Appendix G
Floodplain Analysis

Location Hydraulic Study

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Shea, Kathleen E (DOT)

From: Knapp, Michael W (DOT)
Sent: Wednesday, January 13, 2016 1:27 PM
To: Shea, Kathleen E (DOT)
Cc: Schmid, Tom J (DOT); Arndt, Quinten (DOT); Melocik, Bradley (bmelocik@dowl.com)
Subject: RE: Location Hydraulic Study North Fork Anchor River & South Fork Anchor River- DOT&PF Project No. Z581060000, Sterling Highway MP 157 - MP 169

Kathy,
I have no additional comments on the attachments you sent. Thanks!
Mike

From: Shea, Kathleen E (DOT)
Sent: Tuesday, January 05, 2016 7:38 AM
To: Knapp, Michael W (DOT)
Cc: Schmid, Tom J (DOT); Arndt, Quinten (DOT); Melocik, Bradley (bmelocik@dowl.com)
Subject: FW: Location Hydraulic Study North Fork Anchor River & South Fork Anchor River- DOT&PF Project No. Z581060000, Sterling Highway MP 157 - MP 169

Hi Mike,

Happy New Year! The folks at Dowl have responded to your questions/comments on the L&H and Floodplain Consultation for the Sterling Highway MP 157 – MP 169 project. We'll have a few edits before the documents are final, but please take a look at the responses and let us know if you have additional comments on the content before they can be approved and included in the environmental document.

Thanks,
Kathy

From: Schmid, Tom J (DOT)
Sent: Thursday, December 17, 2015 7:37 AM
To: Shea, Kathleen E (DOT)
Cc: Arndt, Quinten (DOT)
Subject: FW: Location Hydraulic Study North Fork Anchor River & South Fork Anchor River- DOT&PF Project No. Z581060000, Sterling Highway MP 157 - MP 169

Tom J. Schmid, P.E.
Project Manager
Department of Transportation
Preliminary Design and Environmental Section
(907) 269-0543, fax 243-6927

From: Melocik, Bradley [mailto:bmelocik@dowl.com]
Sent: Wednesday, December 16, 2015 6:52 PM
To: Schmid, Tom J (DOT)
Cc: Noble, Steven; Morrill, Adam; Arndt, Quinten (DOT)
Subject: FW: Location Hydraulic Study North Fork Anchor River & South Fork Anchor River- DOT&PF Project No. Z581060000, Sterling Highway MP 157 - MP 169

Hi Tom.

Appended are the revisions that we have incorporated into our documents per Mike Knapp's comments. I have summarized them below.

First bullet: not addressed he agreed with our findings for both bridges.

Second bullet: Work at these locations has minor shifts away from the channel to reduce riprap encroaching into the channel. The revisions include a discussion of the minor road shifts at these locations. The roadway encroaches on the floodplain for approximately 1 mile in the floodplain between MP 158.7 to MP 160.7 (SB passing lane). At this level of design we know that the floodplain encroachment will be minimal, but it has not been modeled. Riprap protection will be extended downstream. We will have to look into excavating and installing the riprap to the existing ground surface to result in no net fill in the floodplain. However, changes in roughness and some encroachment may alter the BFE. Need to run some backwater calculations to see if it will translate in a rise. I recommend that we are general for this section and include an analysis at the Local Review Design level.

Third bullet: Included language to discuss that a major realignment is impractical. Work at MP 159.8 includes replacement of Two Moose Creek.

Fourth bullet: Discussion with DOT&PF on temporary structures.

Fifth bullet: Kathy provided this for documentation for the Federal Flood Risk Management Standard "although the rule is in draft form, we are still meeting the standard…."by constructing the roadway a minimum of 2 feet above the 100-year base flood elevation. This will be included in the location hydraulic study.

Examples:

- MP 160—Finished grade 135 feet and 100-yr floodplain is 132 feet (Need to verify the datum used in all of the flood studies is the same, but it appears so)(3 feet above)
- MP 160.5—Finished grade 150 feet and the 100-yr floodplain is 148 feet
- MP 161—Finished grade 175 feet and the 100-yr floodplain is 168 feet

Below (in red) are our responses from October when we were discussing these issues with Kathy.

I will be in the office first in the morning if you would like to discuss further.

Regards,

Brad

From: Knapp, Michael W (DOT) [mailto:michael.knapp@alaska.gov]
Sent: Thursday, October 29, 2015 3:32 PM
To: Shea, Kathleen E (DOT)
Cc: Tom Schmid; Quinten Arndt; Janke, Paul A (DOT); Melocik, Bradley
Subject: RE: Location Hydraulic Study North Fork Anchor River & South Fork Anchor River- DOT&PF Project No. Z581060000, Sterling Highway MP 157 - MP 169

Kathy,

I have reviewed the documents you sent and offer comments below.

- I agree with DOWL's finding that there will be minimal flood plain "risks" associated with replacing Bridge No. 4020 (NF Anchor River culverts) and Bridge No. 666 (Anchor River).

