US Army Corps of Engineers
Alaska District

Public Notice of Application for Permit

Juneau Field Office
Regulatory Division (1145)
CEPOA-RD
Post Office Box 22270
Juneau, Alaska 99802-2270

PUBLIC NOTICE DATE:	**November 12, 2020**
EXPIRATION DATE:	**December 14, 2020**
REFERENCE NUMBER:	**POA-2009-01254**
WATERWAY:	**Favorite Bay**

Interested parties are hereby notified that a Department of the Army (DA) permit application has been received for work in waters of the United States (U.S.) as described below and shown on the enclosed project drawings.

All comments regarding this Public Notice (PN) should be sent to the address noted above. If you desire to submit your comments by email, you should send it to the Project Manager's email as listed below or to regpagemaster@usace.army.mil. All comments should include the PN reference number listed above.

All comments should reach this office no later than the expiration date of this PN to become part of the record and be considered in the decision. Please contact Randal Vigil at (907) 790-4491, or by email at Randal.P.Vigil@usace.army.mil if further information is desired concerning this notice.

APPLICANT: Alaska Department of Transportation and Public Facilities, Southcoast Region, 6860 Glacier Highway, Juneau, AK 99811.

LOCATION: The project site is located within Section 5, 6, & 8, T. 51 S., R. 68 E., Copper River Meridian; USGS Quad Map Sitka B-2; Latitude 57.475520º N., Longitude 134.553167º W.; in Angoon, Alaska.

PURPOSE: The applicant's stated purpose is to construct a land-based airport.

PROPOSED WORK: The applicant requests authorization for the proposed discharge of fill material into waters of the United States (WOTUS), including wetlands, for the construction of the proposed Angoon land-based airport project:

Summary of Proposed Permanent and Temporary Impacts to WOTUS.

Water resource type	Permanent impacts – convert wetlands to uplands (acres) or stream loss (lf)		Alteration / Temporary impacts Wetlands (acres) and streams (lf)		
	Construct airport (runway, apron, roads etc.)	Maximum Waste disposal	Tree removal – leave stumps	Selective logging	Clearing and stockpiling
Bog forest	24.13 ac	13.45 ac	66.17 ac	9.78 ac	0 ac
Bog woodland	16.27 ac	16.21 ac	46.56 ac	0 ac	0 ac
Streams	1,279.98 lf	0 lf	6,258.07 lf	104.32 lf	0 lf
Subtotal wetlands	40.40 ac	29.66 ac	112.73 ac	9.78 ac	0 ac
Subtotal streams	1,276.98 lf*	0 lf	6,258.07 lf	104.32 lf	0 lf
Total Maximum Wetland Fill		**70.06 ac**	Total Temp. Wetland Impact		**122.51 ac**
Total Stream Loss*		**1,867.90 lf**	Total Temp. Stream Impact		**6,046.39 lf**
Re-aligned Stream 10MF		**550 lf**			
Net Stream Impact		**1,317.90 lf**			

*Includes 1,276.9 cubic yards of fill in Streams 17, 10NF, 10SF, and MF; piping Stream 10SF 175 feet; piping Stream 17 100 feet under the perimeter embankment road and filling 316 feet of Stream 17 in the waste disposal area.

Summary of Types of Fill Proposed in WOTUS.

Type of Fill*	Purpose of Fill and Quantity	
	Airport construction (access road, perimeter road, apron, taxiway and runway)	**Waste Disposal** (organics, fines, woody debris)
General		
Unsuitable material from site excavation – organic soil (peat, muck), fines (silts and clays) and woody debris	De minimus**	46,635 yd.³
Suitable materials from on-site excavation – silt, clay, sand, gravel, rock	355,365 yd.³	--
Subbase	54,516 yd.³	--
Concrete rock drains (2”H x 2”W, var. lengths) for the perimeter road	Up to 21 (each)	--

CS Pipe – 36” plus sand bedding (access road, AWOS pad, second wind cone)	3 (each) + 20 yd.³	--
Stream 10MF Runway Undercrossing and Realignment		
Aluminum Structural Plate (ASP) pipe	261’Lx11’Hx12’W	--
Riprap, Class II- inlet and outlet protection)	1,060 yd.³	--
Class B bedding (for the ASP pipe)	2,150 yd.³	--
Concrete slurry (for the ASP pipe)	600 yd.³	--
Geomembrane (for the ASP pipe)	760 yd.³	--
Sand bedding (for the ASP pipe)	360 yd.³	--
Stream and pool substrate (new channel)	460 yd.³	--
Habitat rocks (new channel)	145 (each)	--
Large Wood (new channel)	45 pieces	--
Subtotal	415,291 yd.³	43,635 yd.³
Total	**458,926 yd.³**	

*Does not include base rock or asphalt for the finished surfaces
**A de minimus amount of organics would be back-filled in wetlands as part of site excavation.

All work would be performed in accordance with the enclosed plan, 6 sheets dated September 10, 2020, and 35 sheets dated July 31, 2020.

ADDITIONAL INFORMATION: In 2016, the Federal Aviation Administration (FAA) published a Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the proposed Angoon land-based airport. The FEIS and ROD is available for review online at: https://www.faa.gov/airports/environmental/records_decision/agn/ or http://dot.alaska.gov/sereg/projects/angoon_airport_new/documents.shtml.

APPLICANT PROPOSED MITIGATION: The applicant proposes the following mitigation measures to avoid, minimize, and compensate for impacts to waters of the U.S. from activities involving discharges of dredged or fill material.

a. Avoidance: Five action alternatives, including the preferred alternative, was evaluated in the FEIS, and all would have significant effects on waters of the U.S. ranging from 43 to 112 acres of wetland fill and 43 to 83 acres of wetland alteration, primarily due to tree removal. The four other action alternatives were located on federal public lands (the Admiralty Island National Monument/Kootznoowoo Wilderness Area) on Favorite Bay to the east. Alternative 12a (the proposed project area) was selected as the preferred alternative because it had the least amount of impacts to historical resources and the environment. It avoided the National Monument/Wilderness Area, had the least amount of terrain disturbance, did not require a bridge, and had the shortest access road (0.2 mile) compared to the other action alternatives. Several variations of the Alternative 12a EIS alignment were evaluated during the early design of the proposed project.

b. Minimization: During construction, several minimization measures are proposed to reduce impacts to water resources. These measures include the following:

- Installing erosion and sediment controls prior to the commencement of earthwork for each construction phase to protect adjacent resources (Sheets P2.0-2.4, Attachment C).
- Establishing staging and stockpiling as close to the airport entrance and Aukta Street as possible to limit the need for temporary construction roads.
- Establishing the minimum number of temporary haul routes and stream crossings necessary to efficiently log the site.
- Leaving the stumps of cut trees in place to minimize soil disturbance.
- Seeding stormwater ditches with an herbaceous wetland seed mix to improve water quality prior to discharge to adjacent bog woodland and bog forest.
- Installing the proposed ASP pipe underpass perpendicular to the runway to minimize the amount of stream length in a pipe.
- Storing fuels and/or equipment more than 100 feet away from streams.
- Isolating stream flows during construction to prevent sedimentation of downstream waters.

c. Compensatory Mitigation: Unavoidable impacts to wetlands and streams are proposed to be offset by purchasing credits from approved mitigation banks and/or in-lieu fee programs. See the enclosed proposed compensatory mitigation plan.

WATER QUALITY CERTIFICATION: A permit for the described work will not be issued until a certification or waiver of certification, as required under Section 401 of the Clean Water Act (Public Law 95-217), has been received from the Alaska Department of Environmental Conservation.

CULTURAL RESOURCES: The lead Federal agency, FAA, is responsible for compliance with the requirements of Section 106 of the National Historic Preservation Act. The Corps of Engineers (Corps) has reviewed the Section 106 documentation from FAA and concurs with their findings and/or determinations.

ENDANGERED SPECIES: No threatened or endangered species are known to use the project area.

We have determined the described activity would have no effect on any listed or proposed threatened or endangered species and would have no effect on any designated or proposed critical habitat under the Endangered Species Act of 1973 (87 Stat. 844). Therefore, no consultation with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service (NMFS) is required. However, any comments they may have concerning endangered or threatened wildlife or plants, or their critical habitat will be considered in our final assessment of the described work.

ESSENTIAL FISH HABITAT: The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996, requires all Federal agencies to consult with the NMFS on all actions, or proposed actions, permitted, funded, or undertaken by the agency, that may adversely affect Essential Fish Habitat (EFH).

No EFH species are known to use the project area.

We have determined the described activity would not adversely affect EFH in the project area.

TRIBAL CONSULTATION: The Alaska District fully supports tribal self-governance and government-to-government relations between Federally recognized Tribes and the Federal government. Tribes with protected rights or resources that could be significantly affected by a proposed Federal action (e.g., a permit decision) have the right to consult with the Alaska District on a government-to-government basis. Views of each Tribe regarding protected rights and resources will be accorded due consideration in this process. This Public Notice serves as notification to the Tribes within the area potentially affected by the proposed work and invites their participation in the Federal decision-making process regarding the protected Tribal right or resource. Consultation may be initiated by the affected Tribe upon written request to the District Commander during the public comment period.

PUBLIC HEARING: Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for public hearings shall state, with particularity, reasons for holding a public hearing.

EVALUATION: The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts of the proposed activity and its intended use on the public interest. Evaluation of the probable impacts, which the proposed activity may have on the public interest, requires a careful weighing of all the factors that become relevant in each particular case. The benefits, which reasonably may be expected to accrue from the proposal, must be balanced against its reasonably foreseeable detriments. The outcome of the general balancing process would determine whether to authorize a proposal and if so, the conditions under which it will be allowed to occur. The decision should reflect the national concern for both protection and utilization of important resources. All factors, which may be relevant to the proposal, must be considered, including the cumulative effects thereof. Among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people. For activities involving 404 discharges, a permit will be denied if the discharge that would be authorized by such permit would not comply with the Environmental Protection Agency's 404(b)(l) guidelines. Subject to the preceding sentence and any other applicable guidelines or criteria (see Sections 320.2 and 320.3), a permit will be granted unless the District Commander determines that it would be contrary to the public interest.

The Corps is soliciting comments from the public; Federal, State, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps to determine whether to issue, modify, condition, or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act.

Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

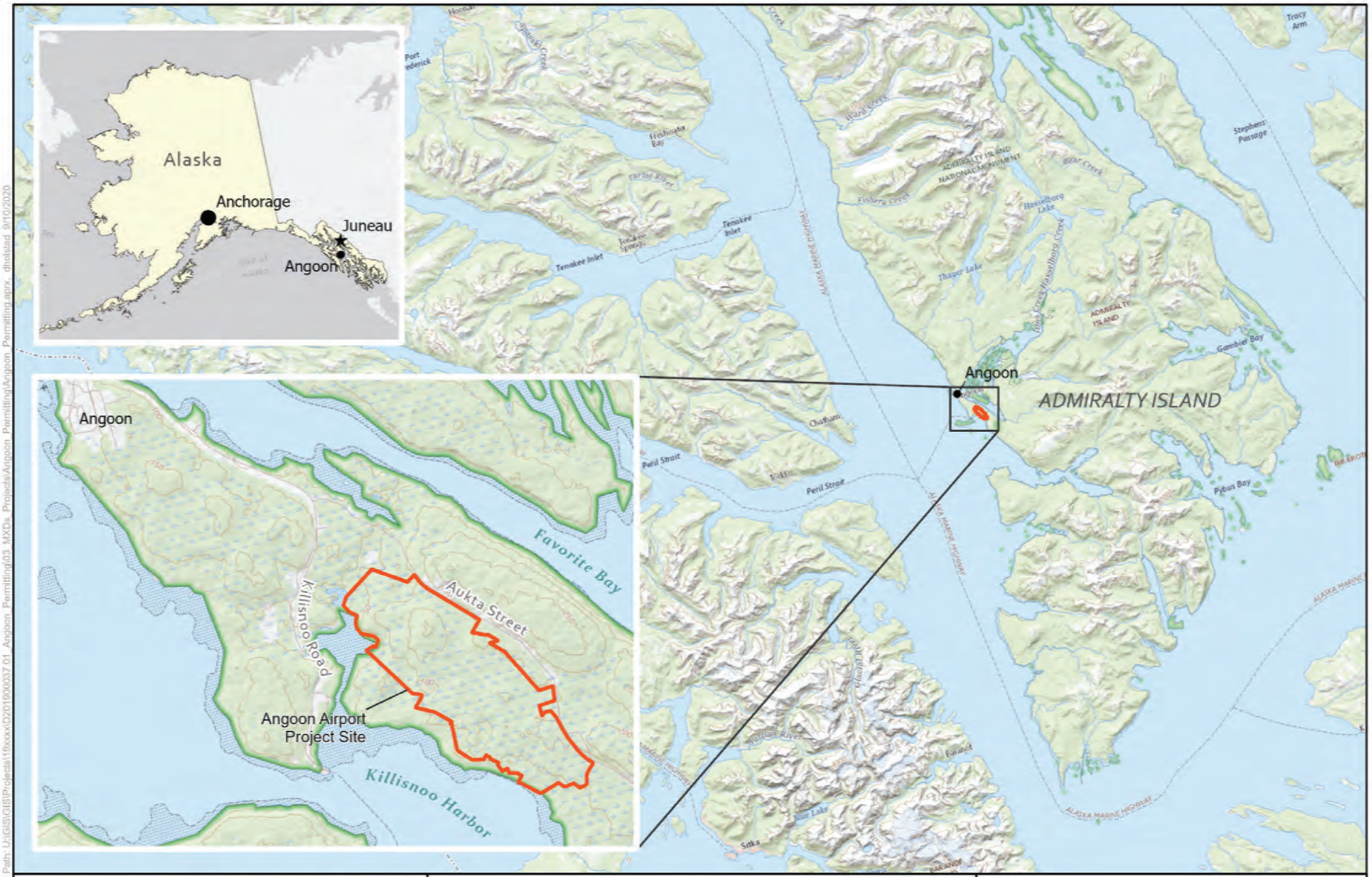
AUTHORITY: This permit will be issued or denied under the following authority:

(X) Discharge dredged or fill material into waters of the United States – Section 404 Clean Water Act (33 U.S.C. 1344). Therefore, our public interest review will consider the guidelines set forth under Section 404(b) of the Clean Water Act (40 CFR 230).

Project drawings are enclosed with this Public Notice.

District Commander
U.S. Army, Corps of Engineers

Enclosures



Parts of Sec 5, 6, & 8, T51S, R68E, CM; 134°33'1"W, 57°28'34"N. Coordinate System: NAD 1983 StatePlane Alaska 1 FIPS 5001 Feet

0 10 Miles

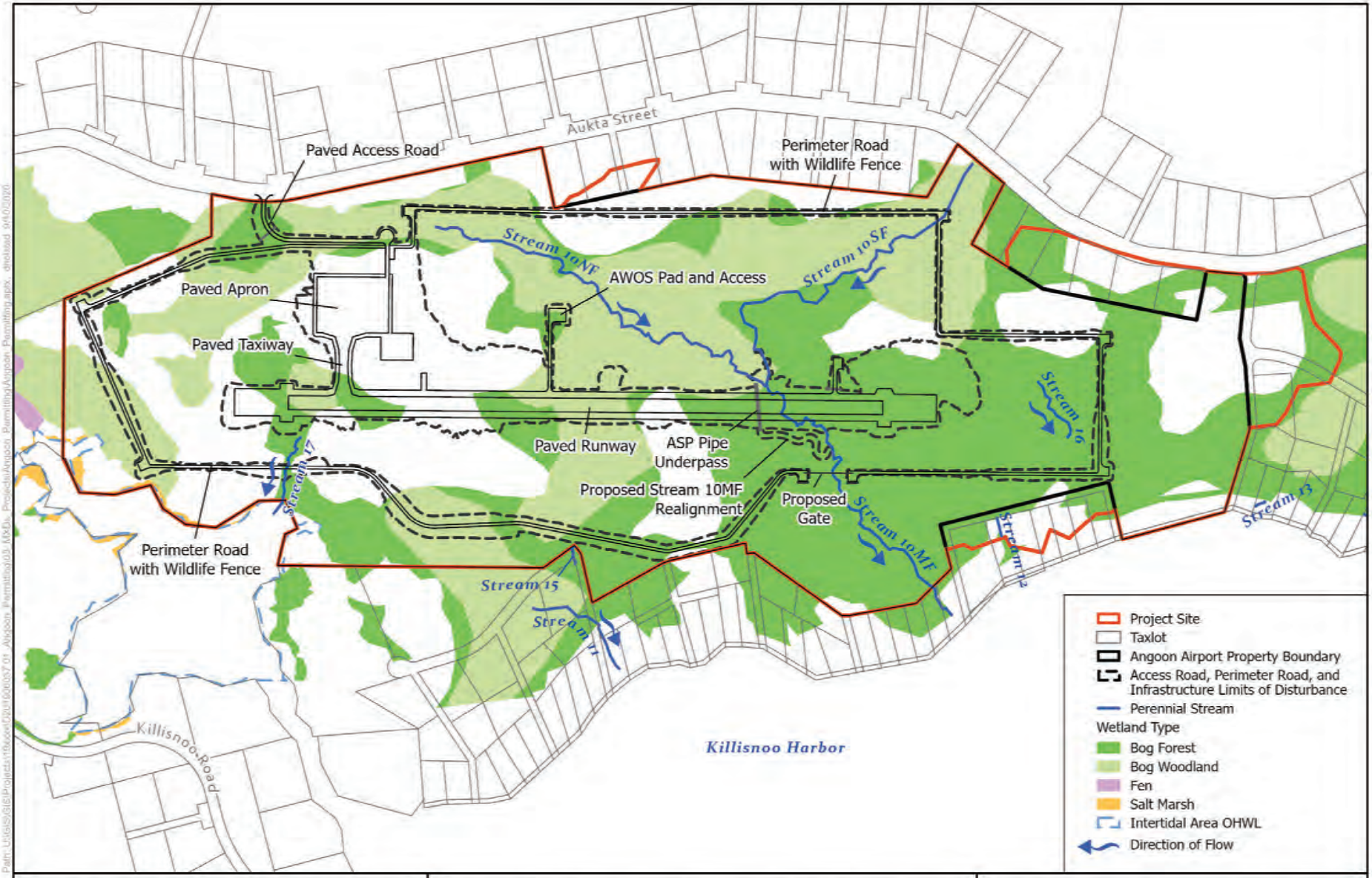
Applicant: Alaska Department of Transportation & Public Facilities
File No.: TBD
Waterway: Killisnoo Harbor
Proposed Activity: Airport and Perimeter Fence Road

Vicinity Map

Sheet 1 of 6

Date 9/10/2020

POA-2009-01254, Favorite Bay



Parts of Sec 5, 6, & 8, T51S, R68E, CM; 134°33'1"W, 57°28'34"N. Coordinate System: NAD 1983 StatePlane Alaska 1 FIPS 5001 Feet

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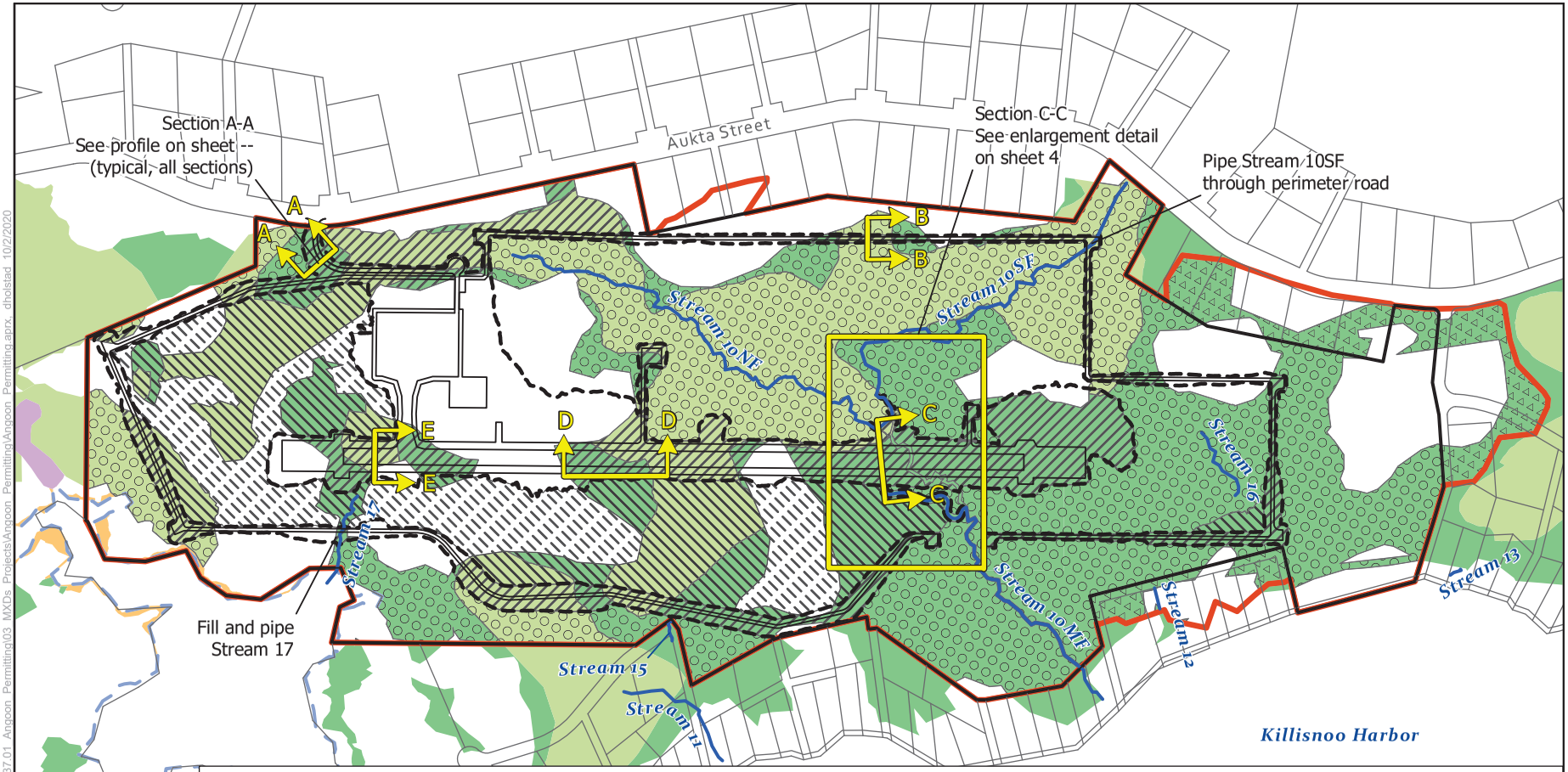
Applicant: Alaska Department of Transportation & Public Facilities
File No.: TBD
Waterway: Killisnoo Harbor
Proposed Activity: Airport and Perimeter Fence Road

Existing and Proposed Conditions

Sheet 2 of 6

Date 9/10/2020

POA-2009-01254, Favorite Bay



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Parts of Sec 5, 6, & 8, T51S, R68E, CM; 134°33'1"W, 57°28'34"N. Coordinate System: NAD 1983 StatePlane Alaska 1 FIPS 5001 Feet

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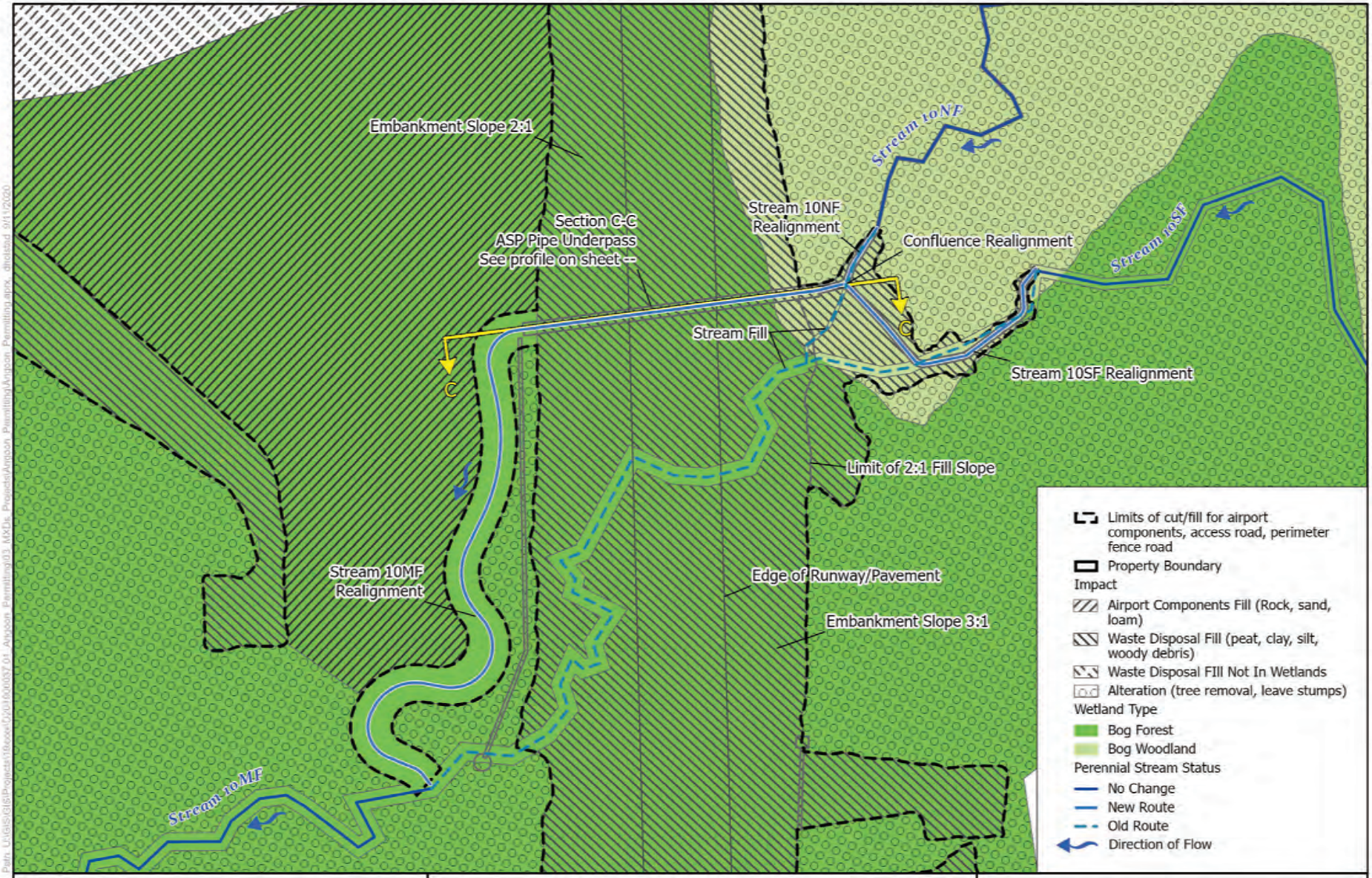
Applicant: Alaska Department of Transportation & Public Facilities
File No.: TBD
Waterway: Killisnoo Harbor
Proposed Activity: Airport and Perimeter Fence Road

Water Resource Impacts

Sheet 3 of 6

Date 9/10/2020

POA-2009-01254, Favorite Bay



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Feet

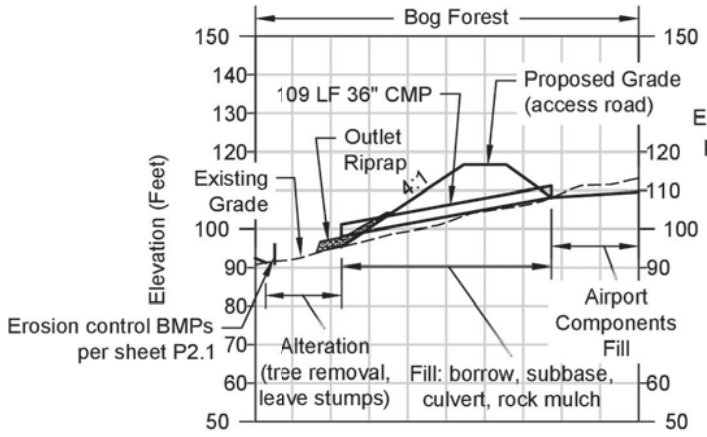
Applicant: Alaska Department of Transportation & Public Facilities
File No.: TBD
Waterway: Killisnoo Harbor
Proposed Activity: Airport and Perimeter Fence Road

Water Resource Impacts Detail

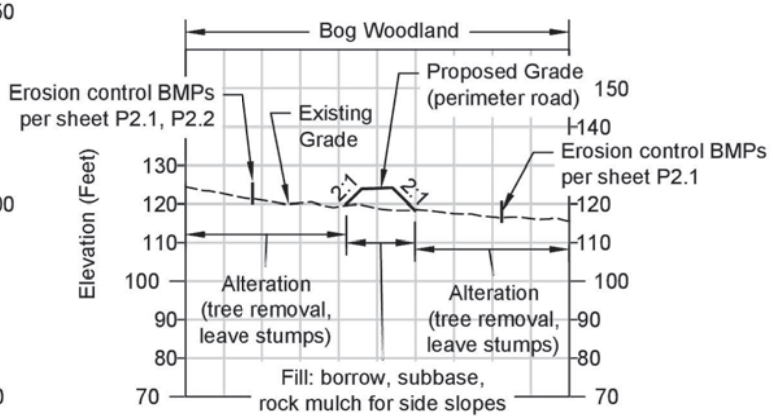
Sheet 4 of 6

Date 9/10/2020

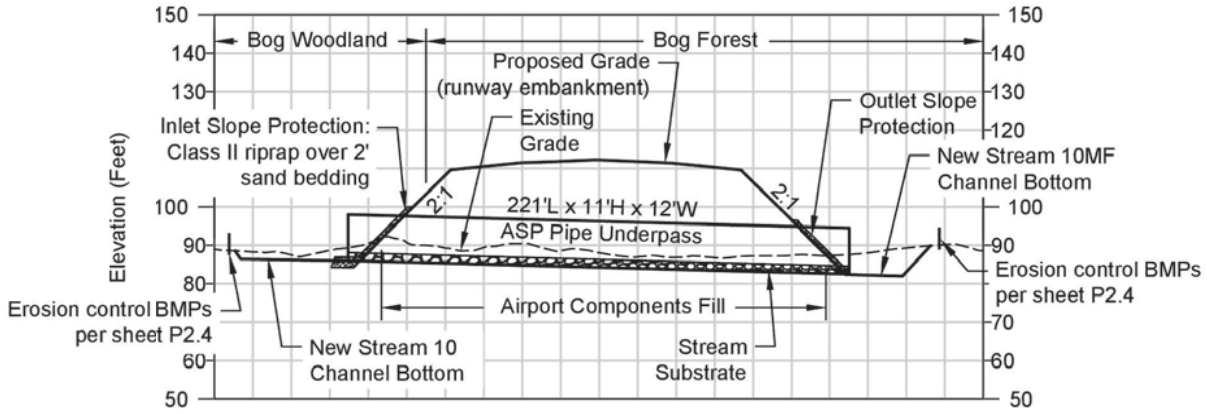
POA-2009-01254, Favorite Bay



Profile View of Section A-A



Profile View of Section B-B



Profile View of Section C-C

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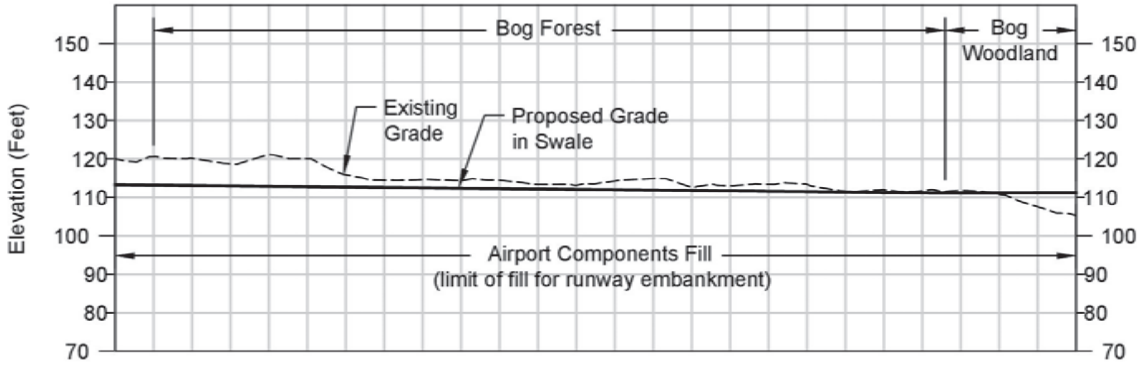
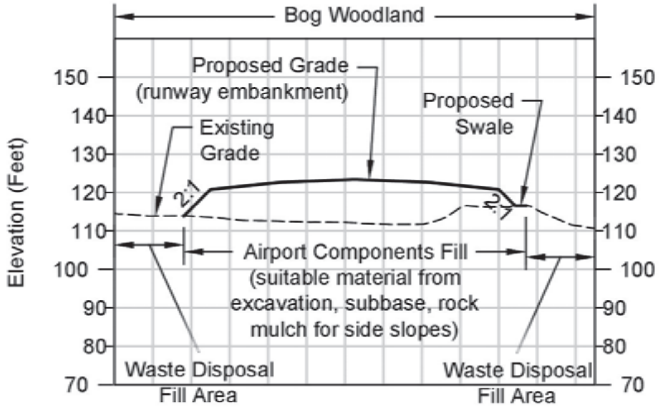
Parts of Sec 5, 6, & 8, T51S, R68E, CM; 134°33'1"W, 57°28'34"N. Coordinate System: NAD 1983 StatePlane Alaska 1 FIPS 5001 Feet	Applicant: Alaska Department of Transportation & Public Facilities File No.: TBD Waterway: Killisnoo Harbor Proposed Activity: Airport and Perimeter Fence Road	Water Resource Impact Profiles Sheet 5 of 6 Date 9/10/2020 POA-2009-01254, Favorite Bay

