCHER AND RECEIVER
②	I/E ROOM AND CUSTODY TRANSFER METER
③	PIPE RACK
④	COMMUNICATION TOWER
⑤	LAYDOWN AREA

**NOTES:**

1. MINIMUM GRAVEL DEPTH 6.0' WITH 2:1 FILL SLOPES.
2. SEE SHEET 14 FOR PAD SECTIONS.
3. BASEMAP SOURCE: HDR2016
4. ACTUAL LAYOUT PENDING ADDITIONAL DESIGN.

**TIE-IN PAD LAYOUT**

REFERENCE: POA-2015-025

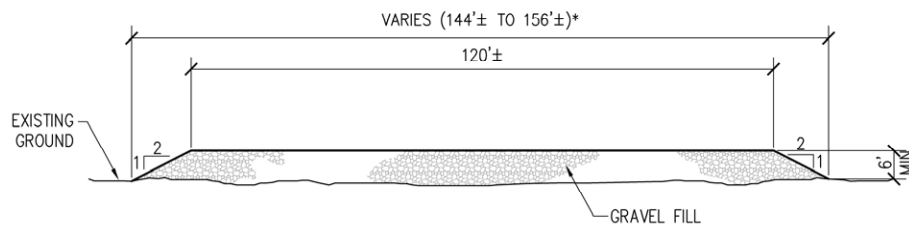
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

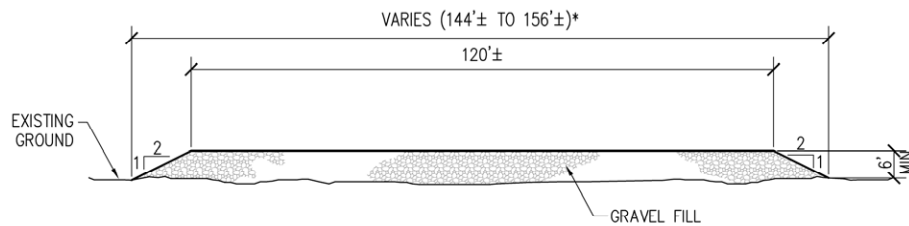
ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **13** of **53** 6-16-17



**SECTION A-A**  
NTS



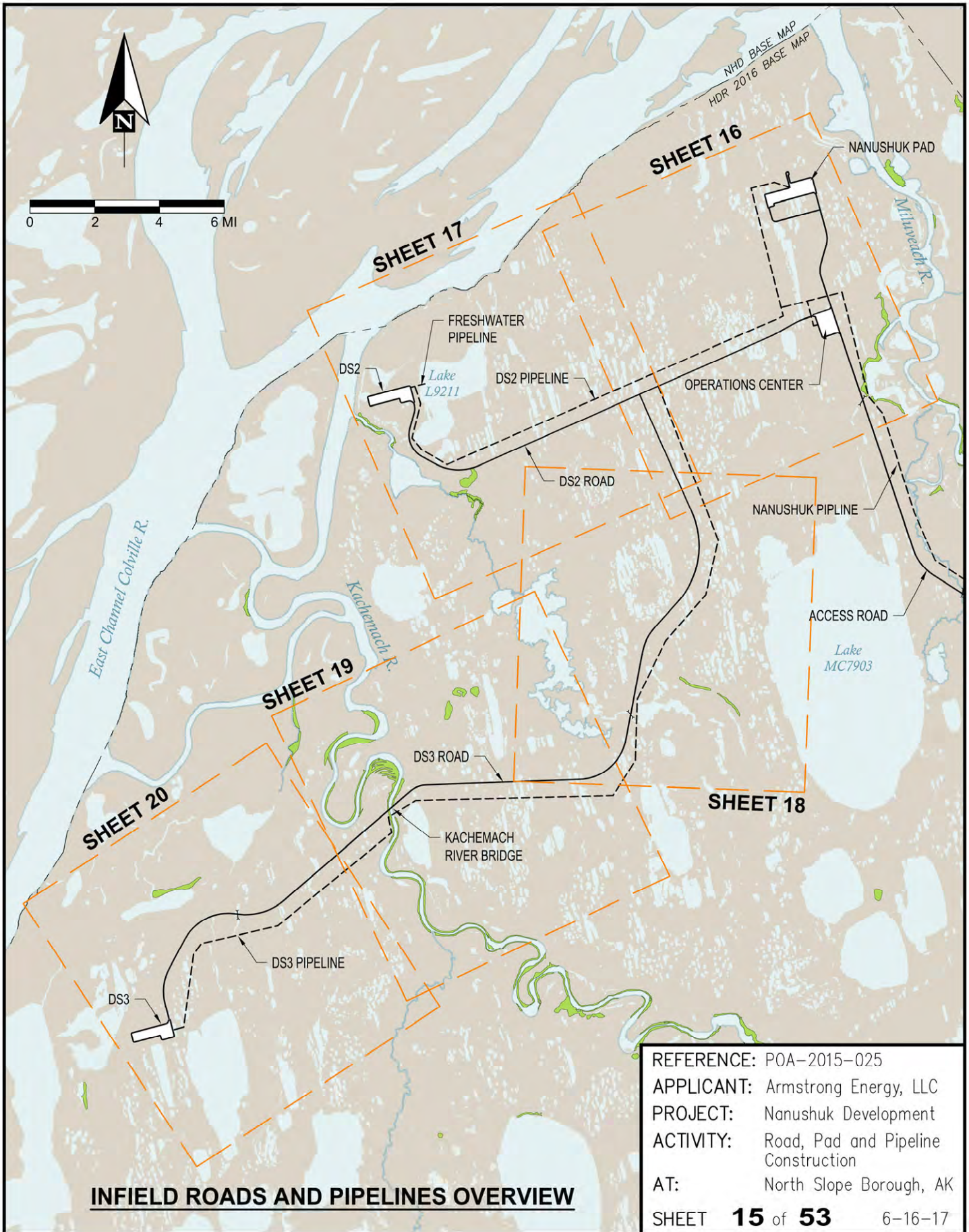
**SECTION B-B**  
NTS

**\*NOTE:**  
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ESTIMATED. ACTUAL DIMENSIONS WILL  
VARY BASED UPON SITE CONDITIONS.

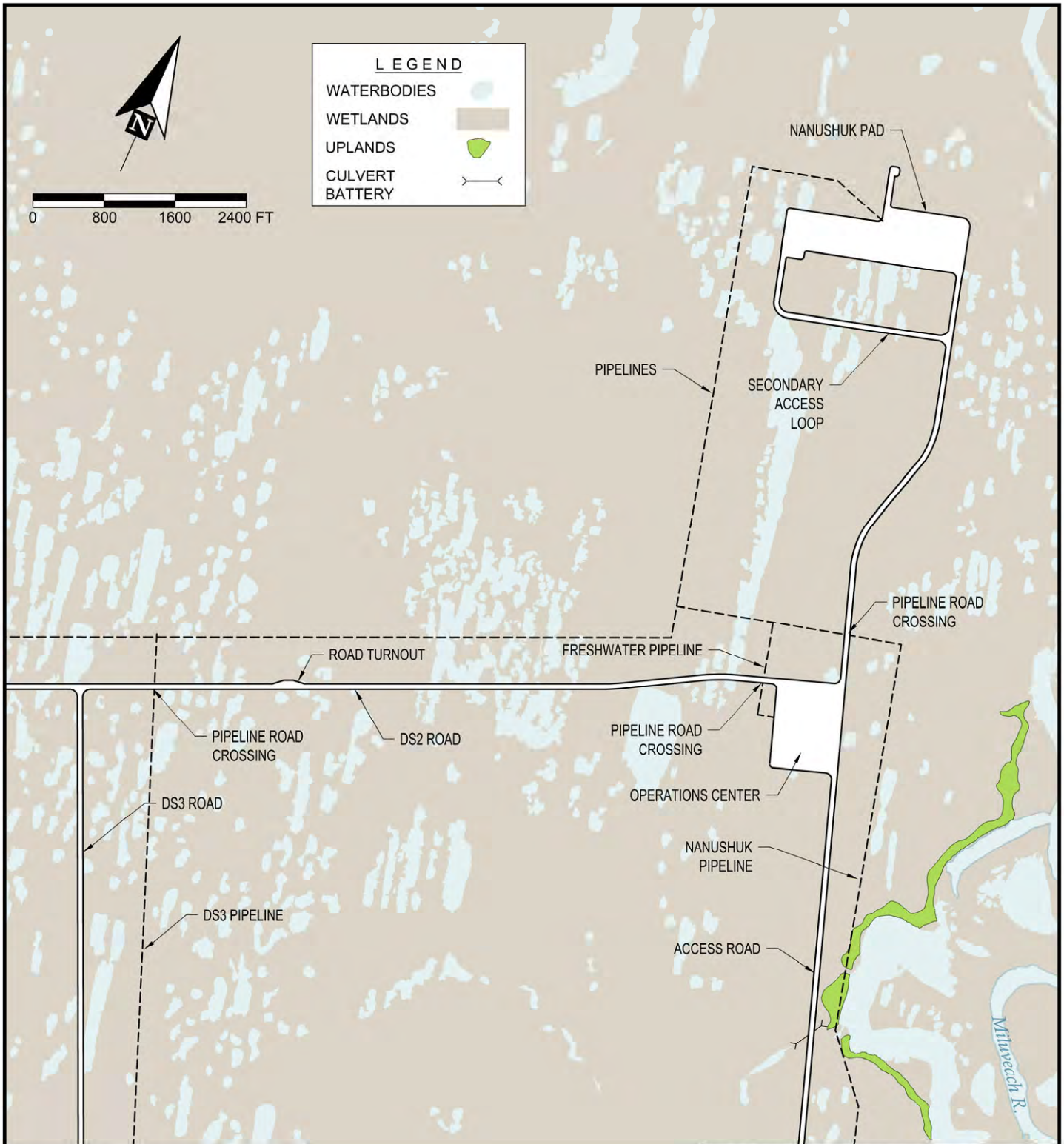
**TIE-IN PAD SECTIONS**

REFERENCE: POA-2015-025  
APPLICANT: Armstrong Energy, LLC  
PROJECT: Nanushuk Development  
ACTIVITY: Road, Pad and Pipeline  
Construction  
AT: North Slope Borough, AK  
SHEET **14** of **53** 6-16-17









**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.
3. CULVERT BATTERY LOCATIONS ARE PRELIMINARY. SITES TO BE INVESTIGATED DURING A SUMMER FIELD PROGRAM.

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

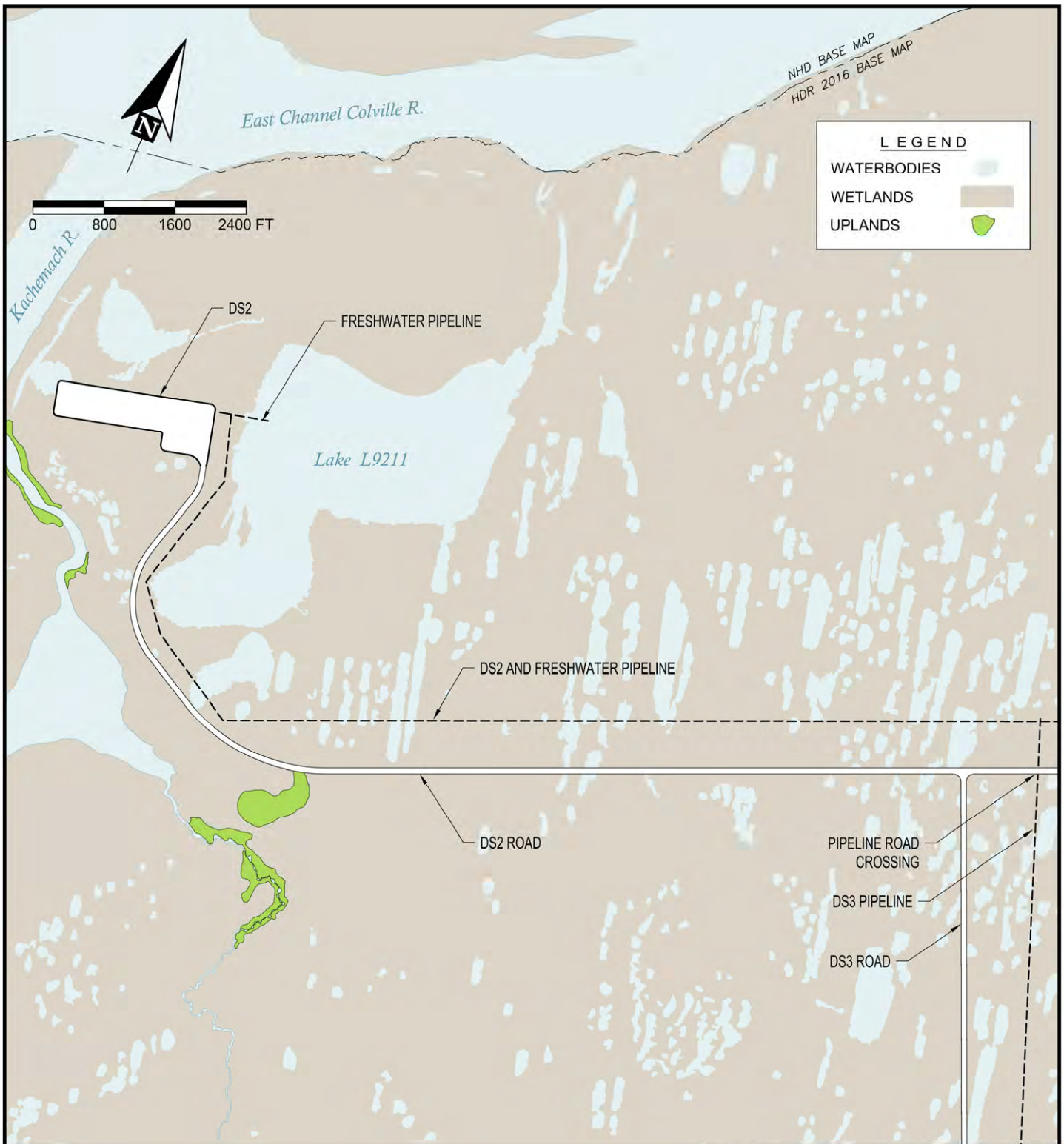
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **16** of **53** 6-16-17

**INFIELD ROADS AND PIPELINES SHT 1 of 5**



**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING AND NHD.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.

**INFIELD ROADS AND PIPELINES SHT 2 of 5**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

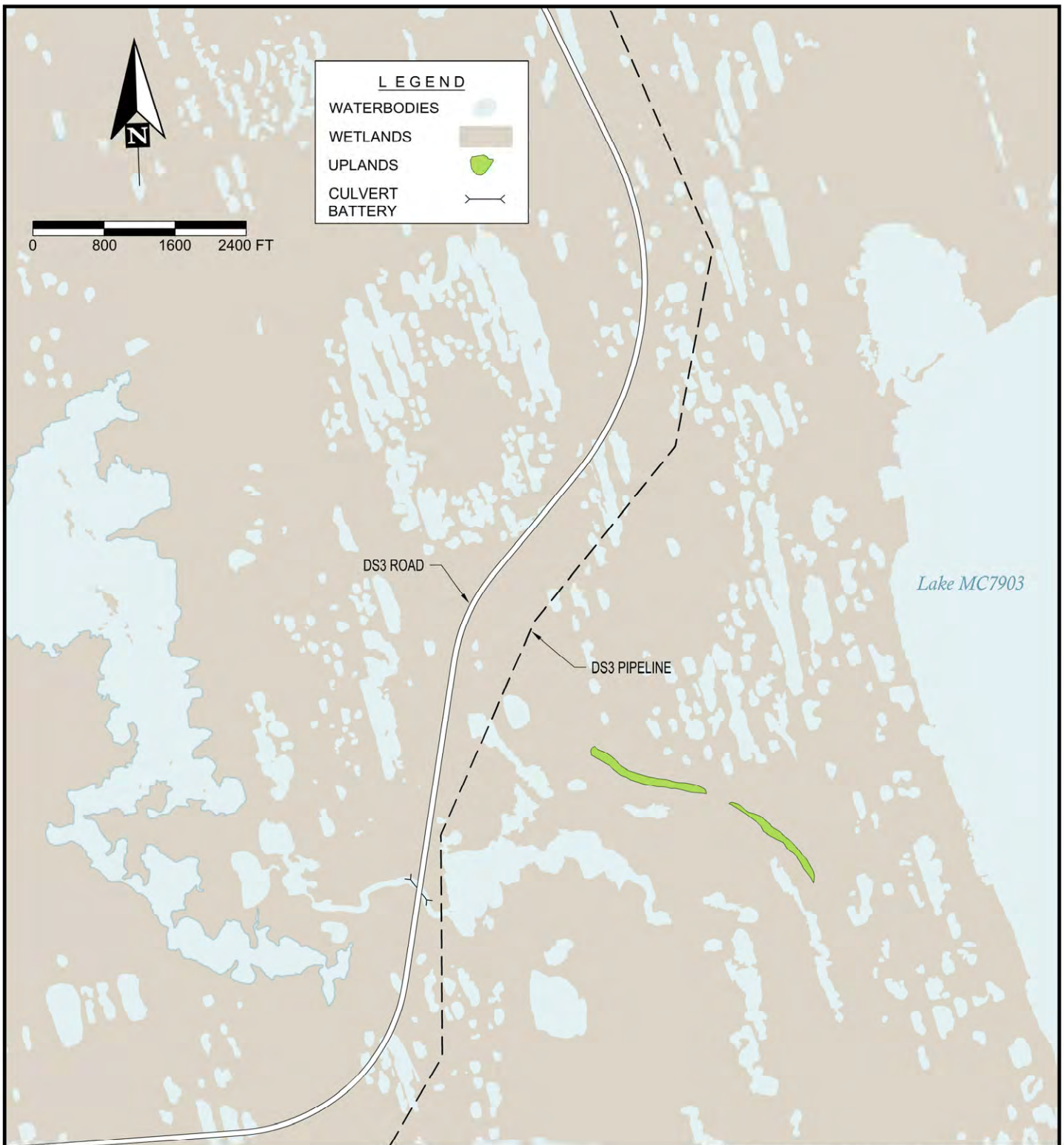
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **17** of **53** 6-16-17





**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.
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**INFIELD ROADS AND PIPELINES SHT 3 of 5**

REFERENCE: POA-2015-025

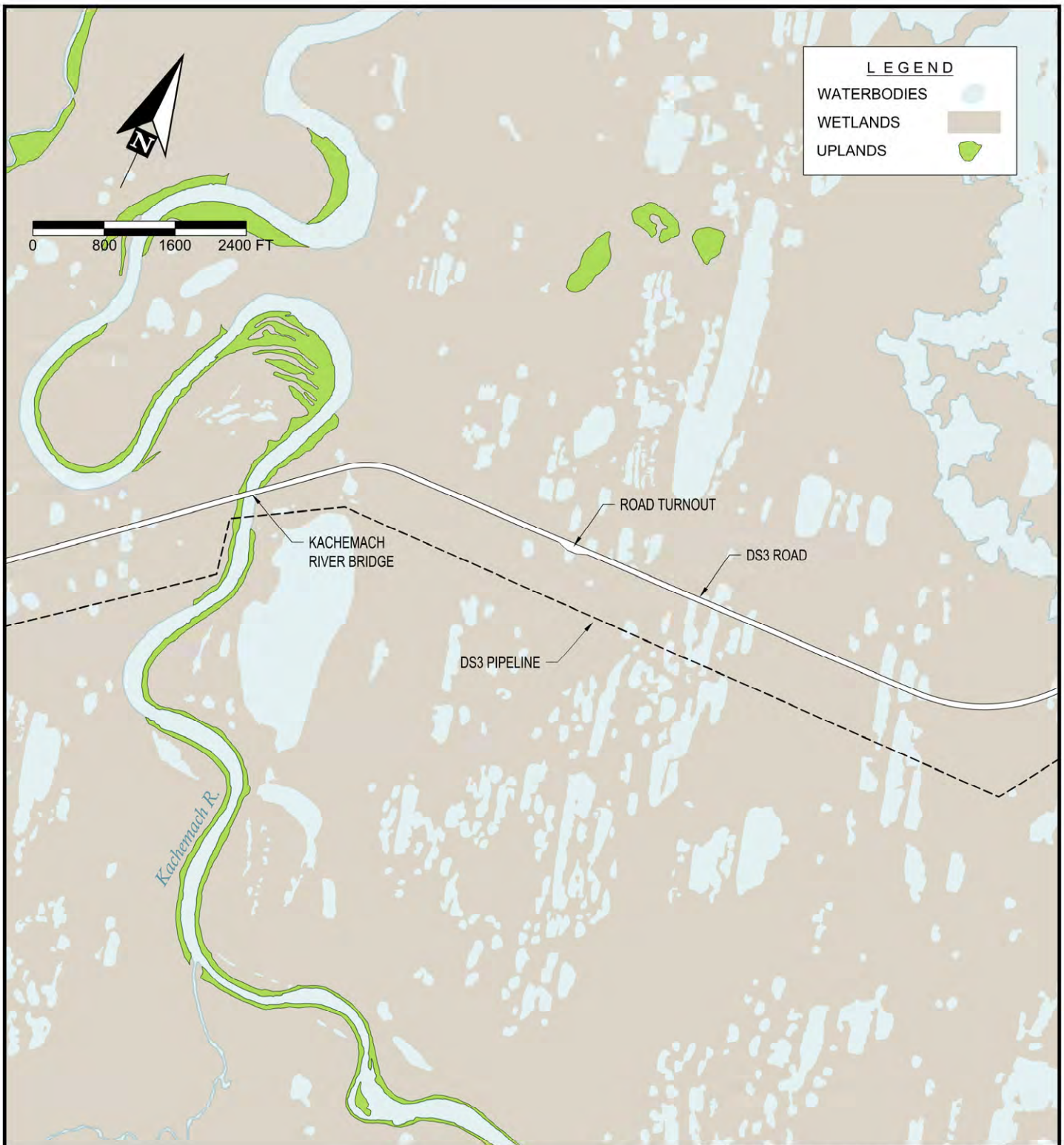
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **18** of **53** 6-16-17