- The proposed embankment widening at MP 159.8 & MP 160.5 might warrant some additional attention. Brad Melocik wrote in his memorandum that both locations are experiencing stream bank erosion, indicating that there may be impinging flow and/or flow concentration potential along the toe of embankment. The Google Earth aerial photographs and "Street View" tool show that there are already riprap provisions at these sites, and I would presume that any widening efforts would extend new riprap provisions further into the channel. Goal is not to widen the existing riprap into the channel any farther, but to extend the riprap north (downstream). This area is mapped as floodplain or floodway. Discussion has been added to the LHS to include alternatives for streambank erosion protection. How much of an encroachment is proposed at these locations? We haven't quantified this yet. Does DOT&PF or the KPB want us to quantify this now or at some future, maybe 35%, design level? Will the proposed action meet the local "no-rise" standard? The goal is 'no rise' but this has not been quantified at this design level. One way this might be achieved is if the erosion protection replaces existing ground and does not result in net fill in the floodplain.

- Mel Langdon's memorandum states *"Due to land ownership and lack of right-of-way, topography, and natural features abutting and paralleling the project, including wetlands and alluvial floodplain, alterantives to the alignment from MP 160 to MP 161 are not practical."* (I took this to also include the MP 159.8 location.) Her statement suggests that realigning the highway away from the river at MP 159.8 and 160.5 was deemed an impracticable option. Correct? Correct. Language has been added to discuss impractabicality of major realignment but to include minor realignment that moves the embankment footprint away from the 100 year floodplain as practical.
- The KPB Floodplain Administrator has in the past (i.e., Bridge No. 427 Ninilchik River) required DOT&PF or its Contractor to evaluate floodplain impacts/risks associated with temporary structures. This included temporary construction structures. It might be worthwhile to check-in with the Floodplain Administrator to ascertain the KPB's expectations and desired level of documentation. Discuss with DOT bridge designers whether they or DOWL are designing the temporary structures.

- I understand that within Central Region, the engineering managers wish to voluntarily comply with E.O. 13690 (and the associated new Federal Flood Risk Management Standard) ahead of formal implementation by federal agencies. Please verify. If so, then there may be additional analysis needed to determine whether the proposed structures and roadway will comply with the new FFRMS. The DOWL H&H analysis for the culvert replacements included considerations to comply with the new FFRMS. We don't know if the bridge design, being done by DOT&PF, includes this analysis.

Thank you for the opportunity to provide comments.

Mike

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Michael W. Knapp, P.E.
Statewide Hydraulics Engineer
Alaska Department of Transportation & Public Facilities
Statewide Design & Engineering Services - Bridge Section
3132 Channel Drive / P.O. Box 112500
Juneau, Alaska 99811-2500
(907) 465-8893 office
michael.knapp@alaska.gov

From: Shea, Kathleen E (DOT)
Sent: Tuesday, October 20, 2015 10:10 AM
To: Knapp, Michael W (DOT)

Cc: Schmid, Tom J (DOT); Arndt, Quinten (DOT); Janke, Paul A (DOT); Melocik, Bradley (bmelocik@dowl.com)
Subject: Location Hydraulic Study North Fork Anchor River & South Fork Anchor River- DOT&PF Project No. Z581060000, Sterling Highway MP 157 - MP 169

Hi Mike,

I have another Location Hydraulic Study, and floodplain consultation, for your review and approval. This project would rehabilitate the Sterling Highway from MP 157 – MP 169. Work would include replacement of the existing culverts at North Fork Anchor River with a bridge, and replacement of the South Fork Anchor River bridge.

Please let me know if you have any questions.

Thanks,
Kathy

Kathy Shea, Environmental Team Leader
Alaska Dept. of Transportation and Public Facilities
Preliminary Design and Environmental Section
P.O. Box 196900, Anchorage, Alaska 99519-6900
Phone 907.269.0530| Fax 907.243.6927

MEMORANDUM

TO:	Tom Schmid, P.E. State of Alaska Department of Transportation &Public Facilities
THROUGH:	Steve Noble, P.E. DOWL
FROM:	mcl for Brad Melocik, P.E., P.H. DOWL
DATE:	January 25, 2016
SUBJECT:	Sterling Highway MP 157 to MP 169 Location Hydraulic Study

PROJECT OVERVIEW

The State of Alaska Department of Transportation and Public Facilities (DOT&PF), in cooperation with the Federal Highway Administration(FHWA), is proposing to improve the Sterling Highway from Anchor Point (Milepost 157) south 12 miles to Baycrest Hill (Milepost 169) in the Kenai Peninsula Borough (Figure 1).

The project consists of rehabilitating the existing facilities and adding safety enhancements and passing/climbing lanes. Rehabilitation of the highway includes resurfacing, pavement structural improvements, shoulder widening, alterations to vertical grades and horizontal curves, removal or protection of roadside obstacles, and drainage improvements. Additional improvements include realigning the intersections with Old Sterling Highway and the addition of auxiliary turn lanes. The bridges over the north and south forks of the Anchor River would be replaced. In areas where the South Fork Anchor River runs parallel to the roadway, measures to protect the highway from erosion would be employed. After construction, the roadway would have two 12-foot-wide travel lanes and 8-foot shoulders, except, where passing/climbing lanes are added, there would be additional 12-foot-wide lanes added. The improvements are needed to preserve and extend the service life of the existing facilities and to improve the capacity and efficiency of the roadway.

This federally-funded project is subject to 23 Code of Federal Regulations (CFR) 650, which requires a Location Hydraulic Study if the proposed action is determined to encroach on the base (100-year) floodplain.

The 23 CFR 650.105(q) states the following:

Significant encroachment shall mean a highway encroachment and any direct support of likely base floodplain development that would involve one or more of the following construction related or flood-related impacts:

1. A significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route,

2. A significant risk, or

3. A significant adverse impact on natural and beneficial floodplain values.

This memo evaluates the proposed project with respect to these regulations. As required by 23 CFR 650.111(a), National Flood Insurance Program maps published by the Federal Emergency Management Agency (FEMA) as Flood Insurance Rate Maps (FIRMs), which are available for the project corridor, are used in this evaluation.