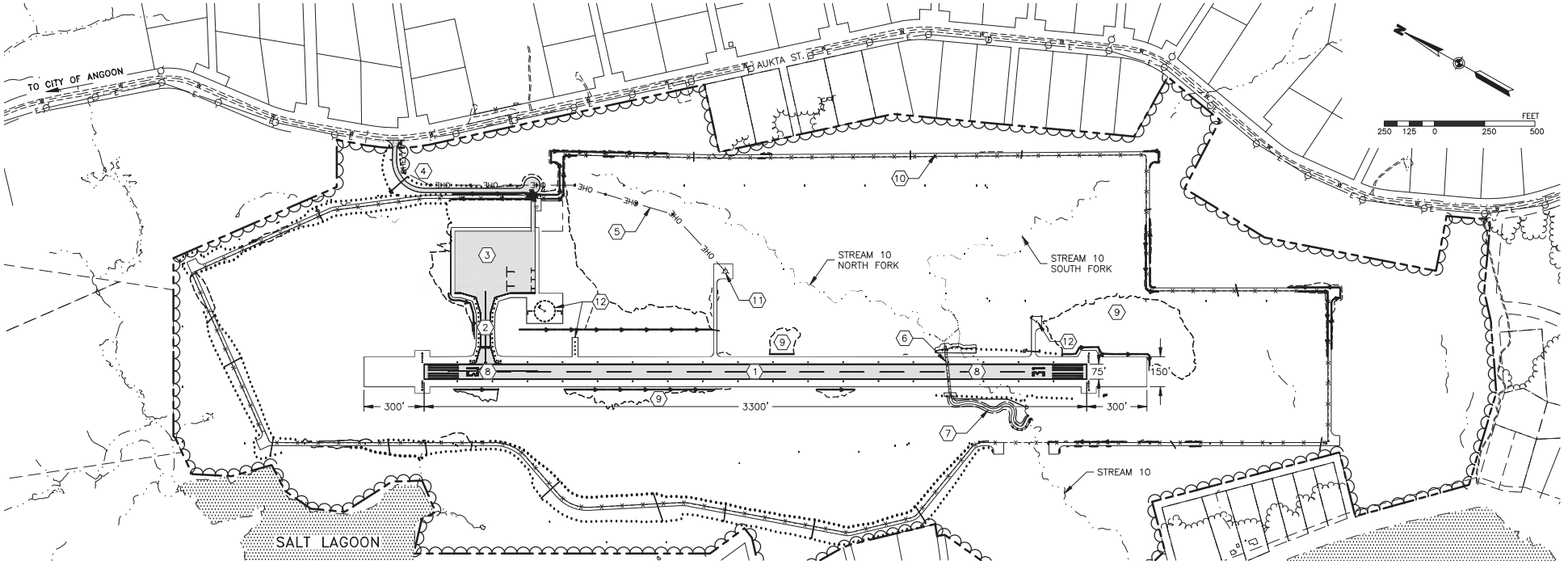


Profile View of Section D-D



Profile View of Section E-E

Parts of Sec 5, 6, & 8, T51S, R68E, CM; 134°33'1"W, 57°28'34"N. Coordinate System: NAD 1983 StatePlane Alaska 1 FIPS 5001 Feet	Applicant: Alaska Department of Transportation & Public Facilities File No.: TBD Waterway: Killisnoo Harbor Proposed Activity: Airport and Perimeter Fence Road	Water Resource Impact Profiles Sheet 6 of 6 Date 9/10/2020 POA-2009-01254, Favorite Bay

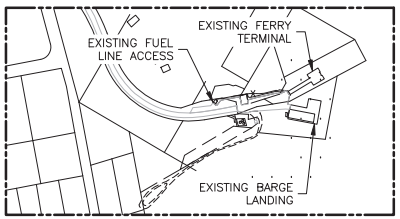


PROJECT SCOPE:

1. PAVED RUNWAY (75'x3300') WITH EDGE LIGHTING, MARKINGS, AND GRAVEL SAFETY AREA (150'x3900')
2. PAVED TAXIWAY (35'x363') WITH MARKINGS
3. PAVED APRON (300'x400') WITH MARKINGS, AIRCRAFT TIE DOWNS, AND GRAVEL LEASE AREA
4. PAVED ACCESS ROAD (20'x875')
5. POWER AND COMMUNICATION UTILITY EXTENSIONS
6. ASP PIPE UNDERPASS
7. STREAM REALIGNMENT
8. EMBANKMENT SURCHARGE
9. TERRAIN OBSTRUCTION REMOVAL
10. PERIMETER ROAD WITH WILDLIFE FENCE
11. AWOS PAD & ACCESS
12. AVIATION INFRASTRUCTURE (WINDCONES, SEGMENTED CIRCLE, PAPI)

SHEET NOTES:

1. PRIOR TO CONSTRUCTION, LOCATE AND VERIFY THE HORIZONTAL AND VERTICAL SURVEY CONTROL TO ENSURE IT HAS NOT BEEN DESTROYED OR DISTURBED.
2. OBTAIN UTILITY FIELD LOCATES PRIOR TO EXCAVATION IN ACCORDANCE WITH THE SPECIFICATIONS.



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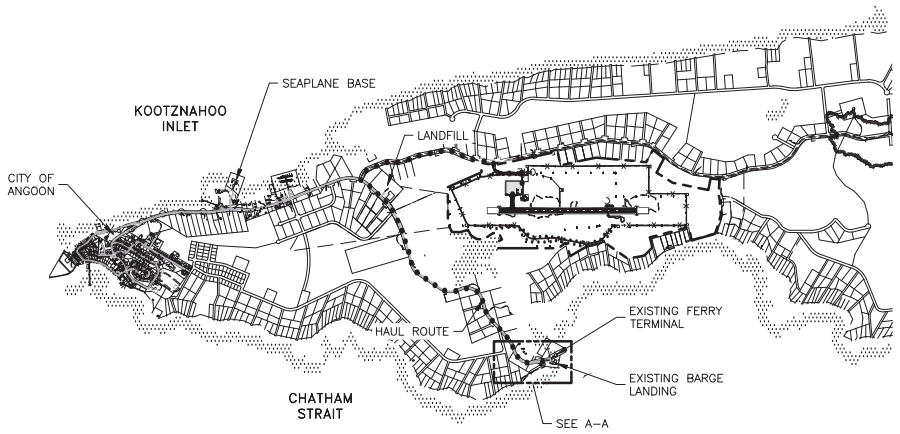

COMMUNITY OVERVIEW

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Checked By: AMS
Date Revised:
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POA-2009-01254, Favorite Bay

95% PS&E

NO.	DATE	REVISION

DEVELOPED BY:
PDC, A RESPEC COMPANY
9109 MENDENHALL MALL RD. STE. 4
JUNEAU, AK 99801
(907) 780-6060

Certificate of Authorization No: AECC605

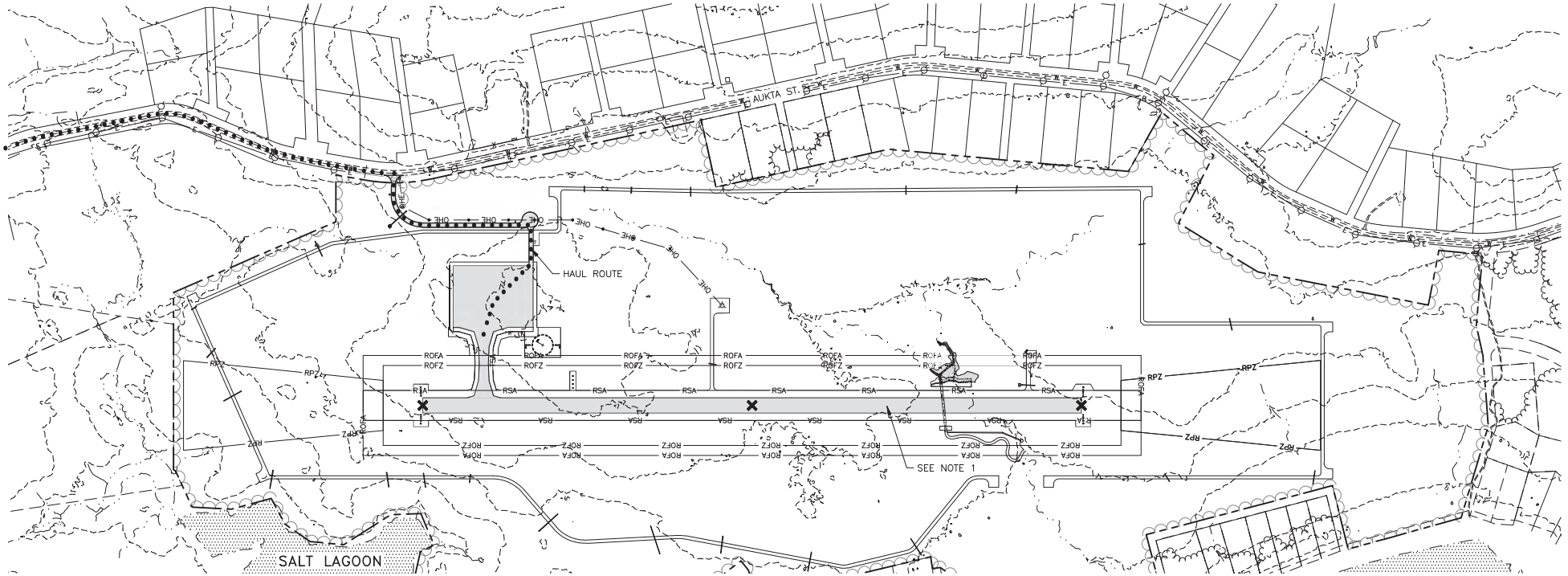
STATE OF ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES - SOUTHCOAST REGION
6860 GLACIER HIGHWAY
JUNEAU, ALASKA 99801
907-465-1763

ANGOON AIRPORT

ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3–02–XXXX–XXX–20XX

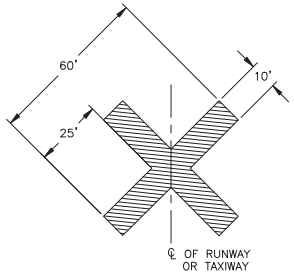
PROJECT LAYOUT PLAN

DATE: 7/31/20
SHEET: A3.0 OF 101
AS–BUILT SHEET:



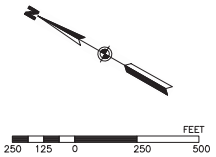
GENERAL SAFETY REQUIREMENTS:

1. SEE APPENDIX D OF THE SPECIFICATIONS FOR THE CONSTRUCTION SAFETY AND PHASING PLAN (CSPP) REQUIREMENTS. THE CONTRACTOR SHALL COMPLY WITH THE SAFETY REQUIREMENTS IN THE CSPP. ALL SAFETY RELATED WORK SHALL BE SUBSIDIARY TO THE CONTRACT AND NO ADDITIONAL PAYMENT WILL BE MADE.
2. THE CONTRACTOR SHALL SUBMIT A SAFETY PLAN COMPLIANCE DOCUMENT (SPCD), PER FAA AC 150/5370-2G, TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO ISSUANCE OF A NOTICE TO PROCEED. IF THE CONSTRUCTION PLAN DIFFERS FROM WHAT IS SHOWN OR IS SUBSEQUENT CHANGES ARE MADE, SUBMIT A REVISION TO THE ENGINEER FOR REVIEW AND APPROVAL.



RUNWAY CLOSURE NOTES:

1. ONCE RUNWAY CONSTRUCTION STARTS CONTRACTOR SHALL PROVIDE RUNWAY CLOSURE MARKERS TO INDICATE THE AREA IS NOT SAFE FOR LANDING. MARKERS SHALL BE IN ACCORDANCE WITH SPECIFICATION P-671.
2. THE CONTRACTOR SHALL MAINTAIN THE CLOSURE MARKERS UNTIL THE AIRPORT IS OPEN TO AIRCRAFT.



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SCALE: NOT TO SCALE

Date Revised:
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Designed By: DAT
Drawn By: EJM/HRB
Checked By: ABG

POA-2009-01254, Favorite Bay

95% PS&E

NO.	DATE	REVISION

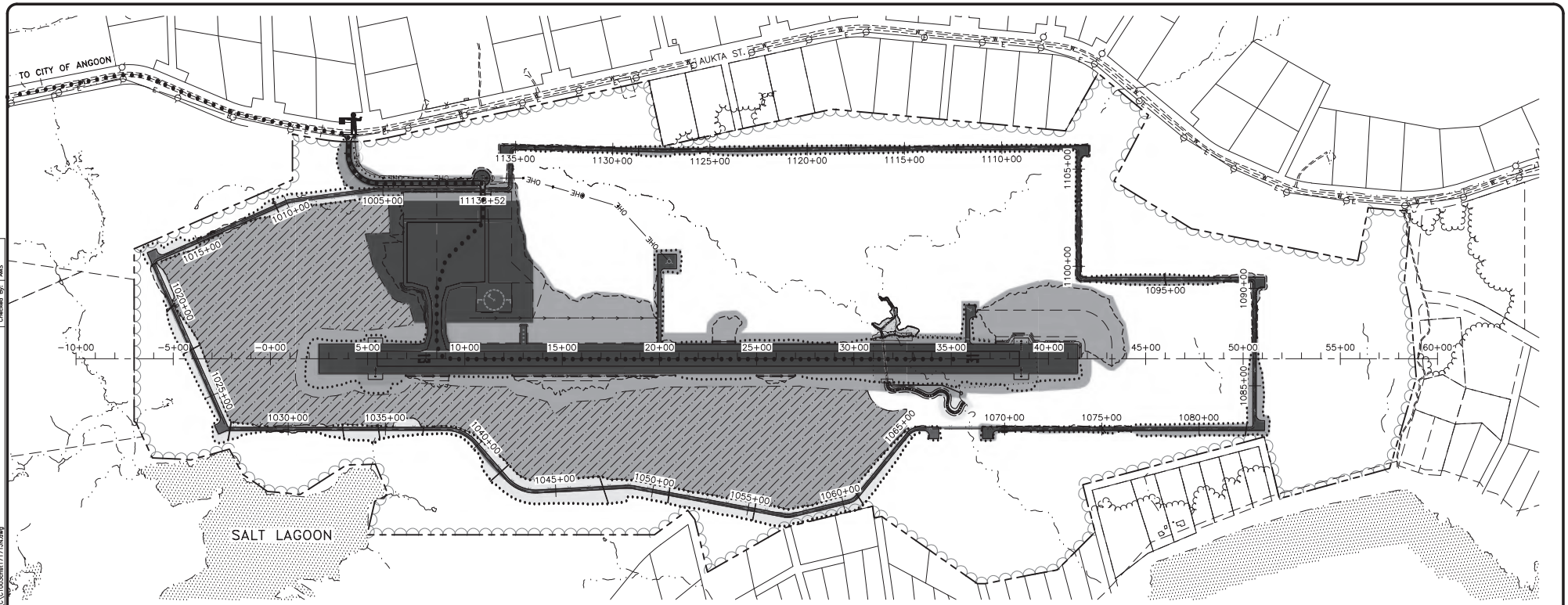
DEVELOPED BY:
PDC, A RESPEC COMPANY
9109 MENDENHALL MALL RD. STE. 4
JUNEAU, AK 99801
(907) 780-6060

Certificate of Authorization No: AECC605

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES - SOUTHCOAST REGION
6860 GLACIER HIGHWAY
JUNEAU, ALASKA 99801
907-465-1763

ANGOON AIRPORT
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
CONSTRUCTION SAFETY PHASING PLAN

DATE: 7/31/20
SHEET: A5.0 OF 101
AS-BUILT SHEET:



LEGEND:

- PHASE 1
- PHASE 2
- PHASE 3
- CONTRACTOR WASTE AREA
- CONTRACTOR HAUL ROUTE
- FLAGGER

SEQUENCE OF WORK NOTES:

THIS SEQUENCE REPRESENTS ONE WAY THE PROJECT COULD BE CONSTRUCTED. HOWEVER, THE CONTRACTOR SHALL BE RESPONSIBLE FOR DEVELOPING THEIR OWN SEQUENCE AND SCHEDULE TO MEET MILESTONE REQUIREMENTS AND PROJECT COMPLETION DATE. SEQUENCE AND SCHEDULE SHALL BE APPROVED BY THE ENGINEER. THE SEQUENCE SHALL BE COORDINATED WITHIN THIS PROJECT PLANS, SPECIFICATIONS, STORM WATER POLLUTION PREVENTION PLAN (SWPPP) MEASURES AND OVERALL CONSTRUCTION SCHEDULE. SUBMIT SEQUENCING PLANS FOR APPROVAL FIVE BUSINESS DAYS BEFORE SWPPP SUBMITTAL AND 10 DAYS BEFORE THE PRE-CONSTRUCTION CONFERENCE. CONSTRUCTION SCHEDULE AND SEQUENCE SHALL PROVIDE SUFFICIENT DETAIL TO ADDRESS REQUIRED SUBMITTALS, REVIEW PERIODS, PROCUREMENT OF MATERIALS, CONSTRUCTION WORK, AND FAA COORDINATION REQUIREMENTS ASSOCIATED WITH ALL ITEMS OF WORK. PROVIDE UPDATES FOR APPROVAL BY THE ENGINEER AS WORK PROGRESSES. DEVIATIONS FROM THE APPROVED SCHEDULE REQUIRE APPROVAL BY THE ENGINEER.

GRUBBING WITHIN THE EMBANKMENT LIMITS SHALL OCCUR PER THE REQUIREMENTS IN SECTION P-151 OF THE SPECIFICATIONS.

GENERAL SEQUENCE OF WORK:

PHASE 1:
ESTABLISH SITE ACCESS, DEVELOP/PREPARE MATERIAL SOURCE(S) AND WASTE DISPOSAL AREAS, CONSTRUCT AIRPORT ACCESS ROAD, CONSTRUCT PERIMETER ROAD TO STA. 1066+62, CONSTRUCT ASP PIPE UNDERPASS, CONSTRUCT STREAM CHANNEL REALIGNMENT, CONSTRUCT SURCHARGE 1, AND CONSTRUCT SURCHARGE 2.

PHASE 2:
GRUBBING AND WASTE DISPOSAL, EXCAVATION AND EMBANKMENT, RE-GRADE EXPOSED ROCK SURFACES, CONSTRUCT PERIMETER ROAD FROM STA. 1068+87 TO END, CONSTRUCT ELECTRIC LINE EXTENSION, REMOVE SURCHARGE 1, AND REMOVE SURCHARGE 2.

PHASE 3:
PROCESS AGGREGATES; INSTALL ELECTRICAL CONDUIT; PLACE SUBBASE, CRUSHED AGGREGATE BASE COURSE, AGGREGATE SURFACING MATERIAL, AND HOT MIX ASPHALT; INSTALL MARKINGS AND TIE-DOWNS; INSTALL AIRPORT LIGHTING, EQUIPMENT, AND NAVAIDS; AND INSTALL PERIMETER FENCE AND GATES.

ESTIMATED PROJECT MILESTONES:

M0	MARCH	2021	DEPARTMENT ISSUES NTP.
M1	MAY	2021	ASP PIPE UNDERPASS AND STREAM CHANNEL REALIGNMENT COMPLETE.
M2	SEPT.	2021	MATERIAL SOURCE(S) AND WASTE DISPOSAL AREAS DEVELOPED.
M3	DEC.	2021	LAST DAY FOR SURCHARGE CONSTRUCTION. BEGIN AUTOMATED MONITORING.
M4	MAY	2022	COMPLETE PERIMETER ROAD EMBANKMENT.
M5	OCTOBER	2022	END MONITORING. BEGIN SURCHARGE REMOVAL.
M6	DEC.	2022	COMPLETE RUNWAY AND TAXIWAY EMBANKMENT.
M7	JULY	2023	SURFACING, PAVING, AND MARKING COMPLETE.
M8	SEPT.	2023	CONSTRUCTION AND TESTING OF FAA NAVAIDS COMPLETE. REQUEST FAA FLIGHT CHECK.
M9	OCTOBER	2023	30 DAYS FOR COMPLETION OF FAA FLIGHT CHECK.

FEET
250 125 0 250 500

Date Revised:
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Designed By: DAT
Drawn By: EJM/HRB
Checked By: ABG

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JUNEAU, AK 99801
(907) 780-6060

Certificate of Authorization No: AECC605

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES - SOUTHCOAST REGION
6860 GLACIER HIGHWAY
JUNEAU, ALASKA 99801
907-465-1763

ANGOON AIRPORT
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
CONSTRUCTION SEQUENCING PLAN OVERALL

DATE: 7/31/20
SHEET: A5.1 OF 101
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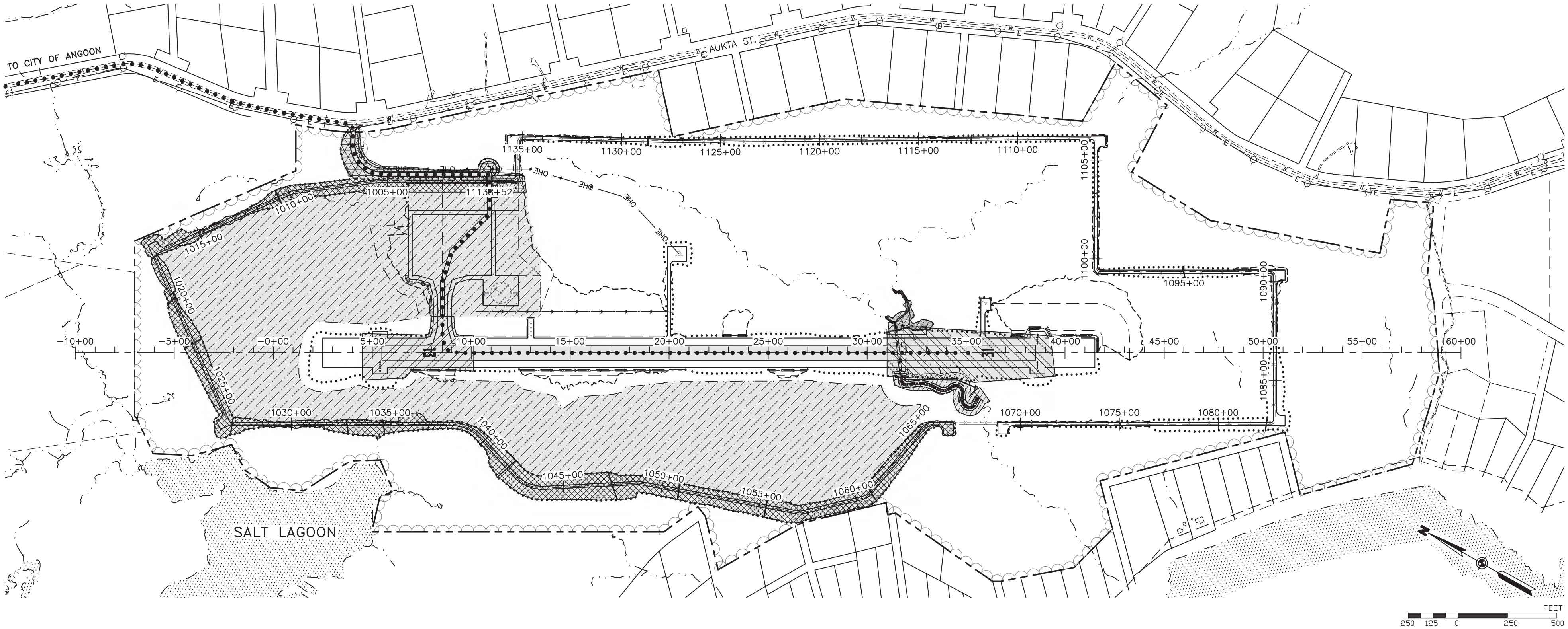
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AUKTA ST.
SALT LAGOON
1135+00
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1100+00
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FEET
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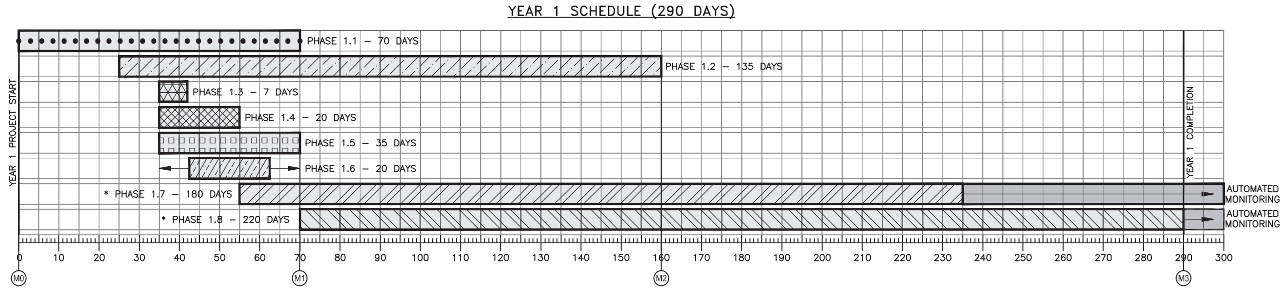
LEGEND:

- PHASE 1.1
- PHASE 1.2
- PHASE 1.3
- PHASE 1.4
- PHASE 1.5
- PHASE 1.6
- PHASE 1.7
- PHASE 1.8
- CONTRACTOR HAUL ROUTE
- FLAGGER

YEAR 1 SCHEDULE (290 DAYS)


PHASE 1.1 – 70 DAYS
PHASE 1.2 – 135 DAYS
PHASE 1.3 – 7 DAYS
PHASE 1.4 – 20 DAYS
PHASE 1.5 – 35 DAYS
PHASE 1.6 – 20 DAYS
* PHASE 1.7 – 180 DAYS
* PHASE 1.8 – 220 DAYS
YEAR 1 PROJECT START
YEAR 1 COMPLETION
AUTOMATED MONITORING
AUTOMATED MONITORING
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300
M0
M1
M2
M3

* ASSUMES UP TO 3,000 CY/DAY EMBANKMENT PLACEMENT PRODUCTION AND A 3 WEEK MONITORING PERIOD FOR EACH STAGE OF EMBANKMENT PLACED.

PHASE 1 SEQUENCE OF WORK:

1.1 ESTABLISH SITE ACCESS TO STAGING AREAS, SURCHARGE LOCATIONS, AND MATERIAL SOURCES.

1.2 DEVELOP/PREPARE MATERIAL SOURCE(S) AND WASTE DISPOSAL AREAS.

1.3 CONSTRUCT AIRPORT ACCESS ROAD TO BOTTOM OF SUBBASE.

1.4 CONSTRUCT PERIMETER ROAD TO BOTTOM OF SUBBASE TO STA. 1066+62.

1.5 CONSTRUCT ASP PIPE UNDERPASS. CONSTRUCT RUNWAY EMBANKMENT TO BOTTOM OF SUBBASE FROM STA. 31+25 TO 31+75.

1.6 CONSTRUCT STREAM CHANNEL REALIGNMENT. COMPLETE STREAM CHANNEL CONSTRUCTION. INSTALL SUBSTRATE. TEST STREAM CHANNEL.

1.7 CONSTRUCT SURCHARGE 1. CONSTRUCT RUNWAY AND TAXIWAY EMBANKMENTS TO BOTTOM OF SUBBASE AND PLACE SURCHARGE. INSTALL INSTRUMENTATION.

1.8 CONSTRUCT SURCHARGE 2. CONSTRUCT RUNWAY EMBANKMENTS TO BOTTOM OF SUBBASE AND PLACE SURCHARGE. INSTALL INSTRUMENTATION.