**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

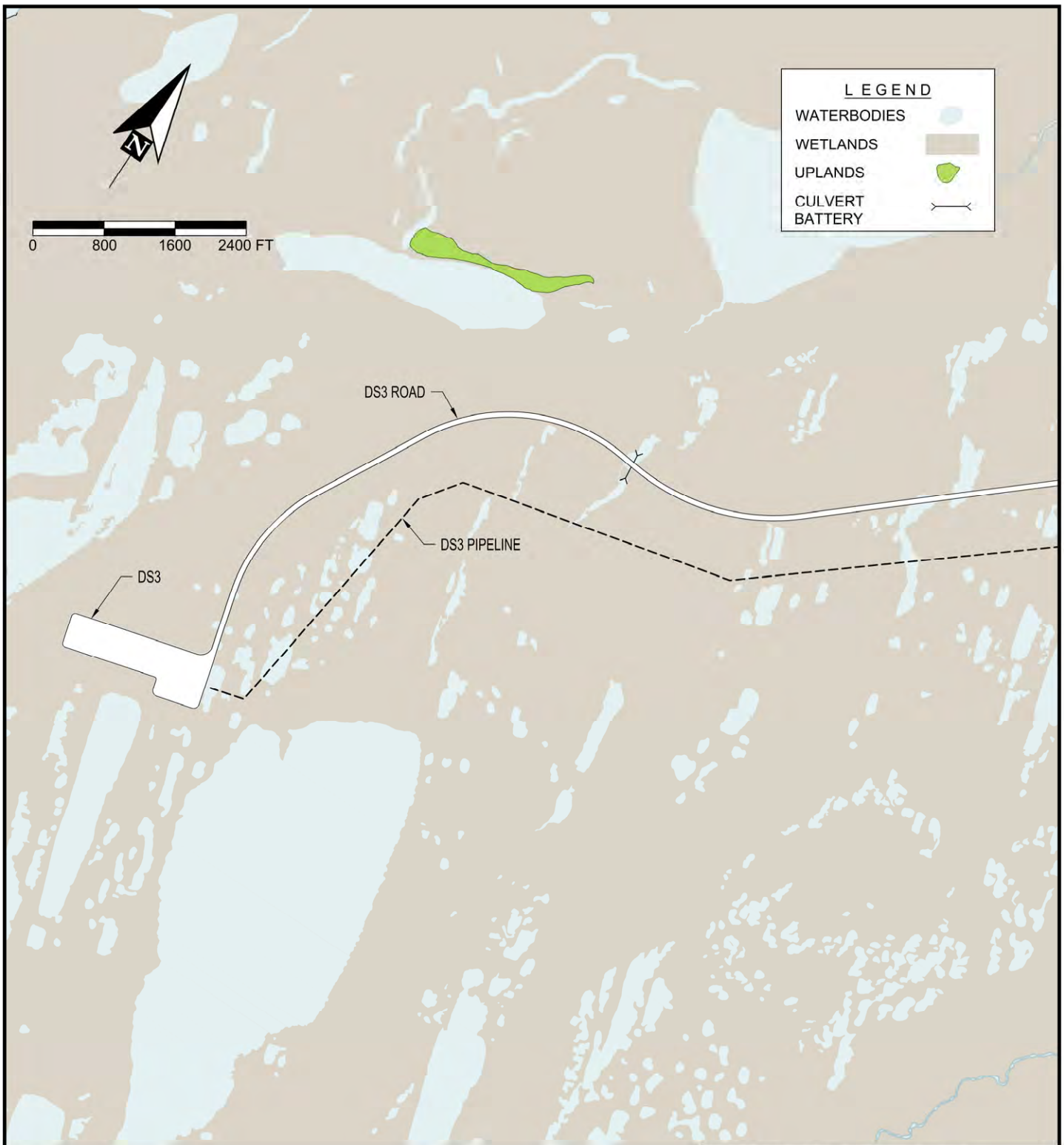
ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **19** of **53** 6-16-17

**INFIELD ROADS AND PIPELINES SHT 4 of 5**





**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING.
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**INFIELD ROADS AND PIPELINES SHT 5 of 5**

REFERENCE: POA-2015-025

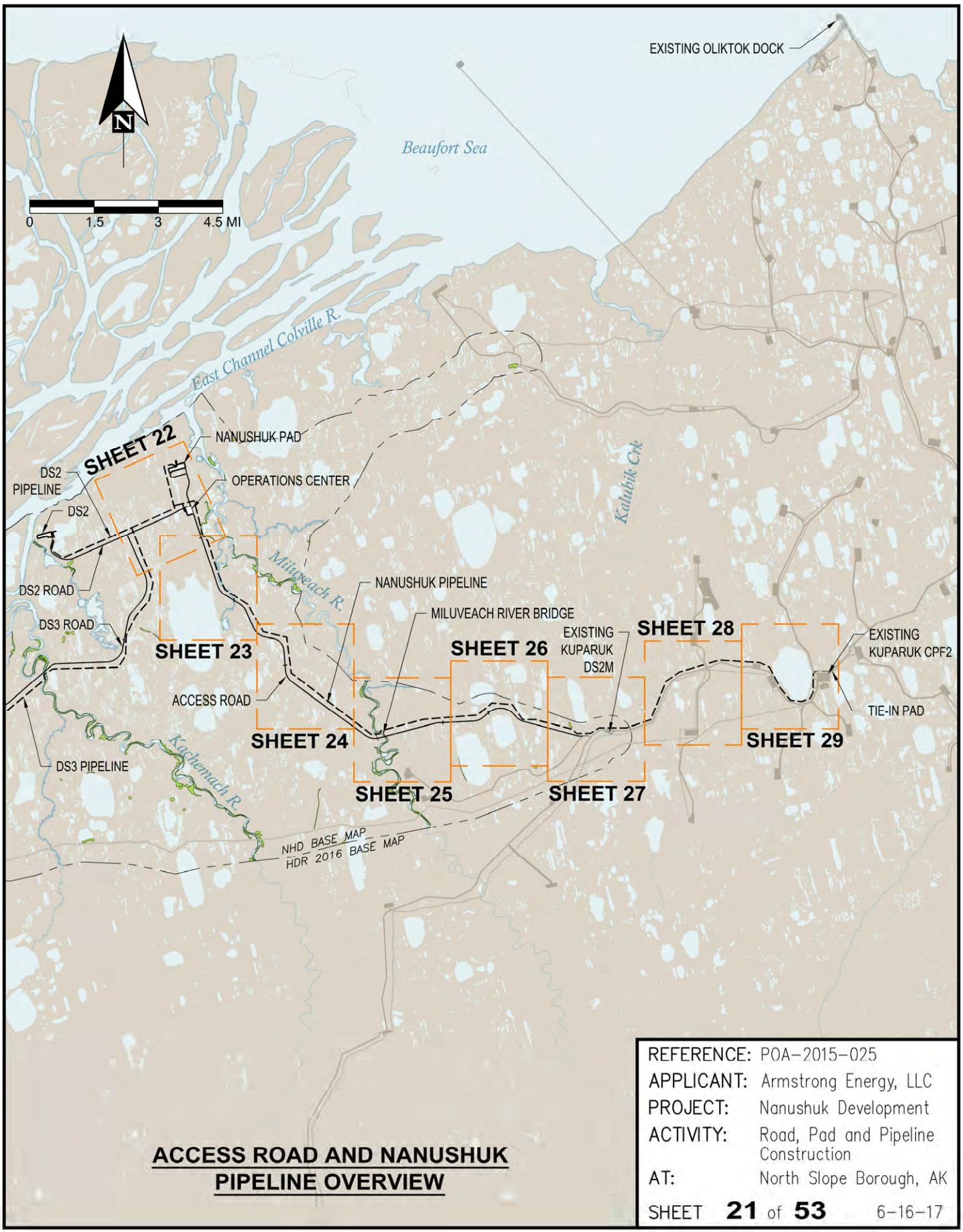
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

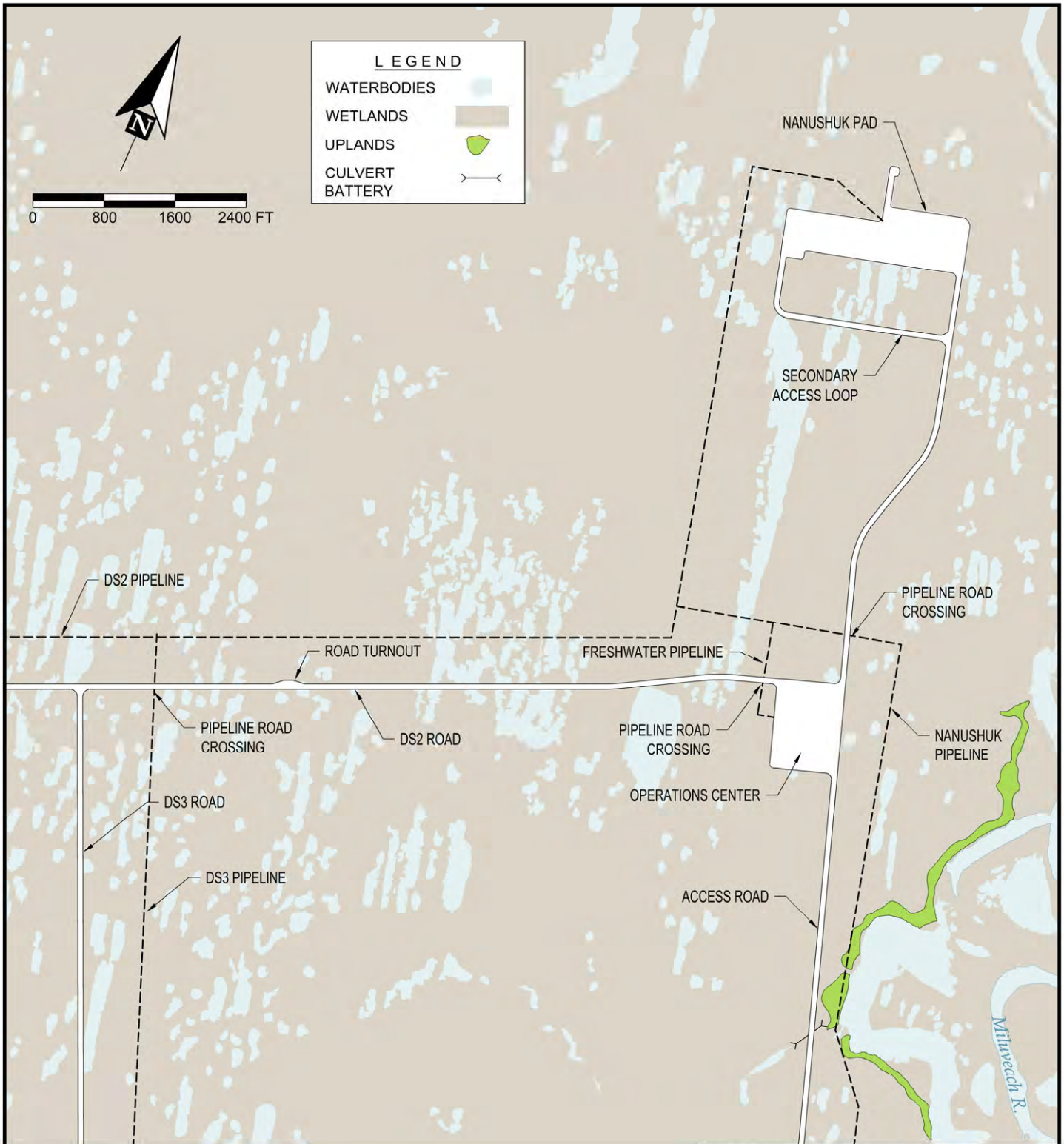
SHEET **20** of **53** 6-16-17



**ACCESS ROAD AND NANUSHUK  
PIPELINE OVERVIEW**

REFERENCE: POA-2015-025  
APPLICANT: Armstrong Energy, LLC  
PROJECT: Nanushuk Development  
ACTIVITY: Road, Pad and Pipeline Construction  
AT: North Slope Borough, AK  
SHEET **21** of **53** 6-16-17





**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.
3. CULVERT BATTERY LOCATIONS ARE PRELIMINARY. SITES TO BE INVESTIGATED DURING A SUMMER FIELD PROGRAM.

**ACCESS ROAD AND NANUSHUK PIPELINE**

**SHT 1 of 8**

**REFERENCE:** POA-2015-025

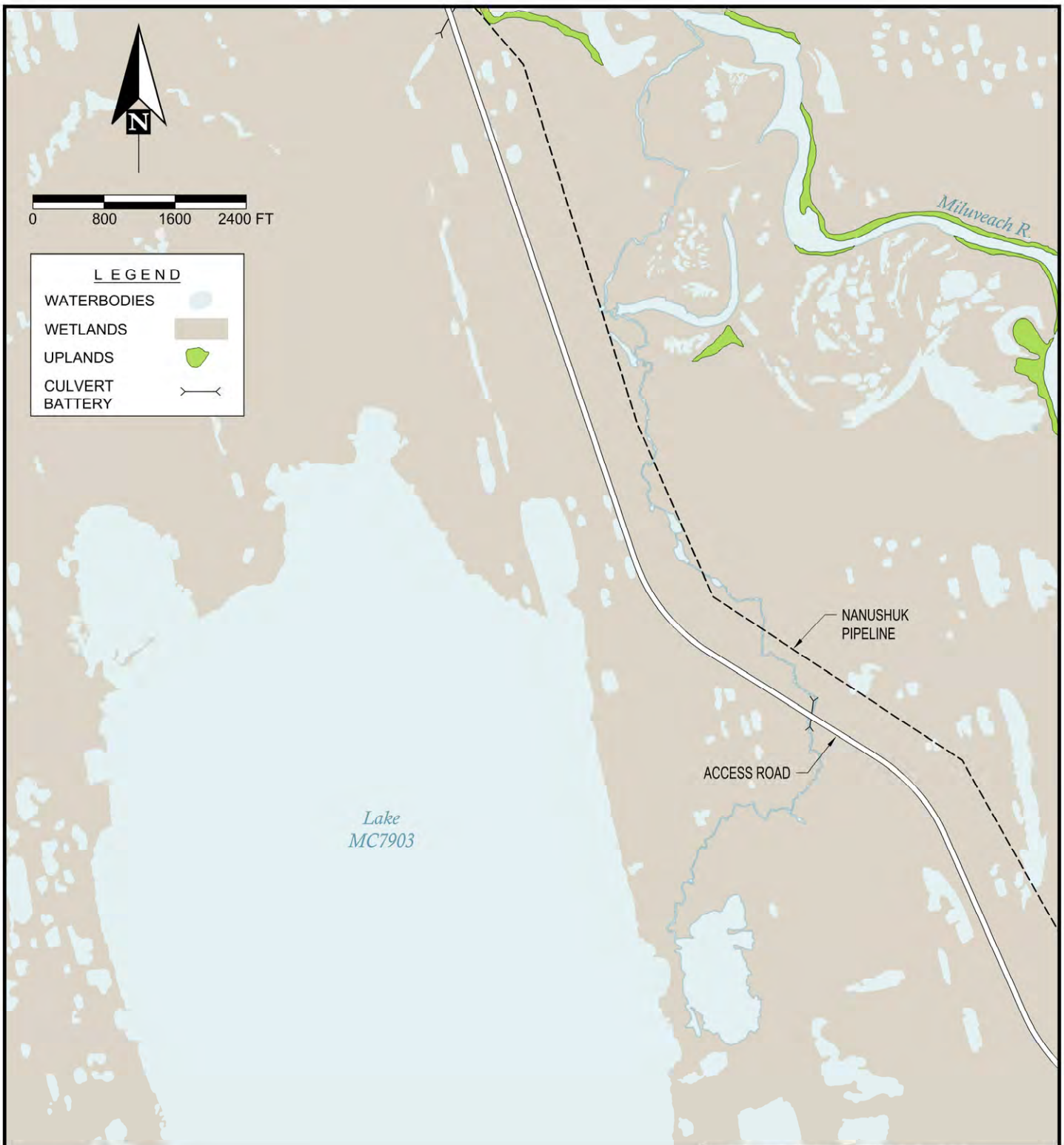
**APPLICANT:** Armstrong Energy, LLC

**PROJECT:** Nanushuk Development

**ACTIVITY:** Road, Pad and Pipeline Construction

**AT:** North Slope Borough, AK

**SHEET 22 of 53** 6-16-17



**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.
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**ACCESS ROAD AND NANUSHUK PIPELINE**  
**SHT 2 of 8**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

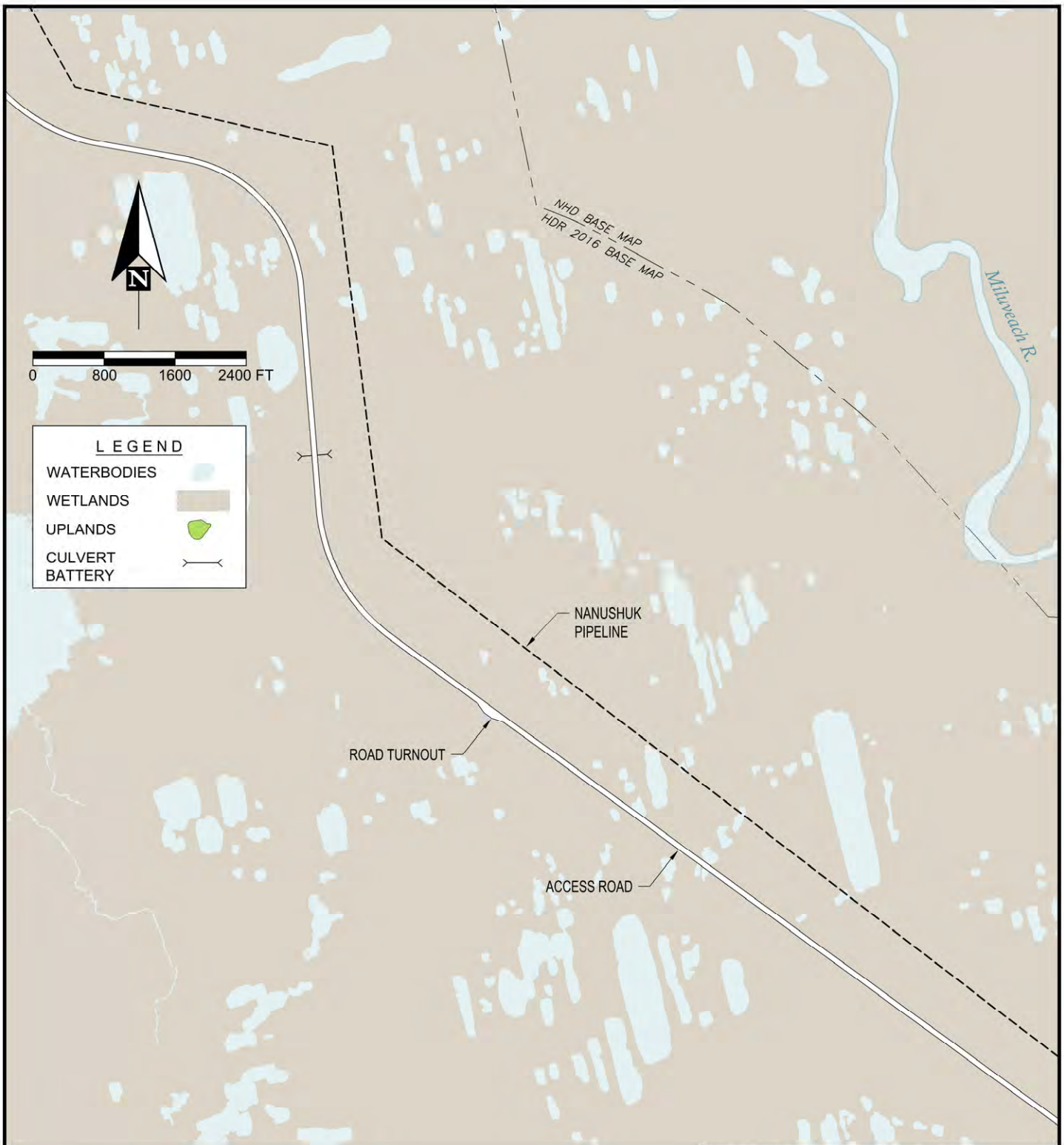
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **23** of **53** 6-16-17





**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING AND NHD.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.
3. CULVERT BATTERY LOCATIONS ARE PRELIMINARY. SITES TO BE INVESTIGATED DURING A SUMMER FIELD PROGRAM.