FLOODPLAIN MAPPING

FEMA has published an effective FIRM for a portion of the project area (FEMA, 1981) and has developed a preliminary digital FIRM (DFIRM) (FEMA, 2014b). Under both the effective and preliminary mapping, portions of the roadway are within a FEMA-delineated 100-year floodplain.

Effective FIRM. According to the effective FIRM Panel 020012 4325A (FEMA, 1981), floodplain mapping along the Anchor River in the vicinity of the project area extends from the confluence with the North Fork Anchor River, at about MP 157.4, south (upstream) along the South Fork Anchor River to MP 158.5, where the study ends (Figure 2). On effective FIRM panel 020107 6020B (FEMA, 2009), floodplain mapping for the City of Homer extends north to MP 168.2, where the study ends. On this panel, the Sterling Highway is outside the mapped 100-year floodplain. Based on the effective FIRM mapping, only the highway crossing of the North Fork Anchor River is within the 100-year floodplain; no other portions of the project area are within the floodplain on the effective FIRMs.

Preliminary DFIRM. The preliminary mapping in the entire project corridor is shown on Figure 3. The majority of the project is outside the mapped base 100-year flood plain, as detailed in Table 1. Areas within the ROW that are not mapped, or are mapped as Zone B, C or X (area determined to be outside the limits of the 100-year floodplain) or Zone D (possible but undetermined flood hazards) are not subject to review in a Location Hydraulic Study since they are not within the 100-year floodplain. The DFIRM maps a 100-year floodplain along the South Fork Anchor River (Figure 4) from the confluence with the North Fork Anchor River south to MP 161.1 as Zone AE (100-year floodplain with base flood elevation), and includes a mapped regulatory floodway. Under this preliminary mapping, the highway crossings at the North Fork Anchor River and at the South Fork Anchor River at MP 161 are within the mapped floodway. The highway ROW itself between MP 160 and MP 161.1 (a longitudinal encroachment), the downstream end of the highway crossing at Two Moose Creek (MP 159.8) and the lower portion of Beaver Creek (MP 160.5) are within the 100-floodway fringe, but not the floodway. Short portions of the southbound side of the right-of-way (ROW) abut the floodway at MP 159.8 and at MP 160.5, including the mouth of Beaver Creek. Both locations are experiencing streambank erosion. Localized flooding occurred in May 2002, near MP 160 (Tunseth, 2002) and caused road closures between MP 157 and MP 165 in November 2002 (Garner, 2002).

Table 1: Preliminary Flood Mapping Along Project Corridor

Start and End Mileposts	Mapped Flood Zone	Subject to Location Hydraulic Study under 23 CFR 650.111(a)
157.0 – 159.6	Zone X (small portion of Zone AE and floodway under bridge)	No
159.6 - 161.1	Zones AE and X and floodway	Yes
161.1 - 161.3	Zones B and X	No
161.3 – 166.0	not mapped	No
166.0 – 168.8	Zone X	No
168.5 – 169.0	Zone D	No

FEMA's preliminary Flood Insurance Study (FIS) states that the principal flood problem on the South Fork Anchor River is the threat to three highway crossings, including the two that are within the limits of this project (FEMA, 2014a).

> "The Sterling Highway crossing of the north fork crossing of the Anchor River is an earth fill structure with four 8-foot diameter culverts that may be subject to hydraulic seepage due to high water on the upstream side of the crossing. The Sterling Highway crossing of the south fork of the Anchor River crossing is a concrete span bridge. Although its bridge abutments are well armored, the crossing is subject to erosion due to high velocities at flood flows. Both of these river crossings are critical because the Sterling Highway is the only road access to a significant portion of the Kenai Peninsula. …. In October 2002, the bridge approach of the Sterling Highway was washed out."

ALTERNATIVES ANALYSIS

The two alternatives considered in this analysis include:

- No Build: No improvements to the project corridor.
- Proposed Action (Alternative 3 in Preliminary Engineering Report (DOT&PF, 2013): Rehabilitate existing pavement, widen shoulders, add/replace culverts at six locations (including five anadromous stream crossings), improve ditches, clear roadside vegetation, provide erosion protection, realign eight horizontal and seven vertical curves, replace the North Fork Anchor River culverts with a bridge, and replace the South Fork Anchor River bridge at MP 161.

The Proposed Action alternative includes replacing the two crossings noted in FEMA's preliminary FIS. No alternatives were considered that would remove the longitudinal encroachment of the existing road on the floodplain between MP 160 and MP 161.

Discussion of alternatives and impacts outlined in 23 CFR 650.111(b) through (d) is as presented in Table 2.