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ANGOON AIRPORT
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX

CONSTRUCTION SEQUENCING PLAN PHASE 1

DATE: 7/31/20
SHEET: A5.2 OF 101
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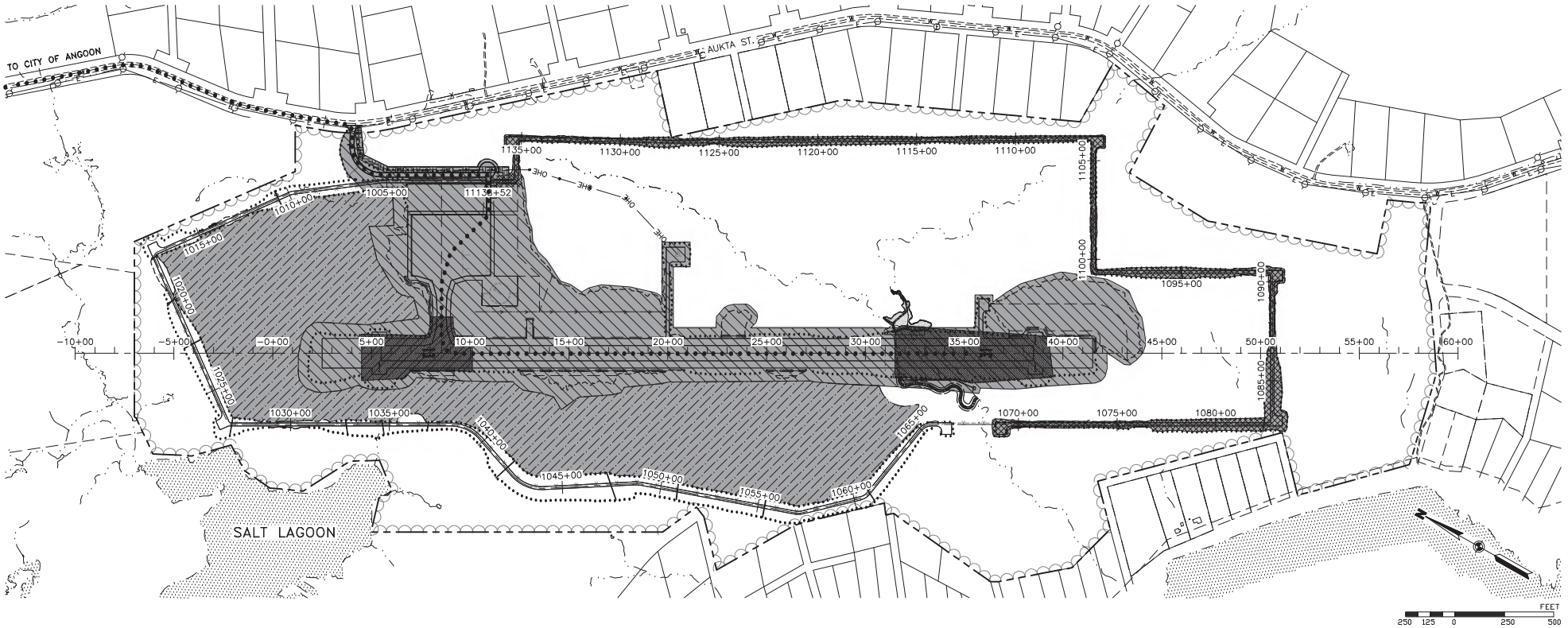
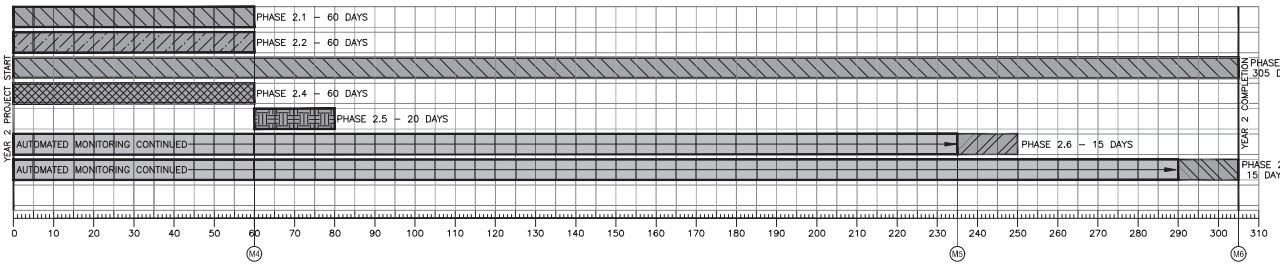


LEGEND:

- PHASE 2.1
- PHASE 2.2
- PHASE 2.3
- PHASE 2.4
- PHASE 2.5
- PHASE 2.6
- PHASE 2.7
- CONTRACTOR HAUL ROUTE
- FLAGGER

YEAR 2 SCHEDULE (305 DAYS)



PHASE 2 SEQUENCING OF WORK:

2.1 GRUBBING.

2.2 WASTE DISPOSAL.

2.3 EXCAVATION AND EMBANKMENT, RE-GRADE EXPOSED ROCK SURFACES.

2.4 CONSTRUCT PERIMETER ROAD FROM STA. 1068+87 TO END.

2.5 CONSTRUCT ELECTRIC LINE EXTENSION. INSTALL UNDERGROUND INFRASTRUCTURE.

2.6 REMOVE SURCHARGE 1. REMOVE EXCESS SURCHARGE EMBANKMENTS TO BOTTOM OF SUBBASE.

2.7 REMOVE SURCHARGE 2. REMOVE EXCESS SURCHARGE EMBANKMENTS TO BOTTOM OF SUBBASE.

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AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX

CONSTRUCTION SEQUENCING PLAN PHASE 2

DATE: 7/31/20
SHEET: A5.3 OF 101
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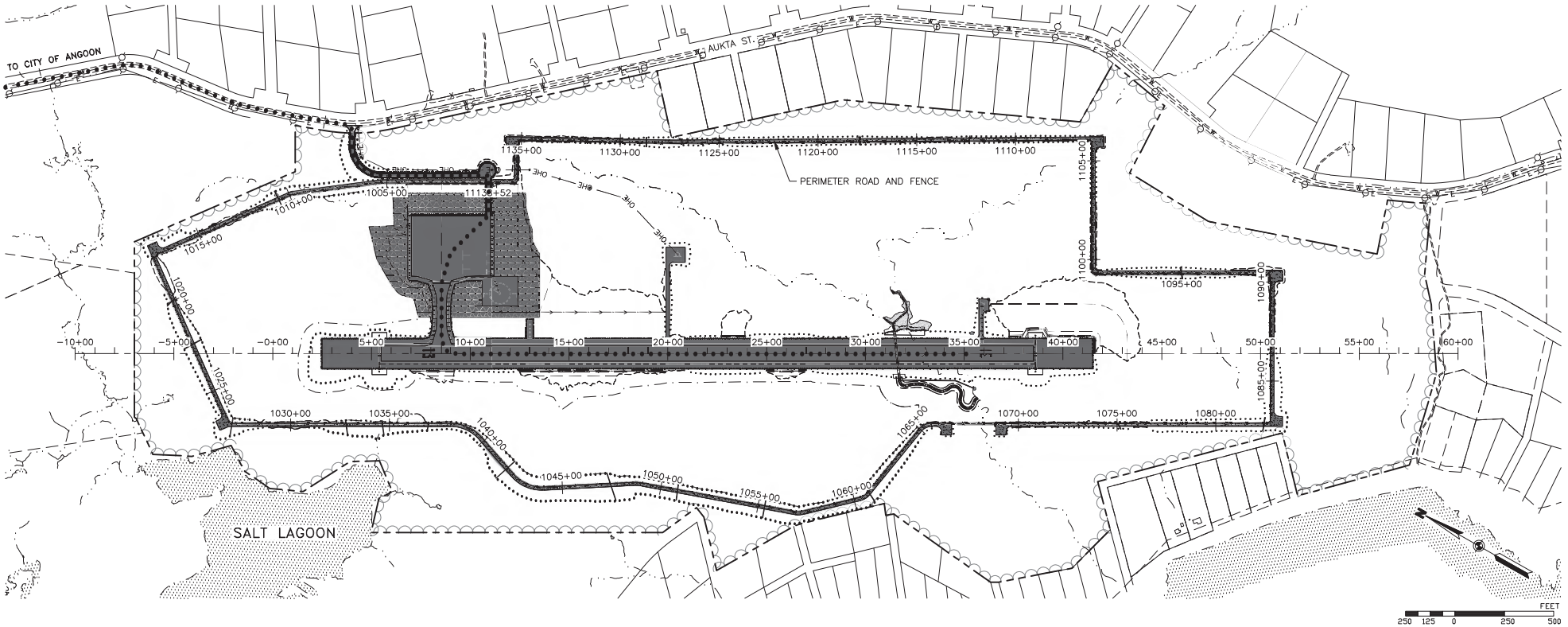

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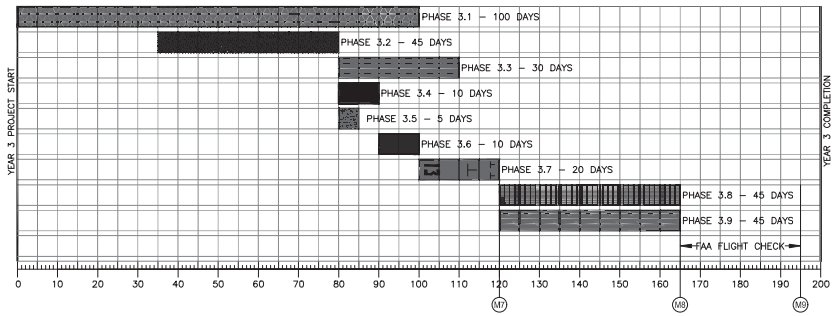
LEGEND:

- PHASE 3.1
- PHASE 3.2
- PHASE 3.3
- PHASE 3.4
- PHASE 3.5
- PHASE 3.6
- PHASE 3.7
- PHASE 3.8
- PHASE 3.9
- CONTRACTOR HAUL ROUTE
- FLAGGER

YEAR 3 SCHEDULE (200 DAYS)



PHASE 3 SEQUENCING OF WORK:

3.1 PROCESS AGGREGATES.

3.2 PLACE SUBBASE.

3.3 INSTALL ELECTRICAL CONDUIT.

3.4 PLACE CRUSHED AGGREGATE BASE COURSE.

3.5 PLACE AGGREGATE SURFACING MATERIAL.

3.6 PLACE HOT MIX ASPHALT.

3.7 INSTALL MARKINGS AND TIE-DOWNS.

3.8 INSTALL AIRPORT LIGHTING, EQUIPMENT, AND NAVAIDS. WINDCONES, AWOS, ROTATING BEACON, PAPI, AND REILS.

3.9 INSTALL PERIMETER FENCE AND GATES.

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ANGOON AIRPORT

ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX

CONSTRUCTION SEQUENCING PLAN PHASE 3

DATE: 7/31/20

SHEET: A5.4 OF 101

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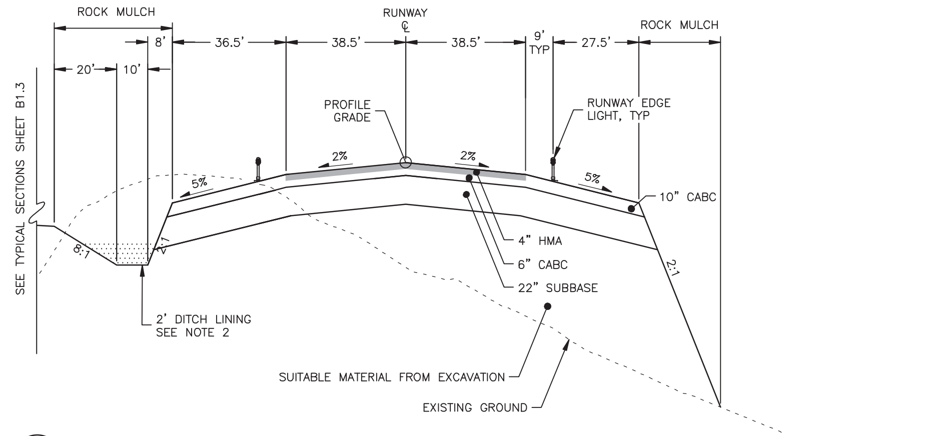

1 B1.0 RUNWAY (STA 5+49 TO 38+51)

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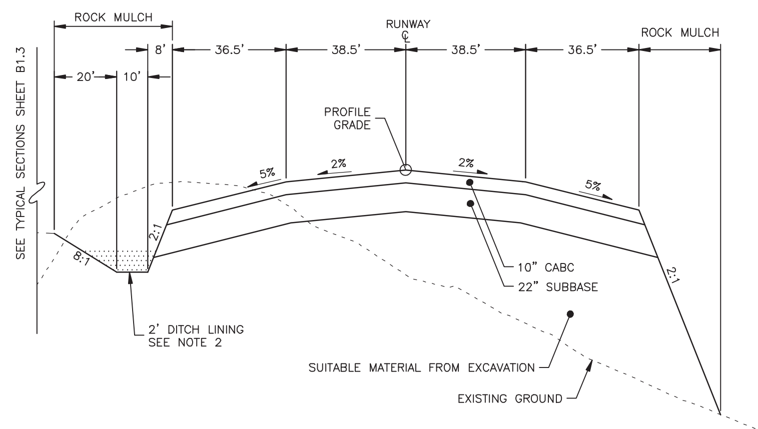

2 B1.0 RUNWAY SAFETY AREA (STA 2+50 TO 5+49) (STA 38+51 TO 41+50)

SCALE: NOT TO SCALE

SHEET NOTES:

1. REMOVE ALL ORGANIC MATERIAL BENEATH EMBANKMENT FOOTPRINT, EXCEPT IN AREAS DESIGNATED FOR SURCHARGE EMBANKMENT. SEE SHEETS D1.1 AND D1.2 FOR SURCHARGE LOCATIONS.
2. DITCH LINING IS NOT REQUIRED ON EXPOSED BEDROCK SURFACES, ENGINEER WILL DETERMINE AND DIRECT FINAL PLACEMENT OF DITCH LINING IN THE FIELD.
3. USE DETAILS 2/B1.3 AND 3/B1.3 FOR DRAINAGE DITCH BETWEEN RUNWAY AND APRON FROM STA 9+50 TO 20+00 LEFT OF RUNWAY CENTERLINE.
4. REGRADE FOR DRAINAGE AND STABILIZE ALL AREAS DISTURBED BY CONSTRUCTION.
5. PLACEMENT OF ROCK MULCH NOT NEEDED ON EXPOSED ROCK SIDE SLOPES,
6. SEE PLAN AND PROFILE SHEETS FOR EXCAVATION & TERRAIN REMOVAL LIMITS.

Date Revised:	7/31/2020, 9:22 AM	Designed By:	BMZN
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File Path and Name:	P:\2017\17171JN-Angoon_Airport\C\C3000cnst17171JN.DWG	Checked By:	RGS

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ANGOON AIRPORT
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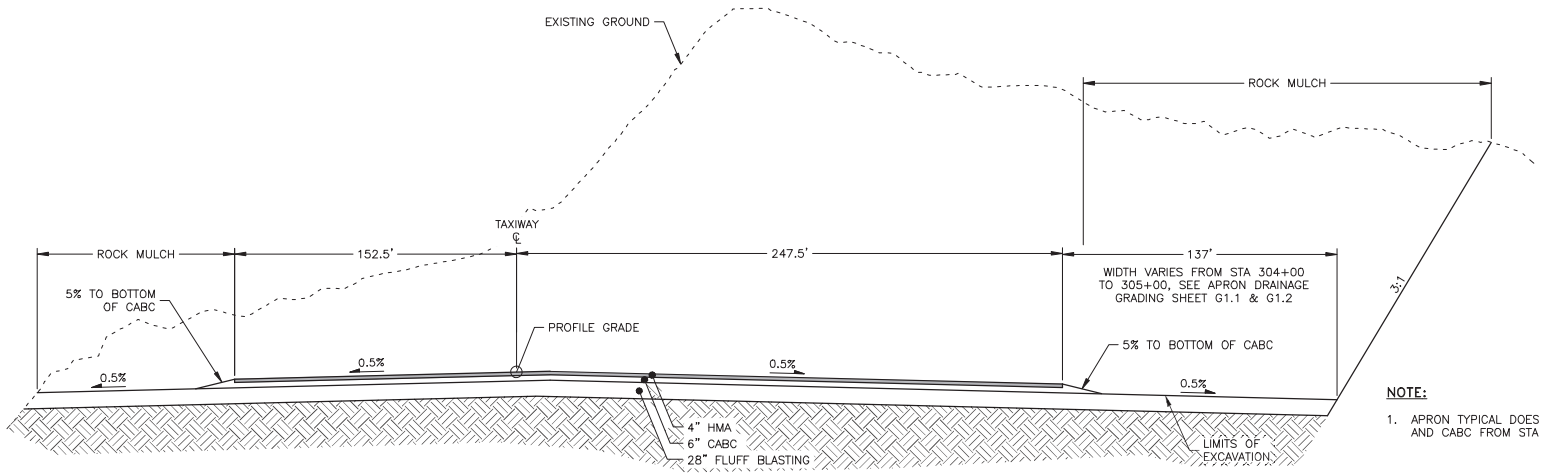
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
TYPICAL SECTIONS (1 OF 6)

DATE: 7/31/20
SHEET: B1.0 OF 101
AS-BUILT SHEET:

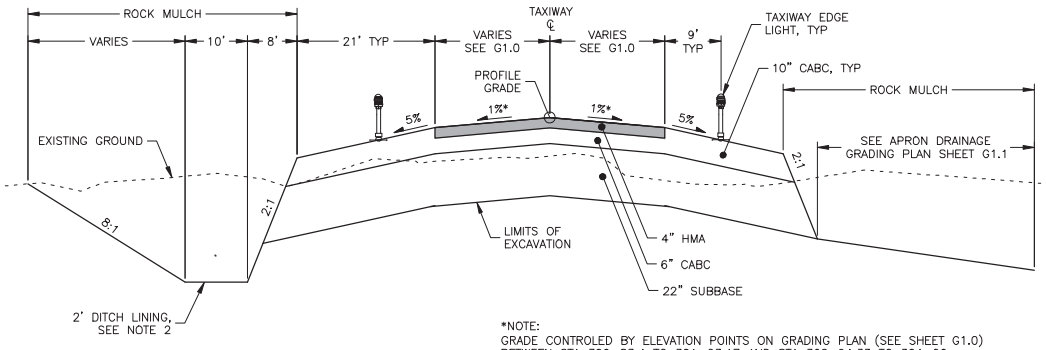


NOTE:

1. APRON TYPICAL DOES NOT INCLUDE HMA AND CABC FROM STA 307+05 TO 307+85.

1 / B1.1 APRON (TAXIWAY STA 304+00 TO 307+85)

SCALE: NOT TO SCALE



*NOTE:
GRADE CONTROLED BY ELEVATION POINTS ON GRADING PLAN (SEE SHEET G1.0) BETWEEN STA 300+83.4 TO 301+23.17 AND STA 302+94.33 TO 304+00.

2 / B1.1 TAXIWAY (STA 300+83.40 TO 304+00)

SCALE: NOT TO SCALE

SHEET NOTES:

1. REMOVE ALL ORGANIC MATERIAL BENEATH EMBANKMENT FOOTPRINT, EXCEPT IN AREAS DESIGNATED FOR SURCHARGE EMBANKMENT. SEE SHEETS D1.1 AND D1.2 AND FOR SURCHARGE LOCATIONS.
2. DITCH LINING IS NOT REQUIRED ON EXPOSED BEDROCK SURFACES, ENGINEER WILL DETERMINE AND DIRECT FINAL PLACEMENT OF DITCH LINING IN THE FIELD
3. REGRADE FOR DRAINAGE AND STABILIZE ALL AREAS DISTURBED BY CONSTRUCTION.
4. PLACEMENT OF ROCK MULCH NOT NEEDED ON ROCK SIDE SLOPES.
5. SEE PLAN AND PROFILE SHEETS FOR EXCAVATION & TERRAIN REMOVAL LIMITS.

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ANGOON AIRPORT
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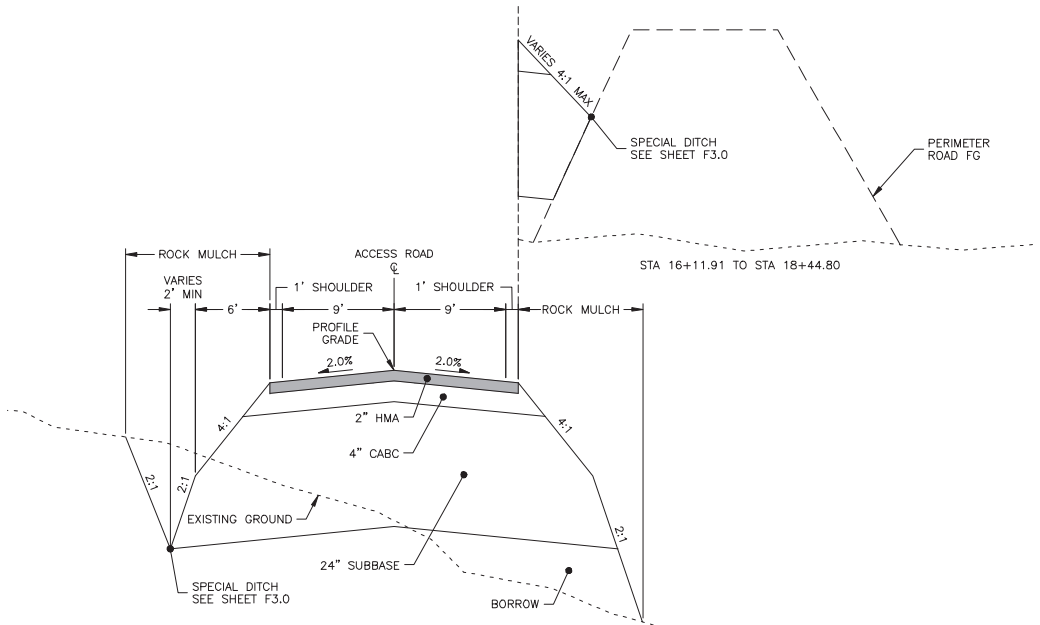
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX

TYPICAL SECTIONS (2 OF 6)

DATE: 7/31/20
SHEET: B1.1 OF 101
AS-BUILT SHEET:



1 B1.2 AIRPORT ACCESS ROAD (STA 10+00 TO 18+91.93)

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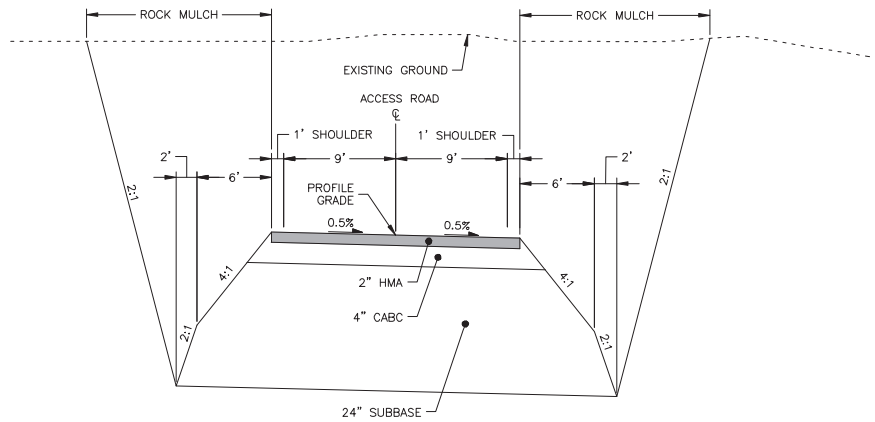

2 B1.2 AIRPORT ACCESS ROAD (STA 18+91.93 TO 20+64)

SCALE: NOT TO SCALE

Date Revised:
Layout Name: Typ Sections 2 B1.2
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PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX

TYPICAL SECTIONS (3 OF 6)

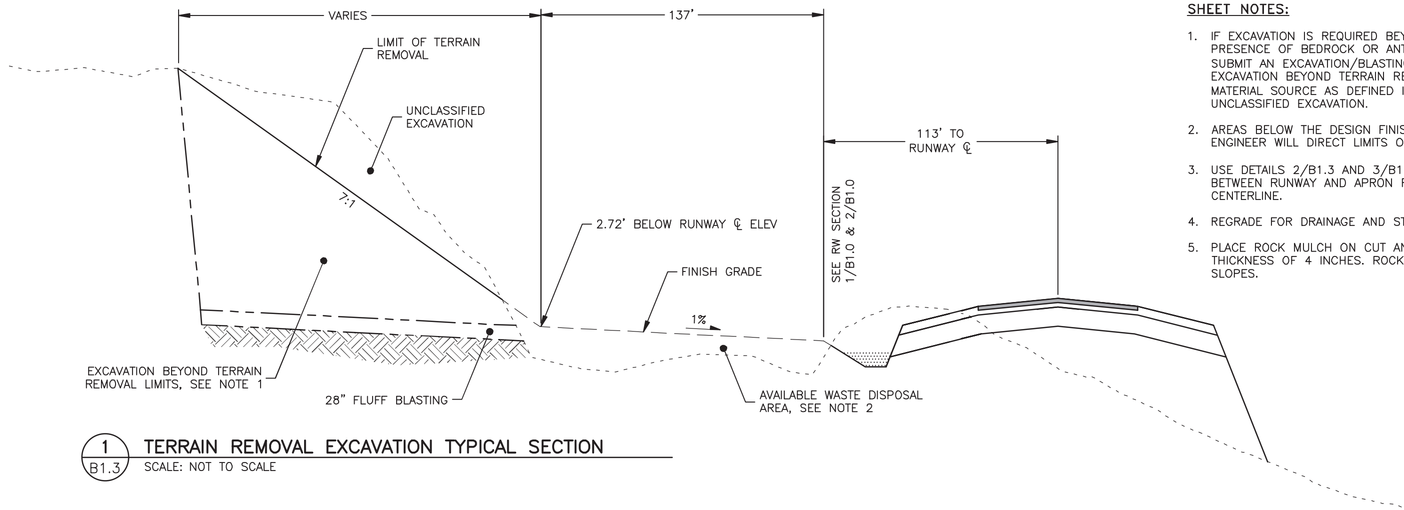
DATE: 7/31/20

SHEET: B1.2 OF 101

AS-BUILT SHEET:

SHEET NOTES:

1. IF EXCAVATION IS REQUIRED BEYOND TERRAIN REMOVAL LIMITS, DUE TO THE PRESENCE OF BEDROCK OR ANTICIPATED ROCK BLASTING, CONTRACTOR SHALL SUBMIT AN EXCAVATION/BLASTING PLAN TO ENGINEER FOR APPROVAL. AUTHORIZED EXCAVATION BEYOND TERRAIN REMOVAL LIMITS MAY BE CONSIDERED AN AVAILABLE MATERIAL SOURCE AS DEFINED IN GCP60.02.d(4) AND SHALL BE PAID FOR AS UNCLASSIFIED EXCAVATION.
2. AREAS BELOW THE DESIGN FINISH GRADE CAN BE USED AS WASTE DISPOSAL. ENGINEER WILL DIRECT LIMITS OF AVAILABLE DISPOSAL.
3. USE DETAILS 2/B1.3 AND 3/B1.3 FOR TERRAIN REMOVAL AND DRAINAGE DITCH BETWEEN RUNWAY AND APRON FROM STA 9+50 TO 20+00 LEFT OF RUNWAY CENTERLINE.
4. REGRADE FOR DRAINAGE AND STABILIZE ALL AREAS DISTURBED BY CONSTRUCTION.
5. PLACE ROCK MULCH ON CUT AND FILL SLOPES WITHIN MINERAL SOILS, MINIMUM THICKNESS OF 4 INCHES. ROCK MULCH NOT NEEDED ON EXPOSED ROCK SIDE SLOPES.



1 / B1.3 TERRAIN REMOVAL EXCAVATION TYPICAL SECTION

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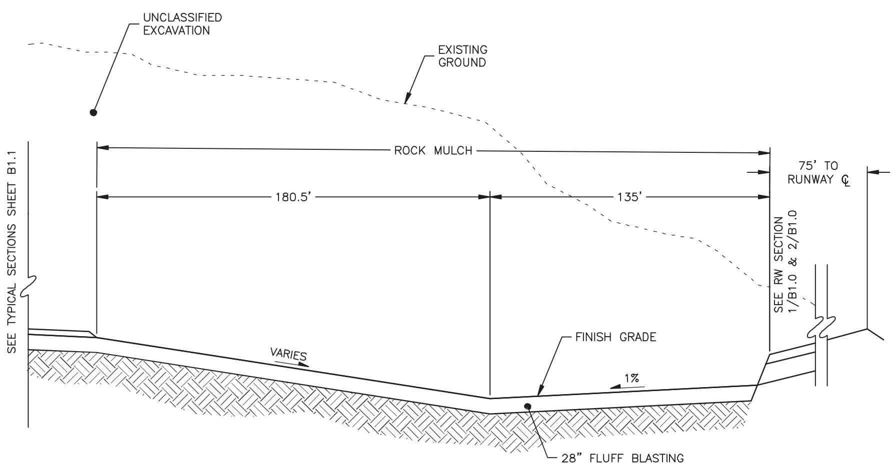
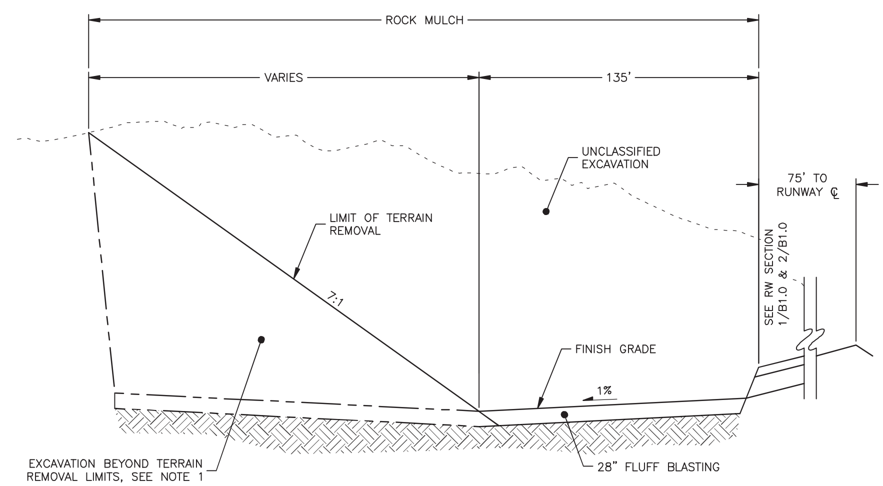


2 / B1.3 RUNWAY– APRON DRAINAGE (RIGHT STA 9+50 TO 12+40



3 / B1.3 UNCLASSIFIED EXCAVATION (RIGHT STA 12+40 TO 20+00)

SCALE: NOT TO SCALE

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TYPICAL SECTIONS (4 OF 6)

DATE: 7/31/20
SHEET: B1.3 OF 101
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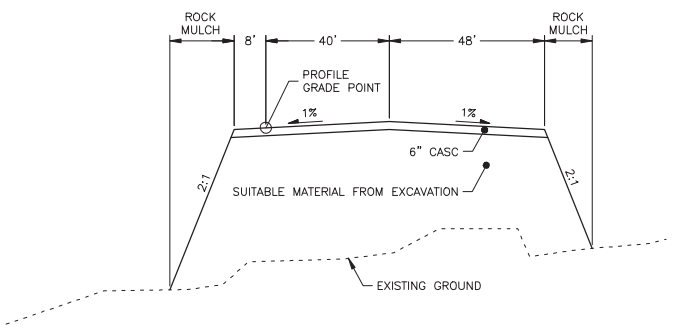

1 B1.4 AWOS PAD
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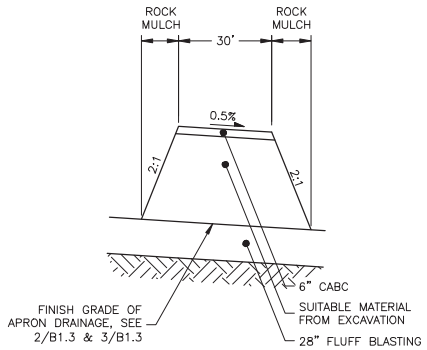
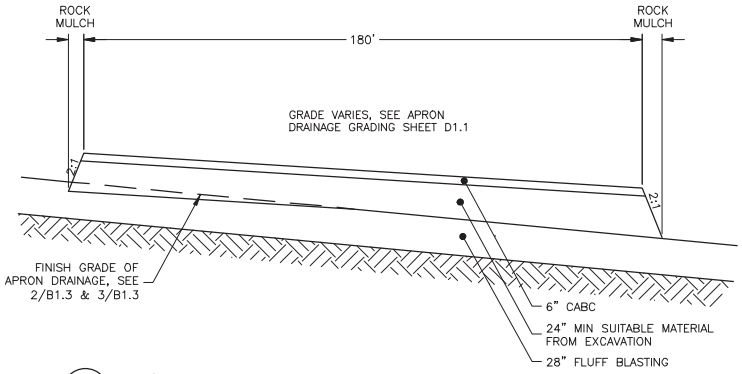
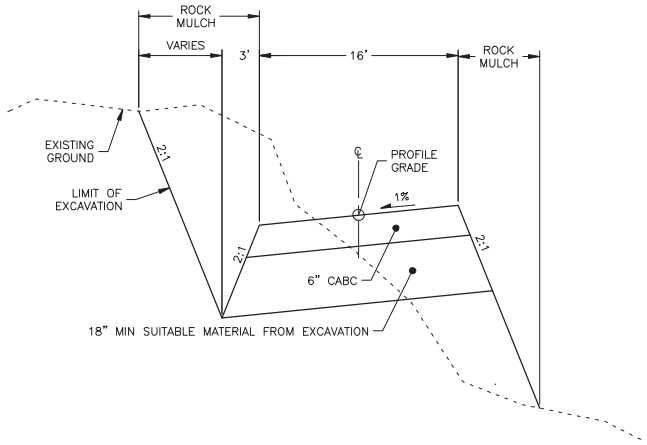


3 B1.4 PAPI PAD
SCALE: NOT TO SCALE



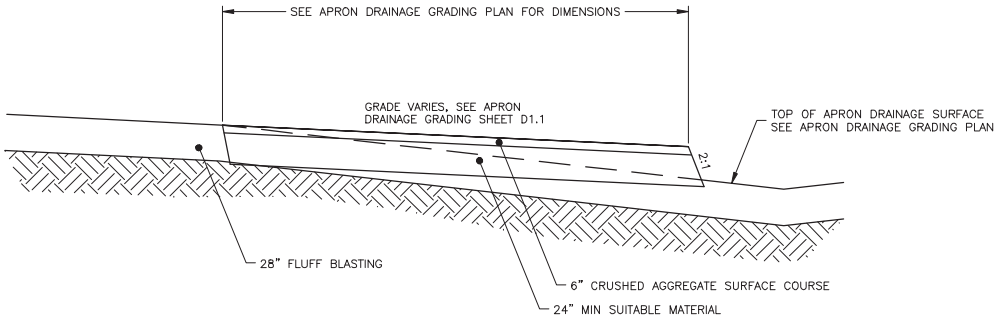
4 B1.4 SEGMENTED CIRCLE
SCALE: NOT TO SCALE



NOTES:

1. USE AWOS ACCESS ROAD FOR EMBANKMENT OF SECONDARY WIND CONE PAD. SEE SHEET G1.3 FOR SECONDARY WIND CONE PAD DIMENSIONS.