**ACCESS ROAD AND NANUSHUK PIPELINE**  
**SHT 3 of 8**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

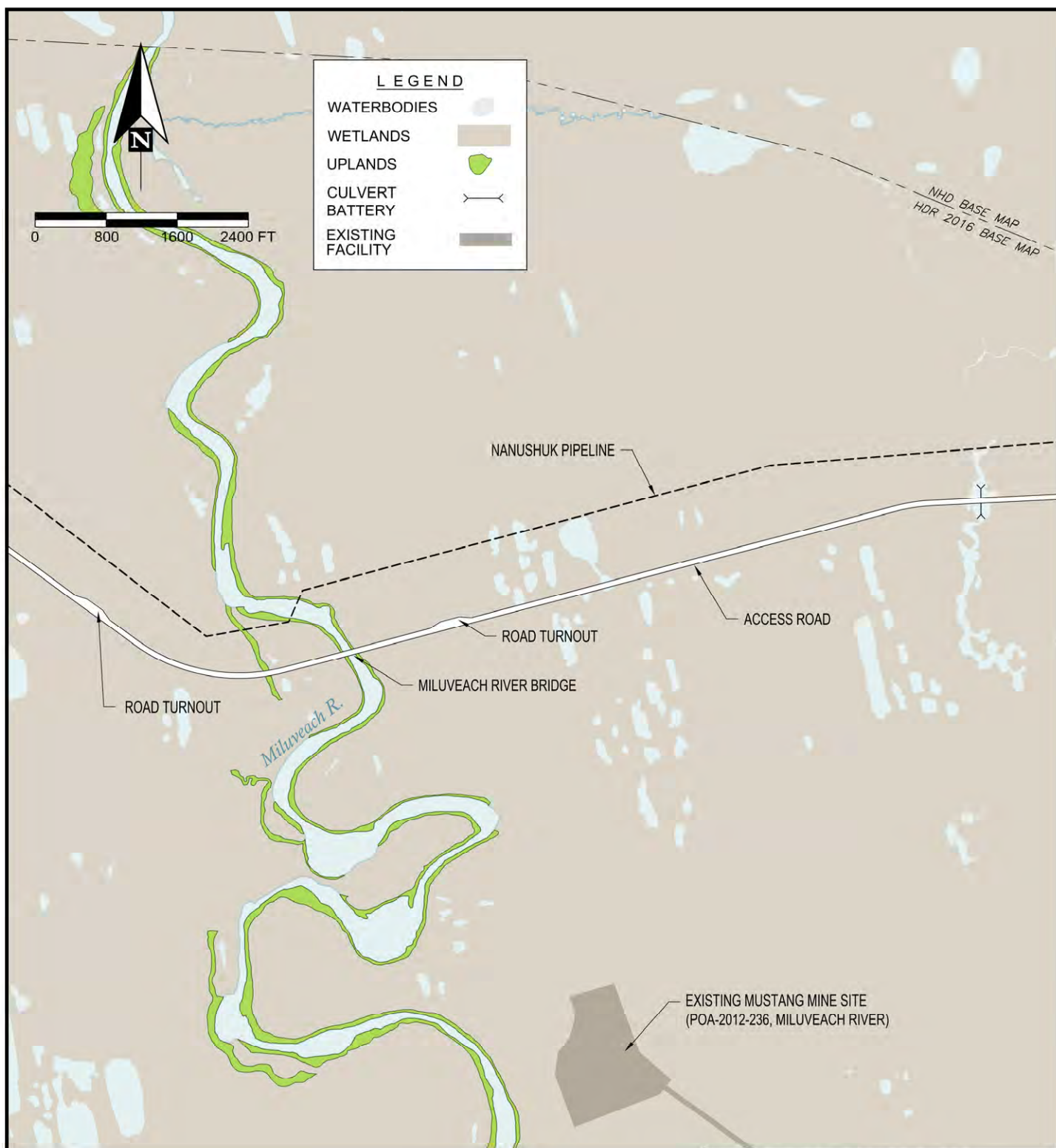
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **24** of **53** 6-16-17





**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING AND NHD.
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**ACCESS ROAD AND NANUSHUK PIPELINE**  
**SHT 4 of 8**

REFERENCE: POA-2015-025

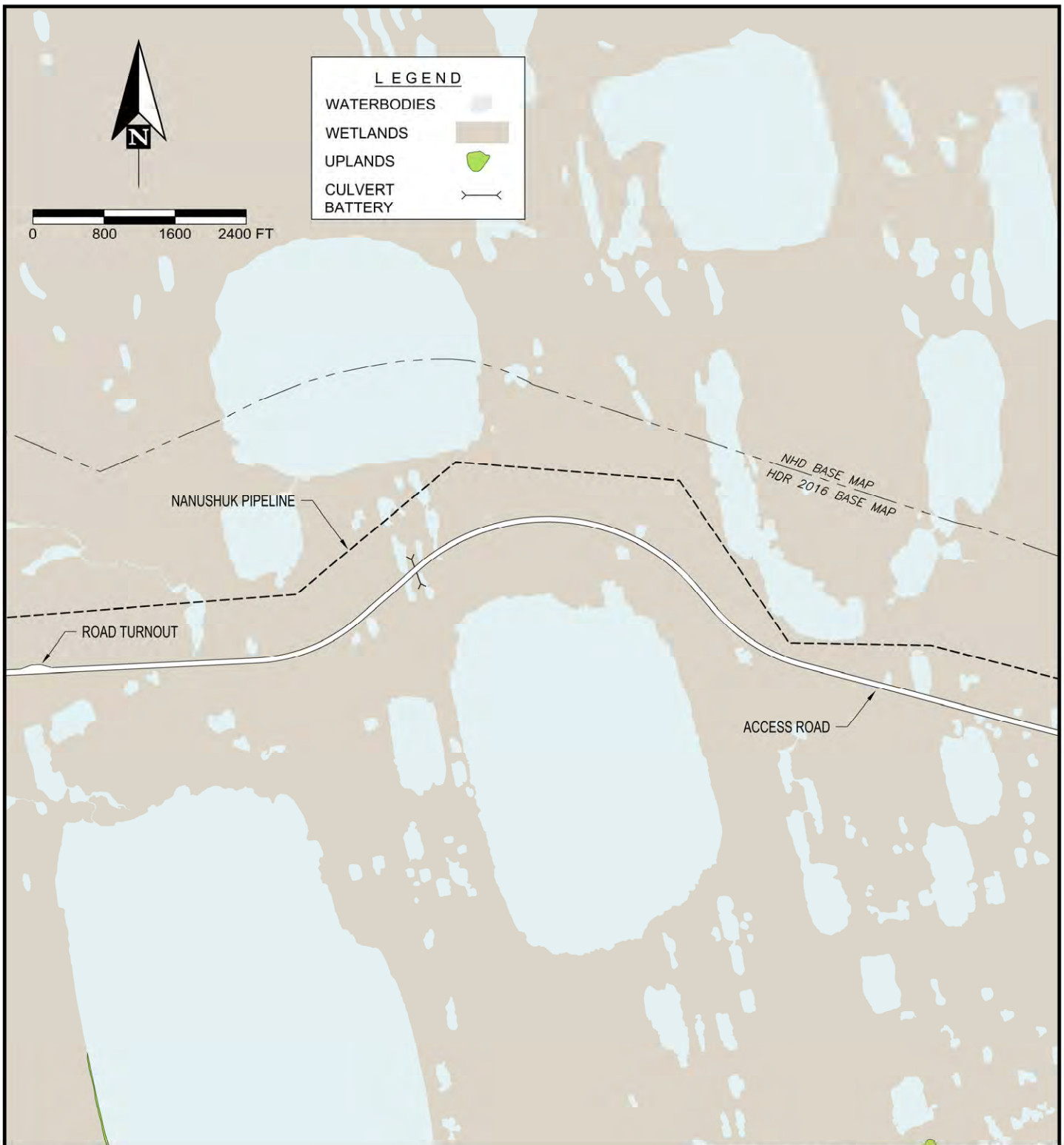
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **25** of **53** 6-16-17



**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING AND NHD.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.
3. CULVERT BATTERY LOCATIONS ARE PRELIMINARY. SITES TO BE INVESTIGATED DURING A SUMMER FIELD PROGRAM.

**ACCESS ROAD AND NANUSHUK PIPELINE**  
**SHT 5 of 8**

REFERENCE: POA-2015-025

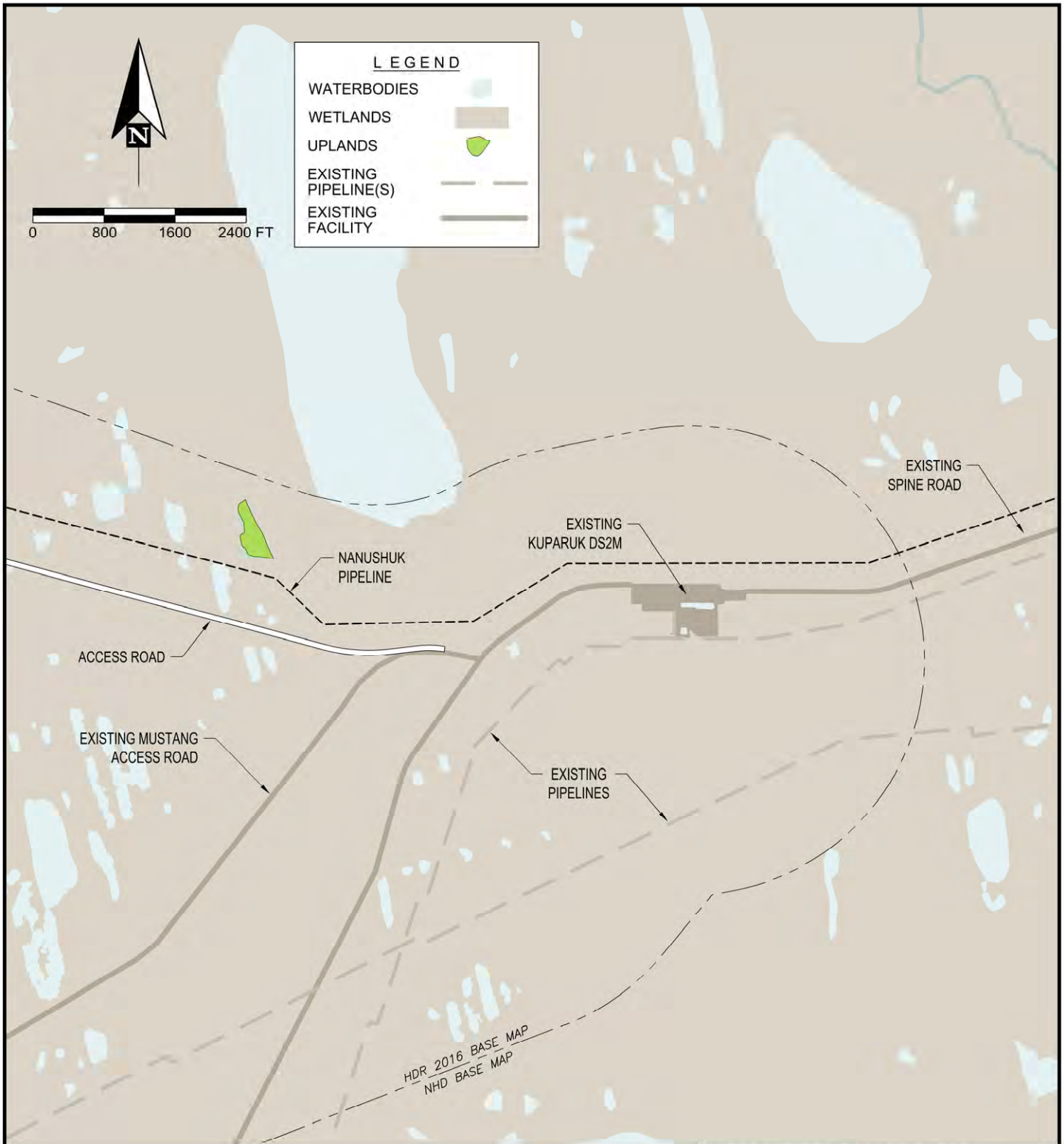
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **26** of **53** 6-16-17



**NOTES:**

1. BASEMAP SOURCE: HDR 2016 JURISDICTIONAL MAPPING AND NHD.
2. CROSS DRAINAGE CULVERTS WILL BE INSTALLED EVERY 500' ON AVERAGE. CULVERT LOCATIONS, SIZES AND QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.

**ACCESS ROAD AND NANUSHUK PIPELINE**  
**SHT 6 of 8**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

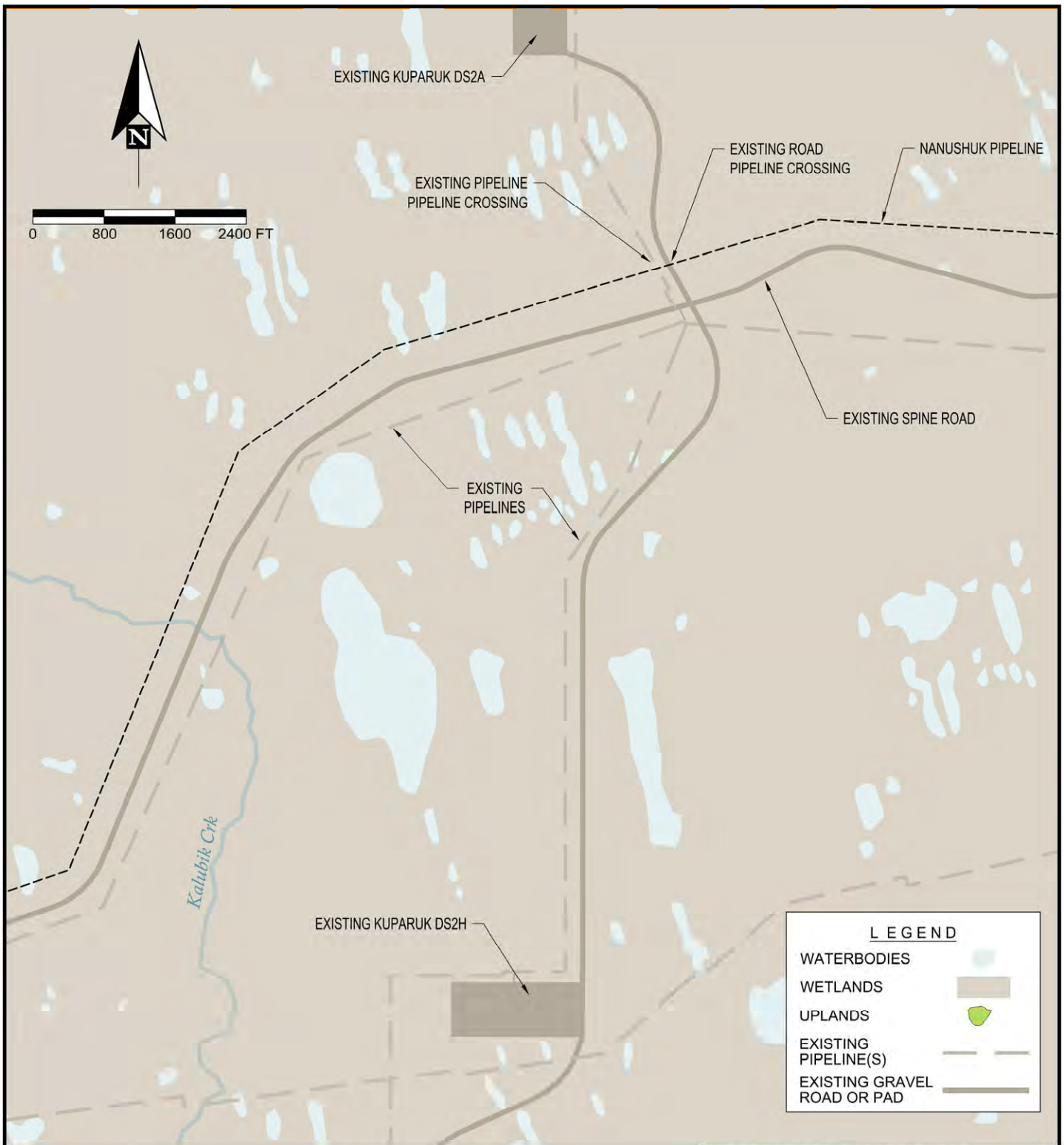
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **27** of **53** 6-16-17





**NOTES:**

1. BASEMAP SOURCE: NHD BASEMAP.

**NANUSHUK PIPELINE SHT 7 of 8**

REFERENCE: POA-2015-025

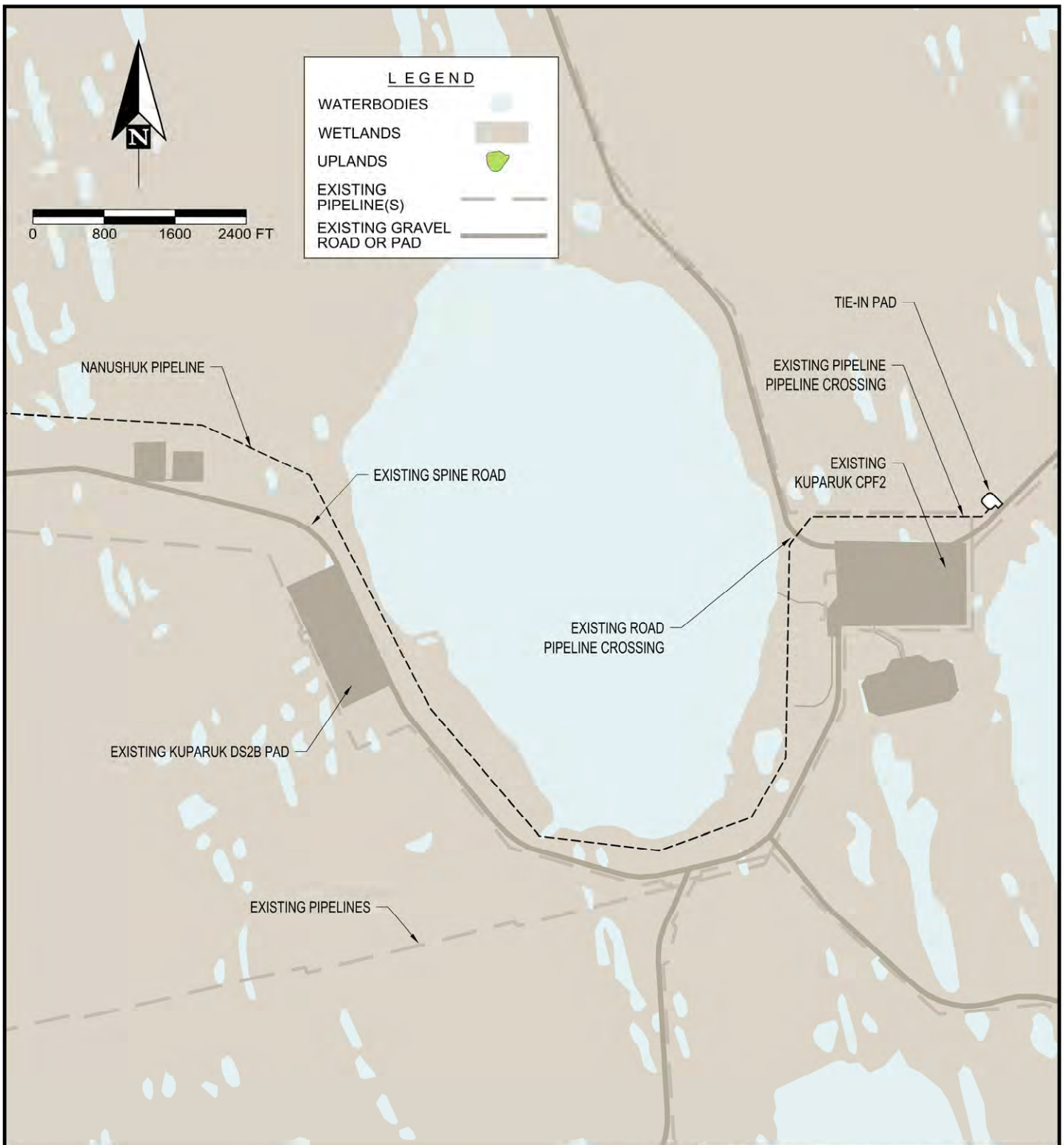
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **28** of **53** 6-16-17