Table 2: 25 CFR 650.111(b) through (d) Discussion

23 CFR 650.111(b) Evaluate and discuss practicality of alternatives to longitudinal encroachments
DISCUSSION: Due to constraints of land ownership and lack of right-of-way, design criteria for horizontal curves in road geometry, topography, and natural features abutting and paralleling the project, including wetlands and alluvial floodplain, large changes in the roadway alignment and changes to the ROW location from MP 159.8 to MP 161 are not practical. Minor changes in alignment that move the footprint of the road within the existing ROW away from the mapped floodplain is a practical alternative. Existing riprap erosion protection of the highway embankment at MP 159.8 (Two Moose Creek) and MP 160.5 (Beaver Creek) will be maintained and not increased in width (encroaching in the channel) but additional protection is needed at the northwest (downstream) ends at both locations. Even with bank protection, it is likely that erosion will continue to occur on the downstream end of the protected areas. Alternatives to protect the road embankment in these downstream areas include riprap, sheetpile or similar rigid wall construction, rerouting the channel, in-channel diversion structures (e.g., rock vanes or weirs) or moving the road away from the channel. Riprap is the most practical alternative due to cost, consistency with existing protection, and ability to adjust to changing conditions. Sheetpile (or other rigid

23 CFR 650.111(b) Evaluate and discuss practicality of alternatives to longitudinal encroachments

structure) is less practical due to comparatively high cost and risk of failure due to continued erosion on the downstream end. Channel rerouting or in-channel work is not considered practical due to cost and potential unforeseen effects on river behavior that may affect other properties.

23 CFR 650.111(c)(1) Risks associated with implementing the proposed action

DISCUSSION:

There are no additional risks associated with the proposed action. The risk of not moving the road out of the floodplain is that it will continue to experience flooding. The risks of not extending erosion protection or stabilizing the banks at MP 159.8 and MP 160.5 include undercutting/over steepening of the banks or washing out the road. Under the proposed action, this risk will be reduced. Under the proposed action, the risk due to damage or failure at the existing crossings at North Fork Anchor River and South Fork Anchor River will be reduced.

23 CFR 650.111(c)(2) Impacts on natural and beneficial floodplain values

DISCUSSION:

Natural and beneficial floodplain values include flood and erosion control, water quality maintenance, groundwater recharge, and fish and wildlife habitat (FIFMTF, 1994). The project will expand the footprint of the road embankment which is located within and along the fringe of the floodplain due to a southbound passing lane and shoulder widening. This will have the effect of a slight decrease in the flood capacity. Since the impact will occur on the edges of the existing floodplain, it may somewhat reduce the water quality maintenance functions of filtering runoff but is unlikely to have a measurable effect groundwater recharge. Additional riprap at the downstream end of existing riprap at MP 169.8 and MP 160.5, the most practical of the erosion protection alternatives, may have negative impacts on fish habitat and channel capacity for flood flow passage, but will improve erosion control.

23 CFR 650.111(c)(3) Support of probably incompatible floodplain development

DISCUSSION:

Neither alternative will allow new routes or provide access to areas that were not previously served and so would not contribute to incompatible floodplain development.

23 CFR 650.111(c)(4) Measures to minimize floodplain impacts associated with the action

DISCUSSION:

Neither alternative proposes to raise the road elevation in the area of longitudinal encroachment. The proposed action includes replacing the crossings of the North Fork Anchor River and South Fork Anchor River with larger capacity structures to minimize floodplain impacts due to high flows. A design goal for erosion protection is for the water surface elevation of the Q_{100} to remain unchanged or be lowered. Placing erosion protection could raise the water surface elevation unless it is placed at or below the existing ground surface. Placment of erosion protection that does not result in net fill in the floodplain will be considered in the design. Managing the footprint of the road within the existing ROW by not increasing its width and by shifting the centerline away from the edge of the floodplain in areas where the floodplain is only mapped on one side of the road (MP 159.6 to MP 160 and near MP 160.5) will be considered in the design.

23 CFR 650.111(c)(5) Measures to restore and preserve the natural and beneficial floodplain values impacted by the action

DISCUSSION:

Existing culverts at North Fork Anchor River, Two Moose Creek, and Beaver Creek are fish passage obstructions. The no-build alternative would not change this. The proposed action includes replacing culverts at Beaver and Two Moose Creeks with culverts designed for fish passage, flood flow, and wetland connectivity. The proposed action would provide a bridge in place of four culverts at the North Fork crossing, which would provide fish passage and animal crossing and enhance stream connectivity. The proposed action will also reconstruct the bridge crossing at the South Fork Anchor River and will extend the span (channel opening) from 80 feet to 280 feet, thereby restoring the floodplain values through a more natural stream bank and river channel.

23 CFR 650.111(d) Evaluate and discuss the practicability of alternatives to any *significant encroachments* or any *support of incompatible floodplain development*

DISCUSSION:

Significant encroachments. There is more potential for interruption of emergency vehicles under the no-build scenario since this highway serves as the only continuous land transportation route south of Anchor Point. The existing crossings at North Fork Anchor River and South Fork Anchor River have been noted by FEMA as threatened by flood flows. Streambank erosion at MP 159.8 and MP 160.5 has the potential for interruption of emergency vehicles. The proposed actions would reduce this potential by replacing the culverts and bridge and providing erosion protection. These alternatives do not pose significant risk or have significant adverse impacts on natural and beneficial floodplain values.

Support base floodplain development. Neither alternative would encourage or allow additional development in the floodplain.

LOCAL FLOODPLAIN MANAGEMENT

There will be local review of the project by the Kenai Peninsula Borough's floodplain management agency for conformance to their criteria.