2 B1.4 AWOS ACCESS ROAD
SCALE: NOT TO SCALE



5 B1.4 SEGMENTED CIRCLE EMBANKMENT SECTION
SCALE: NOT TO SCALE

Date Revised:
Layout Name: Typ_Sections 4 B1.4
File Path and Name: P:\2017\1711JNU-Angoon_Airport\CS\3300\cad\17171JNU.DWG
7/31/2020, 9:24 AM
Designed By: BWN
Drawn By: BWB/HRB
Checked By: RMS

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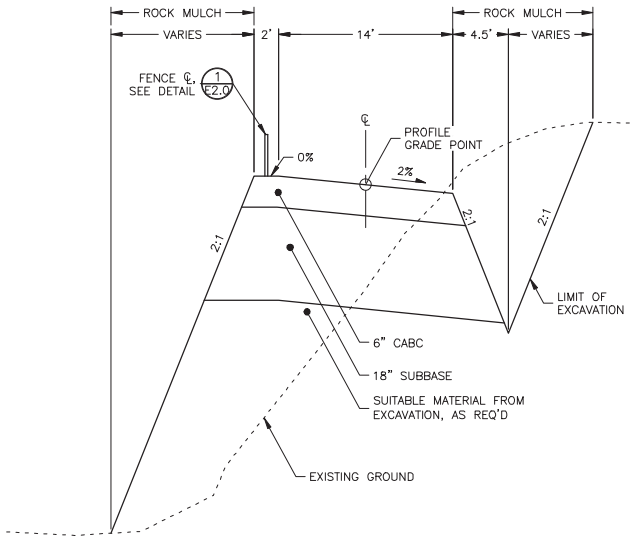
6860 GLACIER HIGHWAY
JUNEAU, ALASKA 99801
907-465-1763

ANGOON AIRPORT
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX

TYPICAL SECTIONS (5 OF 6)

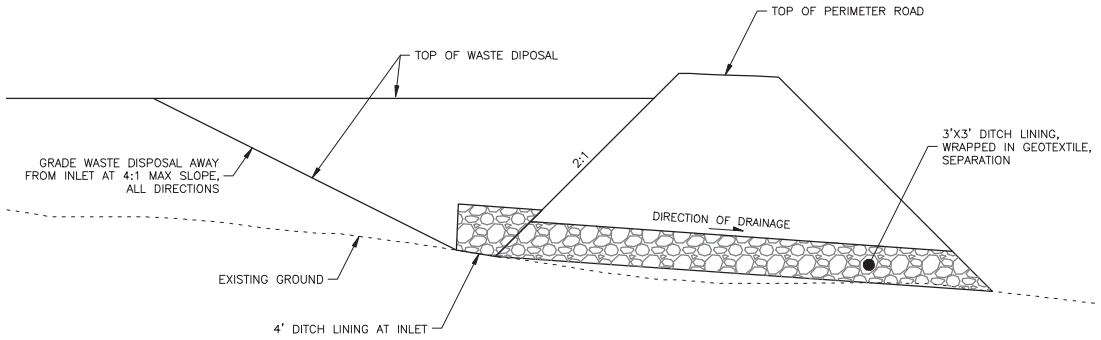
DATE: 7/31/20
SHEET: B1.4 OF 101
AS-BUILT SHEET:



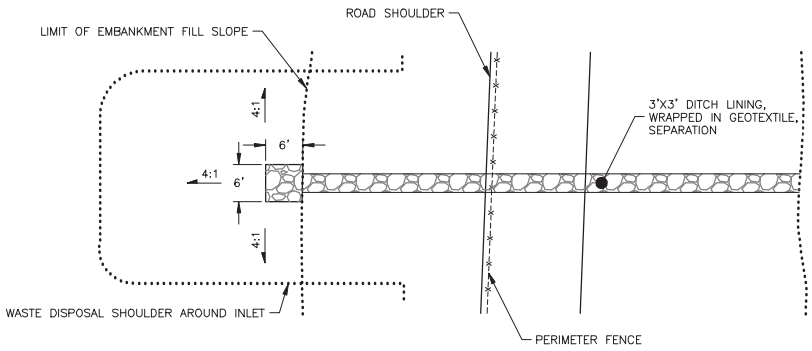
NOTE:

1. GRUBBING IS NOT REQUIRED WITHIN PERIMETER ROAD EMBANKMENT FOOTPRINT.

1 / B1.5 PERIMETER ROAD TYPICAL
SCALE: NOT TO SCALE



ELEVATION



PLAN

2 / B1.5 PERIMETER ROAD ROCK DRAIN DETAILS
SCALE: NOT TO SCALE

Date Revised:
Layout Name: Typ Sections 5, B1.5
File Path and Name: I:\2017\1717JUN-Angoon_Airport\CS\300Const1717JUN.DWG
7/31/2020, 9:25 AM
Designed By: BWN
Drawn By: BWB/HRB
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907-465-1763

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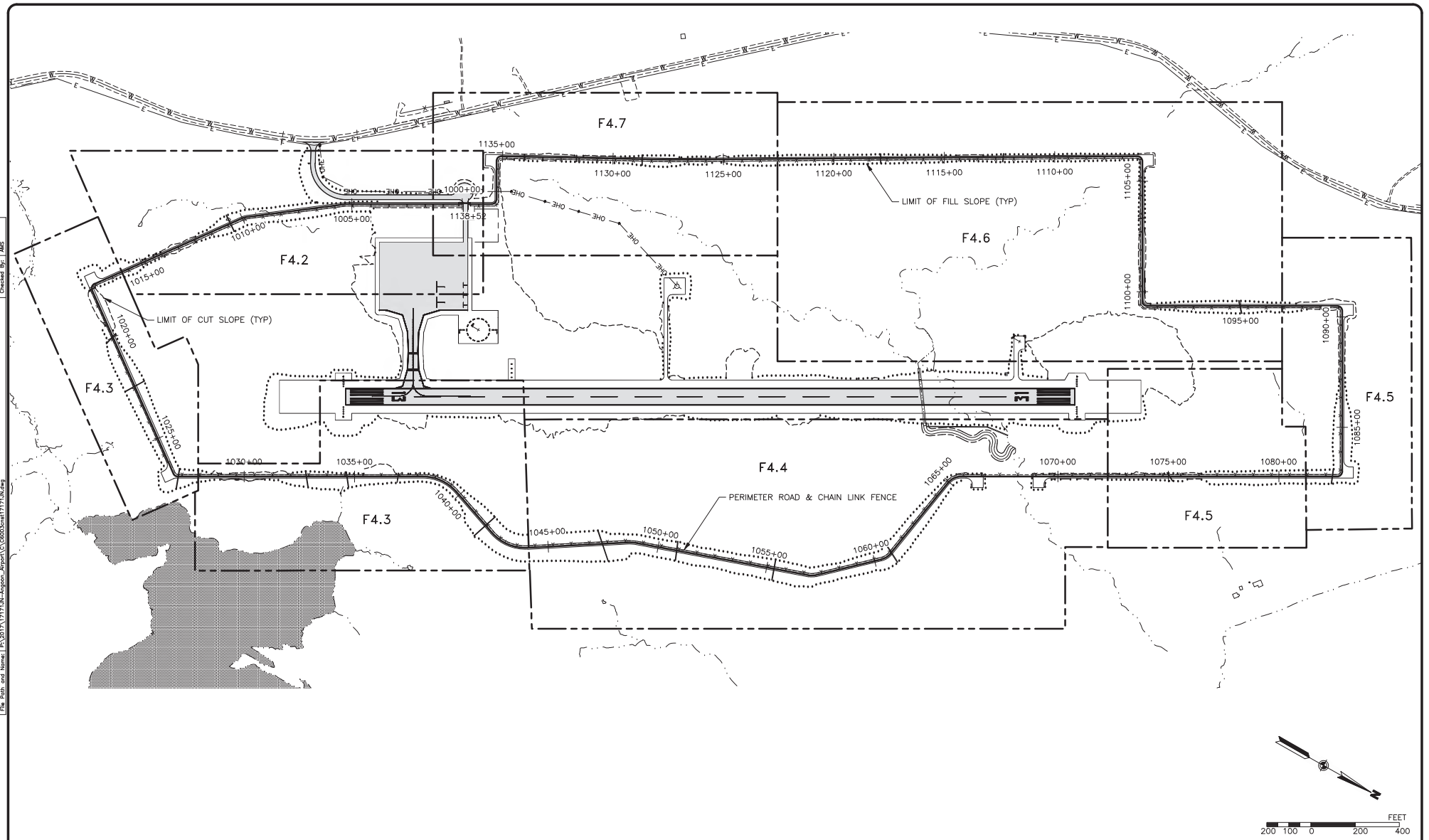
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX

TYPICAL SECTIONS (6 OF 6)

DATE: 7/31/20
SHEET: B1.5 OF 101
AS-BUILT SHEET:



Date Revised: 7/30/2020, 4:38 PM
Layout Name: Perimeter Fence Road Key Map, F4.1
File Path and Name: P:\2017\1717JAK-Angoon_Airport\CS\0600Sheet1717JN.dwg

Designed By: DAT
Drawn By: EJM/HRB
Checked By: ABG

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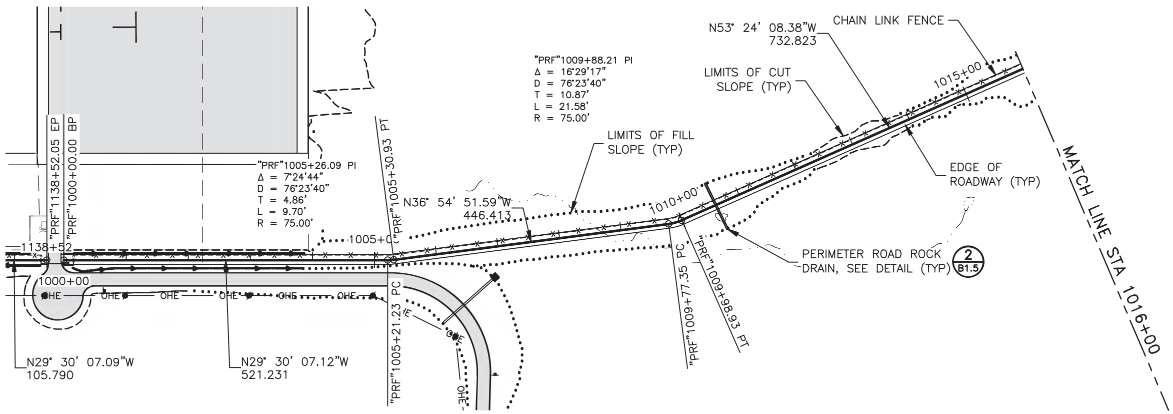
907-465-1763

ANGOON AIRPORT
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
PERIMETER FENCE ROAD
KEY MAP

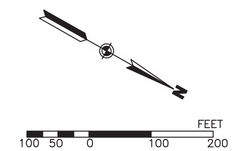
DATE: 7/31/20
SHEET: F4.1 OF 101
AS-BUILT SHEET:

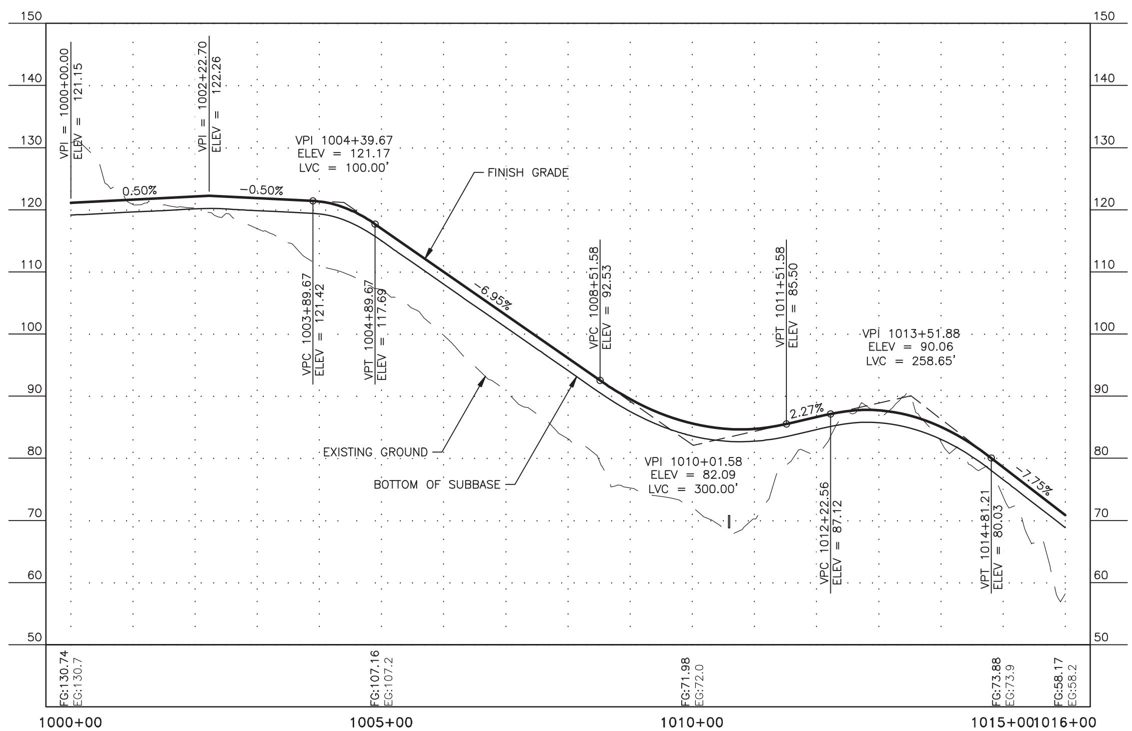


N53° 24' 08.38"W
732.823
CHAIN LINK FENCE
LIMITS OF CUT SLOPE (TYP)
"PRF"1009+88.21 PI
Δ = 16°29'17"
D = 76°23'40"
T = 10.87'
L = 21.58'
R = 75.00'
LIMITS OF FILL SLOPE (TYP)
"PRF"1005+26.09 PI
Δ = 7°24'44"
D = 76°23'40"
T = 4.86'
L = 9.70'
R = 75.00'
N36° 54' 51.59"W
446.413
"PRF"1138+52.05 EP
"PRF"1000+00.00 BP
"PRF"1005+30.93 PT
"PRF"1005+21.23 PC
"PRF"1009+77.35 PC
"PRF"1009+98.93 PT
1138+52
1000+00
1005+00
1010+00
1015+00
EDGE OF ROADWAY (TYP)
PERIMETER ROAD ROCK DRAIN, SEE DETAIL (TYP)
2
B1.5
N29° 30' 07.09"W
105.790
N29° 30' 07.12"W
521.231
OHE
MATCH LINE STA 1016+00

NOTES:

1. PERIMETER ROAD ROCK DRAIN LOCATIONS TO BE SET AT LOCATIONS OF EXISTING DRAINAGE PATHWAYS. ENGINEER SHALL ADJUST FINAL PLACEMENT IN THE FIELD.





150
140
130
120
110
100
90
80
70
60
50
VPI = 1000+00.00
ELEV = 121.15
VPI = 1002+22.70
ELEV = 122.26
VPI 1004+39.67
ELEV = 121.17
LVC = 100.00'
0.50%
-0.50%
FINISH GRADE
VPC 1003+89.67
ELEV = 121.42
VPT 1004+89.67
ELEV = 117.69
-6.95%
VPC 1008+51.58
ELEV = 92.53
VPT 1011+51.58
ELEV = 85.50
VPI 1013+51.88
ELEV = 90.06
LVC = 258.65'
2.27%
EXISTING GROUND
BOTTOM OF SUBBASE
VPI 1010+01.58
ELEV = 82.09
LVC = 300.00'
VPC 1012+22.56
ELEV = 87.12
VPT 1014+81.21
ELEV = 80.03
-7.75%
FG:130.74
EG:130.7
FG:107.16
EG:107.2
FG:71.98
EG:72.0
FG:73.88
EG:73.9
FG:58.17
EG:58.2
1000+00
1005+00
1010+00
1015+00
1016+00

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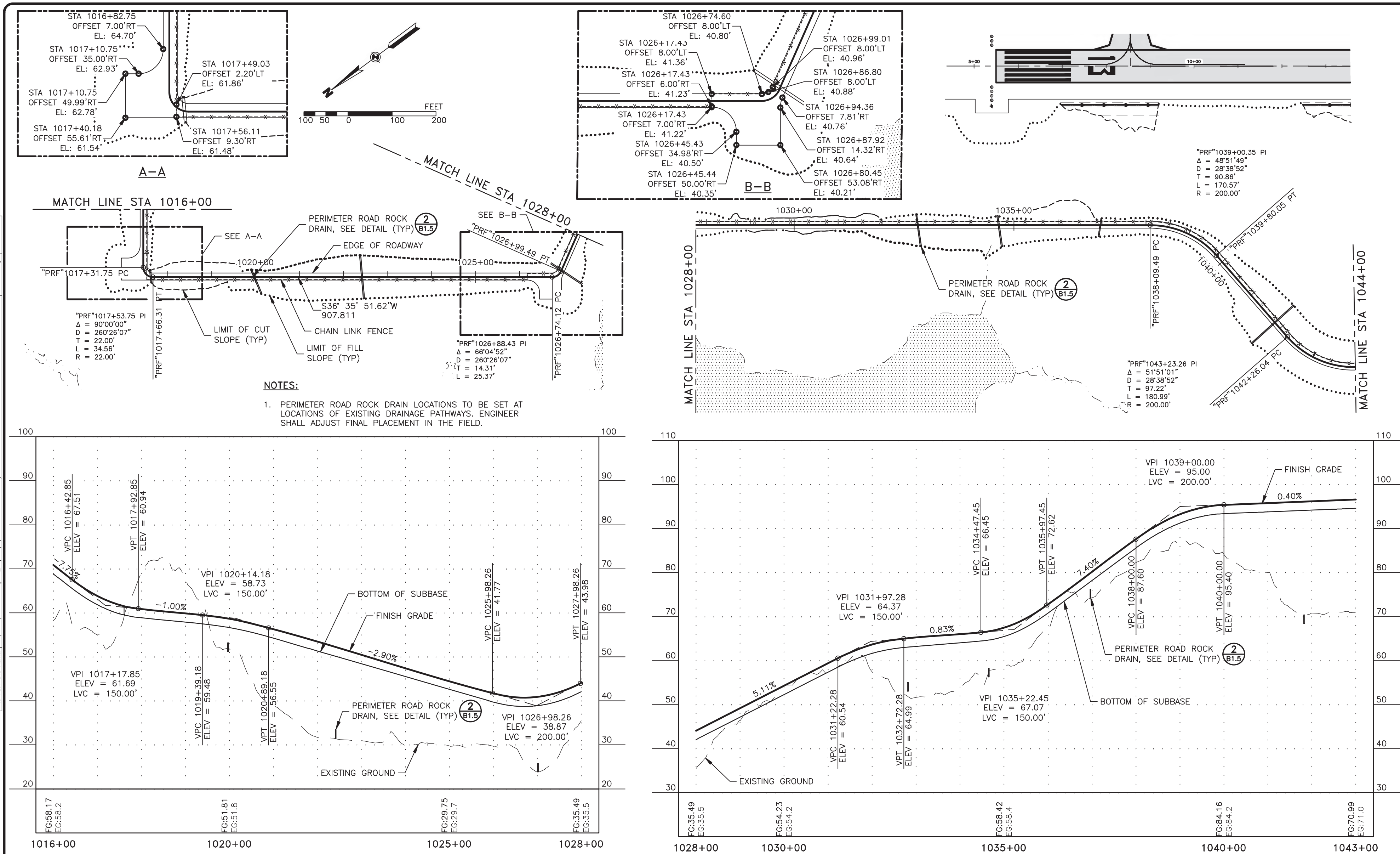
6860 GLACIER HIGHWAY
JUNEAU, ALASKA 99801
907-465-1763

ANGOON AIRPORT
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
PERIMETER FENCE ROAD
PLAN & PROFILE (1 OF 6)

DATE: 7/31/20
SHEET: F4.2 OF 101
AS-BUILT SHEET:

Date Revised:	7/30/2020, 4:38 PM	Designed By:	EAT
Layout Name:	Perimeter Fence Road Plan & Profile (1 of 6) F4.2	Drawn By:	EJM/HRB
File Path and Name:	P:\2017\17171JN-Angoon_Airport\C\C6003cnst17171JN.dwg	Checked By:	AMS


STA 1016+82.75 OFFSET 7.00'RT EL: 64.70'
STA 1017+10.75 OFFSET 35.00'RT EL: 62.93'
STA 1017+10.75 OFFSET 49.99'RT EL: 62.78'
STA 1017+40.18 OFFSET 55.61'RT EL: 61.54'
STA 1017+49.03 OFFSET 2.20'LT EL: 61.86'
STA 1017+56.11 OFFSET 9.30'RT EL: 61.48'
A–A
FEET
100 50 0 100 200
MATCH LINE STA 1028+00
STA 1026+74.60 OFFSET 8.00'LT EL: 40.80'
STA 1026+17.43 OFFSET 8.00'LT EL: 41.36'
STA 1026+17.43 OFFSET 6.00'RT EL: 41.23'
STA 1026+17.43 OFFSET 7.00'RT EL: 41.22'
STA 1026+45.43 OFFSET 34.98'RT EL: 40.50'
STA 1026+45.44 OFFSET 50.00'RT EL: 40.35'
STA 1026+99.01 OFFSET 8.00'LT EL: 40.96'
STA 1026+86.80 OFFSET 8.00'LT EL: 40.88'
STA 1026+94.36 OFFSET 7.81'RT EL: 40.76'
STA 1026+87.92 OFFSET 14.32'RT EL: 40.64'
STA 1026+80.45 OFFSET 53.08'RT EL: 40.21'
B–B
"PRF"1039+00.35 PI Δ = 48°51'49" D = 28°38'52" T = 90.86' L = 170.57' R = 200.00'
MATCH LINE STA 1016+00
SEE A–A
PERIMETER ROAD ROCK DRAIN, SEE DETAIL (TYP) 2 B1.5
EDGE OF ROADWAY
SEE B–B
"PRF"1026+99.49 PT
1020+00
1025+00
"PRF"1017+31.75 PC
"PRF"1017+66.31 PT
"PRF"1026+74.12 PC
S36° 35' 51.62"W 907.811
CHAIN LINK FENCE
LIMIT OF CUT SLOPE (TYP)
LIMIT OF FILL SLOPE (TYP)
"PRF"1017+53.75 PI Δ = 90°00'00" D = 260°26'07" T = 22.00' L = 34.56' R = 22.00'
"PRF"1026+88.43 PI Δ = 66°04'52" D = 260°26'07" T = 14.31' L = 25.37'
NOTES:
1. PERIMETER ROAD ROCK DRAIN LOCATIONS TO BE SET AT LOCATIONS OF EXISTING DRAINAGE PATHWAYS. ENGINEER SHALL ADJUST FINAL PLACEMENT IN THE FIELD.
1030+00
1035+00
1040+00
MATCH LINE STA 1028+00
MATCH LINE STA 1044+00
"PRF"1038+09.49 PC
"PRF"1039+80.05 PT
"PRF"1042+26.04 PC
"PRF"1043+23.26 PI Δ = 51°51'01" D = 28°38'52" T = 97.22' L = 180.99' R = 200.00'
VPC 1016+42.85 ELEV = 67.51
VPT 1017+92.85 ELEV = 60.94
VPI 1017+17.85 ELEV = 61.69 LVC = 150.00'
-1.00%
VPI 1020+14.18 ELEV = 58.73 LVC = 150.00'
VPC 1019+39.18 ELEV = 59.48
VPT 1020+89.18 ELEV = 56.55
BOTTOM OF SUBBASE
FINISH GRADE
-2.90%
VPC 1025+98.26 ELEV = 41.77
VPT 1027+98.26 ELEV = 43.98
VPI 1026+98.26 ELEV = 38.87 LVC = 200.00'
EXISTING GROUND
FG:58.17 EG:58.2
FG:51.81 EG:51.8
FG:29.75 EG:29.7
FG:35.49 EG:35.5
1016+00
1020+00
1025+00
1028+00
VPI 1039+00.00 ELEV = 95.00 LVC = 200.00'
0.40%
VPC 1034+47.45 ELEV = 66.45
VPT 1035+97.45 ELEV = 72.62
7.40%
VPC 1038+00.00 ELEV = 87.60
VPT 1040+00.00 ELEV = 95.40
VPI 1031+97.28 ELEV = 64.37 LVC = 150.00'
0.83%
5.11%
VPC 1031+22.28 ELEV = 60.54
VPT 1032+72.28 ELEV = 64.99
VPI 1035+22.45 ELEV = 67.07 LVC = 150.00'
FG:35.49 EG:35.5
FG:54.23 EG:54.2
FG:58.42 EG:58.4
FG:84.16 EG:84.2
FG:70.99 EG:71.0
1028+00
1030+00
1035+00
1040+00
1043+00

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Certificate of Authorization No: AECC605

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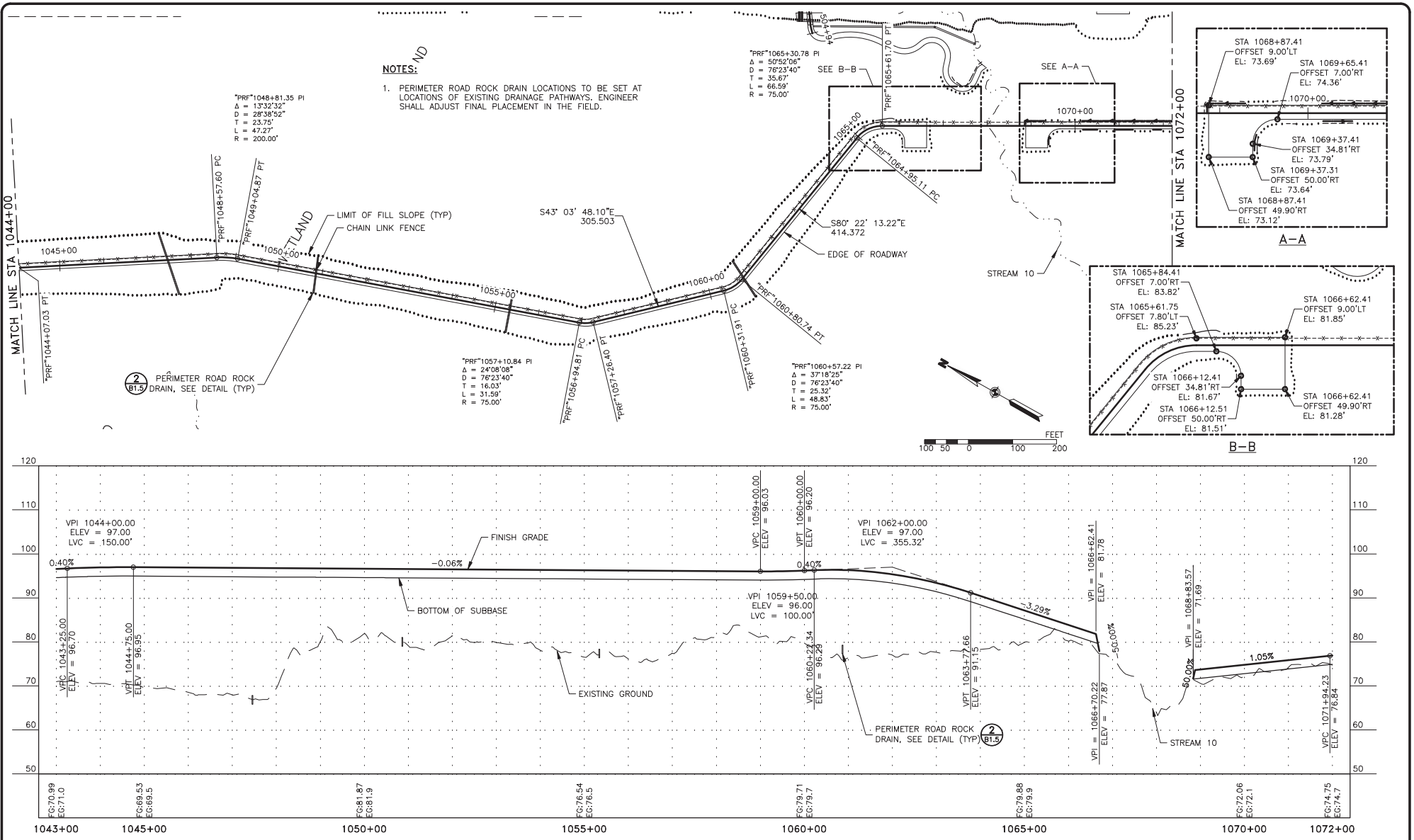
6860 GLACIER HIGHWAY
JUNEAU, ALASKA 99801
907-465-1763

ANGOON AIRPORT
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
PERIMETER FENCE ROAD
PLAN & PROFILE (2 OF 6)

DATE: 7/31/20
SHEET: F4.3 OF 101
AS-BUILT SHEET:

Date Revised:	7/30/2020, 4:39 PM	Designed By:	EAT
Layout Name:	Perimeter Fence Road Plan & Profile (2 of 6)	Drawn By:	EJM/HRB
File Path and Name:	P:\2017\1717JN-Angoon_Airport\C\C600\3cnst1717JN.dwg	Checked By:	AMS



Date Revised: 7/30/2020, 4:59 PM
Layout Name: Perimeter_Fence_Road_Plan_&_Profile_(3_of_6)
File Path and Name: P:\2017\1717JAK-Angoon_Airport\CVL\0505Sheet\1717JAK.dwg
Designed By: DAT
Drawn By: EJM/HRB
Checked By: ABG

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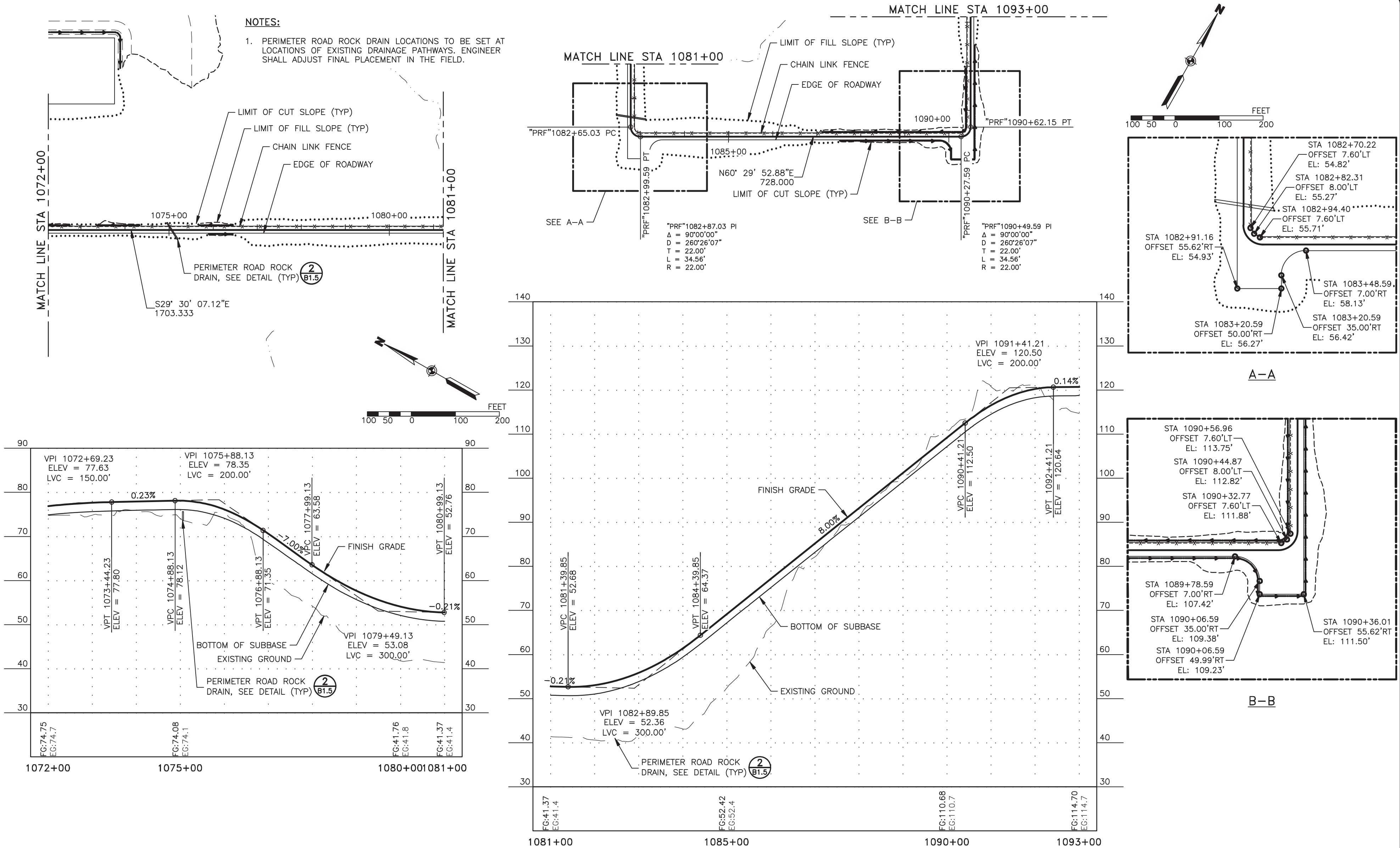
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
PERIMETER FENCE ROAD
PLAN & PROFILE (3 OF 6)

DATE: 7/31/20
SHEET: F4.4 OF 101
AS-BUILT SHEET:



MATCH LINE STA 1072+00
MATCH LINE STA 1081+00
MATCH LINE STA 1093+00
LIMIT OF CUT SLOPE (TYP)
LIMIT OF FILL SLOPE (TYP)
CHAIN LINK FENCE
EDGE OF ROADWAY
1075+00
1080+00
PERIMETER ROAD ROCK DRAIN, SEE DETAIL (TYP) 2 B1.5
S29° 30' 07.12"E
1703.333
"PRF"1082+65.03 PC
"PRF"1082+99.59 PT
1085+00
N60° 29' 52.88"E
728.000
LIMIT OF CUT SLOPE (TYP)
SEE A–A
SEE B–B
1090+00
"PRF"1090+62.15 PT
"PRF"1090+27.59 PC
"PRF"1082+87.03 PI
Δ = 90°00'00"
D = 260°26'07"
T = 22.00'
L = 34.56'
R = 22.00'
"PRF"1090+49.59 PI
Δ = 90°00'00"
D = 260°26'07"
T = 22.00'
L = 34.56'
R = 22.00'
FEET
100 50 0 100 200
STA 1082+70.22
OFFSET 7.60'LT
EL: 54.82'
STA 1082+82.31
OFFSET 8.00'LT
EL: 55.27'
STA 1082+94.40
OFFSET 7.60'LT
EL: 55.71'
STA 1082+91.16
OFFSET 55.62'RT
EL: 54.93'
STA 1083+48.59
OFFSET 7.00'RT
EL: 58.13'
STA 1083+20.59
OFFSET 35.00'RT
EL: 56.42'
STA 1083+20.59
OFFSET 50.00'RT
EL: 56.27'
A–A
STA 1090+56.96
OFFSET 7.60'LT
EL: 113.75'
STA 1090+44.87
OFFSET 8.00'LT
EL: 112.82'
STA 1090+32.77
OFFSET 7.60'LT
EL: 111.88'
STA 1089+78.59
OFFSET 7.00'RT
EL: 107.42'
STA 1090+06.59
OFFSET 35.00'RT
EL: 109.38'
STA 1090+06.59
OFFSET 49.99'RT
EL: 109.23'
STA 1090+36.01
OFFSET 55.62'RT
EL: 111.50'
B–B
VPI 1072+69.23
ELEV = 77.63
LVC = 150.00'
VPI 1075+88.13
ELEV = 78.35
LVC = 200.00'
0.23%
VPT 1073+44.23
ELEV = 77.80
VPC 1074+88.13
ELEV = 78.12
VPT 1076+88.13
ELEV = 71.35
VPC 1077+99.13
ELEV = 63.58
-7.00%
VPT 1080+99.13
ELEV = 52.76
-0.21%
FINISH GRADE
BOTTOM OF SUBBASE
EXISTING GROUND
VPI 1079+49.13
ELEV = 53.08
LVC = 300.00'
FG:74.75
EG:74.7
FG:74.08
EG:74.1
FG:41.76
EG:41.8
FG:41.37
EG:41.4
1072+00
1075+00
1080+001081+00
VPI 1091+41.21
ELEV = 120.50
LVC = 200.00'
0.14%
VPC 1090+41.21
ELEV = 112.50
VPT 1092+41.21
ELEV = 120.64
8.00%
VPC 1081+39.85
ELEV = 52.68
VPT 1084+39.85
ELEV = 64.37
-0.21%
VPI 1082+89.85
ELEV = 52.36
LVC = 300.00'
FG:41.37
EG:41.4
FG:52.42
EG:52.4
FG:110.68
EG:110.7
FG:114.70
EG:114.7
1081+00
1085+00
1090+00
1093+00

NOTES:

1. PERIMETER ROAD ROCK DRAIN LOCATIONS TO BE SET AT LOCATIONS OF EXISTING DRAINAGE PATHWAYS. ENGINEER SHALL ADJUST FINAL PLACEMENT IN THE FIELD.