**NOTES:**

1. BASEMAP SOURCE: NHD BASEMAP.

**NANUSHUK PIPELINE SHT 8 of 8**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

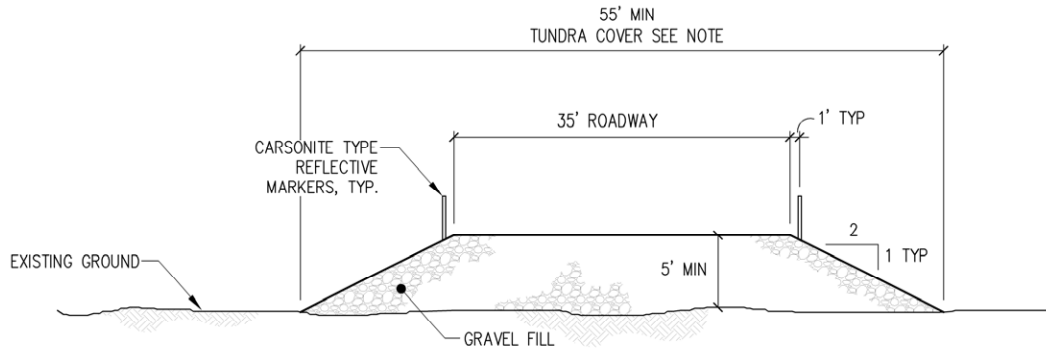
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

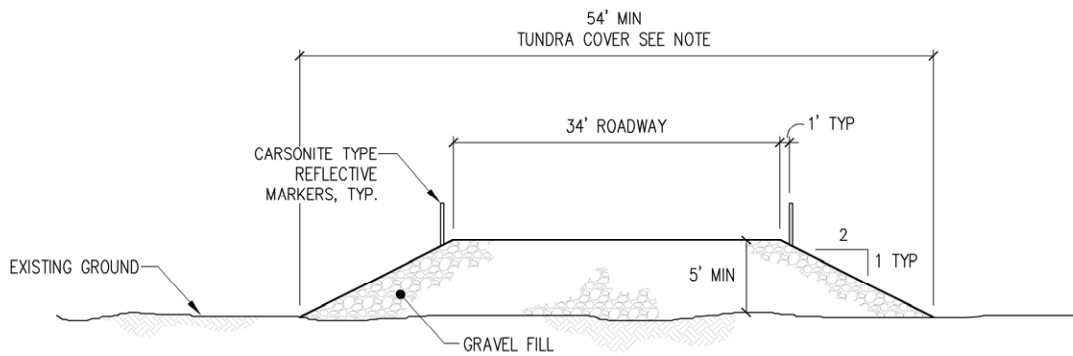
SHEET **29** of **53** 6-16-17





### **TYPICAL GRAVEL ACCESS ROAD SECTION**

NTS



### **TYPICAL GRAVEL INFIELD ROAD SECTION**

NTS

NOTE:  
GRAVEL EMBANKMENT WIDTH WILL VARY  
BASED UPON LOCAL TOPOGRAPHY.

## **TYPICAL ROAD SECTIONS**

REFERENCE: POA-2015-025

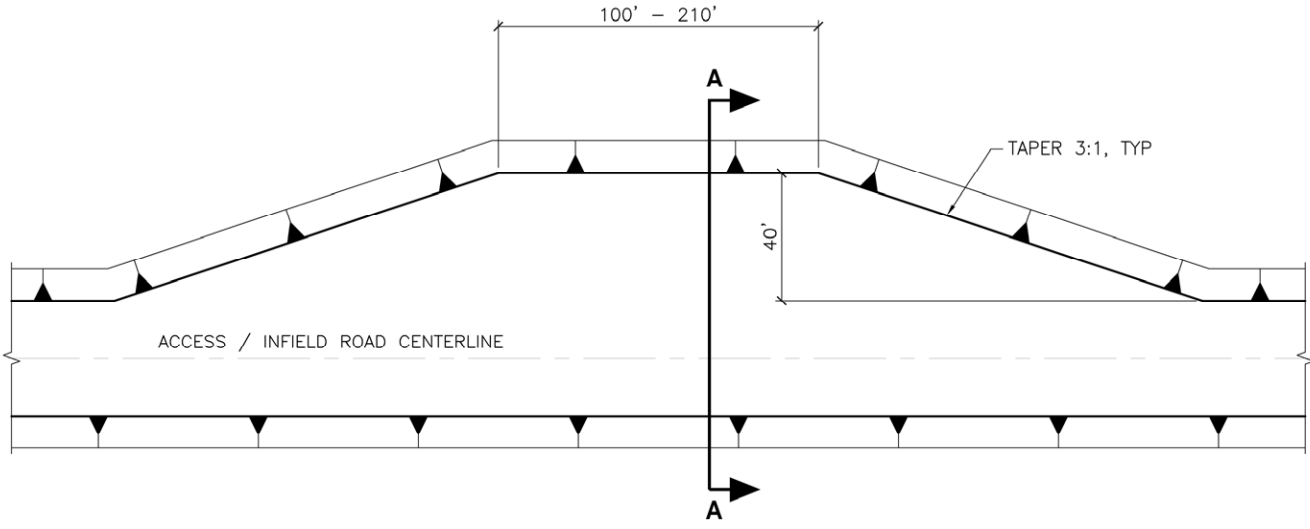
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

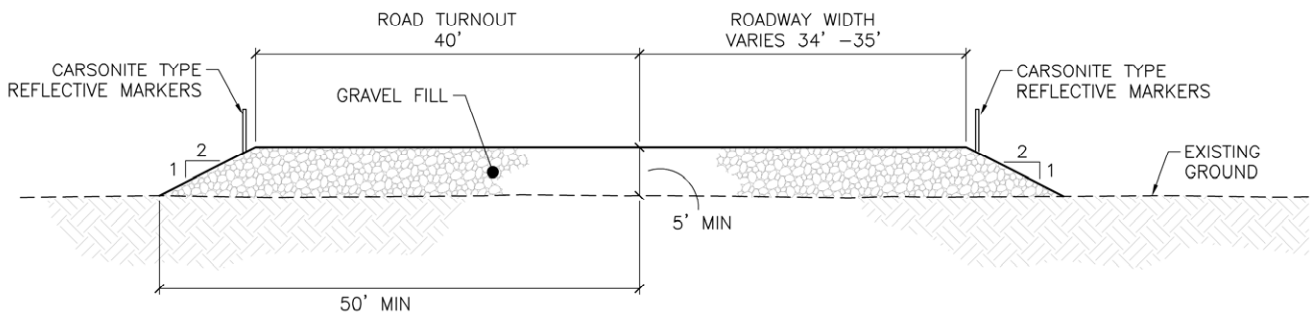
ACTIVITY: Road, Pad and Pipeline  
Construction

AT: North Slope Borough, AK

SHEET **30** of **53** 6-16-17



**PLAN**  
NTS

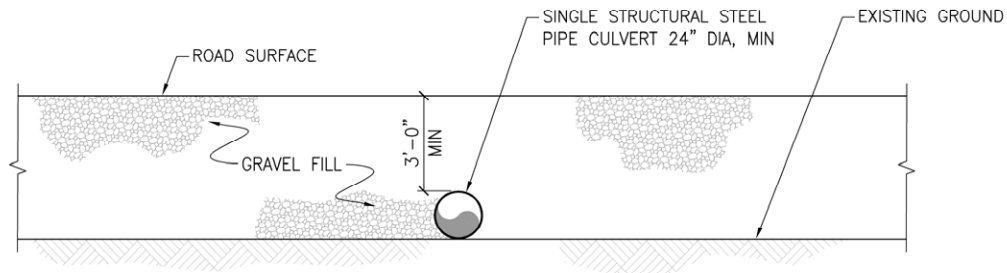


**SECTION A-A**  
NTS

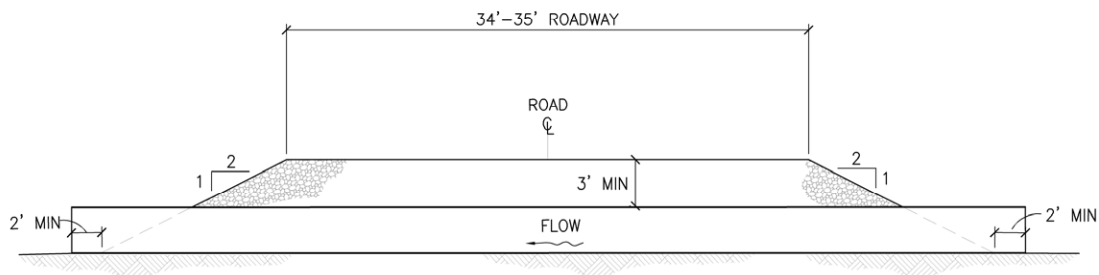
NOTE:  
GRAVEL EMBANKMENT WIDTH WILL  
VARY BASED UPON LOCAL  
TOPOGRAPHY.

**TYPICAL ROAD TURNOUT**

REFERENCE: POA-2015-025  
 APPLICANT: Armstrong Energy, LLC  
 PROJECT: Nanushuk Development  
 ACTIVITY: Road, Pad and Pipeline  
 Construction  
 AT: North Slope Borough, AK  
 SHEET **31** of **53** 6-16-17



### **CROSS DRAINAGE CULVERT ELEVATION**



### **CROSS DRAINAGE CULVERT SECTION**

**NOTE:**

AS A GENERAL GUIDELINE, CROSS-DRAINAGE CULVERTS WILL BE SITED AN AVERAGE OF APPROXIMATELY EVERY 500 FEET ALONG THE ALIGNMENT DURING INITIAL DESIGN EFFORTS, ALTHOUGH EXACT PLACEMENT OF CULVERTS WILL DEPEND ON ACTUAL IN-FIELD LOCAL DRAINAGE PATTERNS.

### **CROSS DRAINAGE CULVERT CROSS SECTIONS**

REFERENCE: POA-2015-025

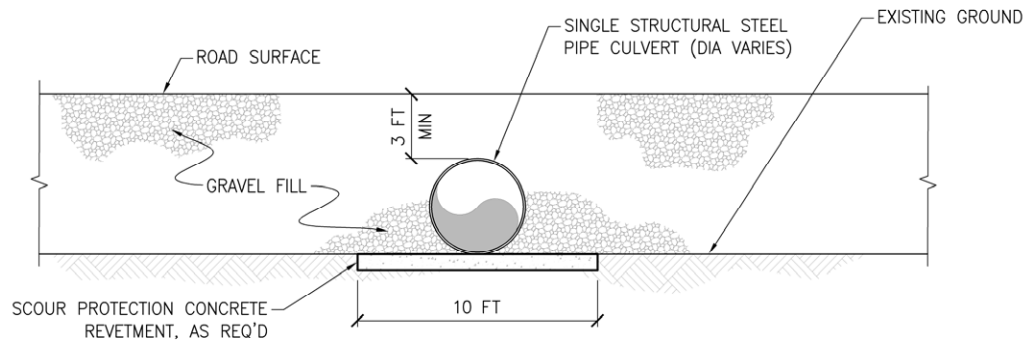
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

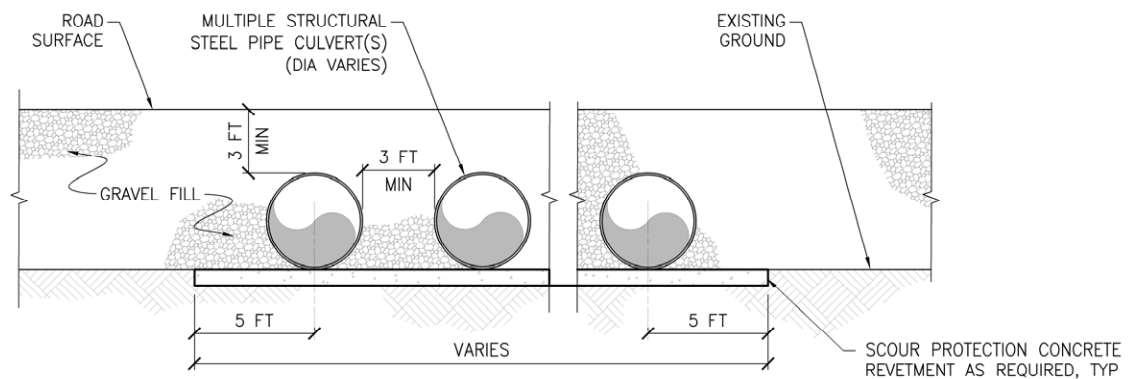
ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

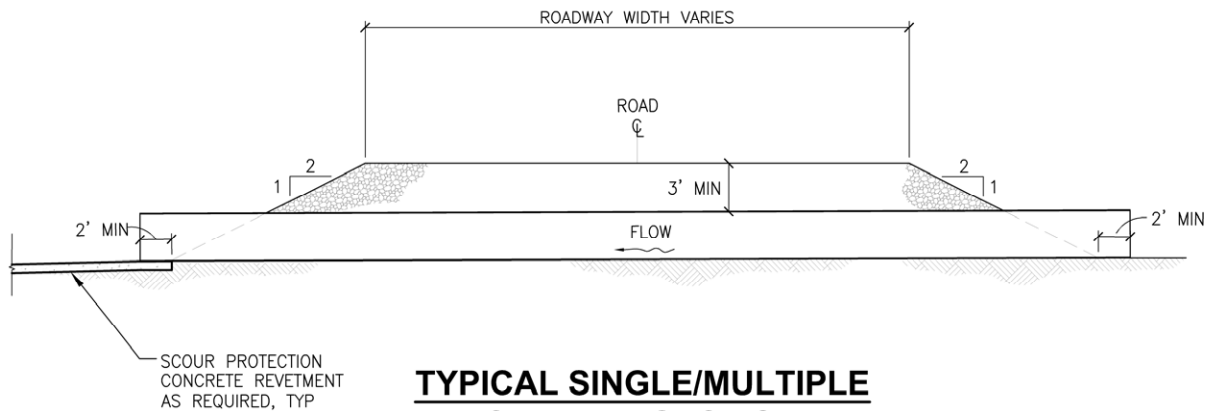
SHEET **32** of **53** 6-16-17



**TYPICAL SINGLE CULVERT ELEVATION**



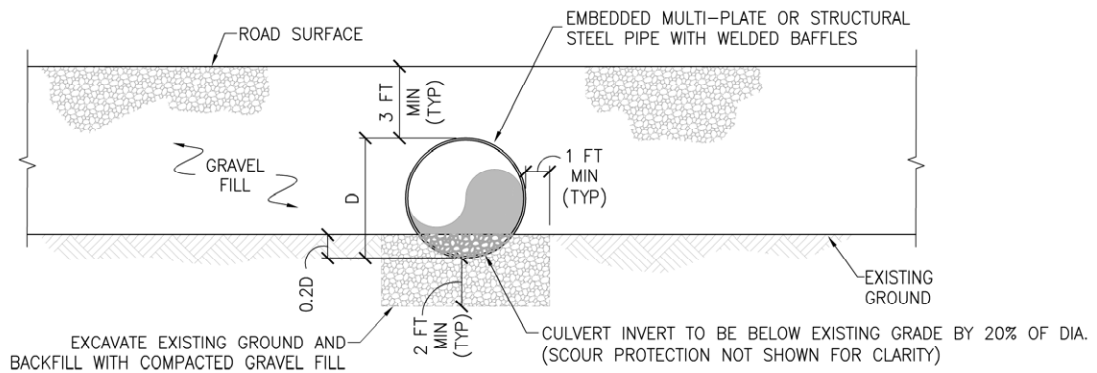
**TYPICAL CULVERT BATTERY ELEVATION**



**TYPICAL SINGLE/MULTIPLE CULVERT SECTION**

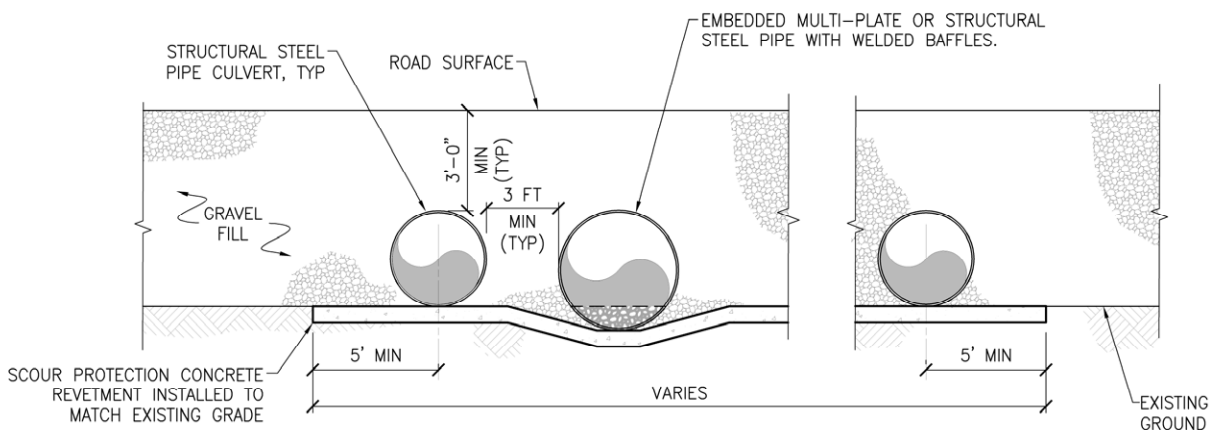
**TYPICAL SINGLE/ MULTIPLE CULVERT BATTERY SECTIONS**

REFERENCE: POA-2015-025  
 APPLICANT: Armstrong Energy, LLC  
 PROJECT: Nanushuk Development  
 ACTIVITY: Road, Pad and Pipeline Construction  
 AT: North Slope Borough, AK  
 SHEET **33** of **53** 6-16-17



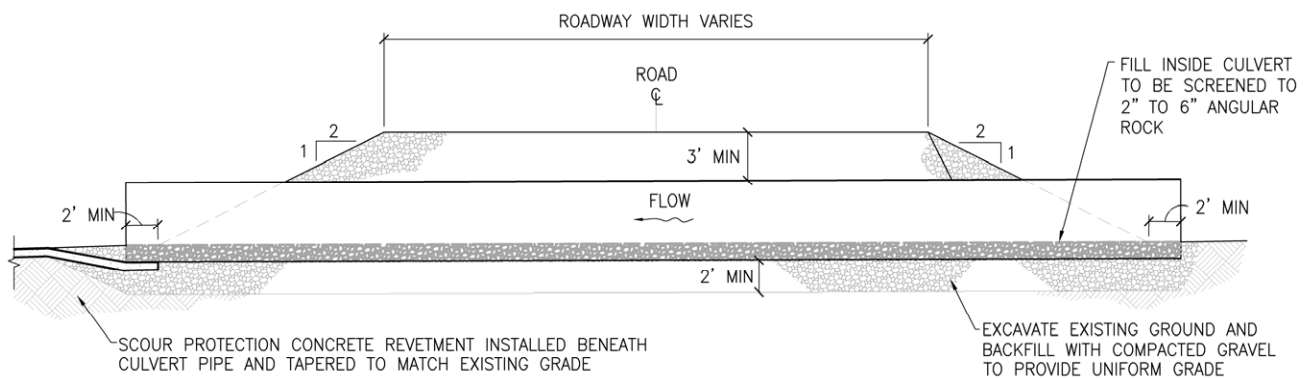
### **TYPICAL FISH PASSAGE CULVERT DETAIL**