FEDERAL FLOOD RISK MANAGEMENT STANDARD

Executive Order 13690, issued January 30, 2015, on floodplain management (80 Federal Register (FR) 6425-6428, 2015) and U.S. Department of Transportation Federal Highways Administration Order 5520; *Transportation System Preparedness and Resilience to Climate Change and Extreme Weather Events* (December 15, 2014) require federally funded highway projects to design for resiliency under climate change. Although no rulemaking has been conducted to carry out these orders, guidelines for implementation suggest that 2- to 3-foot of freeboard should be added to the current base flood elevations for floodplain determination (80 FR 6426, 2015). Although the rule is in draft form, the project design meets these standards. Based on design dated January 2016, road elevations at MPs where Base Flood Elevations are shown on the preliminary DFIRMs are as presented in Table 3.

Table 3 Design Roadway Finished Grade and Base Flood Elevations

Mile Post	Finished Roadway Grade Elevation (feet)	Preliminary DFIRM Base Flood Elevation (feet)
160	137	132
160.5	156	148
161	177	168

SUMMARY/ONLY PRACTICABLE ALTERNATIVE FINDING

The proposed action of rehabilitating the existing road located within in the existing floodplain, providing larger culverts at Two Moose, Beaver, and Ruby creeks, adding passing and climbing lanes, realigning horizontal and vertical curves, and replacing the North Fork Anchor River culverts and South Fork Anchor River bridge is the only practicable alternative due to the environmental impacts and the costs of relocating the road out of the floodplain. There are no practical alternatives that would create less impact than is already incurred by the presence of the road.

As part of the project, an application will be made to the KPB for a floodplain development permit(s) for stream crossings and for fill in the floodplain in the longitudinal encroachment area. By complying with the permit(s), the proposed action conforms to local floodplain protection standards.

Based on the current design, the proposed project will not result in a significant encroachment, as defined in 23 CFR 650.105(q), nor would it be expected to support incompatible floodplain development.

REFERENCES

State of Alaska Department of Transportation & Public Facilities Central Region (DOT&PF). 2013. Preliminary Engineering Report. October 4.

Executive Order 13690 of January 30, 2015, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input. *Federal Register*, 80 FR 6425. Federal Register Document Number: 2015-02379 Filed 2-3-15; 11:15 a.m. (2015): 6425- 6428. Executive Office of the President. Publication Date: Wednesday, February 04, 2015. http://www.gpo.gov/fdsys/pkg/FR-2015-02-04/html/2015-02379.htm. https://federalregister.gov/a/2015-02379

Federal Emergency Management Agency (FEMA). 1981. Flood Insurance Rate Map (FIRM). Kenai Peninsula Borough, Alaska. Community-Panel Number 020012 4325A. May 19.

FEMA. 2009. FIRM Community-Panel Number, 020107 6020B, September 25.

FEMA. 2013. Flood Insurance Study. Kenai Peninsula Borough, Alaska. Flood Insurance Study Number 02122CV00A. September 27.

FEMA. 2014a. Preliminary Flood Insurance Study. Kenai Peninsula Borough, Alaska. Flood Insurance Study Number 02122CV001B. June 13.

FEMA. 2014b. Preliminary FIRM Database. Kenai Peninsula Borough, Alaska. Product ID 02122C_PRELIMDB. June 30.

Federal Interagency Floodplain Management Task Force (FIFMTF). 1994. A Unified National Program for Floodplain Management. Washington, D.C.

Garner, Marcus. 2002. Flooding shuts down Sterling Highway again. Peninsula Clarion. November 24.

Tunseth, Matt. 2002. Flooding closes Sterling Highway near Anchor Point. Peninsula Clarion. May 2.

ATTACHMENTS

Figure 1 Location and Vicinity Map
Figure 2 Current Floodplain Mapping (5/19/1981)
Figure 3 Preliminary Floodplain Mapping (6/30/2014) along Project Corridor
Figure 4 Preliminary Floodplain Mapping (6/30/2014) Zones A and AE