Date Revised:	7/30/2020, 4:40 PM	Designed By:	EAT
Layout Name:	Perimeter Fence Road Plan & Profile (4 of 6)	Drawn By:	EJM/HRB
File Path and Name:	P:\2017\17171JN–Angoon_Airport\C\C600Jcnst17171JN.dwg	Checked By:	AMS

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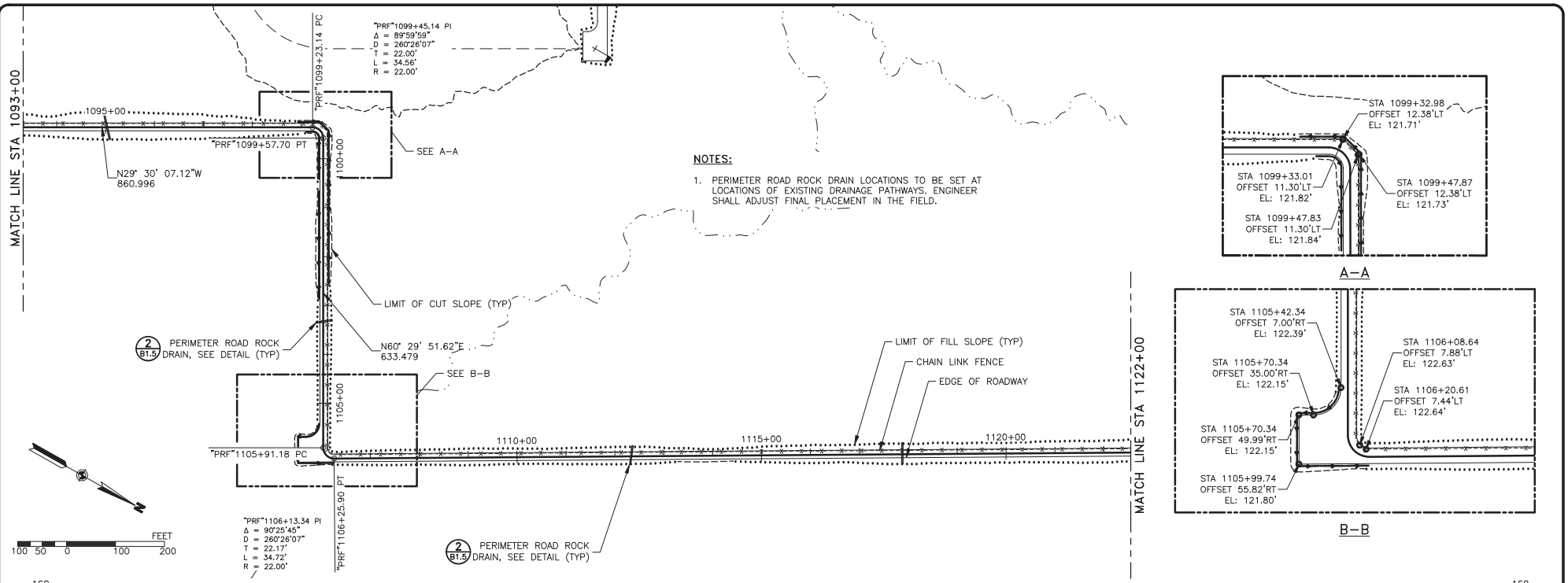
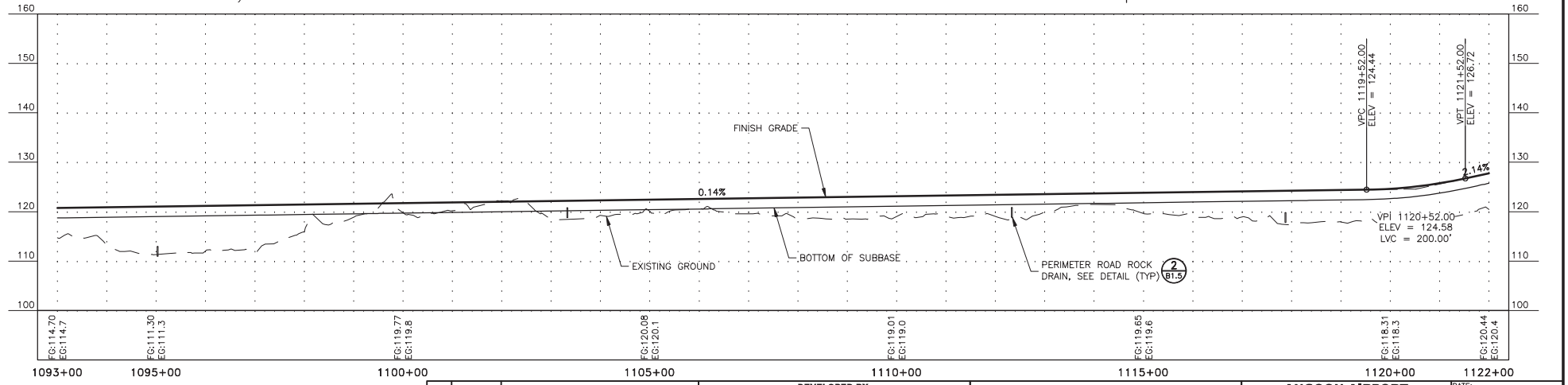
(907) 780-6060
Certificate of Authorization No: AECC605

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES - SOUTHCOAST REGION
6860 GLACIER HIGHWAY
JUNEAU, ALASKA 99801
907-465-1763

ANGOON AIRPORT
ANGOON, ALASKA
AIRPORT IMPROVEMENTS
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
PERIMETER FENCE ROAD
PLAN & PROFILE (4 OF 6)

DATE: 7/31/20
SHEET: F4.5 OF 101
AS-BUILT SHEET:





Designed By: DAT
Drawn By: EJM/HRB
Checked By: AMS

Date Revised:
Layout Name: Perimeter_Fence_Road_Plan_&_Profile_(5_of_6)
File Path and Name: P:\2017\17134-Angoon_Airport\CAD\Sheet\17171-N.dwg
7/30/2020, 4:40 PM

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PROJECT No. SFAPT00086
A.I.P. No. 3–02–XXXX–XXX–20XX
PERIMETER FENCE ROAD
PLAN & PROFILE (5 OF 6)

DATE: 7/31/20
SHEET: F4.6 OF 101
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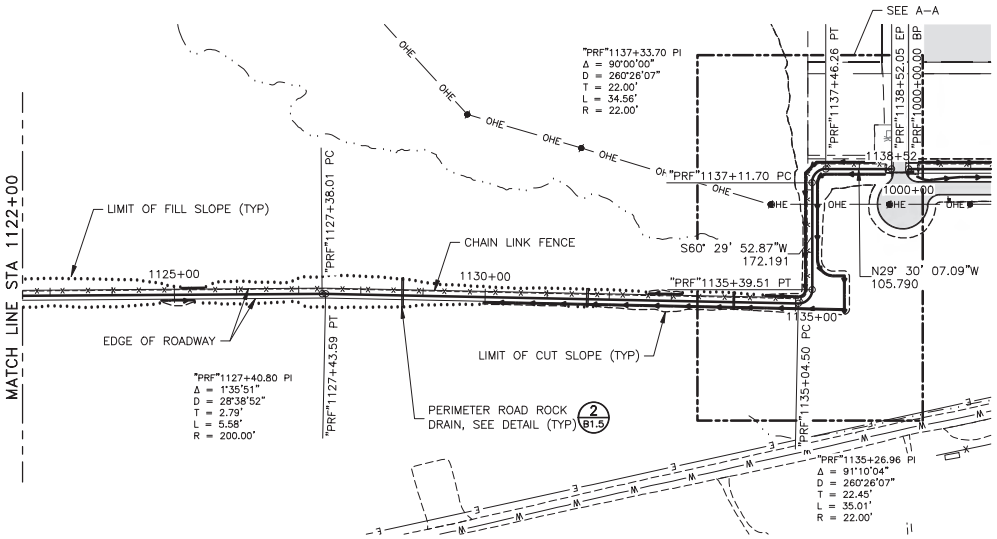
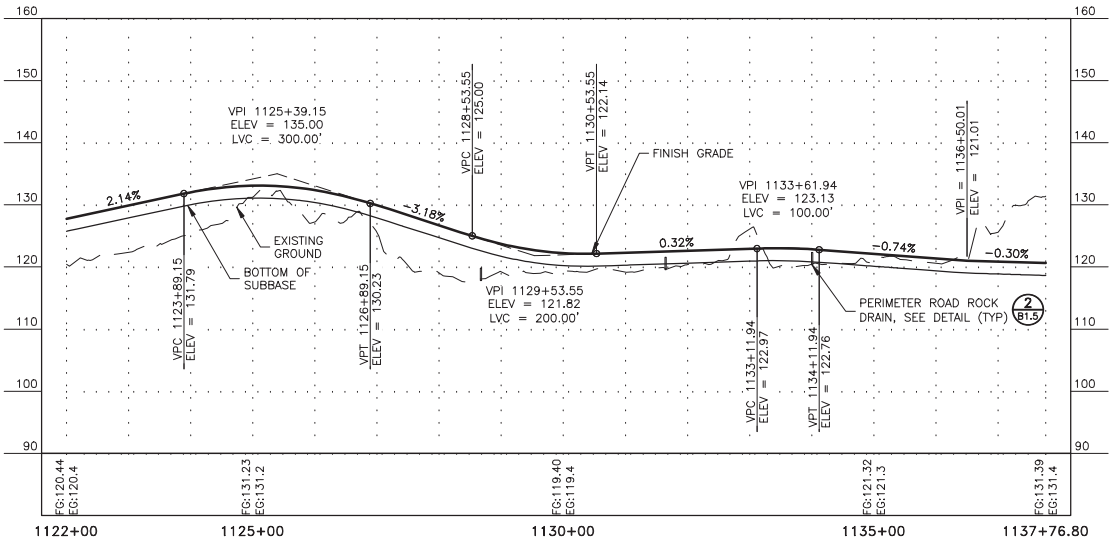
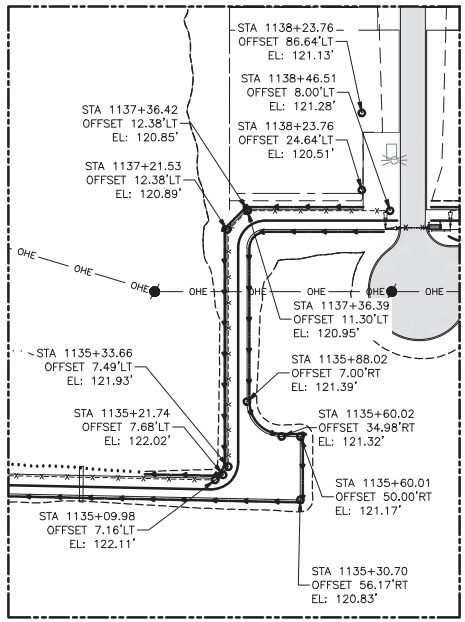


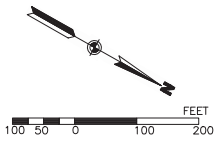




A–A

NOTES:

1. PERIMETER ROAD ROCK DRAIN LOCATIONS TO BE SET AT LOCATIONS OF EXISTING DRAINAGE PATHWAYS. ENGINEER SHALL ADJUST FINAL PLACEMENT IN THE FIELD.



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Designed By: DAT
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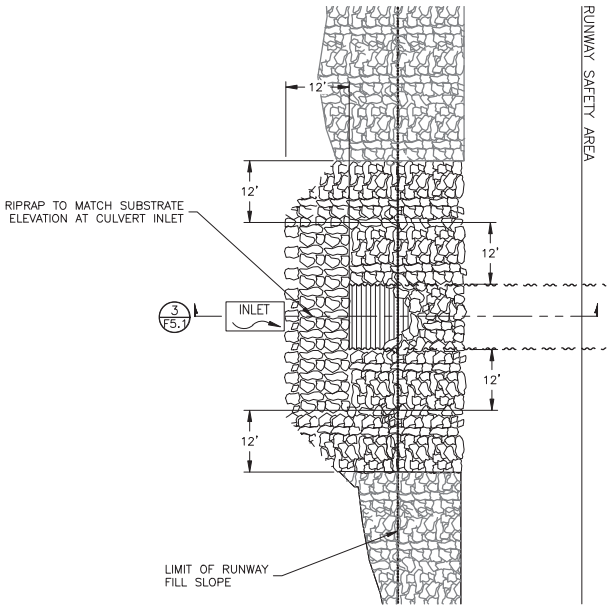
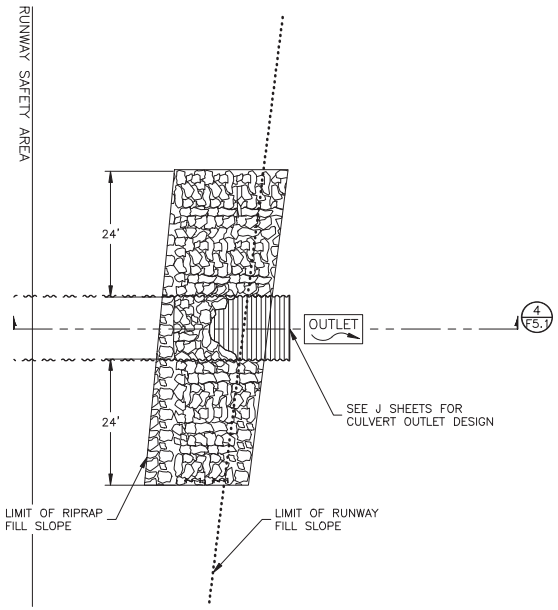
A.I.P. No. 3-02-XXXX-XXX-20XX
PERIMETER FENCE ROAD
PLAN & PROFILE (6 OF 6)

DATE: 7/31/20
SHEET: F4.7 OF 101
AS-BUILT SHEET:



1 F5.1 **INLET PROTECTION PLAN VIEW**
SCALE: NOT TO SCALE



2 F5.1 **OUTLET PROTECTION PLAN VIEW**
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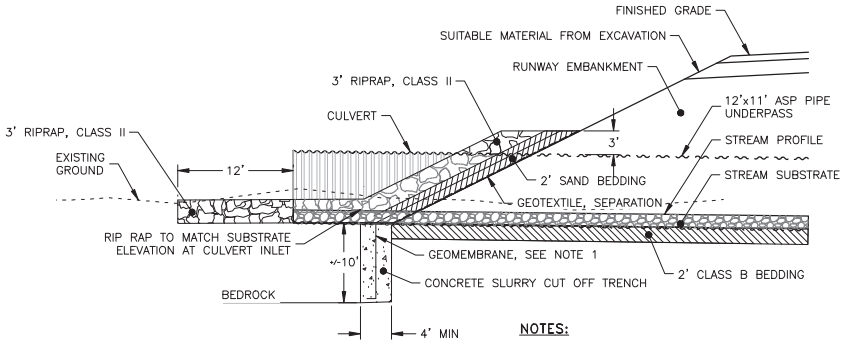
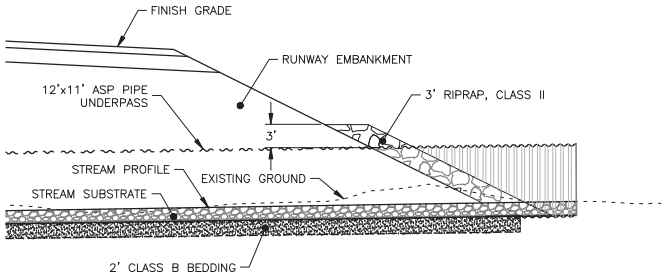


NOTES:

1. USE PREFABRICATED GEOMEMBRANE PIPE BOOT FOR PIPE PENETRATION. USE BANDING TO SECURE THE PIPE BOOT TO THE PIPE IN ACCORDANCE THE MANUFACTURES RECOMMENDATIONS.

3 F5.1 **INLET PROTECTION ELEVATION DETAIL**
SCALE: NOT TO SCALE



4 F5.1 **OUTLET PROTECTION ELEVATION DETAIL**
SCALE: NOT TO SCALE

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Drawn By: BJB/ HRB
Checked By: RMS
Date Revised:
Layout Name: F5.1
File Path and Name: P:\2017\17171AK-Angoon_Airport\CS\S301\cad\17171JN.DWG
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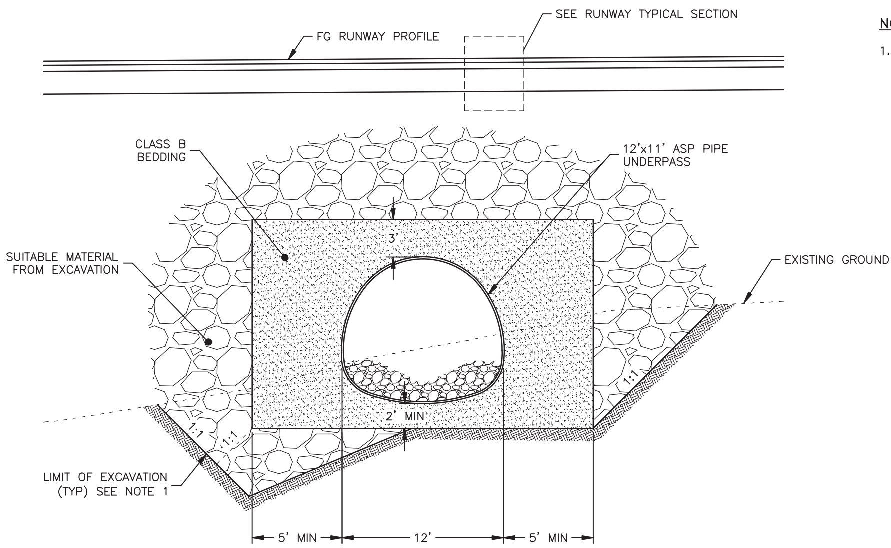
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
CULVERT & STREAM CROSSING DETAILS (1 OF 2)

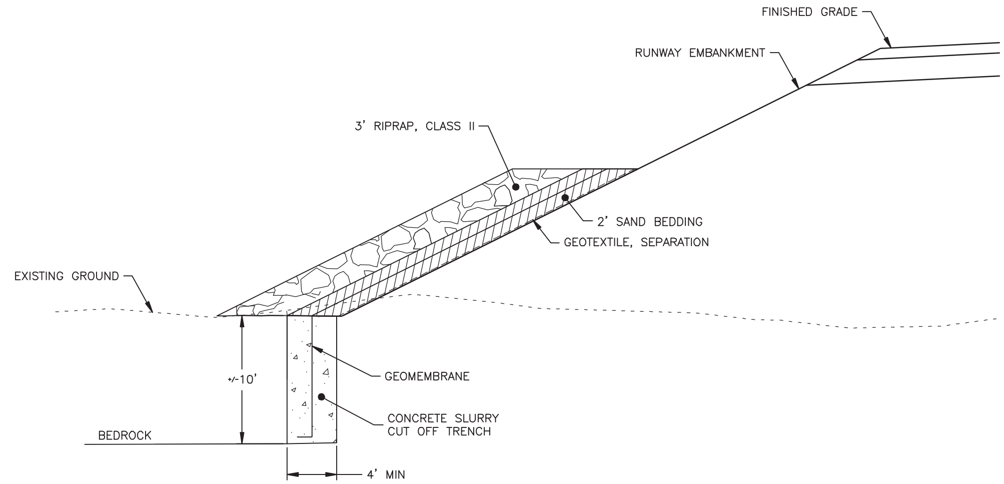
DATE: 7/31/20
SHEET: F5.1 OF 101
AS-BUILT SHEET:



1 / F5.2 **BEDDING EXCAVATION TYPICAL SECTION**
SCALE: NOT TO SCALE

NOTE:

1. EXCAVATE TO BEDROCK WITHIN FOOTPRINT OF BEDDING MATERIAL. EXCAVATION OF BEDROCK MAY BE NECESSARY TO ENSURE SUFFICIENT LIFT OF BEDDING MATERIAL BELOW PIPE.



2 / F5.2 **EMBANKMENT PROTECTION ELEVATION DETAIL**
SCALE: NOT TO SCALE

CULVERT SUMMARY

RUNWAY

STATION	OFFSET	INVERT		STATION	OFFSET	INVERT		DIAMETER (INCHES)	LENGTH (FEET)	TYPE	THICKNESS (GAUGE)
31+44.80	128.16' LT	86.23		31+72.32	131.55 RT	82.33		12'X11'	261.0	ASP	0.25 (INCHES)
36+17.27	98.88 LT	96.23		35+48.51	94.22 LT	94.22		36	68.97	CSP	12

AWOS

STATION	OFFSET	INVERT		STATION	OFFSET	INVERT		DIAMETER (INCHES)	LENGTH (FEET)	TYPE	THICKNESS (GAUGE)
402.09.99	16.47 LT	111.37		402.15.62	19.17	109.98		36	36.11	CSP	12

ASP PIPE UNDERPASS
HYDROLOGIC & HYDRAULIC SUMMARY

FLOOD FREQUENCY (YR)	100
EXCEEDANCE PROBABILTY (%)	1%
DISCHARGE (CFS)	101 (CFS)
WATER SURFACE ELEVATION (FT)	91.23 FT
ANTICIPATED ADDITIONAL BACKWATER (FT)	N/A
HW/D	0.29
DRAINAGE AREA:	0.346 SQUARE MILES

Designed By: EMN
Drawn By: EJO/HRB
Checked By: RGS
Date Revised: 7/30/2020, 4:41 PM
Layout Name: F5.2
File Path and Name: P:\2017\17171JN-Angoon_Airport\C\C3001cnst17171JN.DWG

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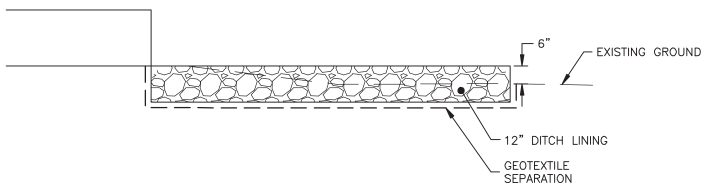
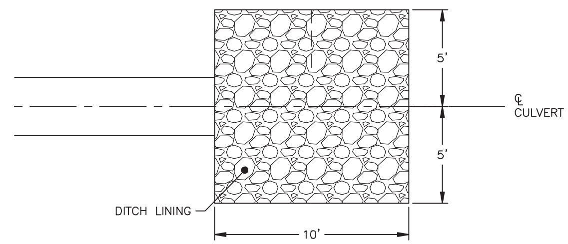
PROJECT No. SFAPT00086
A.I.P. No. 3-02-XXXX-XXX-20XX
CULVERT & STREAM CROSSING DETAILS (2 OF 2)

DATE: 7/31/20
SHEET: F5.2 OF 101
AS-BUILT SHEET:



1 / F5.3 CULVERT VELOCITY DISSIPATION ELEVATION

SCALE: NOT TO SCALE



2 / F5.3 EMBANKMENT PROTECTION ELEVATION DETAIL

SCALE: NOT TO SCALE

CULVERT VELOCITY DISSIPATION NOTES:

1. CONSTRUCT VELOCITY DISSIPATION AT EACH CULVERT INLET AND OUTLET.
2. AFTER STABILIZATION HAS BEEN ESTABLISHED, IN ACCORDANCE WITH APDES CGP, SPREAD VELOCITY DISSIPATION BERM TO MATCH CHANNEL.

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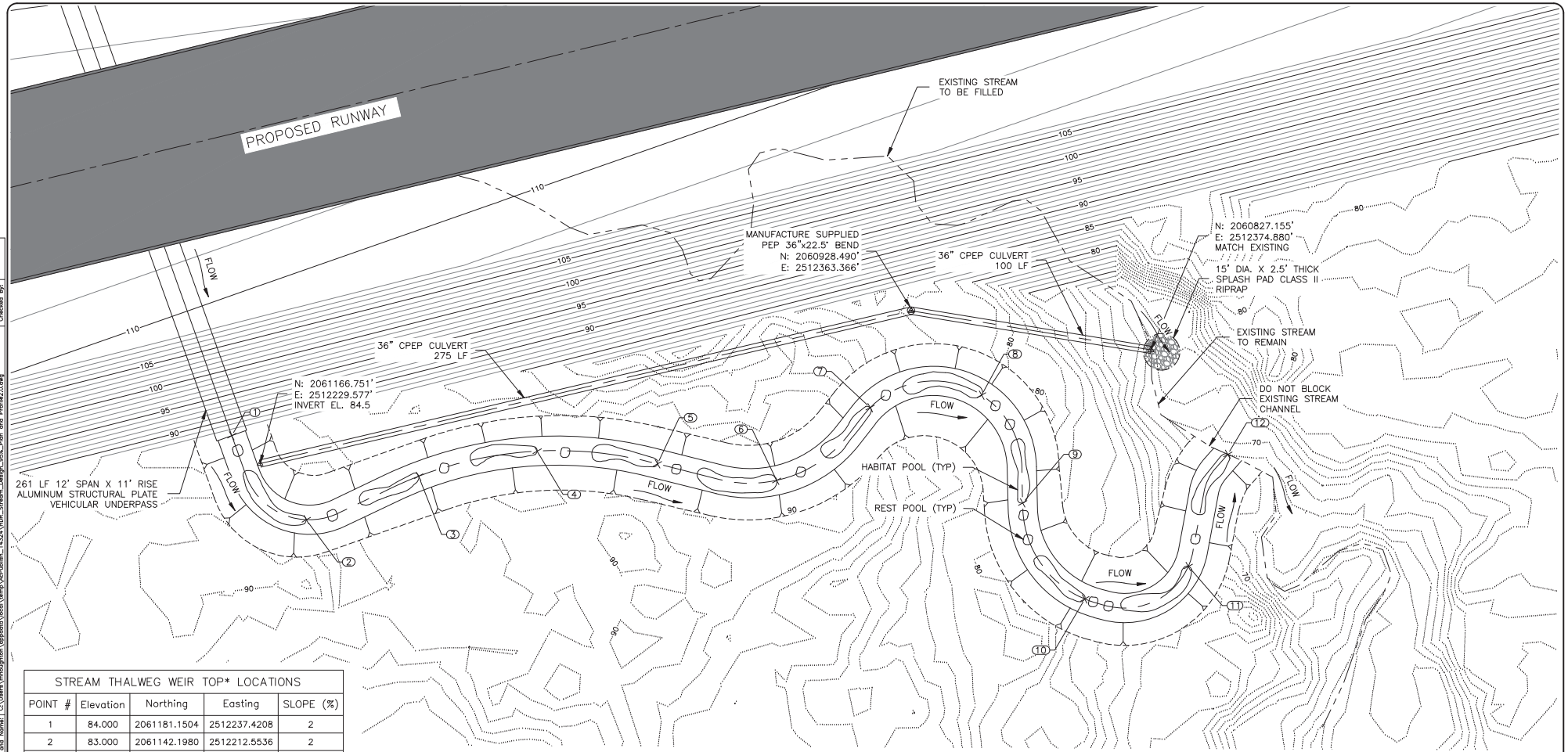
A.I.P. No. 3-02-XXXX-XXX-20XX
CULVERT DETAILS

DATE: 7/31/20
SHEET: F5.3 OF 101
AS-BUILT SHEET:



1 / J1.0 PROPOSED STREAM PLAN

STREAM THALWEG WEIR TOP* LOCATIONS				
POINT #	Elevation	Northing	Easting	SLOPE (%)
1	84.000	2061181.1504	2512237.4208	2
2	83.000	2061142.1980	2512212.5536	2
3	82.000	2061102.6184	2512242.4039	2
4	81.000	2061058.6054	2512265.7052	2
5	80.000	2061009.5396	2512274.2020	2
6	79.000	2060960.5638	2512281.0898	2
7	78.000	2060931.7575	2512320.4000	3
8	76.500	2060889.0581	2512337.8988	4
9	74.500	2060860.7041	2512299.8762	4
10	72.500	2060825.3202	2512268.8394	4
11	70.500	2060788.0406	2512293.3701	2
12	69.300	2060785.0276	2512342.1905	–

LEGEND

(20) STREAM THALWEG, TOP OF WEIR LOCATIONS. SEE LAYOUT TABLE

NOTES:

1. SEE SHEET J1.2, DETAIL 3 FOR STREAM THALWEG STATION EQUATION INFORMATION.

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STREAM PLAN AND PROFILE

DATE: 7/31/20
SHEET: J1.0 OF 101
AS-BUILT SHEET:

Date Revised: 7/28/2020, 2:54 PM
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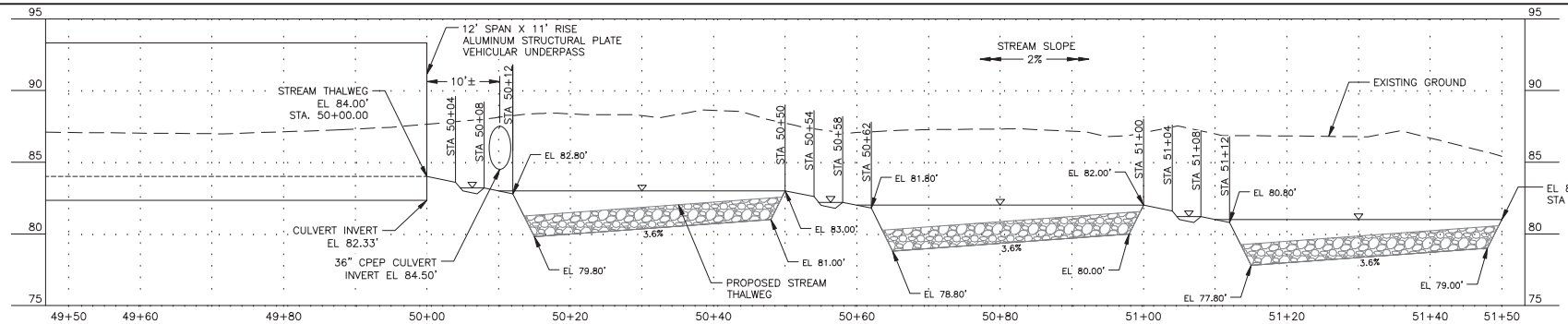
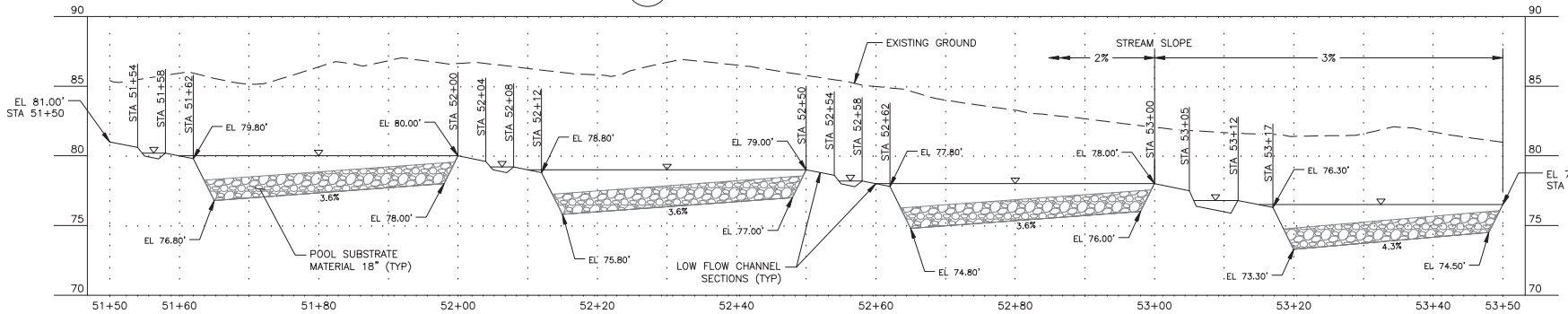
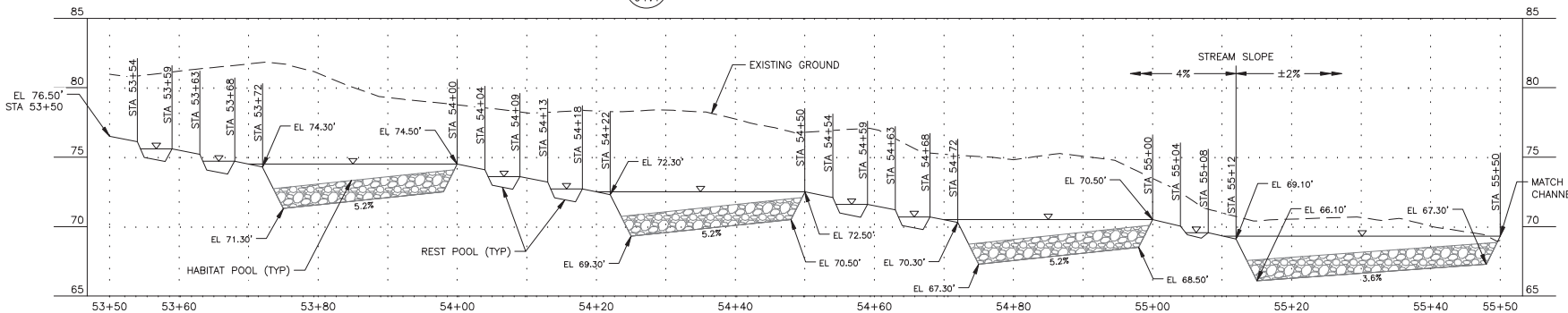
Checked By:



1 J1.1 STREAM PROFILE – STA 50+00 TO 51+50
SCALE: 2' VERTICAL EXAGGERATION



2 J1.1 STREAM PROFILE – STA 51+50 TO 53+50
SCALE: 2' VERTICAL EXAGGERATION



3 J1.1 STREAM PROFILE – STA 53+50 TO 55+50
SCALE: 2' VERTICAL EXAGGERATION

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Proposed Stream Profile
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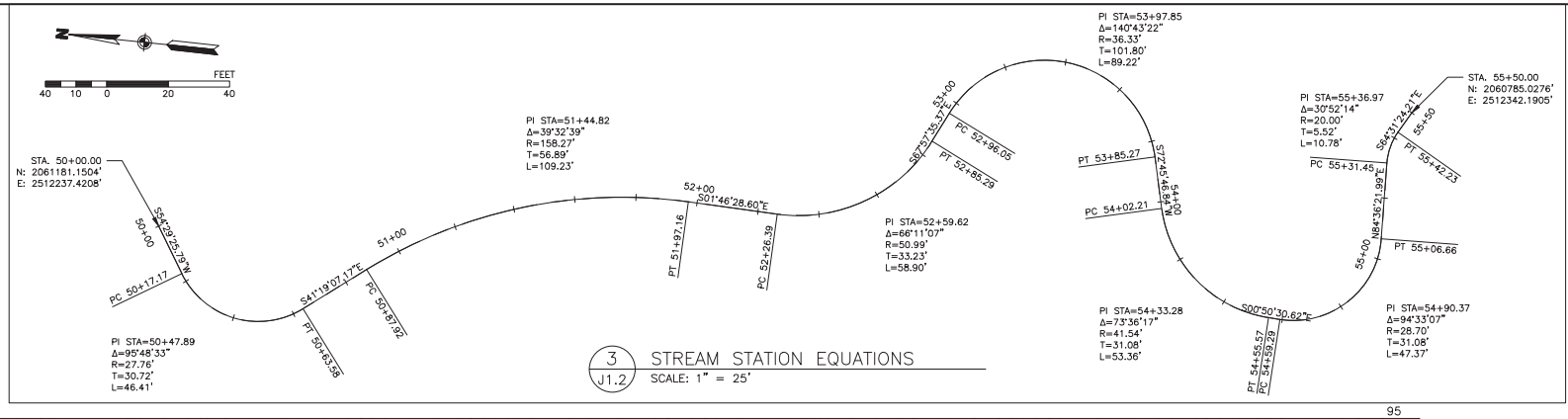
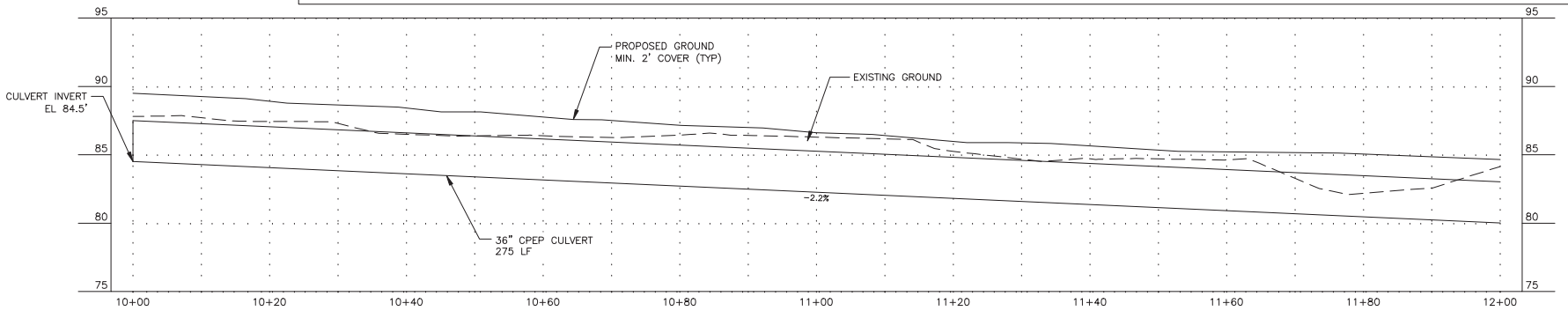
STREAM PLAN AND PROFILE

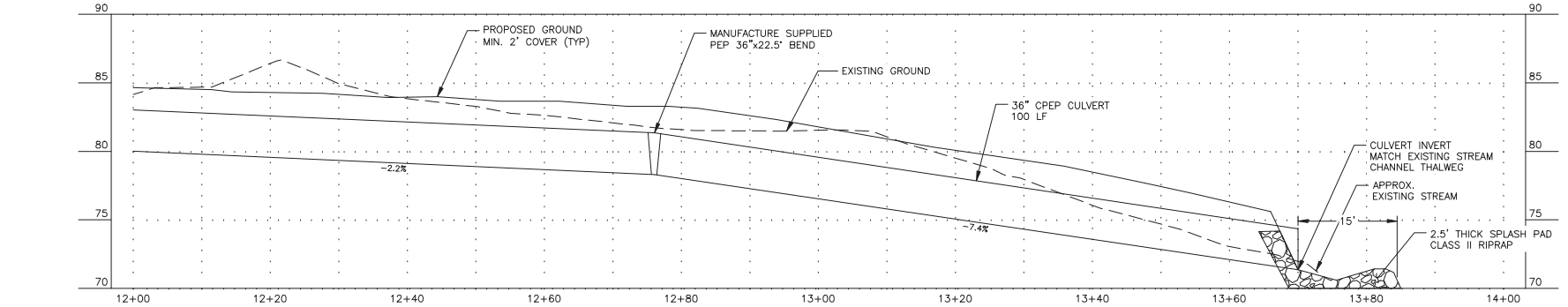
DATE: 7/31/20
SHEET: J1.1 OF 101
AS-BUILT SHEET:



3 J1.2 STREAM STATION EQUATIONS
SCALE: 1" = 25'



1 J1.2 CPEP CULVERT PROFILE – STA 10+00 TO 12+00
SCALE: 2' VERTICAL EXAGGERATION



2 J1.2 CPEP CULVERT PROFILE – STA 12+00 TO 13+65
SCALE: 2' VERTICAL EXAGGERATION

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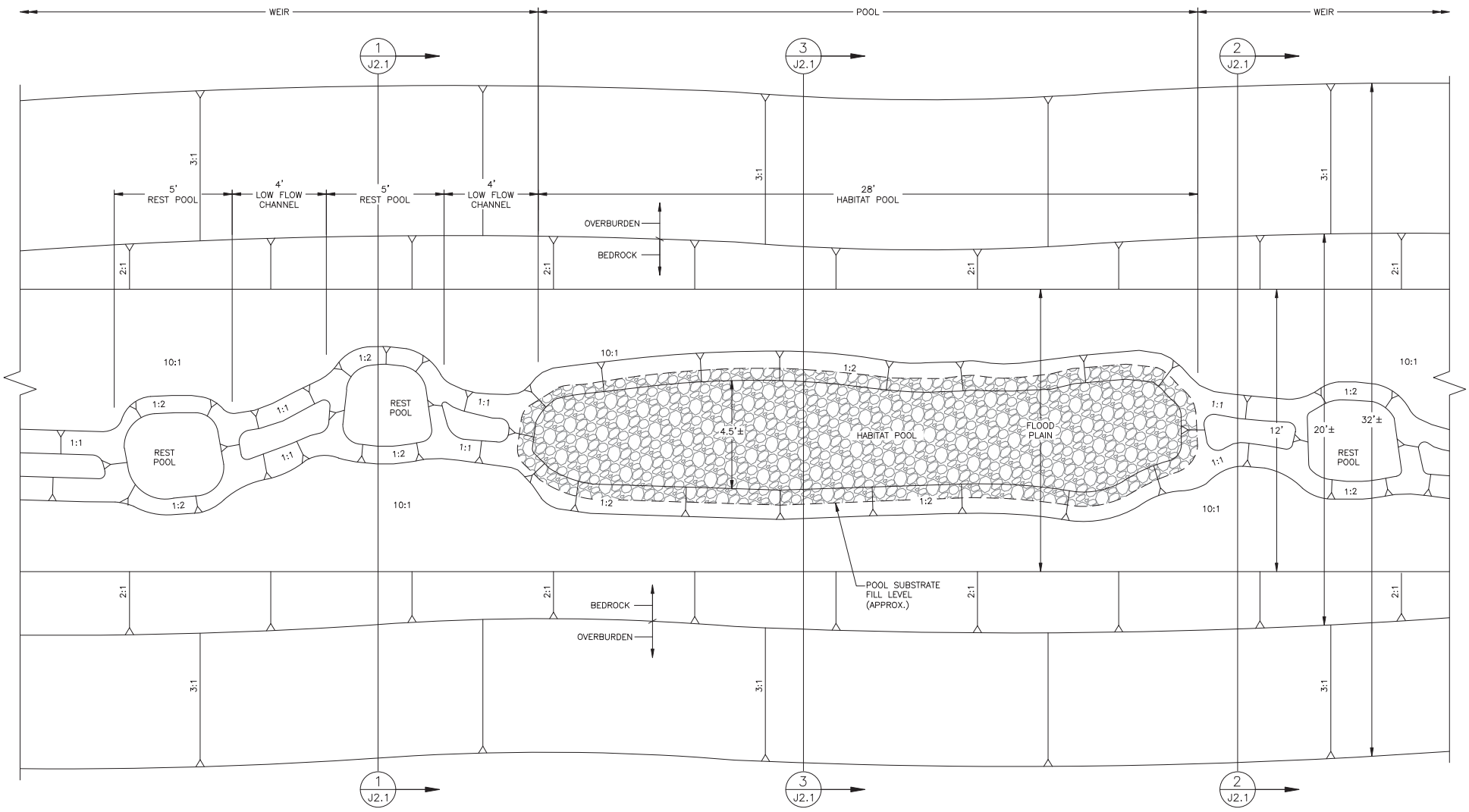
CULVERT PROFILE

DATE: 7/31/20
SHEET: J1.2 OF 101
AS-BUILT SHEET:



1 J2.0 TYPICAL POOL–WEIR SEQUENCE PLAN VIEW

SCALE: NOT TO SCALE

NOTES:

1. 4% CHANNEL SLOPE SHOWN. 3% & 2% CHANNEL SLOPES ARE SIMILAR WITH ONLY ONE REST POOL PER POOL–WEIR SEQUENCE. CROSS SECTION DIMENSIONS ARE THE SAME FOR ALL CHANNEL SLOPES.
2. STREAM CHANNEL AND FEATURES WILL BE CHIPPED OR RIPPED INTO FRACTURED BEDROCK – NO EXPLOSIVE BLASTING WILL BE ALLOWED.

Date Revised: 7/28/2020, 2:27 PM
Layout Name: Pool–Weir Plan
File Path and Name: C:\Users\mhoughton\appdata\local\temp\AcPublish_14524\HDR_Stream_Design_95ft_Sections and Details – Working.dwg
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Drawn By:
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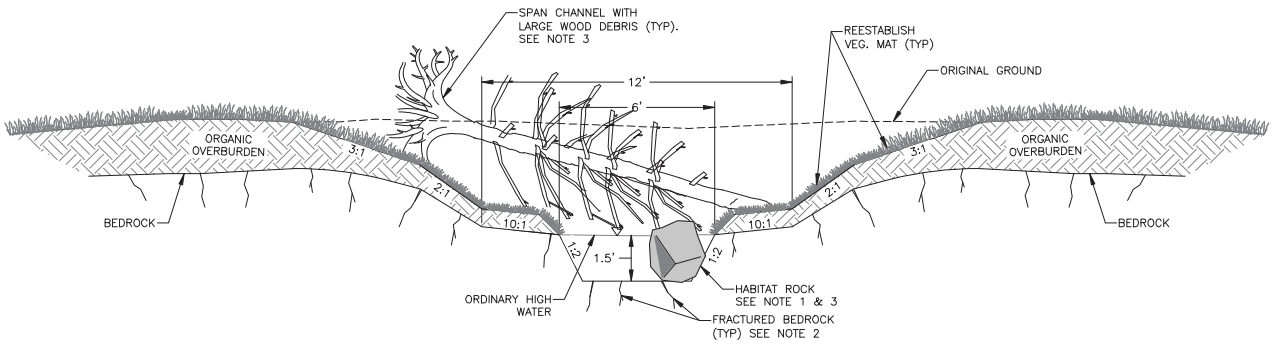
POOL–WEIR PLAN

DATE: 7/31/20
SHEET: J2.0 OF 101
AS–BUILT SHEET:



1 J2.1 TYPICAL REST POOL SECTION
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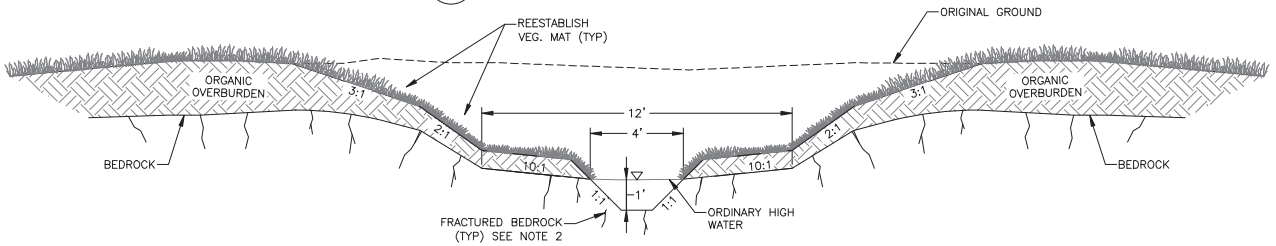

2 J2.1 TYPICAL LOW FLOW CHANNEL SECTION
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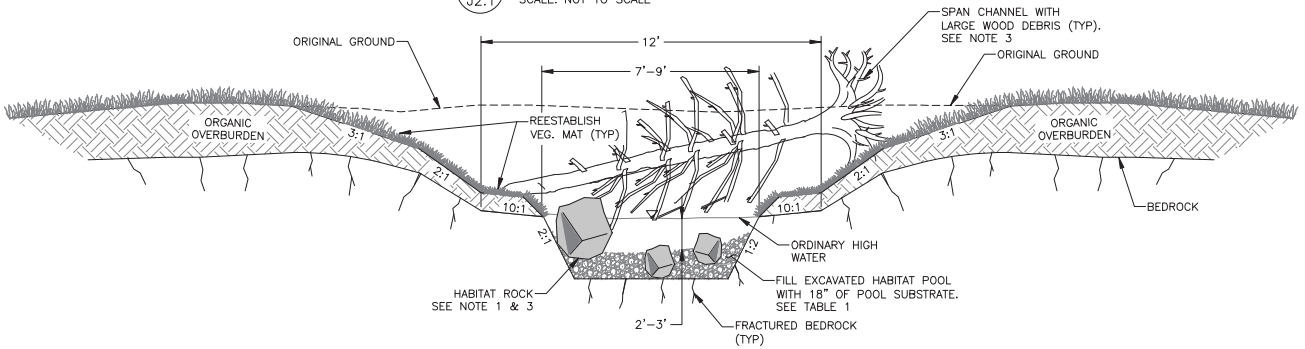

3 J2.1 TYPICAL HABITAT POOL SECTION
SCALE: NOT TO SCALE

TABLE 1

POOL SUBSTRATE MATERIAL	
SIZE	% PASSING
8"	100%
5"	75–85%
2"	45–50%
1"	40–45%
#4	35–40%
#10	30–35%
#40	25–30%
#200	20%

NOTES:

1. PLACE 12 HABITAT ROCKS (18–24") PER POOL–WEIR SEQUENCE AS DIRECTED BY ENGINEER.
2. BEDROCK FRACTURES IN LOW FLOW CHANNEL AND REST POOL TO BE GROUTED WITH BENTONITE CLAY PELLETS OR LOCALLY SOURCED CLAY. CHANNEL MUST BE SEALED AND CAPABLE OF CARRYING WATER.
3. SEE SPECIFICATIONS FOR STREAM FLOW LOSS MITIGATION PRIOR TO PLACING HABITAT ROCKS AND LARGE WOOD DEBRIS.

Date Revised:
Layout Name: Pool–Weir Sections
File Path and Name: C:\Users\mhoughton\appdata\local\temp\AcPublish_14324\HDR_Stream_Design_SMS_Sections and Details – Working.dwg
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Designed By:
Drawn By:
Checked By:

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A.I.P. No. 3–02–XXXX–XXX–20XX

POOL–WEIR TYPICAL SECTIONS

DATE: 7/31/20
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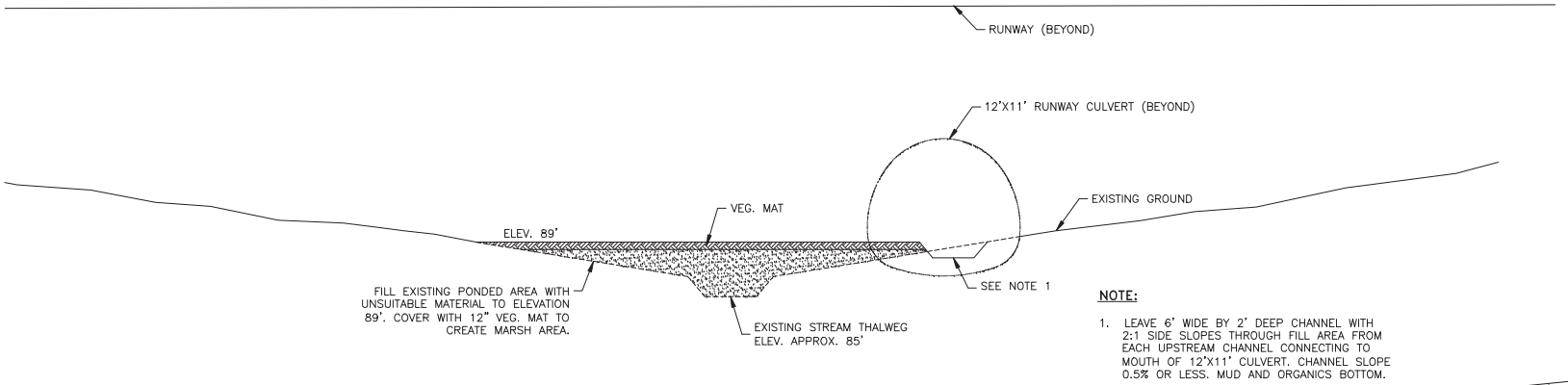

NOTE:

1. LEAVE 6' WIDE BY 2' DEEP CHANNEL WITH 2:1 SIDE SLOPES THROUGH FILL AREA FROM EACH UPSTREAM CHANNEL CONNECTING TO MOUTH OF 12'X11' CULVERT. CHANNEL SLOPE 0.5% OR LESS. MUD AND ORGANICS BOTTOM.

2 / J2.2 TYPICAL POND FILL SECTION
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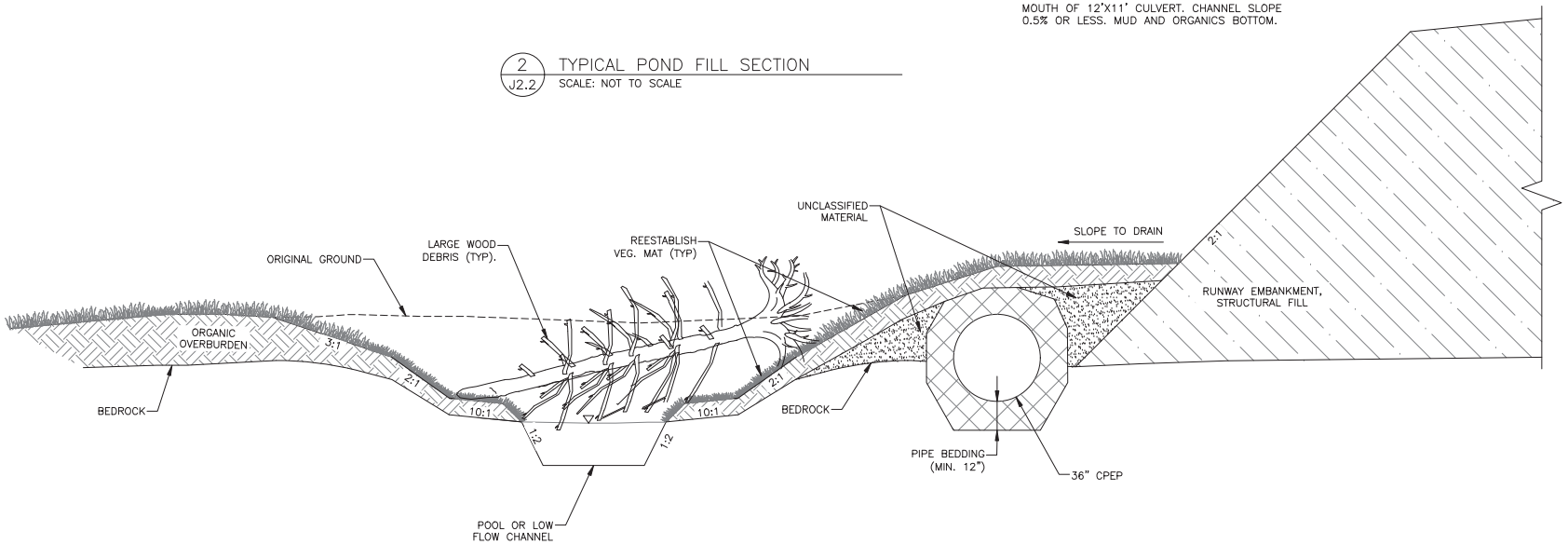

1 / J2.2 TYPICAL CHANNEL SECTION WITH 36" CPEP
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POOL-WEIR TYPICAL SECTIONS

DATE: 7/31/20
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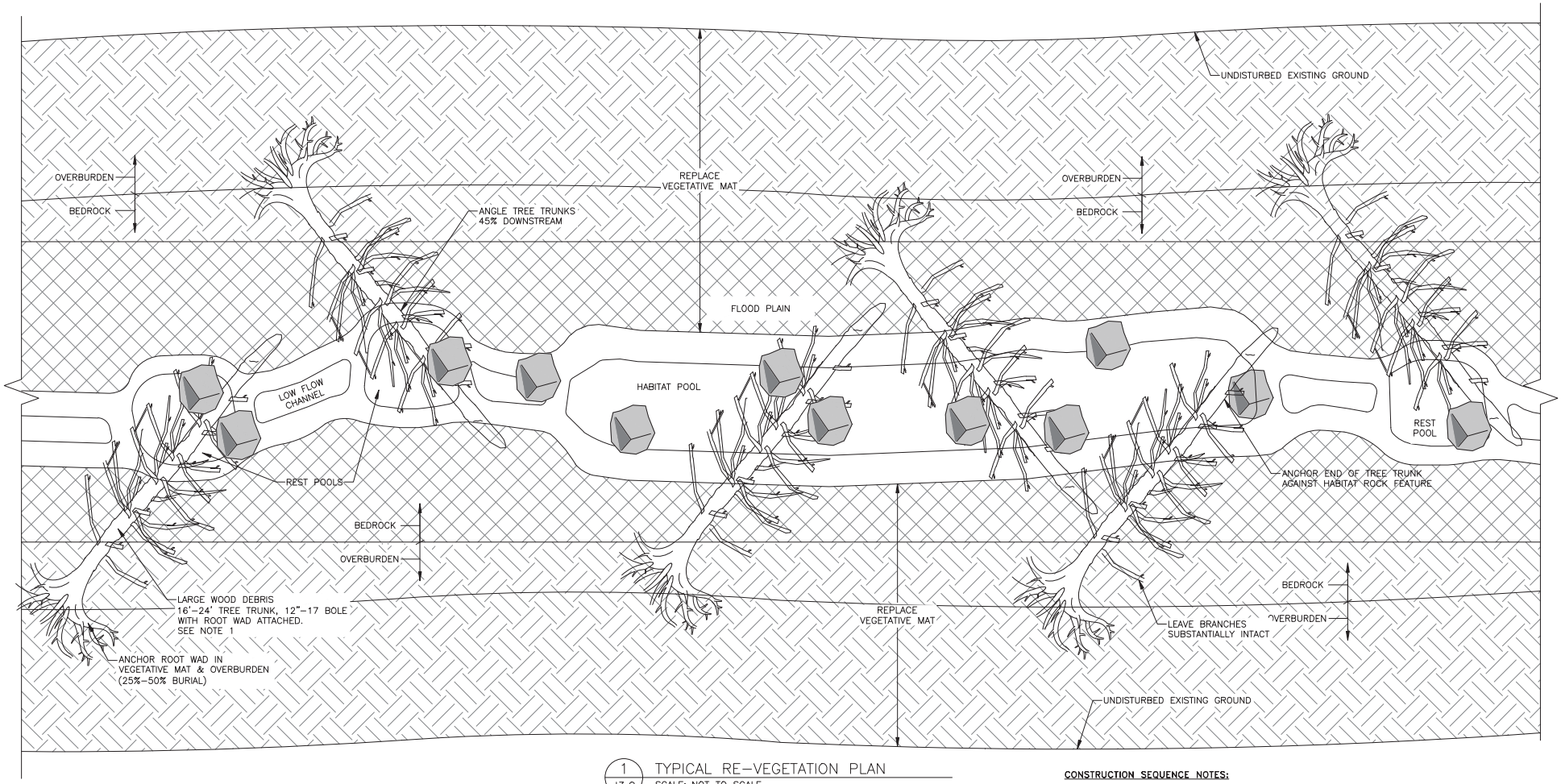

1 / J3.0 TYPICAL RE–VEGETATION PLAN
SCALE: NOT TO SCALE

NOTES:

1. PLACE LARGE WOOD DEBRIS, ONE TREE TRUNK PER REST POOL, THREE PER HABITAT POOL (4–5 PER POOL–WEIR SEQUENCE) AT THE DIRECTION OF THE PROJECT ENGINEER.

CONSTRUCTION SEQUENCE NOTES:

- REMOVE AND STOCK PILE VEGETATIVE MAT (MIN 12") FROM DISTURBED AREA.
- EXCAVATE MAIN CHANNEL TO FLOOD PLAIN. LEAVE SURFACES ROUGH AND BROKEN.
- EXCAVATE LOW FLOW CHANNEL AND POOL FEATURES. LEAVE SURFACES ROUGH AND BROKEN.
- PARTIALLY BACKFILL HABITAT POOLS WITH POOL SUBSTRATE AND SEAL BEDROCK FRACTURES IN LOW FLOW CHANNEL & REST POOL WITH BENTONITE CLAY PELLETS.
- CONFIRM THAT CHANNEL CARRIES WATER. SEE SPECIFICATIONS FOR FLOW LOSS MITIGATION.
- PLACE HABITAT ROCKS, LARGE WOOD DEBRIS AND REPLACE VEGETATIVE MAT ON ALL SIDE SLOPES DOWN TO THE EDGE OF ACTIVE CHANNEL.