NTS



### **TYPICAL FISH PASSAGE CULVERT BATTERY ELEVATION**

NTS



### **TYPICAL FISH PASSAGE CULVERT SECTION**

NTS

### **TYPICAL FISH PASSAGE CULVERT CROSS SECTIONS**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

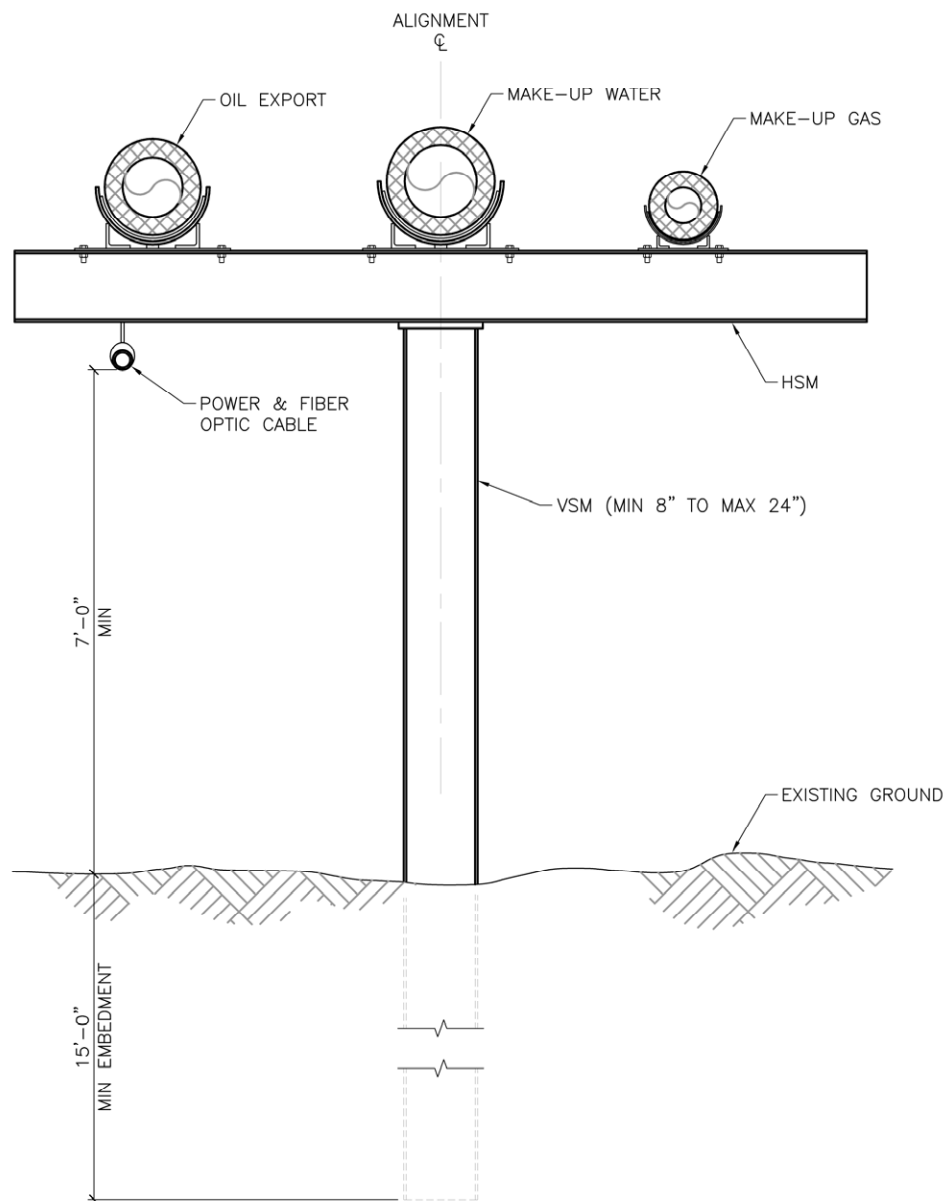
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **34** of **53** 6-16-17





## NANUSHUK PIPELINE GUIDED PIPE SUPPORT

REFERENCE: POA-2015-025

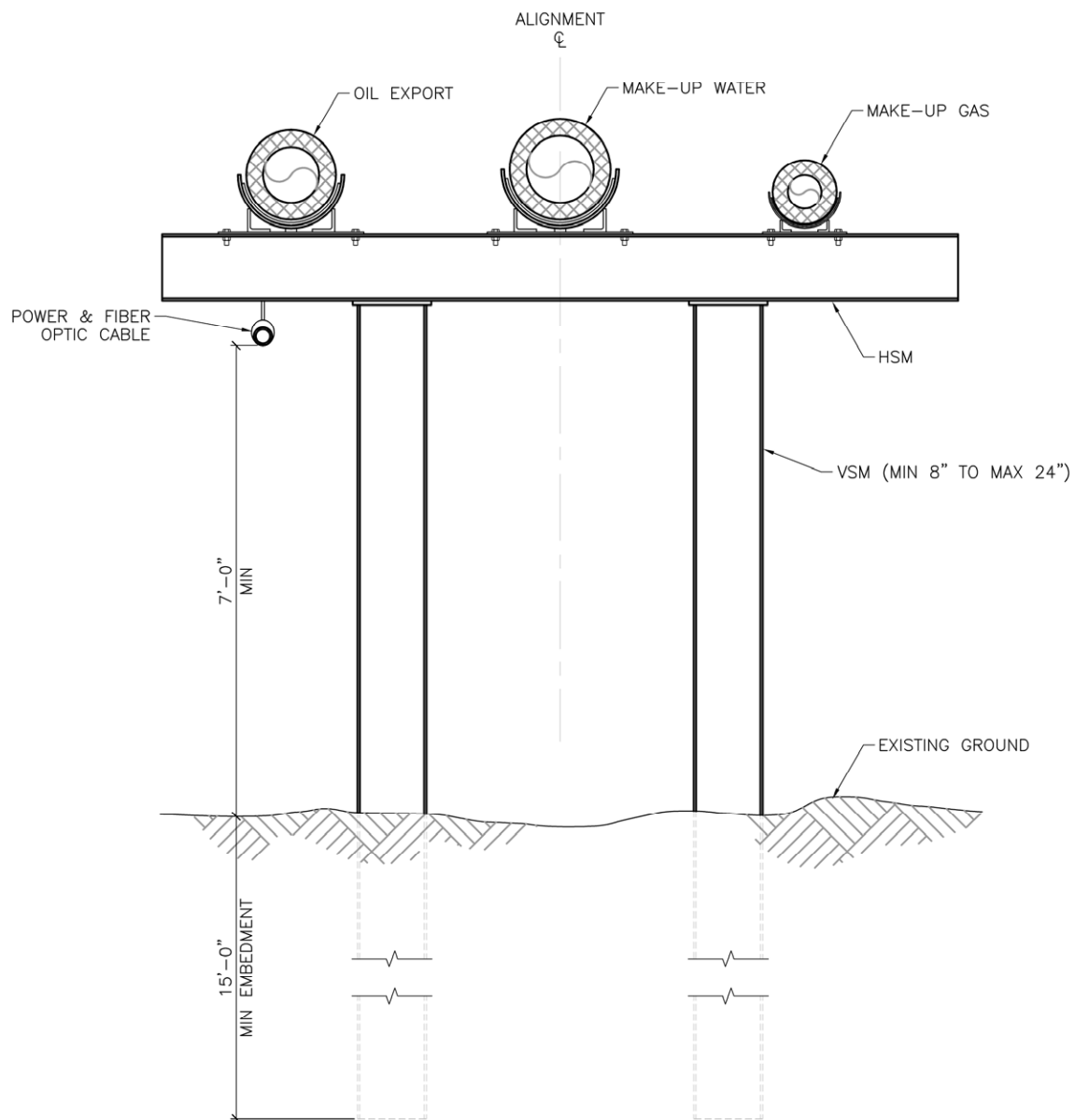
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **35** of **53** 6-16-17



## NANUSHUK PIPELINE ANCHOR PIPE SUPPORT

REFERENCE: POA-2015-025

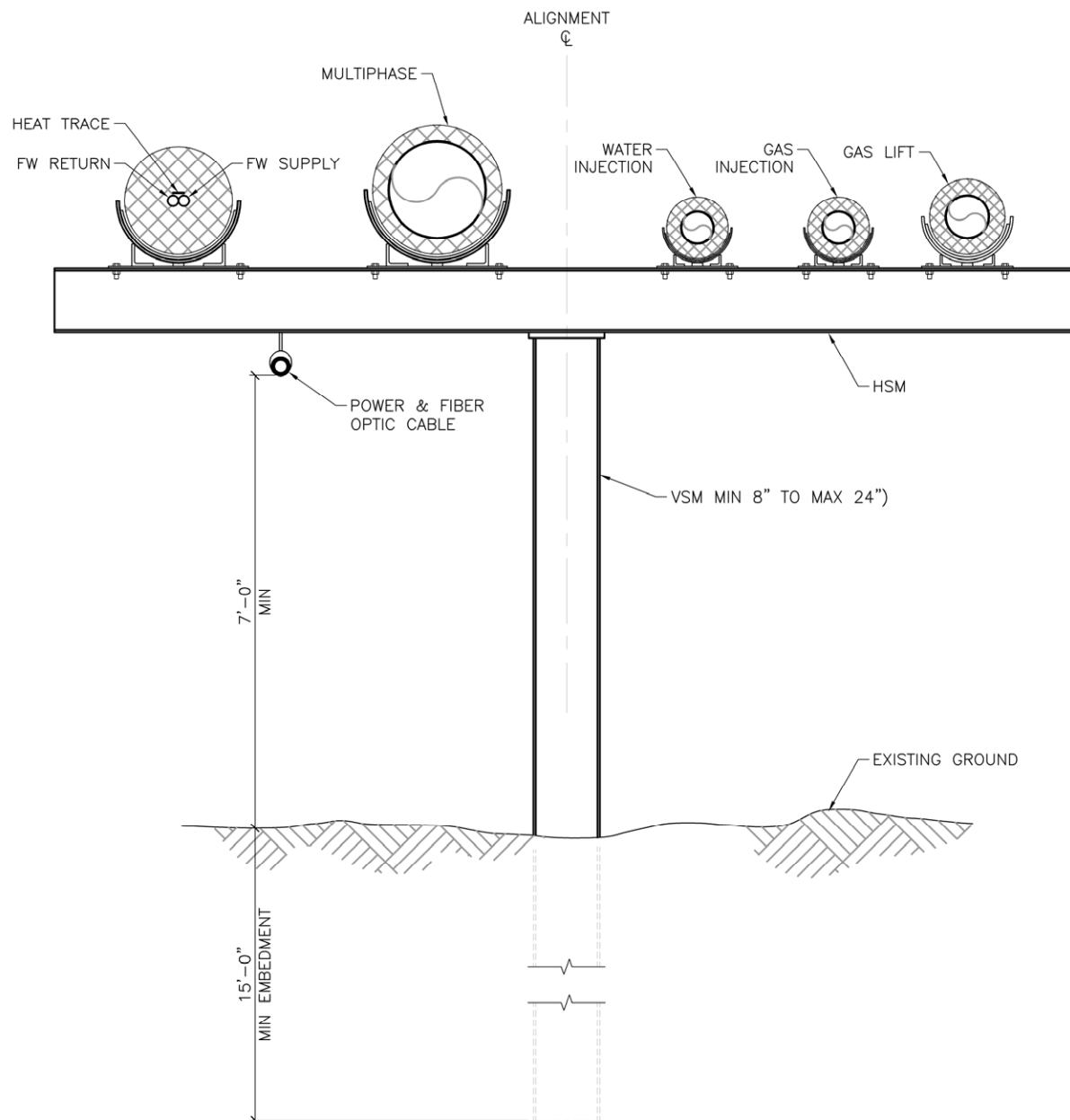
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **36** of **53** 6-16-17



## **DS2 PIPELINE GUIDED PIPE SUPPORT**

REFERENCE: POA-2015-025

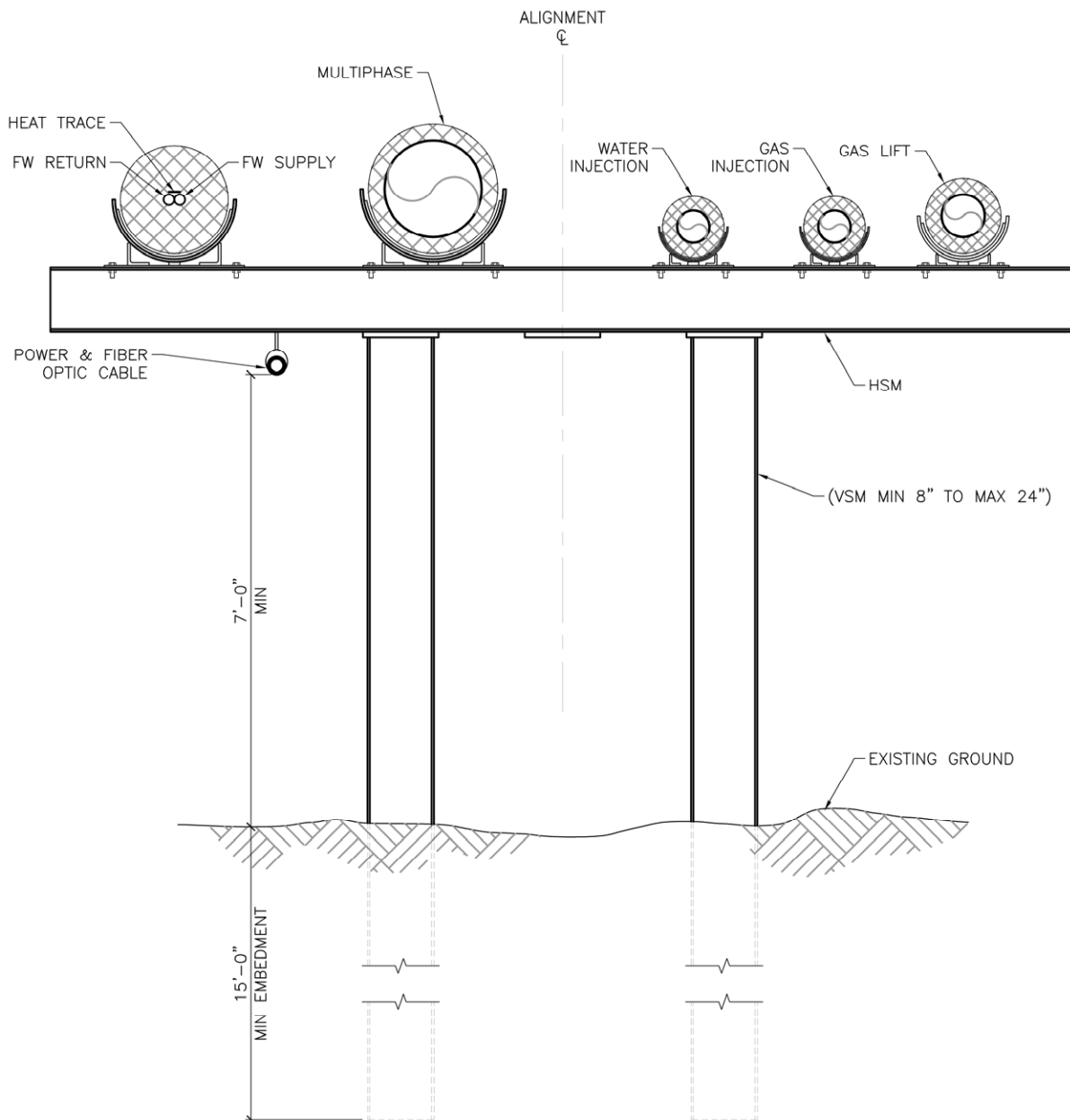
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **37** of **53** 6-16-17



## DS2 PIPELINE ANCHOR PIPE SUPPORT

REFERENCE: POA-2015-025

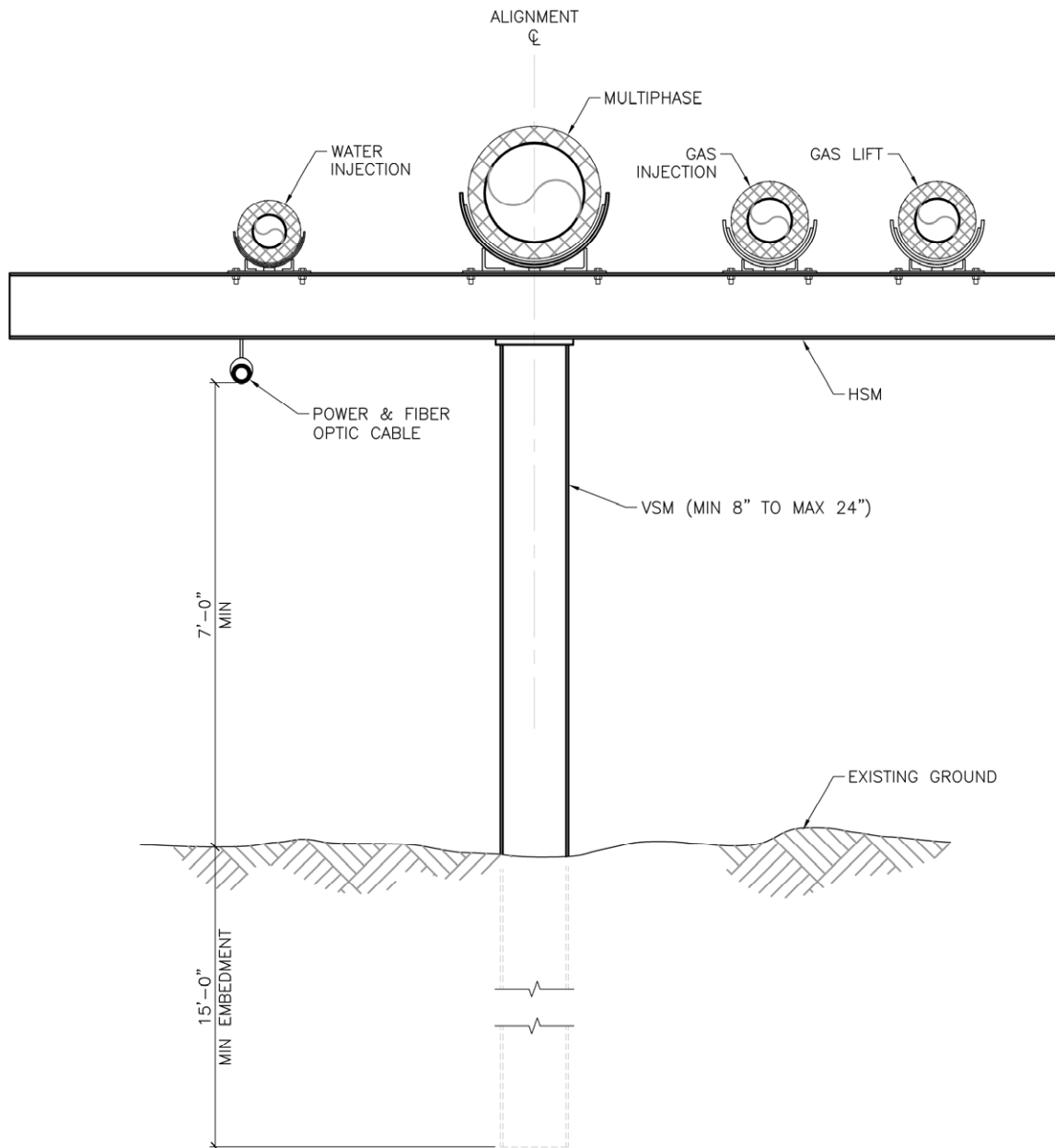
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **38** of **53** 6-16-17