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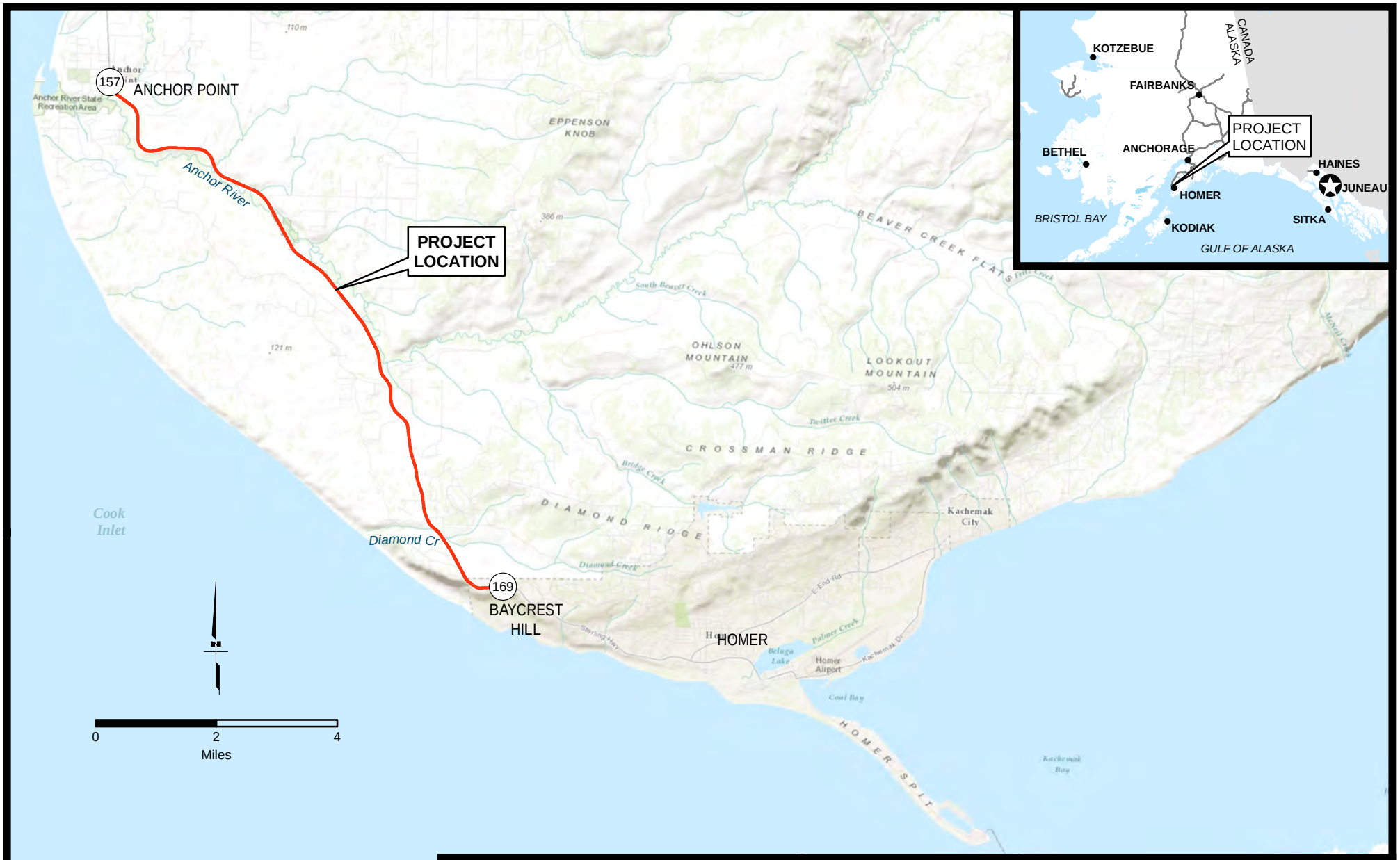

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Figure 1
Location & Vicinity Map

Sec 18-20,29,32-33 T5S R14W,
Sec 4-5, 9, 15-16 T6S R14W
Sec 3-4, 10-13 T5S R15W
Seward Meridian, Alaska

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

DOT & PF Project No.Z581060000
Federal Project No. 0211052
Sterling Hwy MP 157-169
Location Hydraulic Study

Anchor Point to Homer, Alaska

January 27, 2016 | Figure 1

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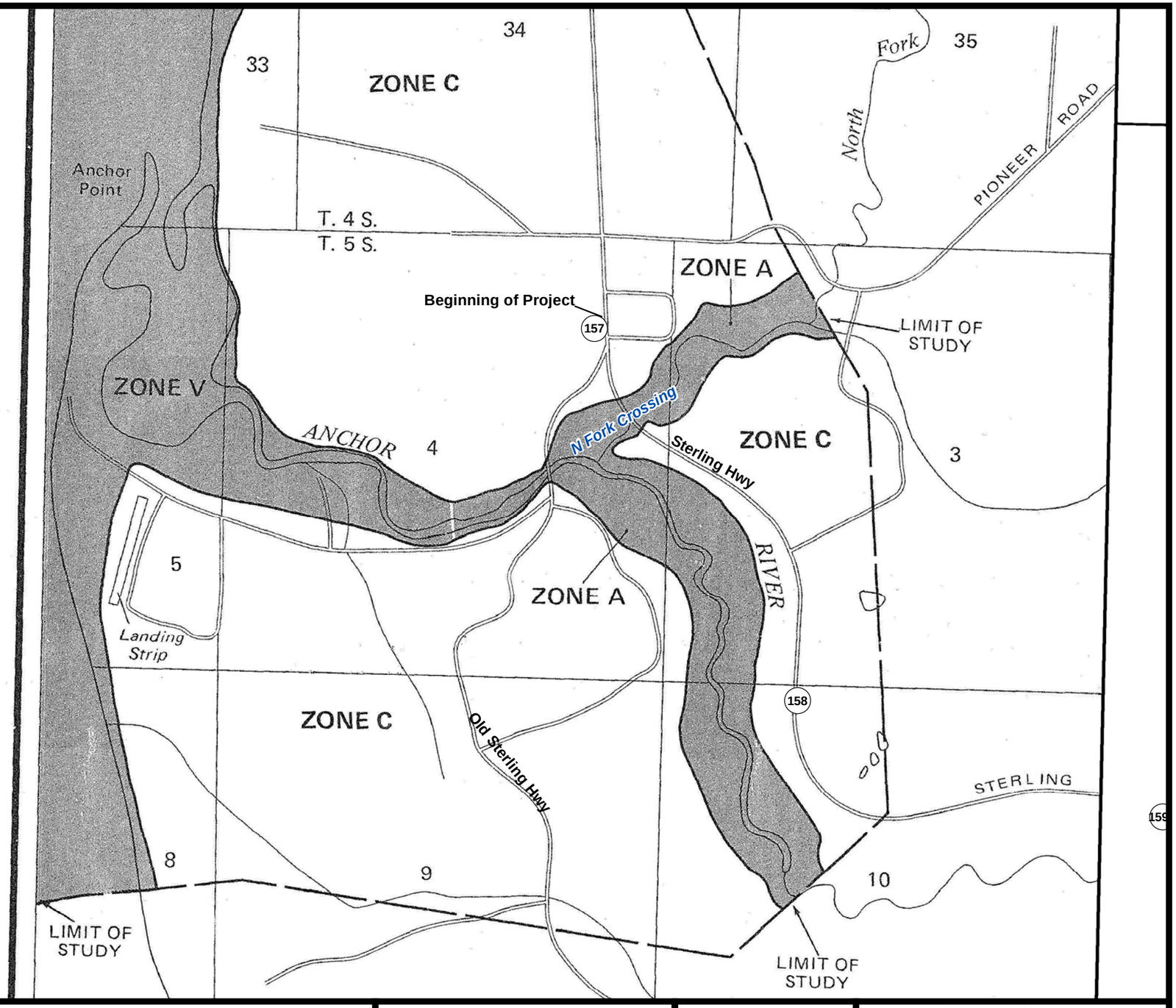