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RE–VEGETATION PLAN

DATE: 7/31/20
SHEET: J3.0 OF 101
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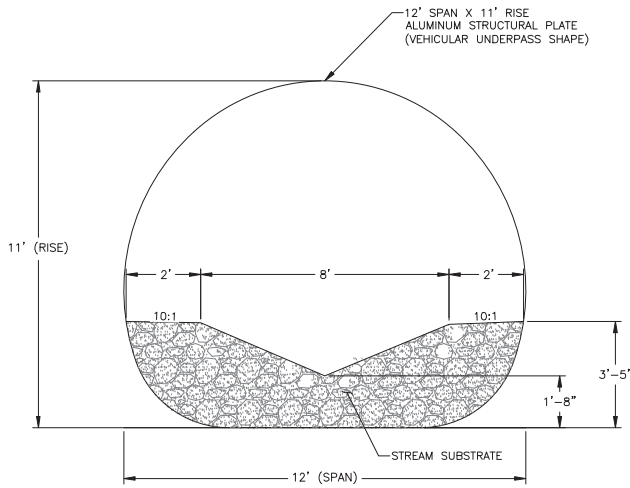
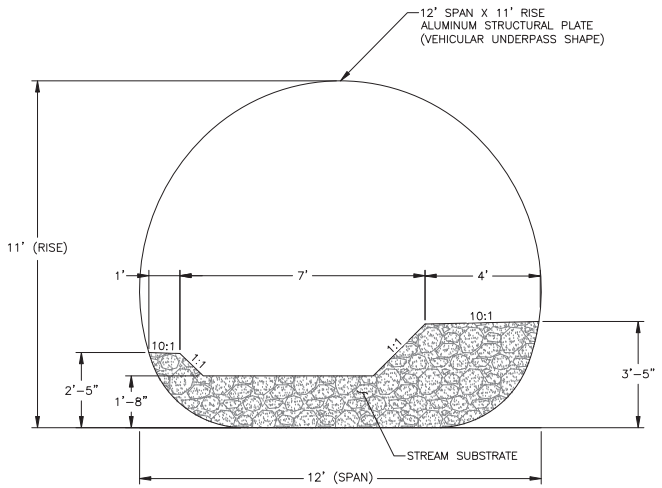


2 J4.1 CULVERT SUBSTRATE RIFFLE SECTION
SCALE: NOT TO SCALE



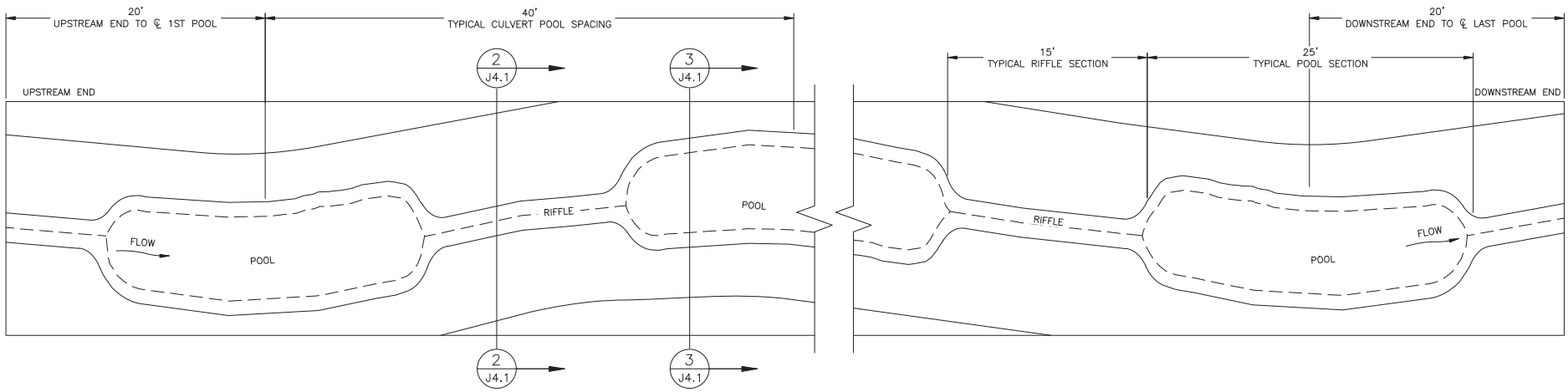
3 J4.1 CULVERT SUBSTRATE POOL SECTION
SCALE: NOT TO SCALE

NOTES:

1. STREAM SUBSTRATE SHALL BE MIXED AT SITE USING 1 PART CLASS II RIP RAP, 2 PARTS CLASS I RIP RAP AND 2 PARTS FINE MATERIAL. FINE MATERIAL SHALL FOLLOWING THE GRADATION IN TABLE 1.
2. CONSTRUCT STREAM CHANNEL LEAVING A NON-UNIFORM, ROUGH SURFACE. WASH OR TAMP FINE MATERIALS INTO COARSE MATERIALS UNTIL BED IS SEALED AND WATER POOLS ON SURFACE. ADDITIONAL FINES MAY BE REQUIRED DURING THE PROCESS.

TABLE 1

FINE MATERIAL	
SIZE	% PASSING
4"	100%
2.5"	75-85%
2"	65-75%
1"	45-55%
#4	25-35%
#10	20%
#40	15%
#200	10%



1 J4.1 TYPICAL CULVERT SUBSTRATE PLAN
SCALE: NOT TO SCALE

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CULVERT SUBSTRATE DETAILS

DATE: 7/31/20
SHEET: J4.0 OF 101
AS-BUILT SHEET:

1 J5.0 EXAMPLE REACH – HABITAT POOL SECTION
0% – 2.0%

2 J5.0 EXAMPLE REACH – WEIR SECTION
> 2.0%

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REFERENCE REACHES

DATE: 7/31/20
SHEET: J5.0 OF 101
AS–BUILT SHEET:

LEGEND

- HAUL ROUTE
- VEGETATION BUFFER (BMP-38.00 DOT&PF SWPPP GUIDE)
- SURFACE FLOW DIRECTION
- DITCH (NEW)
- CULVERT (NEW)
- CUT LIMITS
- FILL LIMITS
- TEMPORARY PERIMETER CONTROLS- FIBER ROLLS, SILT FENCE (BMP-10.01, BMP-20.00, DOT&PF SWPP GUIDE) OR EQUIVALENT.
- VEHICLE TRACKING EXIT/ENTRANCE (BMP-23.00 & 24.00 DOT&PF SWPPP GUIDE)
- WETLANDS
- CULVERT INLET PROTECTION (BMP-8.00 DOT&PF SWPPP GUIDE)

NOTES:

1. PHASE 1 CONTROLS COINCIDE WITH CONSTRUCTION SEQUENCE PHASE 1.
2. SEED ALL WASTE DISPOSAL AREAS UTILIZED IN PHASE 1 FOLLOWING T-901 OF THE PROJECT SPECIFICATIONS. INCLUDE HYDRAULIC GROWTH MEDIUM AS SPECIFIED IN T-908.

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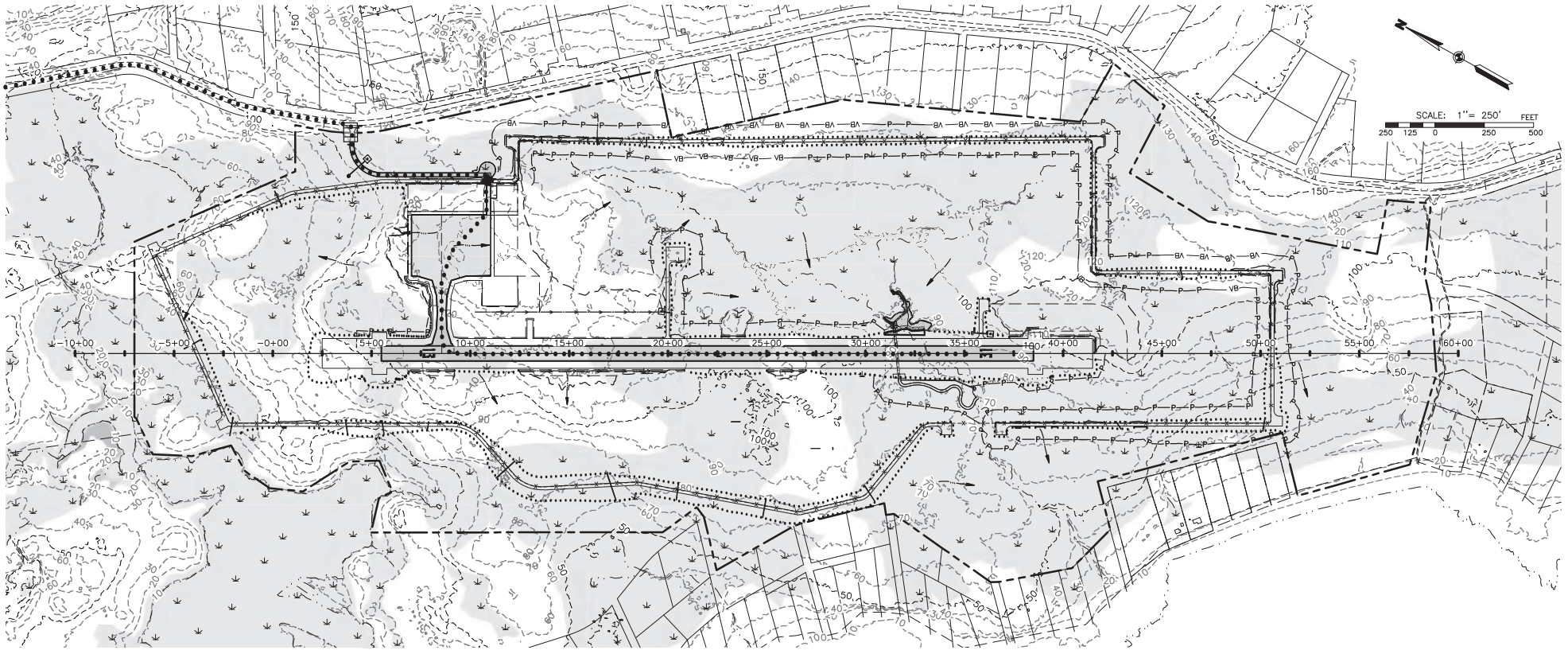

LEGEND

- HAUL ROUTE
- VEGETATION BUFFER (BMP-38.00 DOT&PF SWPPP GUIDE)
- SURFACE FLOW DIRECTION
- DITCH (NEW)
- CULVERT (NEW)
- CUT LIMITS
- FILL LIMITS
- TEMPORARY PERIMETER CONTROLS- FIBER ROLLS, SILT FENCE (BMP-10.01, BMP-20.00, DOT&PF SWPP GUIDE) OR EQUIVALENT.
- VEHICLE TRACKING EXIT/ENTRANCE (BMP-23.00 & 24.00 DOT&PF SWPPP GUIDE)
- WETLANDS
- CULVERT INLET PROTECTION (BMP-8.00 DOT&PF SWPPP GUIDE)

NOTES:

1. PHASE 2 CONTROLS COINCIDE WITH CONSTRUCTION SEQUENCE PHASE 2.
2. SEED ALL WASTE DISPOSAL AREAS UTILIZED IN PHASE 2 FOLLOWING T-901 OF THE PROJECT SPECIFICATIONS. INCLUDE HYDRAULIC GROWTH MEDIUM AS SPECIFIED IN T-908.

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Checked By: AGS

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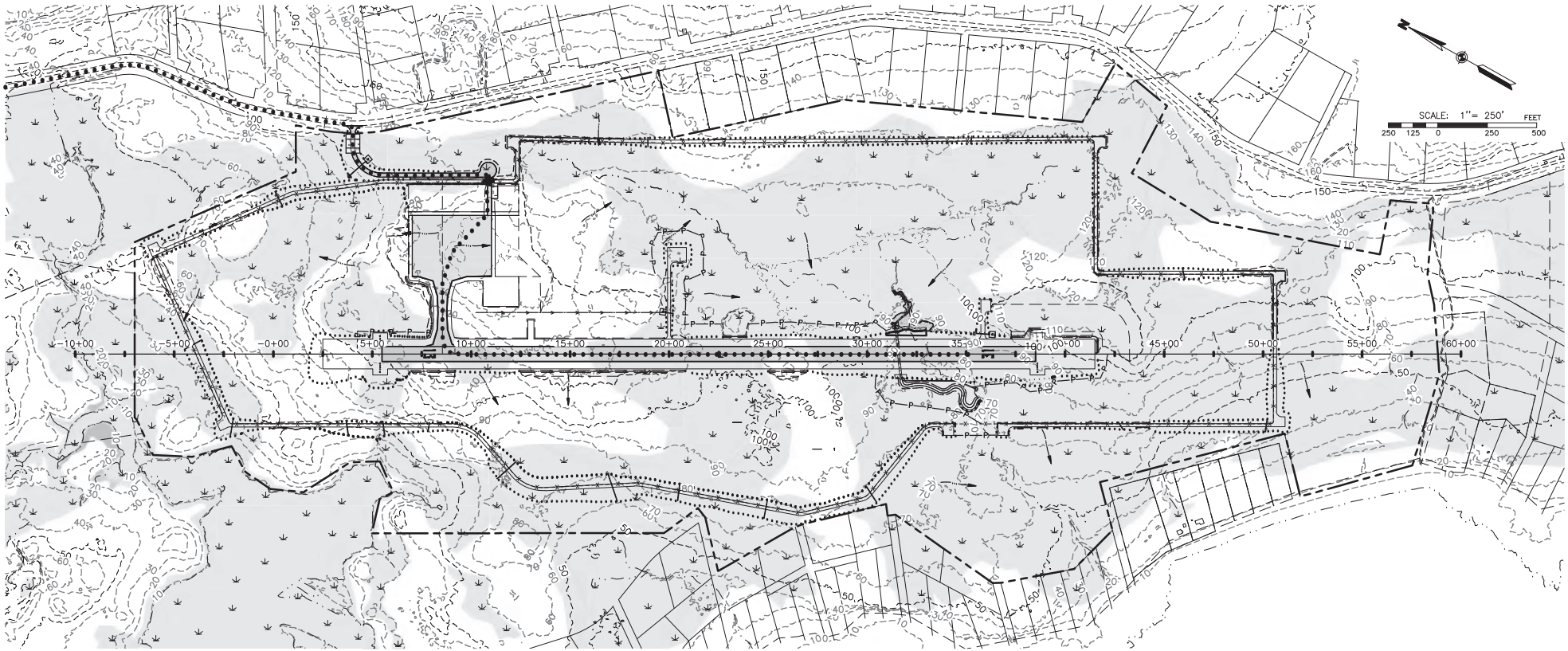

LEGEND

- HAUL ROUTE
- VB VB — VEGETATION BUFFER (BMP-38.00 DOT&PF SWPPP GUIDE)
- SURFACE FLOW DIRECTION
- DITCH (NEW)
- CULVERT (NEW)
- CUT LIMITS
- FILL LIMITS
- P P P — TEMPORARY PERIMETER CONTROLS- FIBER ROLLS, SILT FENCE (BMP-10.01, BMP-20.00, DOT&PF SWPP GUIDE) OR EQUIVALENT.
- VEHICLE TRACKING EXIT/ENTRANCE (BMP-23.00 & 24.00 DOT&PF SWPPP GUIDE)
- WETLANDS
- CULVERT INLET PROTECTION (BMP-8.00 DOT&PF SWPPP GUIDE)

NOTES:

1. PHASE 3 CONTROLS COINCIDE WITH CONSTRUCTION SEQUENCE PHASE 3.
2. SEED ALL WASTE DISPOSAL AREAS UTILIZED IN PHASE 3 FOLLOWING T-091 OF THE PROJECT SPECCIFICATIONS. INCLUDE HYDRAULIC GROWTH MEDIUM AS SPECIFIED IN T-908.

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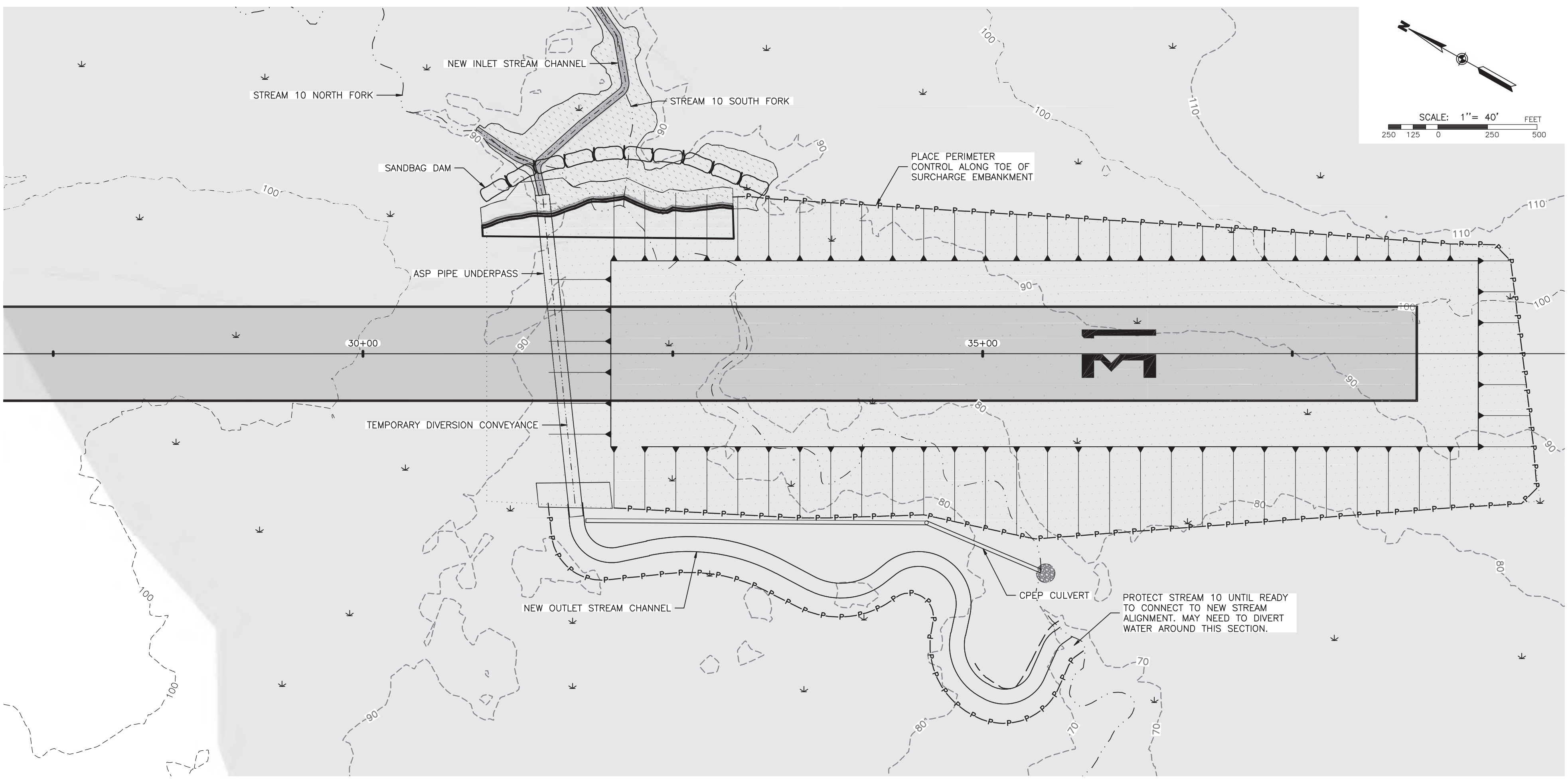

LEGEND

- HAUL ROUTE
- VEGETATION BUFFER (BMP-38.00 DOT&PF SWPPP GUIDE)
- SURFACE FLOW DIRECTION
- WETLANDS
- DITCH (NEW)
- CUT LIMITS
- FILL LIMITS
- TEMPORARY PERIMETER CONTROLS- FIBER ROLLS, SILT FENCE (BMP-10.01, BMP-20.00, DOT&PF SWPP GUIDE) OR EQUIVALENT.

CULVERT BYPASS SEQUENCE:

1. AFTER INSTALLATION OF CPEP CULVERT, BLOCK STREAM USING SANDBAG DAM (BMP-34.00 DOT&PF SWPPP GUIDE OR FUNCTIONAL EQUIVALENT).
2. INSTALL TEMPORARY DIVERSION CONVEYANCE (BMP-34.00 DOT&PF SWPPP GUIDE OR FUNCTIONAL EQUIVALENT)FROM UPSTREAM OF DAM TO INLET OF CPEP CULVERT. TEMPORARY DIVERSION CONVEYANCE MAY BE PLACED WITHIN ASP CULVERT. CONTRACTOR MAY CHOOSE TO ALTER LOCATION WITH APPROVAL OF ENGINEER.
3. INSTALL ASP CULVERT. CONSTRUCT NEW INLET STREAM CHANNEL AND NEW OUTLET STREAM CHANNEL.
4. WHEN OUTLET STREAM CHANNEL IS APPROVED FOR OPERATION, REMOVE DAM, TEMPORARY DIVERSION CONVEYANCE AND BLOCK CPEP CULVERT INLET.

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Checked By:	AMS

ANGOON AIRPORT

Compensatory Wetland Mitigation Approach

Prepared for

Alaska Department of Transportation

October 2020

ESA

ANGOON AIRPORT

Compensatory Wetland Mitigation Approach

Prepared for

Alaska Department of Transportation

October 2020

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Compensatory Wetland Mitigation Approach

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ANGOON AIRPORT
Compensatory Wetland Mitigation Approach

1.0 Introduction

The Alaska Department of Transportation & Public Facilities (ADOT & PA) authorized Environmental Science Associates (ESA) to prepare this Compensatory Wetland Mitigation (CWM) Approach Report to support a Department of the Army (DA) permit for a new airport near the community of Angoon on Admiralty Island in southeast Alaska.

This report describes how unavoidable water resource impacts from the proposed airport would be offset according to the Mitigation Rule (Corps/EPA 2008) and guidelines set forth in 33 CFR part 332 and 40 CFR Part 230 Subpart J – *Compensatory Mitigation for Losses of Aquatic Resources*. Current guidelines require CWM to occur within the same watershed as the impact site and to consider mitigation options according to the following hierarchy:

(1) Mitigation bank credits;

(2) In-lieu fee program credits;

(3) Permittee-responsible mitigation under a watershed approach;

(4) Permittee-responsible mitigation; and

(5) Permittee-responsible mitigation through off-site and/or out-of-kind mitigation.

Purchasing credits at a mitigation bank is the first option to consider in part because use of a mitigation bank can help reduce risk and uncertainty, as well as temporal loss of resource functions and services. Purchasing in-lieu fee program credits is next in the hierarchy and is preferable to permittee-responsible mitigation because they often address high-priority resource needs on a watershed scale. The mitigation approach for the Angoon Airport relies on the first two mitigation options. The impact site and potential mitigation providers are presented in Figure 1 (Appendix A).

Supporting information is included in the following appendices:

Appendix A.	Mitigation Service Provider Map
Appendix B.	Site Photographs
Appendix C.	WESPAK Assessment Summary Tech Memo
Appendix D.	Modified HGM Summary Tech Memo
Appendix E.	Post-Project WESPAK Scores for Altered Wetlands
Appendix F.	Post-Project Modified HGM Scores for Altered Wetlands

This report was prepared by Sarah Hartung, Professional Wetland Scientist; Luke Johnson, Wetland and Stream Ecologist; and Susan Cunningham, Biological Resources Director.

2.0 Baseline Conditions of the Impact Site

General Site Description

The proposed 293.91-acre impact site is within the temperate coastal rainforest ecosystem of southeast Alaska where rainfall averages approximately 60 inches a year (USDA 2018). With a few exceptions, the project site and immediate vicinity are undeveloped and consist largely of a mature western hemlock (*Tsuga heterophylla*) and Sitka spruce (*Picea stichensis*) forest. Existing site disturbances include selective harvesting of trees from Aukta Street and the construction of a small gravel parking pad at the southeastern end for residents who live along Killisnoo Harbor. Residents cut-through the site on a compact earthen path. A narrow swath was cut through the forest along the center alignment of the runway for geotechnical studies.

Elevation ranges from sea level to a height of 212.8 feet mean sea level (msl); the average elevation of the site is 203.5 feet msl. In general, the site slopes downward from the northern end to the southern end, and also from the eastern edge to the west (coast line), The terrain is gently rolling hills with slopes ranging from 3 to 15 percent.

Description of Water Resources

Approximately 193 acres or 66 percent of the impact site consists of wetland, including bog forest, bog woodland and salt marsh (Table 1). Perennial streams and a small intertidal area are also found on-site (Table 1).

Table 1. Wetland and Other Water Types Delineated at the Proposed Angoon Airport Project Site

Wet Habitat	Cowardin Class*	HGM Class	Extend beyond the project site?	Size within project site)
Wetland Type				
Bog Forest (BF)	PFO4B	Slope Forest	Yes	121.95 acres
Bog Woodland (BW)	PFO1B	Slope Bog	Yes	79.04 acres
Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Yes	0.63 acres
				Total: 193.2 acres
Other Water Types				
Stream 10MF	R2UB	NA	Yes	2,088.0
Stream 10NF	R2UB	NA	Yes	2,487.5
Stream 10SF	R2UB	NA	Yes	2,357.3
Stream 12	R2UB	NA	Yes	104.3 ft
Stream 16	R2UB	NA	No	403.7 ft.
Stream 17	R2UB	NA	Yes	492.4 ft.
				Total: 7,535 linear feet
Intertidal Area	E1UB1N	NA	Yes	0.5 acre

*PFO4B: Palustrine, Forested, Needle-Leaved Evergreen, Saturated; PFO1B: Palustrine, Forested, Broad-Leaved Deciduous, Saturated; E2EM1N: Estuarine, Intertidal, Emergent, Persistent, Regularly Flooded; R2UB: Riverine, Lower Perennial, Unconsolidated Bottom; E1UB1N: Estuarine, Subtidal, Unconsolidated Bottom (Tidal Pond), Regularly Flooded

Several polygons of bog forest, the most extensive wetland type found on-site, were delineated and categorized into groups based on shared characteristics (ESA 2020a). Two bog forest groups occur in the project site – Group 4 and Group 6 however, the following describes the shared

characteristics of bog forest. This wetland type is characterized by multiple vegetation strata including a canopy, subcanopy, shrub and herbaceous layer. The canopy cover of mature spruce and hemlock ranges from 60 to 80 percent. The shrub layer was relatively dense in some areas and excluded herbaceous growth. Soils consisted of saturated organic material (> 20 inches deep) with some areas of clay and silts underlying the organics. The bog forest wetlands had a high degree of microtopography, large downed wood, upland hummocks, and were often bordered by convex upland formations. Dominant trees and shrubs of the bog forest include western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea stichensis*), oval-leaf blueberry (*Vaccinium ovalifolium*), Alaska blueberry (*Vaccinium alaskaense*), false azalea (*Menziesia ferrunginea*), and Devil's club (*Oplopanax horridus*). Skunk cabbage (*Lysichiton americanus*) was a dominant herbaceous species.

One group of bog woodland wetlands – Group 5 comprising 7 polygons – is identified for the site. Bog woodland is distinguished from bog forest by having stunted or short-statured trees with an overall cover of 5 percent or less, less than 30 percent shrub cover, and a dense herbaceous layer of sedges, herbs and bryophytes. Dominant trees included crabapple (*Malus fusca*), dwarf birch (*Betula nana),* shore pine (*Pinus contorta*) and western hemlock. Labrador tea (*Rhododendron groenlandicum*) and crowberry (*Empetrum nigrum*) were relatively abundant in the bog woodlands. Soils were a thick layer of saturated organic peat and fibrous histosols. Several small pockets of ponded water in the bog woodlands gathered into short stream segments that frequently disappeared and reappeared in the dense ground layer.

A small area of salt marsh occurs in the northwestern portion of the project site adjacent to the saltwater lagoon or intertidal area. The salt marsh is inundated regularly and was dominated by Lyngbye's sedge. No impacts to salt marsh are anticipated due to the project as no trees are rooted in this wetland type.

Seven streams were delineated for the project site and have a classification of riverine, lower perennial (ESA 2019). Stream 10, the largest drainage system on-site, consists of a main fork (MF), a south fork (SF), and north fork (NF). Stream 10SF enters the site through a 36-inch, corrugated metal pipe (CMP) under Aukta Street and meanders in a westerly-northwesterly direction while transitioning from bog woodland to bog forest wetland. Stream 10NF originates in a bog woodland at the toe of a mounded bedrock feature (the knob) and flows in a south-southeasterly direction. Both Streams 10NF and 10SF are low gradient and marshy, with some stretches in open marsh and other areas heavily forested.

The two forks converge in an existing beaver pond at the eastern (upstream) boundary of the project area. Downstream of the confluence, flows increase in hydraulic energy in the main stem of Stream 10 (10MF) and there are more sediments and larger cobbles over an underlying clay layer. Further downstream, Stream 10MF is confined to a narrow bedrock channel through dense forest with an abundance of woody debris in the channel and floodplain. There is limited sediment, mostly in pool sections between bedrock-dominated riffles and short cascades. There does not appear to be a large amount of debris or bed load movement during high-flow events, and much of the large wood structures have heavy moss cover and appear to be rotting in place (HDR 2020).

Segments of the following streams are proposed to be culverted due to the project: Stream 10SF, Stream 10MF, and Stream 17. A portion of Stream 17 is also proposed to be filled. The riparian habitat of all streams on-site would be altered due to tree removal.

Streams 12 and 16, proposed for alteration due to tree removal, are small perennial waterways that originate from bog forest wetland and flow westerly. Both streams emerge from subsurface sources and flow in well-defined, channels before disappearing underground. Stream 17, approximately 500 feet in length, flows west drains through an incised, well defined channel. The average bankfull width is 2 feet with an average bankfull height of 2 feet. Stream 17 drains bog forest and disappears subsurface before reaching Killisnoo Harbor.

Assessment of Baseline Functions and Values

Baseline functions and values of the on-site wetlands were assessed in the field and office using WESPAK (Wetland Ecosystem Services Protocol for Alaska Southeast) and a modified HGM (hydrogeomorphic) approach (ESA 2020a and ESA 2020b). WESPAK is the wetland assessment methodology used by the SAWC in-lieu fee program and by Trillium Mitigation Bank to determine debits/credits. The Natzuhini Mitigation Bank uses a modified HGM approach to assess functions of wetlands and streams for mitigation banking purposes. The assessment of stream functions pre- and post-project are described in more detail in Section 4 of this report. Overall the bog forest and bog woodlands on site scored relatively high indicating the wetlands are providing multiple ecosystem services (Table 2).

Table 2. Overall Functional Assessment Scores of Baseline Wetland Conditions at the Angoon Airport Project Site using WESPAK and Modified HGM

Wetland Type	Group	Grouped Wetlands	Pre-project Condition – WESPAK Score*		Pre-project Condition – Modified HGM Aggregate Score		Notes
Forested bog	4	D, E, I	7.18	Higher	0.88	Highest	Multiple canopy layers; rated lower than Group 6 because of smaller patch size.
Forested bog	6	G2, 3, 5, 9-15; 17-19, 21, 23-25	7.64	Higher	0.92	Highest	Extensive stream shading, micro-topography, and down wood; somewhat higher occurrence of disturbance compared to open bog.
Bog woodland	5	G1, 4, 6, 7, 16, 20, 22	7.89	Higher	0.81	High	Relatively undisturbed open bog with few trees and low shrub occurrence; no invasive species

*Normalized WESPAK scores are as follows: Group 4 = 0.718; Group 5 = 0.789; and Group 6 = 0.764

3.0 Summary of Water Resource Impacts

Impacts to water resources are divided into two main types: permanent conversion of wetlands to uplands and loss of stream acreage due to piping or fill; and alteration of wetlands and streams due to tree removal and construction activities (Table 3). Alteration to wetlands and

streams is occasionally referred to as "temporary" impacts indicating that these features are anticipated to continue functioning as water resources after the project is complete.

Table 3 Summary of Permanent and Temporary Impacts to Water Resources

Water resource type	Permanent impacts – convert wetlands to uplands (acres) or stream loss (lf)		Alteration / Temporary impacts Wetlands (acres) and streams (lf)		
	Construct airport (runway, apron, roads etc.)	Maximum Waste disposal	Tree removal – leave stumps	Selective logging	Clearing and stockpiling
Bog forest	24.13 ac	13.45 ac	66.17 ac	9.78 ac	0 ac
Bog woodland	16.27 ac	16.21 ac	46.56 ac	0 ac	0 ac
Streams	1,279.98 lf	0 lf	6,258.07 lf	104.32 lf	0 lf
Subtotal wetlands	40.40 ac	29.66 ac	112.73 ac	9.78 ac	0 ac
Subtotal streams	1,276.98 lf*	0 lf	6,258.07 lf	104.32 lf	0 lf
Total Maximum Wetland Fill		**70.06 ac**	Total Temp. Wetland Impact		**122.51 ac**
Total Stream Loss*		**1,867.90**	Total Temp. Stream Impact		**6,046.39 lf**
Re-aligned Stream 10MF		**550 lf**			
Net Stream Impact		**1,317.90 lf**			

*Includes 1,276.9 of fill in Streams 17, 10NF, 10SF, and MF; piping Stream 10SF 175 feet; piping Stream 17 100 feet under the perimeter embankment road and filling 316 feet of Stream 17 in the waste disposal area.