# **DS3 PIPELINE GUIDED PIPE SUPPORT**

REFERENCE: POA-2015-025

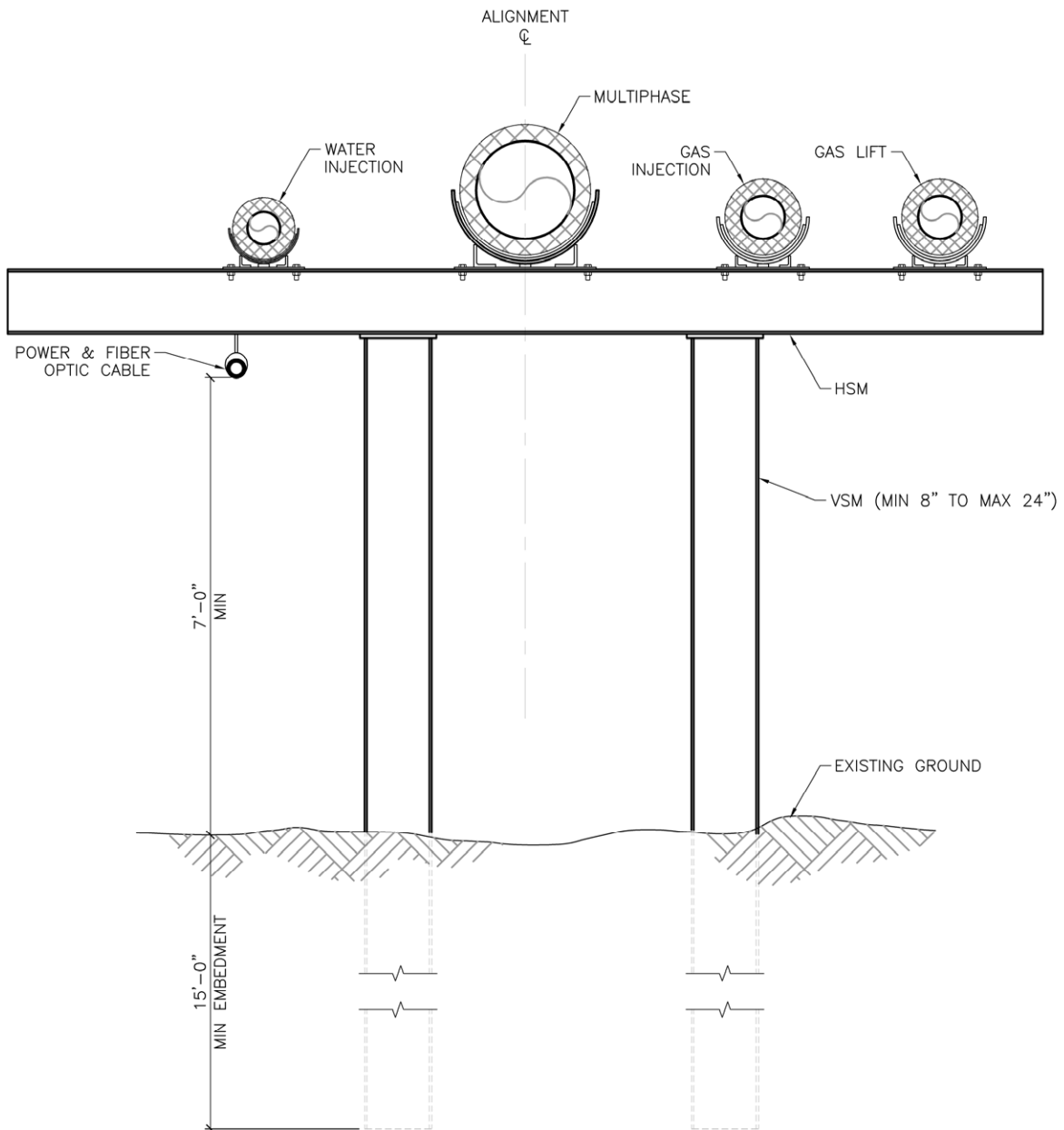
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **39** of **53** 6-16-17



## DS3 PIPELINE ANCHOR PIPE SUPPORT

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

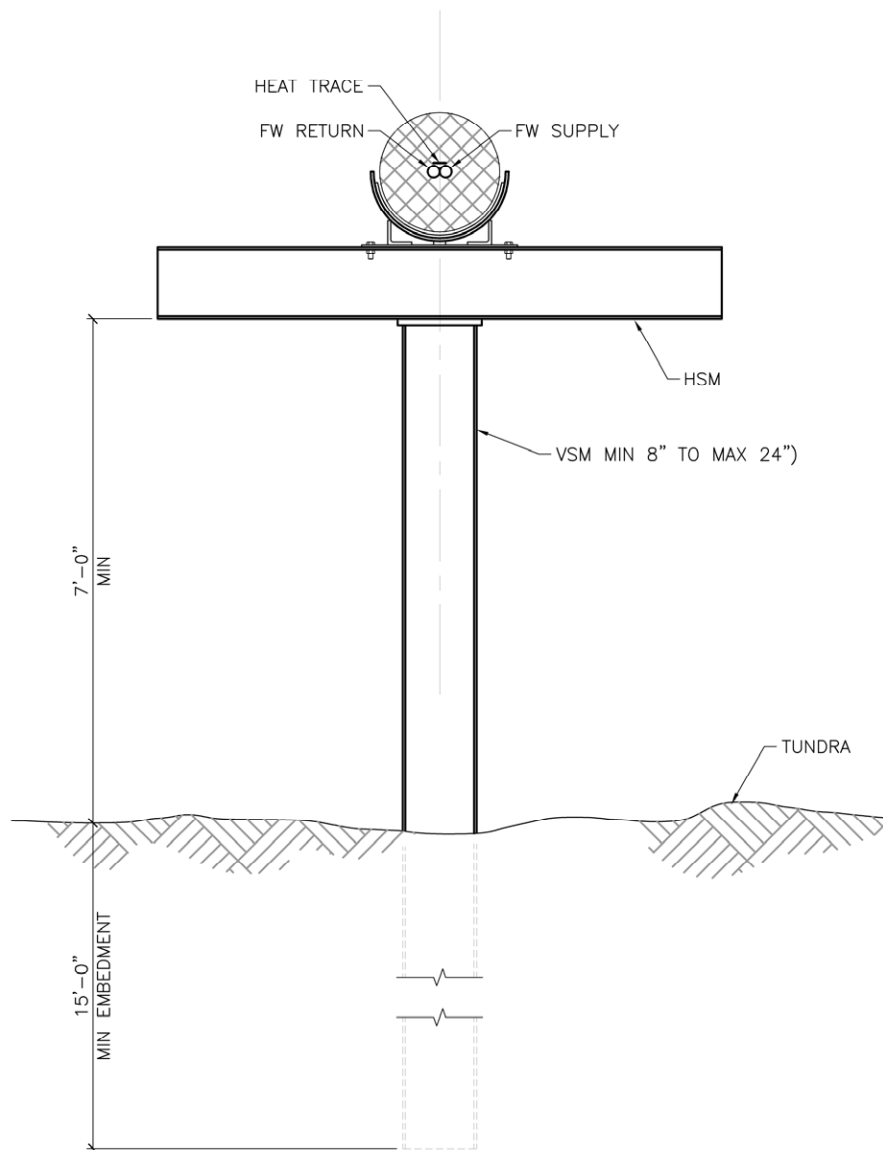
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

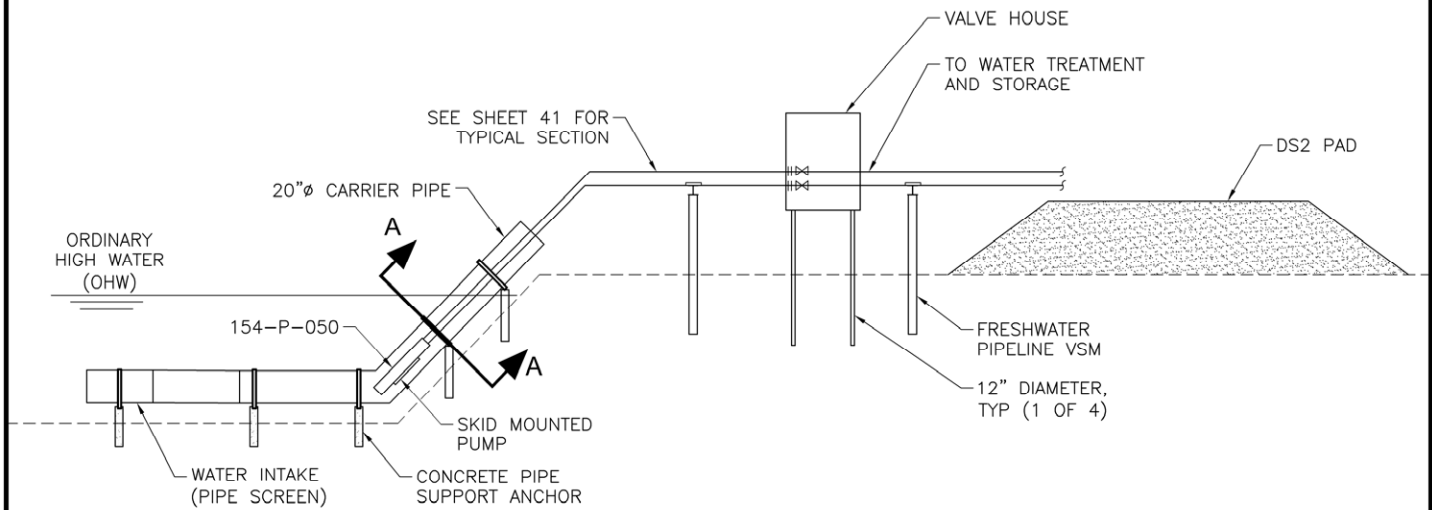
SHEET **40** of **53** 6-16-17





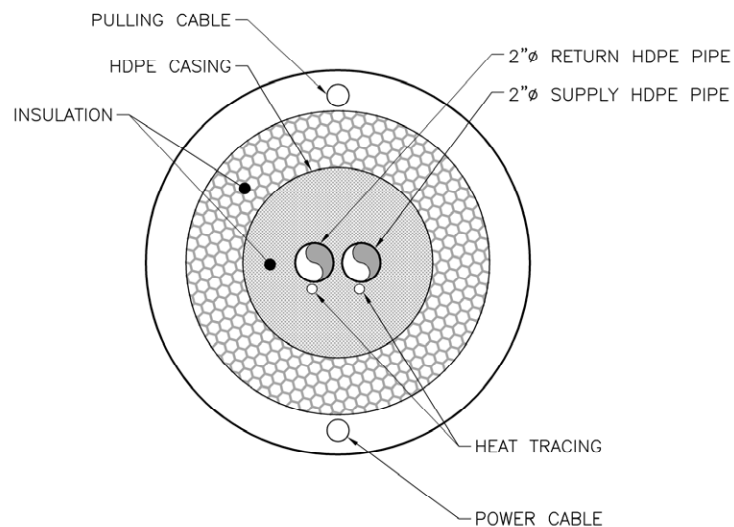
**FRESHWATER PIPELINE BETWEEN L9211  
AND DS2 PIPELINE PIPERACK**

REFERENCE: POA-2015-025  
 APPLICANT: Armstrong Energy, LLC  
 PROJECT: Nanushuk Development  
 ACTIVITY: Road, Pad and Pipeline  
 Construction  
 AT: North Slope Borough, AK  
 SHEET **41** of **53** 6-16-17



## WATER INTAKE STRUCTURE

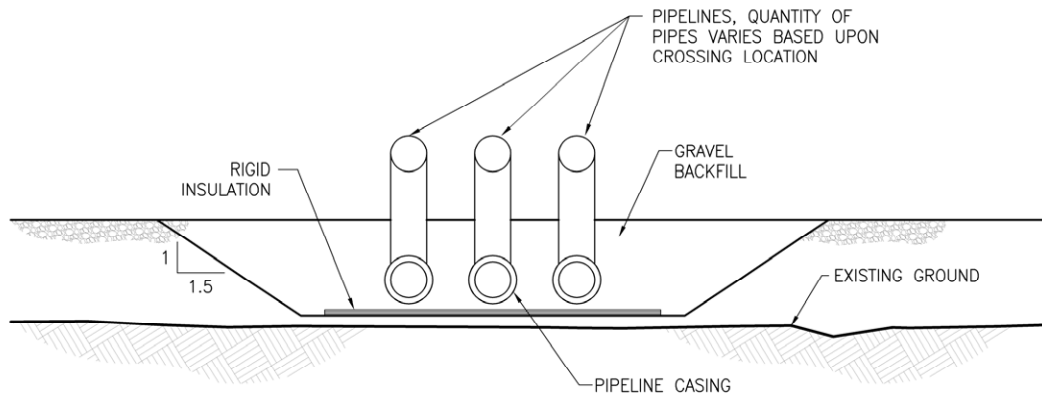
NTS



## SECTION A-A

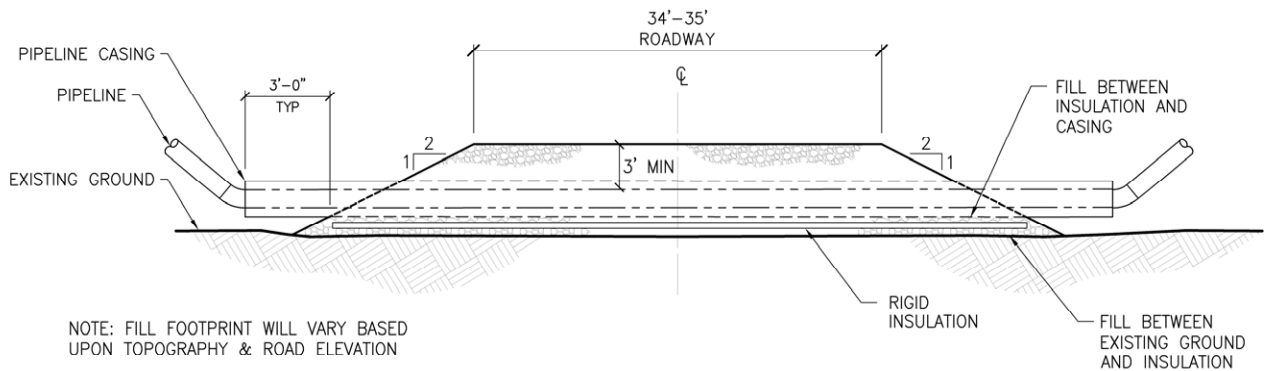
NTS

REFERENCE: POA-2015-025  
 APPLICANT: Armstrong Energy, LLC  
 PROJECT: Nanushuk Development  
 ACTIVITY: Road, Pad and Pipeline Construction  
 AT: North Slope Borough, AK  
 SHEET **42** of **53** 6-16-17



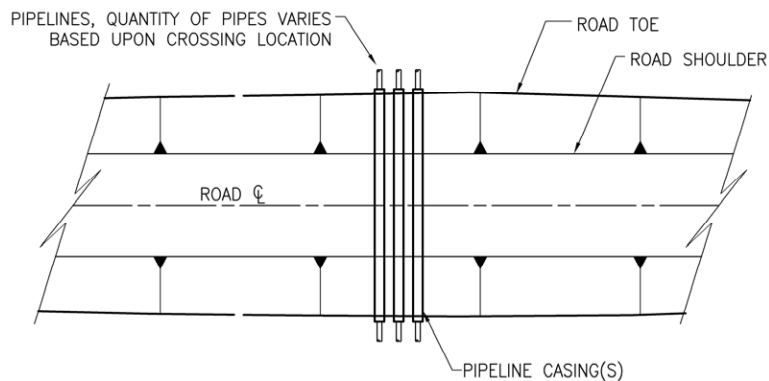
### **PROPOSED ROAD PIPELINE CROSSING PROFILE**

NTS



### **PROPOSED ROAD PIPELINE CROSSING SECTION**

NTS



### **PROPOSED ROAD PIPELINE CROSSING PLAN**

NTS

## **TYPICAL PIPELINE PROPOSED ROAD CROSSING**

REFERENCE: POA-2015-025

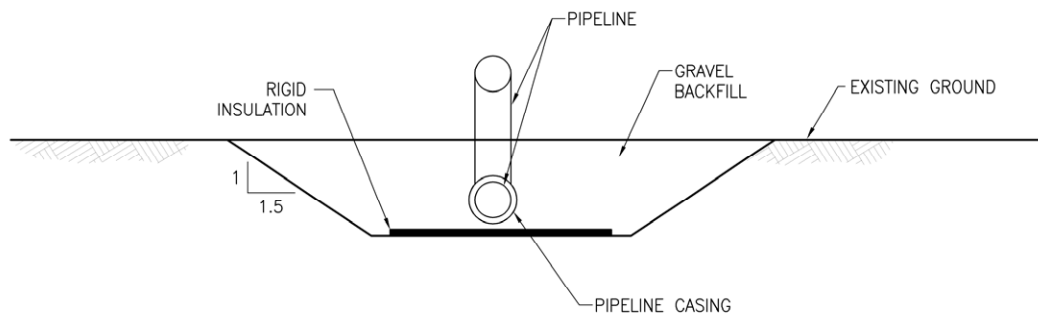
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

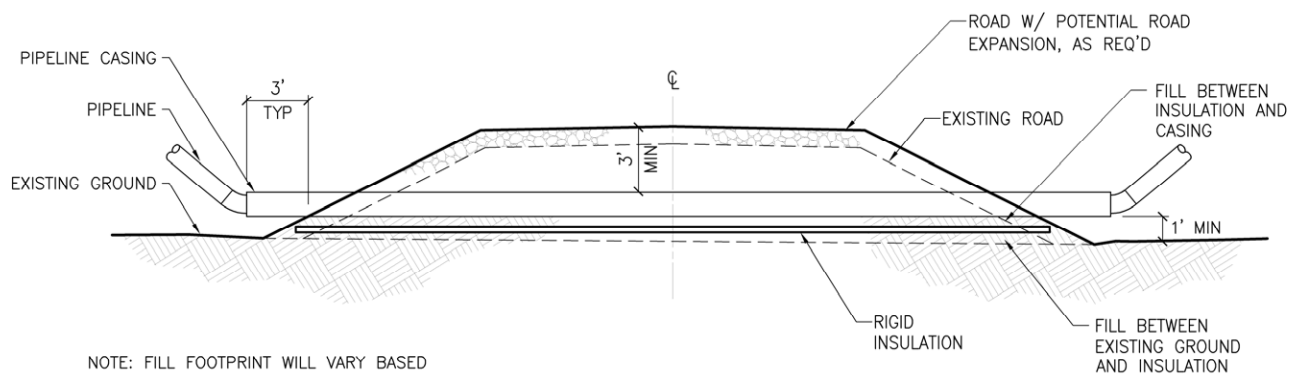
AT: North Slope Borough, AK

SHEET **43** of **53** 6-16-17



### **EXISTING ROAD PIPELINE CROSSING PROFILE**

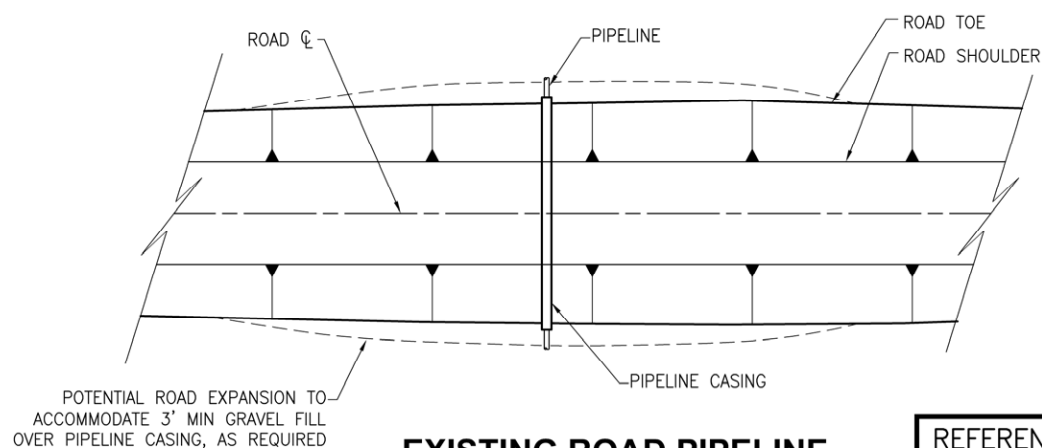
NTS



NOTE: FILL FOOTPRINT WILL VARY BASED UPON TOPOGRAPHY & ROAD ELEVATION

### **EXISTING ROAD PIPELINE CROSSING SECTION**

NTS



### **EXISTING ROAD PIPELINE CROSSING PLAN**

NTS

### **TYPICAL EXISTING ROAD PIPELINE CROSSING**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

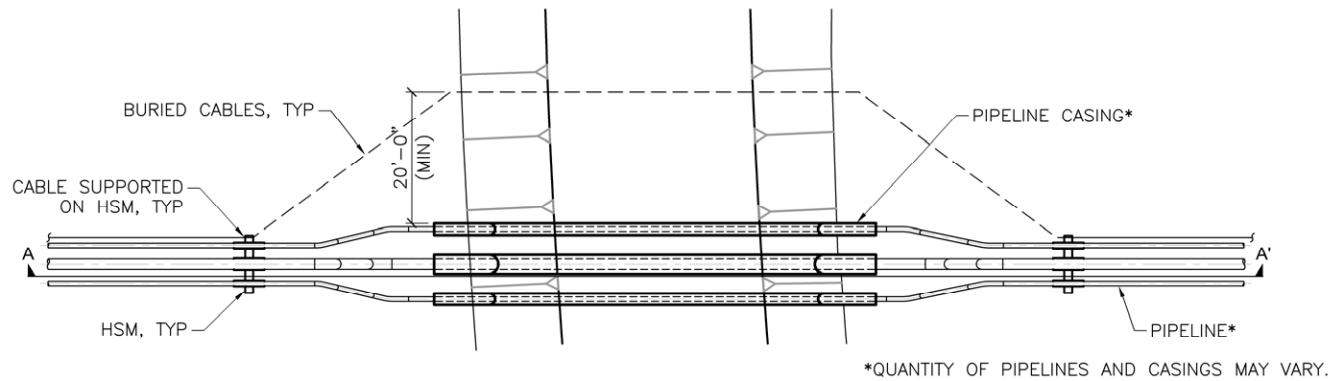
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