0 500 1,000
Feet

Figure 2
Current (5/19/1981)
Floodplain Mapping

Sec 34 T4S R15W
Sec 3-4, 10-13 T5S R15W
Seward Meridian, Alaska

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

DOT & PF Project No.Z581060000
Federal Project No. 0211052
Sterling Hwy MP 157-169
Location Hydraulic Study

Anchor Point to Homer, Alaska

January 27, 2016 | Figure 2

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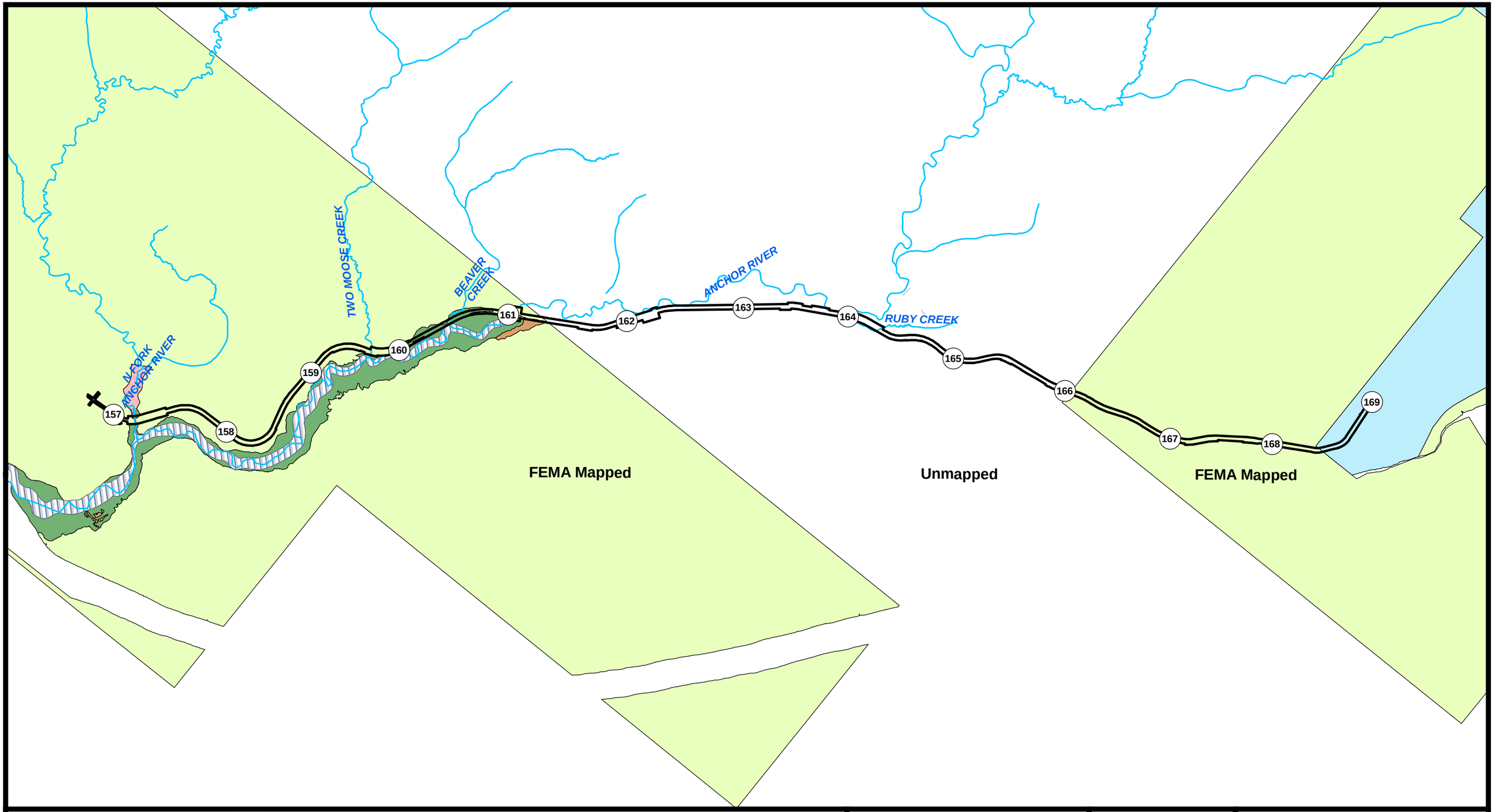