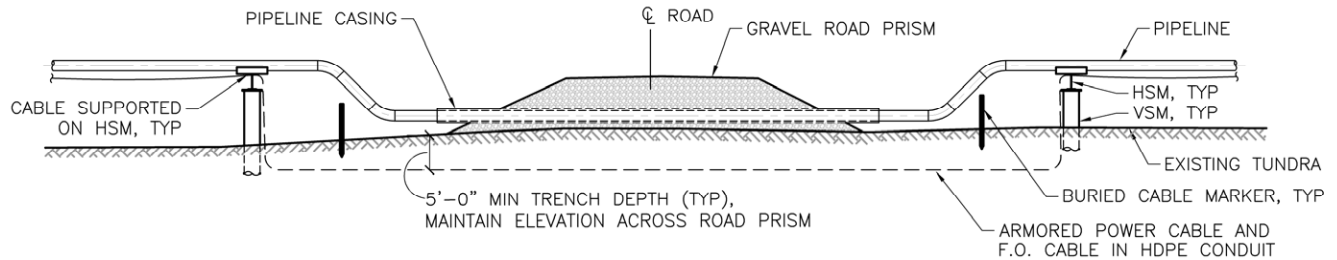
SHEET **44** of **53** 6-16-17





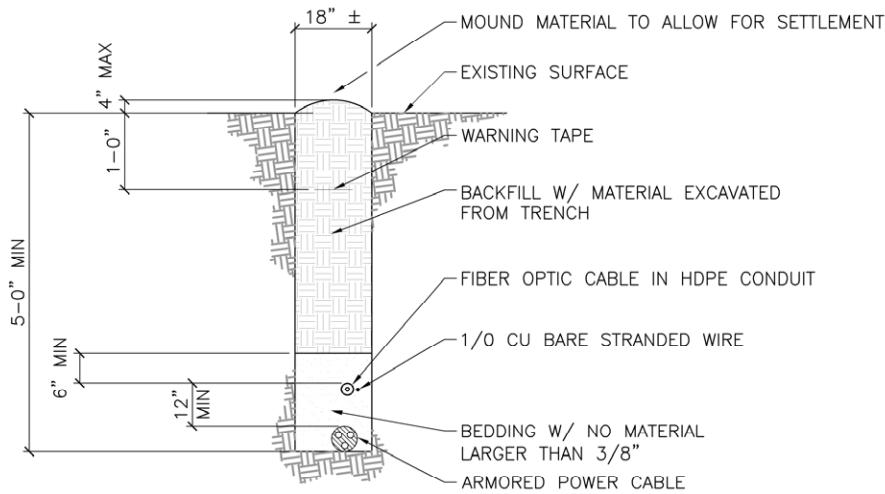
### **TYPICAL BURIED ELECTRICAL AND FIBER OPTIC CABLE AT PIPELINE CROSSING - PLAN**

NTS



### **TYPICAL BURIED ELECTRICAL AND FIBER OPTIC CABLE AT PIPELINE CROSSING**

NTS



### **TRENCH DETAIL**

NTS

#### **NOTES:**

1. NO SPLICES IN HDPE DUCT, CONTINUOUS RUN.
2. PLACE CABLE ROUTE MARKER EVERY 50 FT ALONG TRENCH ALIGNMENT.

### **TYPICAL BURIED ELECTRICAL AND FIBER OPTIC CABLE AT PIPELINE CROSSING**

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

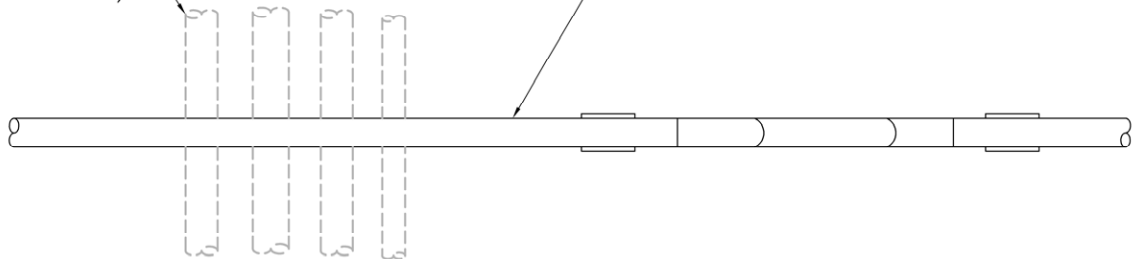
ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **45** of **53** 6-16-17

EXISTING PIPELINES  
(NUMBER OF PIPES AND  
CONFIGURATION VARIES)

NANUSHUK PIPELINE



## PLAN

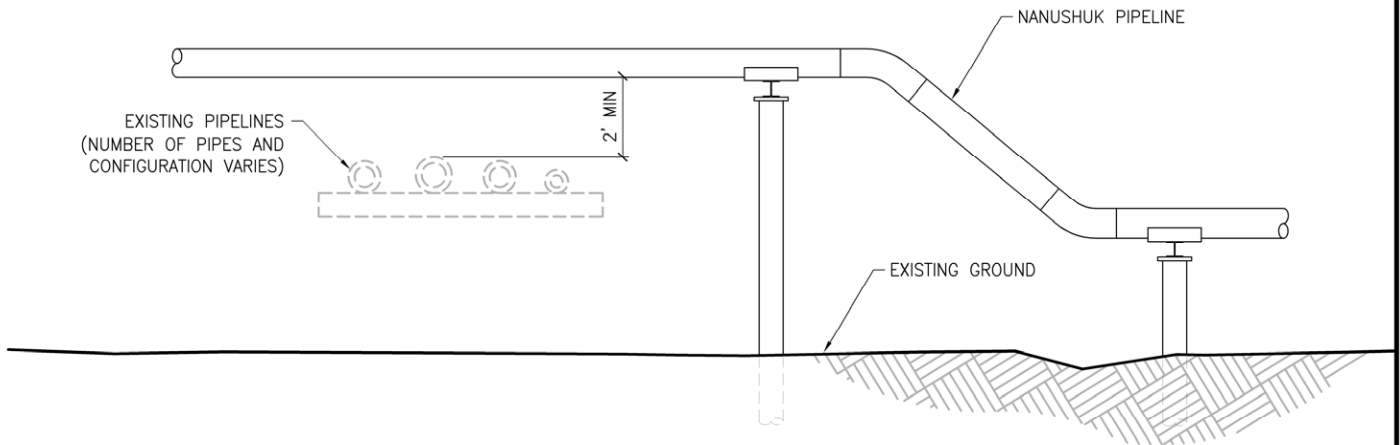
NTS

EXISTING PIPELINES  
(NUMBER OF PIPES AND  
CONFIGURATION VARIES)

NANUSHUK PIPELINE

2' MIN

EXISTING GROUND



## ELEVATION

NTS

### TYPICAL NANUSHUK PIPELINE CROSSING OVER EXISTING PIPELINES

REFERENCE: POA-2015-025

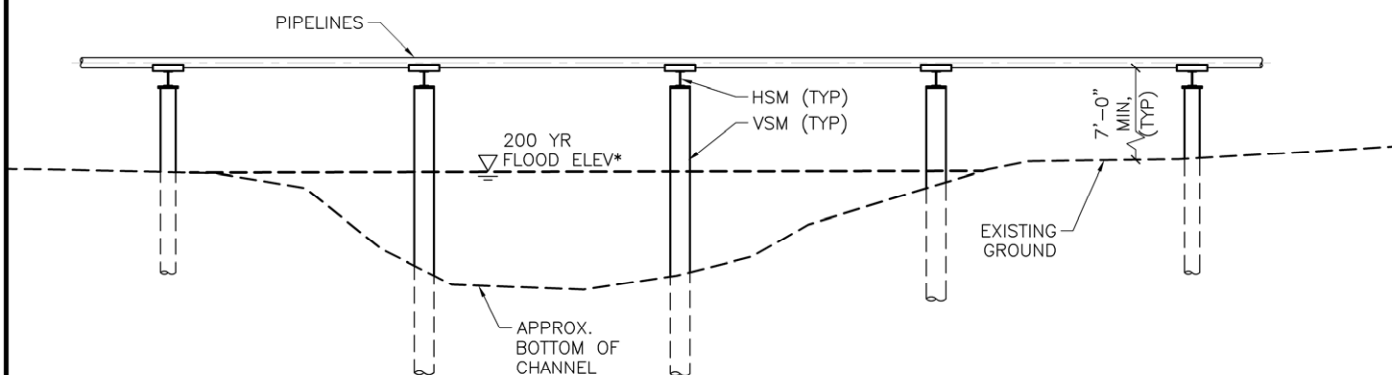
APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline  
Construction

AT: North Slope Borough, AK

SHEET **46** of **53** 6-16-17



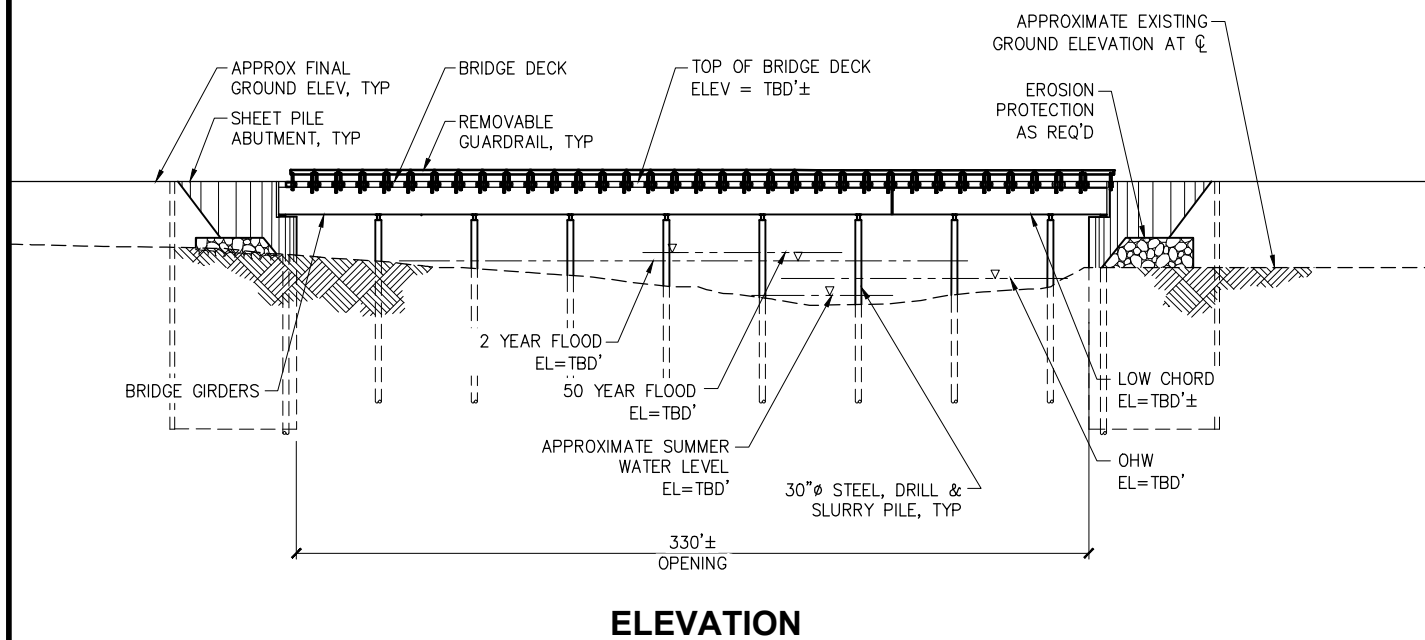
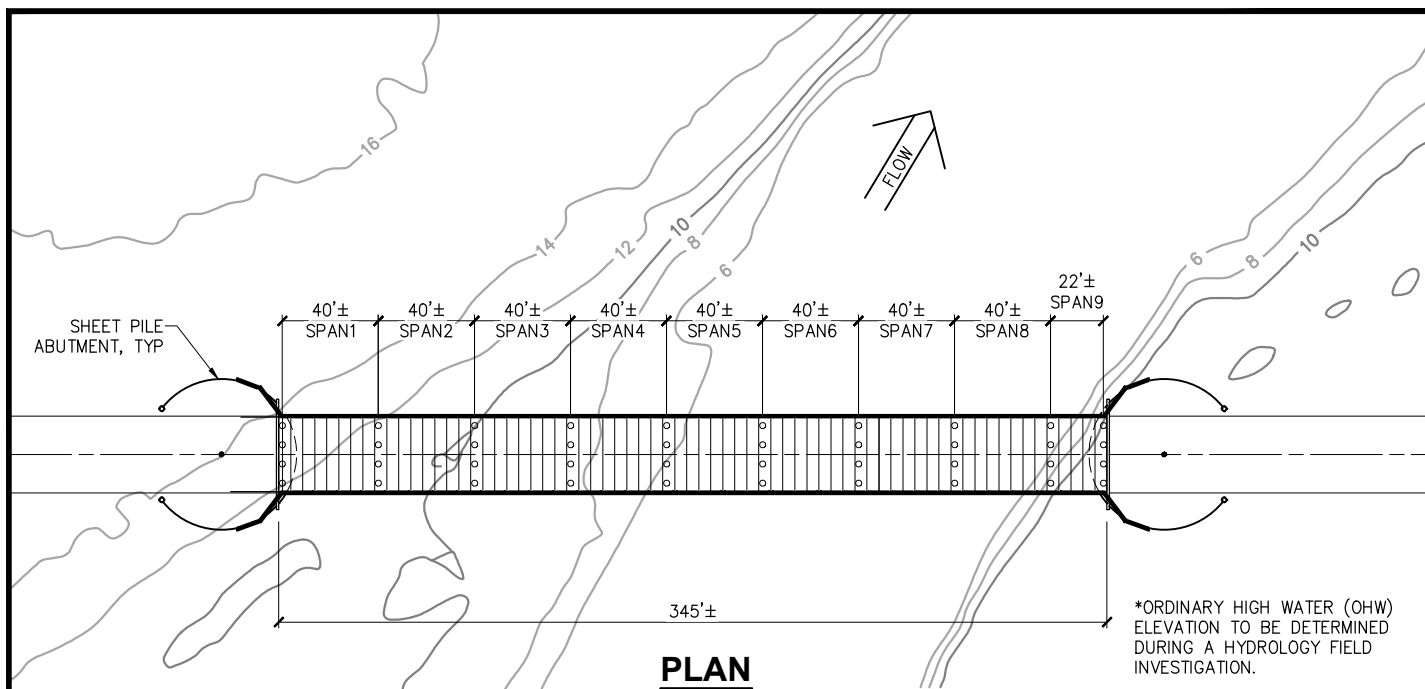
### **TYPICAL PIPELINE RIVER CROSSING**

NTS

\* NOTE:  
THE BOTTOM OF PIPE ELEVATION WILL BE A  
MINIMUM THREE (3) FEET ABOVE THE HIGHEST OF  
THE PREDICTED ELEVATION FROM THE 200-YEAR  
FLOOD OR STORM SURGE, OR THE HIGHEST  
RECORDED HISTORICAL WATER SURFACE ELEVATION.

### **PIPELINE RIVER CROSSING**

REFERENCE: POA-2015-025  
APPLICANT: Armstrong Energy, LLC  
PROJECT: Nanushuk Development  
ACTIVITY: Road, Pad and Pipeline  
Construction  
AT: North Slope Borough, AK  
SHEET **47** of **53** 6-16-17



#### NOTES:

1. VERTICAL SCALE SHOWN 2X HORIZONTAL SCALE.
2. SIDE SLOPES TO BE SEEDED AS REQUIRED. SEED SHALL CONSIST OF NATIVE PLANT SPECIES WITH BIODEGRADABLE EROSION PROTECTION.
3. VERTICAL DATUM IS NAVD 88.
4. BRIDGE LOW CHORD ELEVATION WILL BE A MINIMUM OF THREE (3) FEET ABOVE HIGHEST PREDICTED ELEVATION OF THE 200-YEAR FLOOD OR THE MAXIMUM OBSERVED STATE ELEVATION PLUS THREE (3) FEET, WHICHEVER IS GREATER.