- Milepost
- Highway Right-of-Way
- Anadromous Streams ADF&G
- Regulatory Floodway
- Zone A - 100 Year Floodplain
- Zone AE - 100 Year Floodplain with Base Flood Elevation
- Zone B - 500 Year Floodplain
- Zone D - Possible but undetermined flood hazard
- Zone X - Area Determined to be Outside the 500 Year Floodplain

0 0.5 1
Miles

Figure 3
Preliminary (6/3/2014)
Floodplain Mapping
Along Project Corridor

Sec 34 T4S R15W
Sec 3-4, 10-13 T5S R15W
Seward Meridian, Alaska

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

DOT & PF Project No.Z581060000
Federal Project No. 0211052
Sterling Hwy MP 157-169
Location Hydraulic Study

Anchor Point to Homer, Alaska

January 27, 2016 | Figure 3

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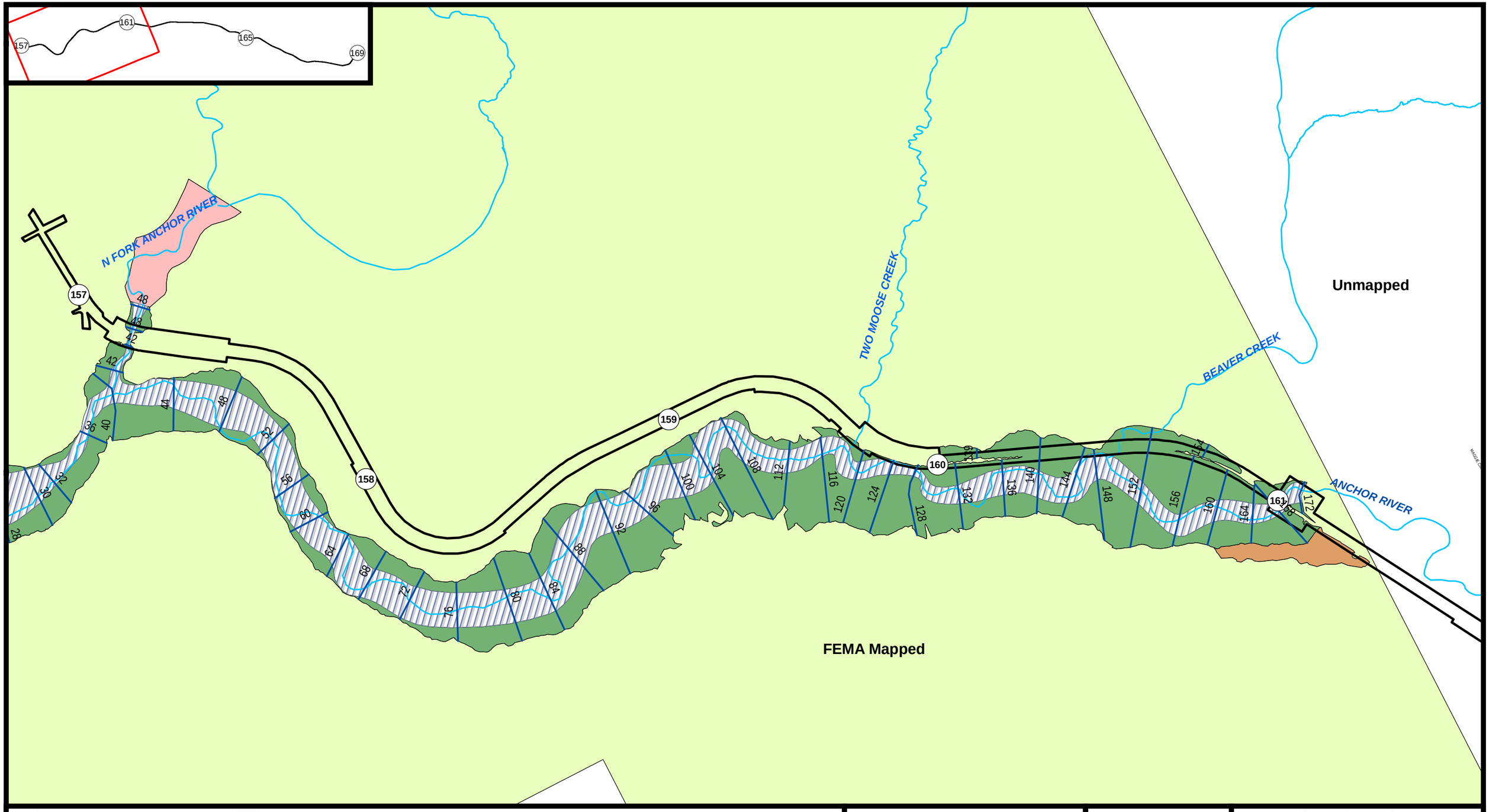

Figure 4
Preliminary (6/3/2014) Floodplain Mapping Zones A and AE

Sec 34 T4S R15W
Sec 3-4, 10-13 T5S R15W
Seward Meridian, Alaska

- (#) Milepost
- Highway Right-of-Way
- Anadromous Streams ADF&G
- XX Base Flood Elevation (Elevations listed in feet)
- Regulatory Floodway
- Zone A - 100 Year Floodplain
- Zone AE - 100 Year Floodplain with Base Flood Elevation
- Zone B - 500 Year Floodplain
- Zone X - Area Determined to be Outside the 500 Year Floodplain

0 500 1,000
Feet

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

DOT & PF Project No.Z581060000
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Sterling Hwy MP 157-169
Location Hydraulic Study

Anchor Point to Homer, Alaska

January 27, 2016 | Figure 4

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