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

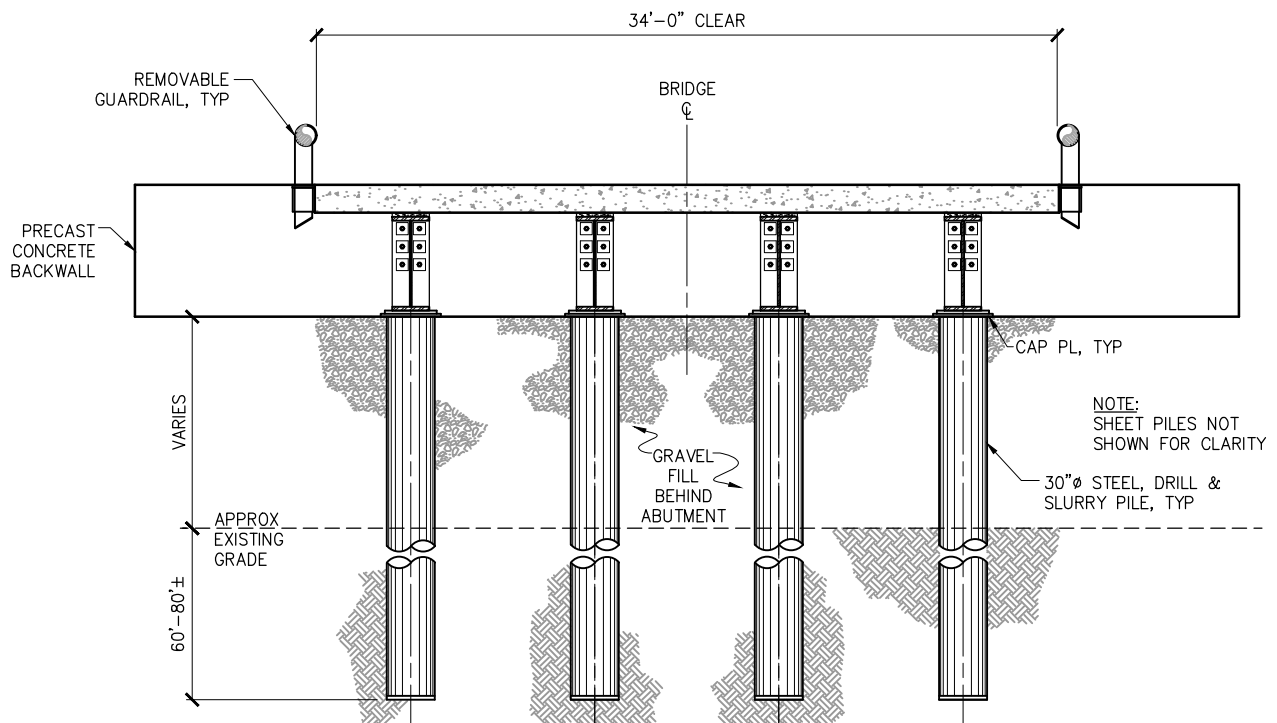
AT: North Slope Borough, AK

SHEET **48** of **53**

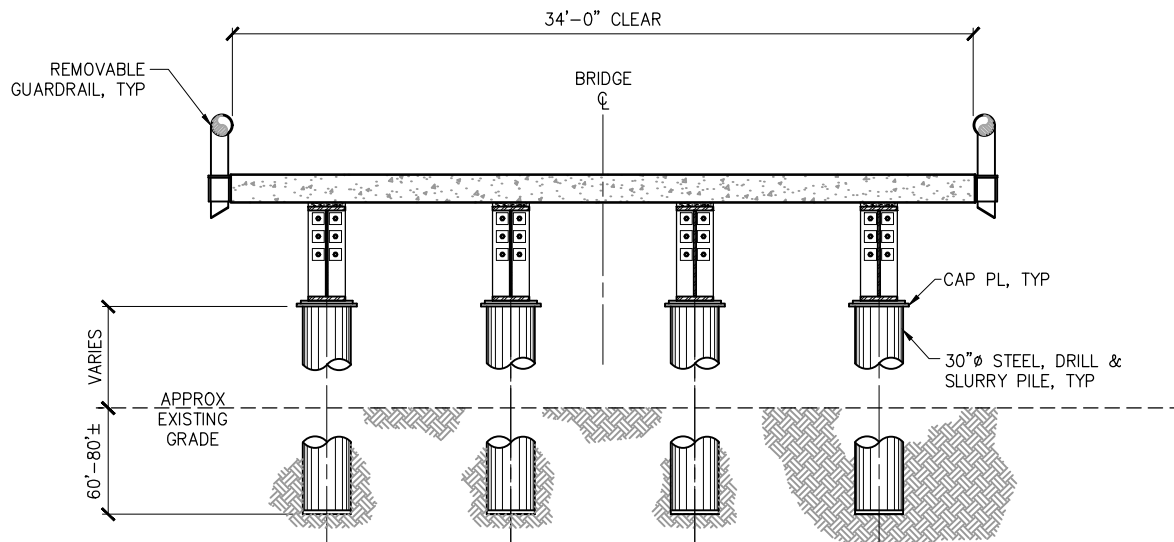
7-5-17

## KACHEMACH RIVER BRIDGE





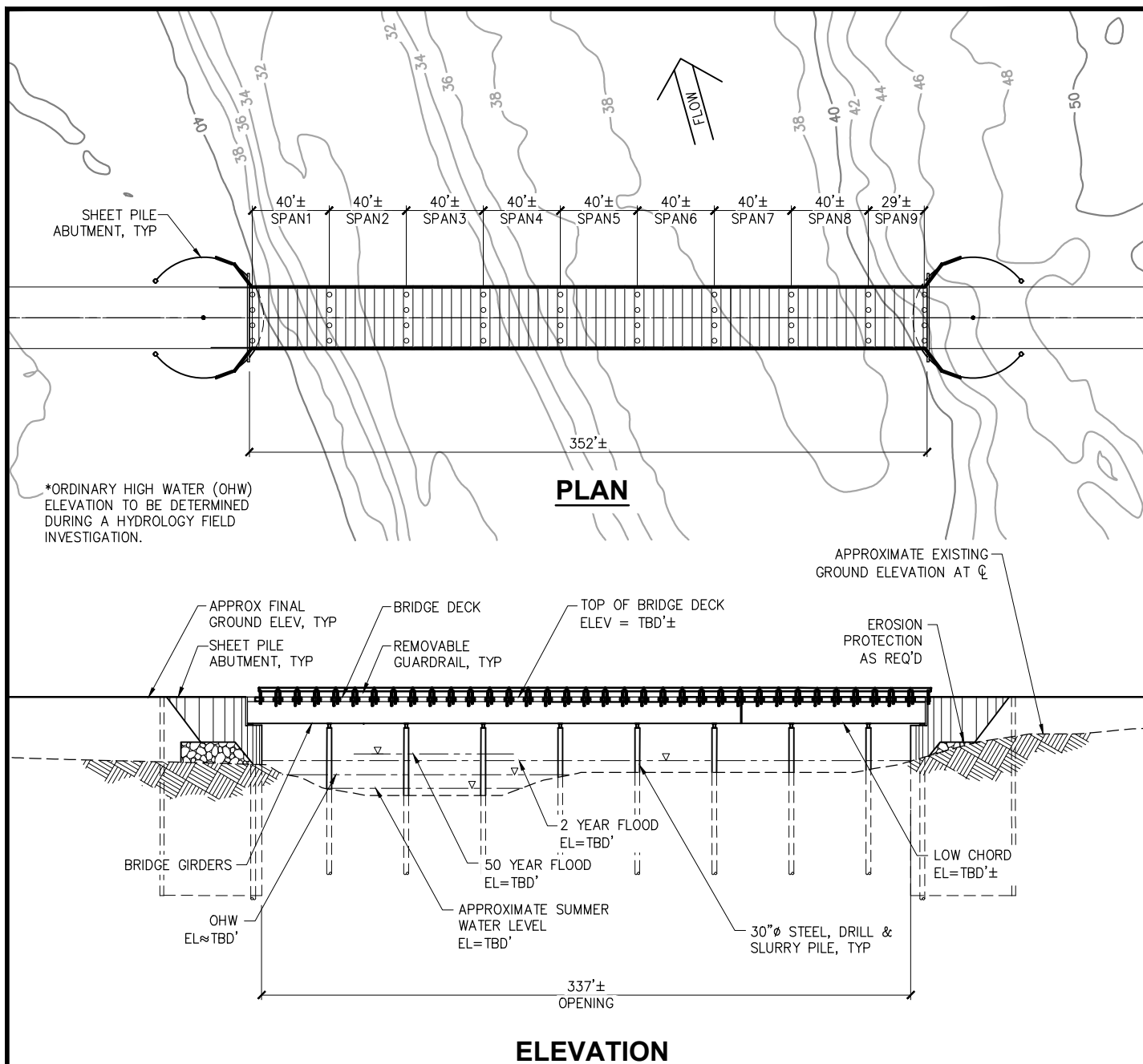
**TYPICAL SECTION AT ABUTMENT**



**TYPICAL SECTION AT PIER**

**KACHEMACH RIVER BRIDGE PIER SECTIONS**

REFERENCE: POA-2015-025  
 APPLICANT: Armstrong Energy, LLC  
 PROJECT: Nanushuk Development  
 ACTIVITY: Road, Pad and Pipeline Construction  
 AT: North Slope Borough, AK  
 SHEET **49** of **53** 7-5-17



#### NOTES:

1. VERTICAL SCALE SHOWN 2X HORIZONTAL SCALE.
2. SIDE SLOPES TO BE SEEDED AS REQUIRED. SEED SHALL CONSIST OF NATIVE PLANT SPECIES WITH BIODEGRADABLE EROSION PROTECTION.
3. VERTICAL DATUM IS NAVD 88.
4. BRIDGE LOW CHORD ELEVATION WILL BE A MINIMUM OF THREE (3) FEET ABOVE HIGHEST PREDICTED ELEVATION OF THE 200-YEAR FLOOD OR THE MAXIMUM OBSERVED STATE ELEVATION PLUS THREE (3) FEET, WHICHEVER IS GREATER.

### MILUVEACH RIVER BRIDGE

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

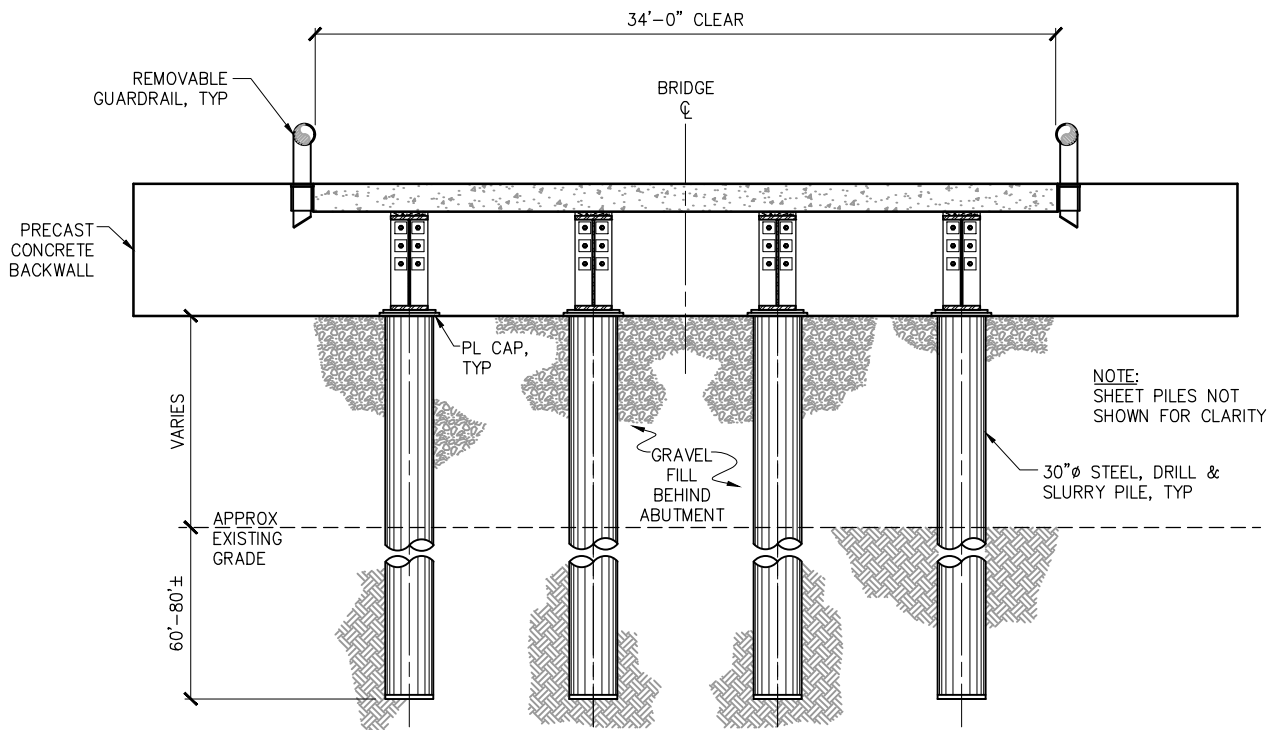
PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

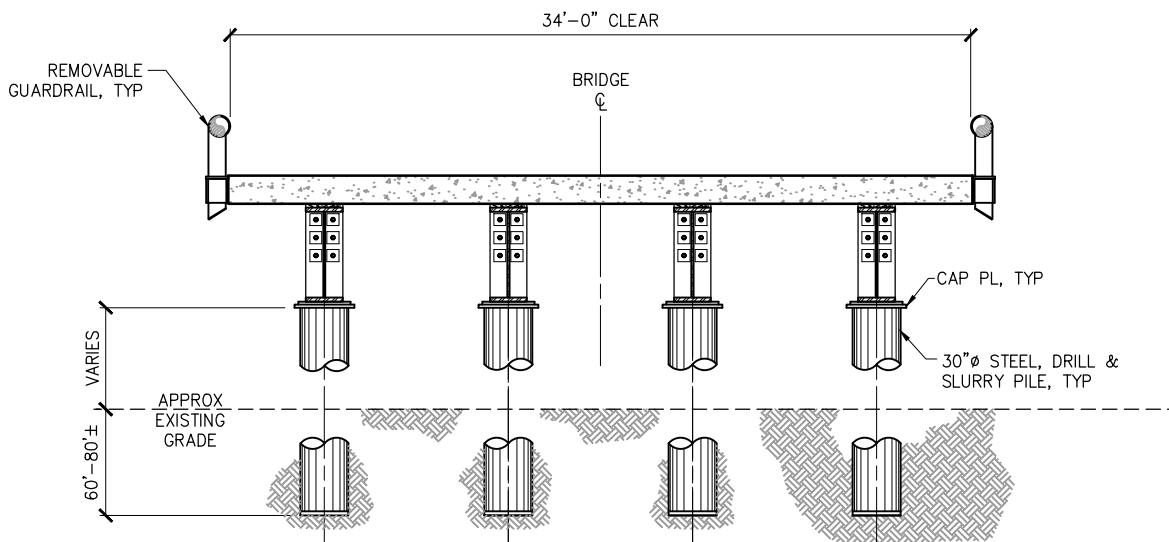
AT: North Slope Borough, AK

SHEET **50** of **53**

7-5-17



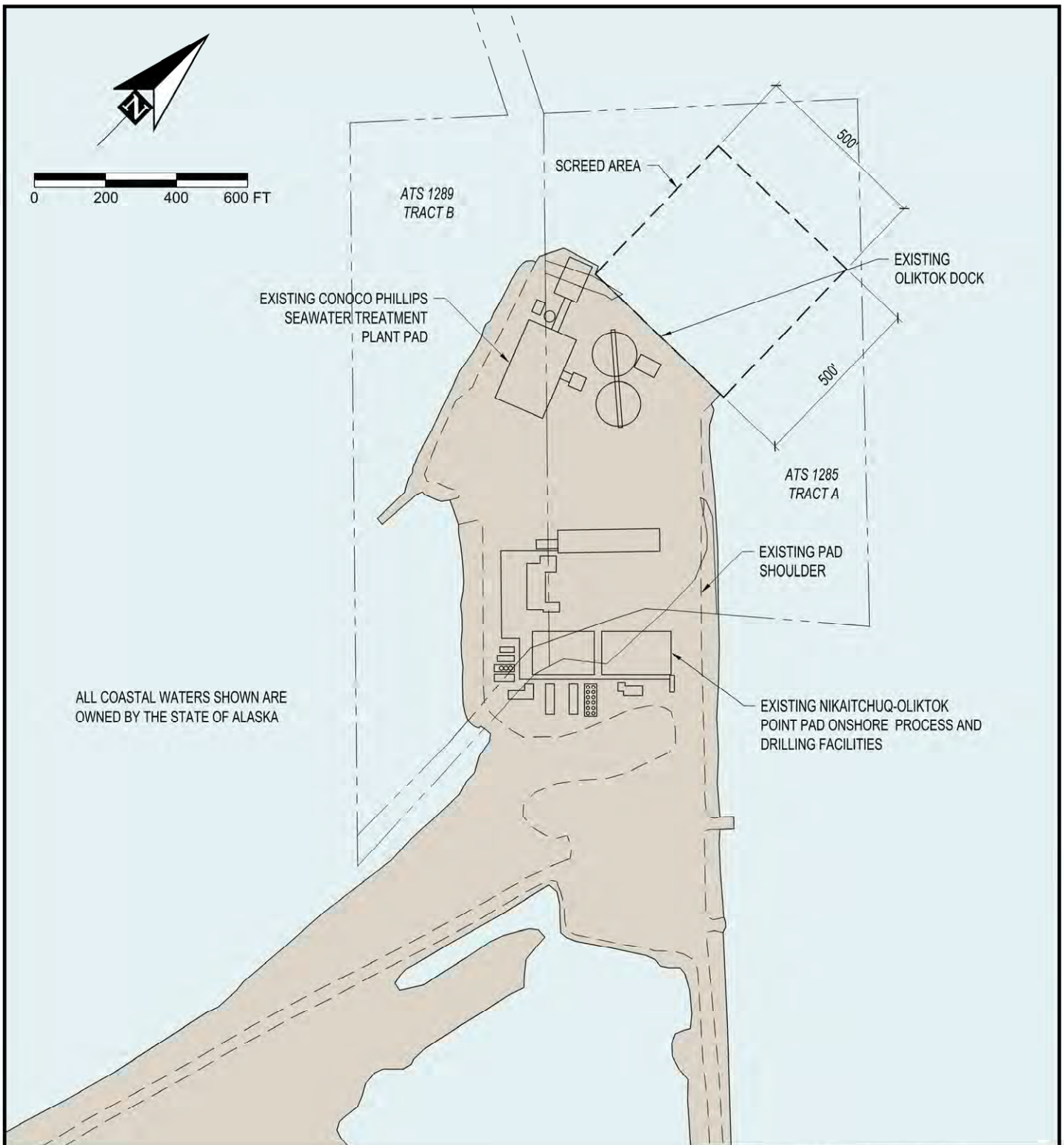
**TYPICAL SECTION AT ABUTMENT**



**TYPICAL SECTION AT PIER**

**MILUVEACH RIVER BRIDGE PIER SECTIONS**

REFERENCE: POA-2015-025  
 APPLICANT: Armstrong Energy, LLC  
 PROJECT: Nanushuk Development  
 ACTIVITY: Road, Pad and Pipeline Construction  
 AT: North Slope Borough, AK  
 SHEET **51** of **53** 7-5-17



## SCREEDING FOOTPRINT

REFERENCE: POA-2015-025

APPLICANT: Armstrong Energy, LLC

PROJECT: Nanushuk Development

ACTIVITY: Road, Pad and Pipeline Construction

AT: North Slope Borough, AK

SHEET **52** of **53** 6-16-17



FEATURE	LENGTH (MI)	GRAVEL FILL (CY)	FOOTPRINT (ACRES)
GRAVEL PADS			
NANUSHUK PAD	—	391,000±	26.9±
DS2 PAD	—	263,000±	19.1±
DS3 PAD	—	248,000±	18.0±
OPERATIONS CENTER PAD	—	232,000±	16.4±
TIE-IN PAD	—	8,000±	0.6±
GRAVEL ROADS			
ACCESS ROAD	13.6±	842,000±	101.7±
DS2 ROAD	3.8±	271,000±	29.6±
DS3 ROAD	7.6±	457,000±	55.5±
SECONDARY ACCESS LOOP	0.5±	30,000±	3.7±
TOTAL	25.5±	2,742,000±	271.5±

FEATURE	VALUE	UNIT
BRIDGE AND CULVERTS		
MILUVEACH RIVER BRIDGE	337±	LF
KACHEMACH RIVER BRIDGE	330±	LF
CULVERTS*	270± MIN	EA

\*CULVERTS TO BE INSTALLED EVERY 500' ON AVERAGE. ADDITIONAL CULVERTS WILL BE ADDED AS NEEDED. LENGTHS DIAMETERS, QUANTITIES TO BE DETERMINED DURING A SUMMER FIELD SURVEY PRIOR TO CONSTRUCTION.

FEATURE	VSM (TOTAL)* (EA)	SINGLE HOLE AREA 30" OD (SF)	TOTAL VSM AREA HOLE AREA (SF, AC)	TOTAL VSM SLURRY VOL (CY)	TOTAL VSM STEEL (LF)
VSM AND SLURRY:					
NANUSHUK PIPELINE	3,080±	4.9±	15,130± SF	8,400±	67,760±
DS2 PIPELINE	710±	4.9±	3,470± SF	1,950±	15,620±
DS3 PIPELINE	1,450±	4.9±	7,140± SF	3,950±	31,900±
STAND ALONE FRESHWATER PIPELINE L9211 TO DS2.DS2 TO OP CENTER	80±	4.9±	380± SF	220±	1,760±
TOTAL	5,320±	—	26,120± SF, 0.6± AC	14,520± CY	117,040 (LF)

\* APPROXIMATE

FEATURE	FOOTPRINT (AC)	FILL QUANTITY (CY)	NOTES/DIMENSIONS
SCREEDING FOOTPRINT	5.7±	—	500 FT BY 500 FT SCREEDING AREA TO DEPTH OF 8.0 TO 8.5 MLLW
POWER/FIBER OPTIC CABLE TRENCHING	0.1±	420±	APPROX 300 FT LONG BY 18 INCH WIDE BY 5 FT DEEP TRENCH @ EA PIPELINE ROAD CROSSING. TOTAL OF 5 PIPELINE ROAD CROSSINGS
TOTAL AREA OF IMPACT	5.8±	420±	

**NOTES:**

- VSM AREA IS BASED ON THE LARGEST SIZE VSM FOR THE PROJECT. ACTUAL VSM SIZED WILL RANGE FROM 8 INCH OUTSIDE DIAMETER TO 24 INCH OUTSIDE DIAMETER.

## **FILL ACREAGE AND VOLUMES**

REFERENCE: POA-2015-025  
 APPLICANT: Armstrong Energy, LLC  
 PROJECT: Nanushuk Development  
 ACTIVITY: Road, Pad and Pipeline Construction  
 AT: North Slope Borough, AK  
 SHEET **53** of **53** 6-16-17