Assessment of Post-project Functions for Wetlands Altered During Construction

Wetlands proposed for alteration due to tree removal and construction stockpiling were rated for post-project conditions according to both WESPAK and a modified HGM to determine loss of functions. Although the wetlands are proposed to be logged with stumps left in-place and compacted by heavy equipment, some level of wetland functionality is anticipated to remain post-construction because no permanent cut or fill is proposed in the wetlands. Wetlands that are permanently converted to uplands have a post-project functional score of "0."

Wetland conditions were scored assuming 5 years elapsed time since site rehabilitation. Other assumptions used to predict wetland conditions post-project using WESPAK and a modified HGM include the following:

- no trees and only a limited amount of shrubs would remain on the airport property;
- stream shading would be substantially diminished;
- herbaceous vegetation would be dominated by only a few species (i.e. species richness would decrease);
- microtopography and hydrologic heterogeneity would decrease; and
- non-native, invasive plant species would colonize the site and/or increase in abundance.

Refer to Table 4 for a comparison of pre-project and post-project wetland conditions using WESPAK and Refer to Table 5 for a comparison of pre-project and post-project wetland conditions using a modified HGM.

Table 4. Pre- and Post-Project Functional Assessment Scores of wetlands using WESPAK

Wetland Type	Group	Pre-project – WESPAK Overall Score*		Post-project – WESPAK Overall Score*		Change in score (delta)	Notes
Forested bog	4	0.718	Higher	0.604	Moderate	-0.114	Slightly higher post-project score than G5 because ground irregularity is assumed to be "intermediate" (but decreased from "extensive micro-topography")
Forested bog	6	0.764	Higher	0.604	Moderate	-0.193	
Bog woodland	5	0.789	Higher	0.596	Moderate	-0.160	Similar post-project changes expected as for forested peatland, except the ground irregularity is assumed to decrease from "intermediate" to "none" due to disturbance

*Normalized on a scale of 0 to 1

Table 5. Pre- and Post-Project Functional Assessment Scores of Wetlands using Modified HGM

Wetland Type	Group	Pre-project – HGM Aggregate Score*		Post-project – HGM Aggregate Score*		Change in score (delta)	Notes
Forested bog	4	0.88	Highest	0.55	Moderate	-0.33	Post-project scores are assumed to be similar due to disturbed soils and universal loss of woody vegetation overhanging streams and reducing shading.
Forested bog	6	0.92	Highest	0.55	Moderate	-0.37	
Bog woodland	5	0.81	High	0.55	Moderate	-0.26	

*Notes

4.0 Mitigation Approach

Service Providers

The mitigation providers summarized in Table 6 are proposed for use to offset unavoidable losses to water resources due to the project. The proposed impact site is at the same sub-basin level (8-digit HUC) as the SAWC in-lieu fee program and the Natzuhini Bay Mitigation Bank (Figure 1). The impact site is at the same basin level or 6-digit HUC as the Trillium Mitigation Bank and is considered to be an option per a Memorandum of Agreement (MOU) established between the Corps and EPA (2018) that allows flexibility in compensatory mitigation for remote sites.

Table 6. Summary of Mitigation Providers and Available Credits

Provider	Type	Assessment Method		Available Credits
Southeast Alaska Watershed Coalition (SAWC)[1],	In-lieu Fee Program	WESPAK	Wetland	18 funct. advance credits
			Stream	450 funct. credits, linear feet
Trillium Mitigation Bank[2]	Mitigation Bank	WESPAK	Wetland	126.75 credits
			Stream	126.75 credits
Sealaska Corporation / Natzuhini Bay[3]	Mitigation Bank	Modified HGM per Appendix 5	Wetland	168.25 credits
			Stream	66.98 credits
			Estuarine	118.97 credits

[1]Jessica Kayser Forster jess.kayser@sawcak.org; [2]Bernie M Shockeyt, Gen Mngr, bschokelt@carbonates.com; [2]Bank POC – Francis@eco-land.com; [3]Cathie Needham, cathy@kaienvironmental.com; [3]Bill Bennett, Bank POC, Bill.Bennett@sealaska.com

Determination of Credits

The Alaska District Credit/Debit Methodology (Corps 2012) was used to determine the number of debits generated by project due to permanent conversion of water resources and alteration of water resources during construction (tree removal, staging and stockpiling, etc.). The SAWC in-lieu fee program offers advanced credits for wetlands and streams. The Trillium Mitigation Bank offers universal credits that could be used to compensate for any type of aquatic resource impacts (F. Naglich, pers. comm. 2020). The Natzuhini Mitigation Bank also offers relatively universal credits for palustrine wetland, palustrine streambed (stream) as well as estuarine credits.

The allocation of impacts or debits was determined based on the availability of credits, proximity to the project site, and discussions held with the agencies during the EIS. All 18 credits offered by the SAWC in-lieu fee program are proposed to be purchased because it is believed that this will have the greatest ecological lift to wetland resources, this site was specifically identified as a potential mitigation site in the EIS, and it is the closest mitigation site to the project site. Following the Final Compensatory Mitigation Rules, the remain credits will be purchased from the Natzuhini Mitigation Bank since the project site is located within the service area of the bank.

The Natzuhini Mitigation Bank relies on a modified HGM to determine wetland functions. Consequently, a portion of the bog forest and bog woodland impacts were converted to debits using the Alaska District Credit/Debit Methodology for SAWC (WESPAK), and the remaining were converted for Natzuhini (Modified HGM Assessment). In Table 7a, the adjustment factor is 1.00 (Column F) and the adjusted delta (Column G) is the same as the Delta (Column F) because no time lag or risk was assumed for purchasing credits to offset permanent wetland impacts.

In Table 7b, the adjustment factor of 1.33 (Column F) represents the product of a 5-year time lag (1.07) multiplied by a risk factor of 1.25 (moderately low risk). The 5-year time lag is the elapsed time between the impact (i.e. tree removal) and when the wetland is judged to achieve post-project conditions (Column D). The adjustment factor (Column F) is multiplied by the Delta (Column E) to yield the adjusted Delta. The adjusted Delta (Column G) is then multiplied by the number of wetland acres proposed to be altered (Column H) to yield debits (Column I).

Table 7a. Permanent Conversion of Wetlands and No. of Mitigation Debits by Provider

A. Provider (Funct. Method)	B. Wetl. Type & Group	C. Pre-impact Funct	D. Post-impact Funct	E. Delta (Col. C – D)	F. Adjust-ment factor	G. Adjusted Delta (E*F)	H. Impact Area (acres)	I. Debits (Col. G*H)
SAWC (WESPAK)	BF, 6	0.764	0	0.76	1.00	0.76	12.25	9.31
	BW, 5	0.789	0	0.79	1.00	0.79	11	8.69
							Subtotal: 23.25 ac	Subtotal: 18.00
Natzuhini (HGM)	BF/PW, 6	0.92	0	0.92	1.00	0.92	25.33	23.30
	BW/PW, 5	0.81	0	0.81	1.00	0.81	21.48	17.40
							Subtotal: 46.81 ac	Subtotal: 40.70
							Total: 70.06 ac	**Total: 58.70 debits**

Table 7b. Alteration to Wetlands due to Tree Removal and No. of Mitigation Debits by Provider

A. Provider (Funct. Method)	B. Wetl. Type & Group	C. Pre-impact Funct	D. Post-impact Funct	E. Delta (Col. C – D)	F. Adjust-ment factor	G. Adjusted Delta (E*F)	H. Impact Area (acres)	I. Debits (Col. G*H)
Natzuhini (HGM)	BF/PW, 4	0.88	0.55	0.33	1.33	0.44	0.04	0.02
	BF/PW, 6	0.92	0.55	0.37	1.33	0.49	75.91	37.20
	BW/ PW, 5	0.81	0.55	0.26	1.33	0.34	46.56	15.83
							Subtotal: 122.51	Subtotal: 53.04
							Total: 122.51 ac	**Total: 53.04 debits**

Notes: Trillium Mitigation Bank is included in the event that credits are purchased at that provider, although no credits are allocated at this time.

Column B: BF = Bog forest; BW = Bog woodland; PW = Palustrine wetland.

Column G: The "Adjusted Delta" is the change in wetland condition post-project (Column F) multiplied by an adjustment factor (time lag*risk). For Table 7a, the adjustment factor is 1. For Table 7b, the adjustment factor is 1.33 which is the time lag to achieve the score in Column E (5 years or a value of 1.07) multiplied by the risk factor (1.25). The risk factor is estimated on a scale of 1 to 3 and is based on a moderately low risk of failed site restoration after tree removal.

The number of debits summarized in Table 7a (permanent conversion of wetlands to uplands) and in Table 7b (alteration/temporary impacts to wetlands), are allocated between SWAC and Natzuhini based on availability of credits to compensate for wetland impacts due to the Angoon Airport (Table 8). Additionally, ADOT&PF is proposing to purchase credits from SEAL Trust to compensate for temporary impacts from construction staging areas. It is estimated that staging areas may impact about 8 acres of wetlands, so 8 acres will be purchased from SEAL Trust.

Table 8. Credits Proposed for Purchase to Mitigate Permanent and Temporary Wetland Impacts

A. Provider	B. Available wetland credits	C. # Wetland credits proposed to purchase		D. Total # of Credits
		1. Permanent Conversion (Table 7a)	2. Wetland Alteration (Table 7b)	
SAWC (WESPAK)	18	18	0	18
Trillium (WESPAK)	126.75	0	0	0
Natzuhini (Modified HGM)	168.25	40.70	53.04	93.74
		58.70 credits	53.04 credits	**111.74 credits***

*The number of credits changes depending on the number of impact acres allocated to providers who use WESPAK (SAWC, Trillium e.g.) to determine debits versus the provider who uses a modified HGM assessment (Natzuhini Mitigation Bank) to determine debits. Trillium Mitigation Bank is included in the event that credits are purchased from that provider, although no credits are allocated at this time.

Streams

As described in the Hydrology and Hydraulics Report, all of the proposed impacts to the Stream 10 channels would follow design parameters as laid out in current editions of the ADF&G and DOT&PF Memorandum of Agreement and U.S. Fish and Wildlife Service's Alaska Fish Passage Guidance document (HDR 2020). Stream 10MF is known to support resident populations of cutthroat trout (*Oncorhynchus clarkii*), therefore flows will be maintained to sustain aquatic habitat throughout all portions of Stream 10MF proposed for impact.

The proposed permanent impacts to Stream 10MF would be partially self-mitigating, in large part due to the reconstructed and newly constructed stream channels. Portions of this project are considered to be a restoration project because of several project design elements that would provide long-lasting benefits to both stream and riparian habitat. Several project elements are proposed to either increase fluvial function, restore riparian habitat, or minimize impacts to water resources.

The 550 lf of new stream channel downstream (west) of the proposed runway alignment would be designed to include channel sinuosity that would attenuate stream velocities and create flow refugia for native fish. Additionally, the three constructed habitat types (riffle, rest pool, and habitat pool) would be comprised of habitat rocks, large wood, graded banks that will create diversity of channel depths at varying flow regimes. Two of three of existing vegetation strata, herb and shrub layers, would be restored through salvaging existing shrubs and seeding. A canopy layer would not be reestablished within the proposed Airport boundary, however, portions of the reconstructed Stream 10MF channel would receive regular shade through the installed habitat features.

As Table 9 demonstrates, all stream channels within the permanent impact area would have at least a 50-percent reduction in projected ecological function five years after construction. Of the five streams with permanent impacts, Stream 10MF received higher projected function rating than other streams because of the proposed restoration actions within the 550 lf of restored channel. Streams 10NF and 10SF would have minimum habitat features installed and revegetation efforts would be limited to salvaged vegetation mats and seeding.

Table 9. Pre- and Post-Project Scores of Stream Proposed to be Permanently Impacted using Modified HGM

		Permanent Impacts		Channel Restoration			
A. Stream Name	**B. Pre-project *Funct. Score**	**C. Impact Area (**acres)**	**D. Impact Debits (Cx10xB)**	**E. Restored Area (**acres)**	**F. Post-project ***Funct. Score**	**G. Restoration Credits (Ex10xF)**	**H. Total Permanent Impact Debits (D-G)**
10M	0.90	0.26	2.31	0.31	0.47	1.45	0.86
10NF	0.83	0.01	0.08	0.02	0.42	0.07	0.01
10SF	0.90	0.18	1.62	0.07	0.42	0.28	1.34
17	0.88	0.03	0.26	0.00	0.00	0.00	0.26
		0.48	4.27	0.40		1.80	**2.47**

*Functional Scores are the "Aggregate Functional Index" from the modified HGM assessment, as provided by Natzuhini Bay Mitigation Bank. For more information, see the HGM memo (ESA, 2020b).
**Palustrine Streambed (Stream) acreage is calculated by multiplying length and 2 times average bankfull width.
***The projected functional score anticipates site conditions 5 years post-restoration.

All stream channels within the temporary impact areas are anticipated to have a reduction in ecological function five years after construction (Table 10). Stream 12 received a higher projected function rating than other streams because of the proposed selective logging within the stream vicinity versus clear-cutting. Streams 10M, 10NF, 10SF, 16 and 17 would have full tree removal within their vicinity and, as result, received lower projected function ratings.

Table 10. Pre- and Post-Project Scores of Streams Proposed to be Altered using Modified HGM

		Alteration (Temporary Impacts)				
A. Stream Name	**B. Existing *Functional Score**	**C. Tree removal – leave stumps (**acres)**	**D. Selective logging (**acres)**	**E. Post-project *Functional Score 5-years post-construction**	**F. Reduction in *Funct. Score (B-E)**	**G. Temporary Impact Debits ([C+D]x10xF)**
10MF	0.90	0.44	0.00	0.550	0.35	1.52
10NF	0.83	0.16	0.00	0.550	0.28	0.45
10SF	0.90	0.46	0.00	0.550	0.35	1.62
12	0.83	0.00	0.01	0.790	0.04	0.01
16	0.83	0.03	0.00	0.550	0.28	0.08
17	0.88	0.01	0.00	0.550	0.33	0.03
		1.12	0.01			**3.71**

*Functional Scores are the "Aggregate Functional Index" from the modified HGM assessment (ESA 2020b).
**Palustrine Streambed (Stream) acreage is calculated by multiplying length and 2 times average bankfull width.

Using the number of debits summarized in Table 9 and Table 10, Table 11 presents the total number of credits proposed for purchase, including accounting for risk factor and time lag for the recovery of streams impacted on-site.

Table 11. Credits Proposed for Purchase to Mitigate Permanent and Temporary Stream Impacts – Includes Adjustments for Risk Factor and Time Lag

A. Stream Name	B. Permanent Impact Debits (Table 9)	C. Temp. Impacts Debits (Table 10)	D. *Risk Factor	E. *Time Lag Factor (5 years)	F. Total Credits ([B+C]xDxE)
10M	0.86	1.52	1.25	1.07	2.89
10NF	0.01	0.45	1	1.07	0.49
10SF	1.34	1.62	1	1.07	3.17
12	0.00	0.01	1.5	1.07	0.02
16	0.00	0.08	1	1.07	0.08
17	0.26	--	1	1.00	0.26
17	--	0.03	1	1.07	0.03
	2.47	3.71			**6.94 credits**

*Factors determined using Alaska District Credit Debit Methodology, (Corps 2018)

5.0 Summary

Unavoidable impacts to water resources due to the project are proposed to be compensated by using mitigation banks and an in-lieu fee program. A portion of the project will be "self-mitigating" by re-aligning and enhancing Stream 10MF on-site. The following summarizes the number of credits proposed for purchase to offset impacts to water resources:

- 112 wetland credits[1]
    - 18 credits proposed to be purchased from SAWC
    - 94 credits proposed to be purchased from the Natzuhini Mitigation Bank
- 7 stream credits proposed for purchase at Natzuhini Mitigation Bank
- 8 acres will be purchased from SEAL Trust to off-set impacts from construction staging areas.

6.0 References

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[1] Note: If the number of wetland impact acres is allocated differently than presented here, then the total number of wetland credits would change according to whether the provider uses WESPAK or a modified HGM assessment method to determining debits/credits.

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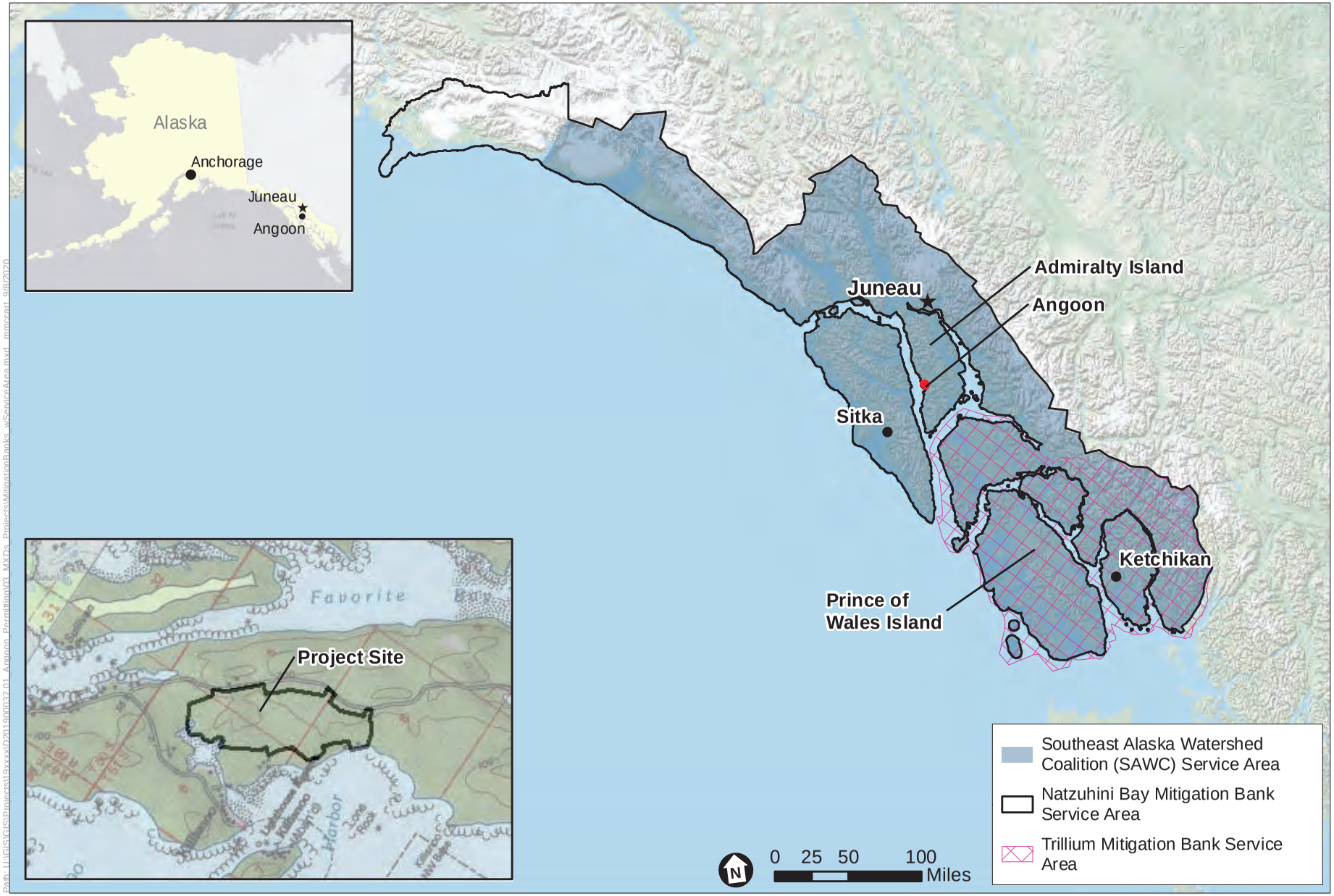
APPENDIX A

Mitigation Service Provider Map



SOURCE: USGS, 2018; USACE, 2020

Angoon Permitting

Figure 1
Mitigation Banks and ILF Provider Service Area

ESA

APPENDIX B

Site Photographs

Photo: 1	**Bog woodland in the northwest portion of the site; Wetland G20 (2017)**

Photo: 2	**Bog woodland in the northeast portion of survey area, showing the headwaters of Stream 10NF; Wetland G1 (2017)**

Photo: 3	**Typical bog forest in the southwest portion of survey area; skunk cabbage and devil's club in the foreground; Wetland G15 (2017)**

Photo: 4	**Stream 11 in the northwest portion of survey area, looking downstream (2017)**

Photo: 5	**Upland forest near sample plot 102 with false azalea in the foreground (2017)**

Photo: 6	**Bog forest with pockets of skunk cabbage, hummocks, downed wood and blueberry bushes; Wetland G15 (2017)**

Photo: 7	**The downstream reach of Stream 10MF; looking towards coastline and barrier bar, which are just beyond extent of the photo (2017)**

Photo: 8	**Wetland E (bog forest) in the southwest portion of survey area with mix of fern and devil's club (2017)**

Photo: 9	**Wetland G15 (bog forest) with mature trees, standing water, and dense emergent vegetation, east of coast, at the south end of survey area (2017)**

Photo: 10	**Typical bog forest wetland conditions of Wetland G15, located upslope of the shoreline in the southwest portion of the survey area (2017)**

Photo: 11	**Dense understory of devil's club and *Vaccinium* spp. in bog forest wetland (Wetland G15) in the southern end of the survey area (2017)**

Photo: 12	**The wetland boundary of Wetland G15 in the southeast portion of survey area, formed by the road prism and indicated by the yellow line (2017)**

Photo: 13	**Jacob's ladder along with sedges and grasses in the bog woodland (Wetland G16) at the southeast end of the survey area (2017)**

Photo: 14	**Upland forest looked similar to wetland forest, but lacks saturated soils, hydrophytic vegetation, and hydric soils (2017)**

Photo: 15	**Stream 10MF, Wetland G15 is on right side of photo, upland is on the left (2017)**

Photo: 16	**Bog forest/upland boundary with skunk cabbage in the foreground; taken in the northeast portion of the survey area (2017)**

Photo: 17	**Waters of the U.S. with skunk cabbage, looking at Stream 10MF braiding (2017)**

Photo: 18	**Bog woodland Wetland G1 in the northeast portion of the survey area (2017)**

APPENDIX C

WESPAK Assessment Summary Tech Memo

Final

ANGOON AIRPORT WETLAND WESPAK WETLAND ASSESSMENT

SURVEY RESULTS

Prepared for
ADOT&PF Southcoast Region

November 2019

ESA

Final

ANGOON AIRPORT WETLAND WESPAK WETLAND ASSESSMENT

SURVEY RESULTS

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APPROACH

Several wetlands were delineated in the Proposed Project Area, and each has been classified as one of four types: *bog forest*, *bog woodland*, fen, and *salt marsh*; using the naming convention provided by the National Environmental Policy Act, Final Environmental Impact Statement (FEIS) for the Proposed Project (FAA 2016). For the wetlands likely to be determined to be jurisdictional (see ESA 2019), an assessment of their function and value has been performed to provide key mitigating metrics in the event they are impacted by the Proposed Project. Assessments were performed using Wetland Ecosystem Services Protocol for Southeast Alaska (WESPAK-SE) (Adamus 2015). Because both tidal and non-tidal wetlands are present in the Proposed Project Area, and WESPAK provides two assessment methods based on whether a wetland is tidally influenced, both methods were used as appropriate. A summary of the delineated wetlands is provided in Table 1.

With the exception of fen wetlands, more than one wetland was delineated for each wetland type. In some cases, each delineated wetland was assessed independently because of being unique to the Proposed Project Area. However, in other cases, more than one wetland shared a diversity of characteristics, allowing them to be grouped and assessed by a single WESPAK-SE. These wetlands are generally part of larger wetland complexes; are the same wetland type; and share multiple characteristics such as geography, geology, and hydrology. An example from this survey is Wetland A (Table 1), which is composed of 10 separately delineated wetlands that share numerous characteristics. The similarity across the 10 Wetland A wetlands allows them to be grouped for WESPAK-SE, with a single representative wetland being assessed, and output applied to all wetlands in that group.

To assess the delineated wetlands using WESPAK-SE in a manner applicable to the greater Proposed Project, each wetland type was aligned across the three classification systems that have been used to date:

- The system established by the FEIS (FAA 2016)
- Cowardin classification system (Cowardin et al. 1979)
- HGM classification system (Powell et al. 2003)

Once each wetland was coded across these three wetland typing systems, they were then matched to the four wetland classes established by WESPAK-SE: *forested peatland*, *open peatland*, *fen/marsh*, and *tidal marsh* (Adamus 2015) (included in Table 1). The wetland ratings were performed using *Non-tidal WESPAK-SE v.2* for non-tidal wetlands, and *Tidal WESPAK-SE v.2* for tidally-influenced wetlands.

The condition of the wetlands in the Proposed Project Area have been degraded through time due to the various environmental and geotechnical studies performed in support of the Proposed Project. Thus, this WESPAK-SE wetland assessment is based specifically on the condition of the wetlands prior to the start of the study and degradation.

Table 1. Summary of wetlands delineated within the Proposed Project Area, including acreage and type

Wetland Name	Delineated Area (acre)*	Wet Habitat**	Cowardin Class	HGM Class	WESPAK-SE Wetland Type
A1	0.7	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A2	0.4	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A3	0.1	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A4	0.4	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A5	0.1	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A6	0.1	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A7	0.1	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A8	0.05	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A9	0.1	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
A10	0.1	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
B	0.1	Bog Forest	PFO4B	Slope Forest	Forested Peatland
C	0.006	Bog Forest	PFO4B	Slope Forest	Forested Peatland
D	1.0	Bog Forest	PFO4B	Slope Forest	Forested Peatland
E	0.2	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G1	67.0	Bog Woodland	PFO1B	Slope Bog	Open Peatland
G2	2.7	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G3	0.6	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G4	0.2	Bog Woodland	PFO1B	Slope Bog	Open Peatland
G5	2.7	Bog Forest	PFO4B	Slope Bog	Forested Peatland
G6	14.3	Bog Woodland	PFO1B	Slope Bog	Open Peatland
G7	9.6	Bog Woodland	PFO1B	Slope Bog	Open Peatland
G8	1.2	Fen	PEM1H	Slope Tidal	Fen/Marsh
G9	0.8	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G10	0.3	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G11	2.4	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G12	1.7	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G13	0.2	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G14	0.2	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G15	120.1	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G16	24.5	Bog Woodland	PFO1B	Slope Bog	Open Peatland
G17	0.7	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G18	0.3	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G19	2.7	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G20	14.5	Bog Woodland	PFO1B	Slope Bog	Open Peatland
G21	10.1	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G22	1.5	Bog Woodland	PFO1B	Slope Bog	Open Peatland
G23	0.1	Bog Forest	PFO4B	Slope Forest	Forested Peatland

Wetland Name	Delineated Area (acre)*	Wet Habitat**	Cowardin Class	HGM Class	WESPAK-SE Wetland Type
G24	0.6	Bog Forest	PFO4B	Slope Forest	Forested Peatland
G25	1.5	Bog Forest	PFO4B	Slope Forest	Forested Peatland
I	1.5	Bog Forest	PFO4B	Slope Forest	Forested Peatland
J	0.5	Bog Forest	PFO4B	Slope Forest	Forested Peatland
K	0.8	Bog Forest	PFO4B	Slope Forest	Forested Peatland
L	0.09	Bog Forest	PFO4B	Slope Forest	Forested Peatland
M	0.04	Bog Forest	PFO4B	Slope Forest	Forested Peatland
N	2.2	Bog Forest	PFO4B	Slope Forest	Forested Peatland
O	0.02	Bog Forest	PFO4B	Slope Forest	Forested Peatland
P	0.1	Bog Forest	PFO4B	Slope Forest	Forested Peatland
Q	1.2	Bog Forest	PFO4B	Slope Forest	Forested Peatland
R	0.5	Bog Forest	PFO4B	Slope Forest	Forested Peatland
S	3.0	Bog Forest	PFO4B	Slope Forest	Forested Peatland

* Some wetlands extend outside of the Proposed Project Area, and only portions located within are reported

** The water resource names used in the FEIS (FAA 2016)

RESULTS

Delineated wetlands with shared characteristics were clustered into 9 different groups for WESPAK-SE assessment (Table 2). Each wetland group received one WESPAK-SE assessment that represented all of the wetlands within that group.

Following the performing of WESPAK-SE on each group, outputs were produced that provide both quantitative and qualitative scores of quality. These scores are summarized in Table 3, below. Because more specific scores are also calculated and can provide additional insight on the functions and values of each wetland, a copy of the scoresheet for each group is provided in Appendix A. Copies of each entire workbook from each WESPAK-SE group are are available upon request.

Table 2. Grouped wetlands with shared characteristics and their associated WESPAK-SE wetland type

Group Number	Grouped Wetlands	WESPAK-SE Wetland Type
1	A (1-10)	Tidal Marsh
2	B, J	Forested Peatland
3	C, K, O, P	Forested Peatland
4	D, E, I	Forested Peatland
5	G1, 4, 6, 7, 16, 20, 22	Open Peatland
6	G2, 3, 5, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 21, 23, 24, 25	Forested Peatland
7	G8	Fen
8	L, M	Forested Peatland
9	N, Q, R, S	Forested Peatland

Table 3. Summary table of WESPAK-SE overall scores and ratings for each wetland group

Group Number	Grouped Wetlands	Overall Score	Overall Rating
1	A (1-10)	5.36	Moderate
2	B, J	6.68	Moderate
3	C, K, O, P	6.58	Moderate
4	D, E, I	7.18	Higher
5	G1, 4, 6, 7, 16, 20, 22	7.89	Higher
6	G2, 3, 5, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 21, 23, 24, 25	7.64	Higher
7	G8	8.09	Higher
8	L, M	7.45	Higher
9	N, Q, R, S	7.79	Higher

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Appendix A

WESPAK-SE Scoresheets for each Wetland Group Assessed in the Proposed Angoon Airport Project Area; Groups are Presented in the Order They Appear in Table 2 and Table 3

ESA

Group 1

Scores for TIDAL Wetland Functions and Values: WESPAK-SE version 2	
Site Name or Site ID#:	Angoon Airport
Investigator Name:	Environmental Science Associates (ESA)
Date of Field Assessment:	13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018
Nearest Town:	Angoon, Alaska
Latitude (decimal degrees):	57.475520°
Longitude (decimal degrees):	-134.553167°
HUC12 Watershed #:	19010204
Approximate size of the Assessment Area (AA, in acres)	8 acres, including area of open water (2.15 acres of fringe wetland)
AA as percent of entire wetland (approx.)	100
Tidal phase during most of visit:	Low
What percent (approx.) of the **wetland** were you able to visit?	100
What percent (approx.) of the **AA** were you able to visit?	100
Have you attended a training session for this protocol? If so, indicate approximate month & year.	No. Familiar with protocol and certified/trained in Oregon ORWAP and SFAM
How many wetlands have you assessed previously using this protocol (approx.)?	6

Scores will appear below after data are entered in worksheets OF, T, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this Tidal Wetland Assessment Area (AA):

Functions and Their Values:	Score Raw	Score Raw	Score (normalized)	n Rating	Score (normalize	Value Rating	FV	FV Index	(normalized)	FUNCTION: Median of Normalized F Scores	FUNCTION: Thresholds for Function Rating (normalized score) Low is < or =	FUNCTION: Thresholds for Function Rating (normalized score) High is >	VALUE: Median of Normalized V Scores	VALUE: Thresholds for Value Rating (normalized) Low is < or =	VALUE: Thresholds for Value Rating (normalized) is > or =
Sediment Retention & Stabilization (SR)	7.25	10.00	6.33	High	10.00	High	8.17	8.17	7.90	4.11	3.56	5.96	5.22	5.22	10.00
Carbon Sequestration (CS)	6.64		3.85	Moderate			3.85	3.85	2.93	3.40	2.65	5.62			
Organic Nutrient Export (OE)	6.21		7.33	High			7.33	7.33	7.33	5.72	3.81	6.80			
Anadromous Fish Habitat (FA)	5.12	10.00	9.20	High	10.00	High	9.60	9.60	9.60	6.95	6.12	7.64	5.00	3.56	6.67
Waterbird Feeding Habitat (WBF)	6.94	10.00	8.92	High	10.00	High	9.46	9.46	9.46	4.12	3.34	5.88	0.00	0.00	0.67
Songbird, Raptor, & Mammal Habitat (SB	2.36	10.00	1.13	Low	10.00	High	5.57	5.57	5.18	5.79	2.98	6.41	0.00	0.00	10.00
Native Plant Habitat (PH)	3.60	1.00	1.71	Low	0.00	Low	0.86	1.71	1.43	5.14	2.93	6.42	2.59	2.59	6.30
Other Values or Attributes:															
Public Use (PU)		2.29			0.73	Low	0.73	0.73	0.00				4.40	3.30	6.24
Subsistence & Provisioning Services (Subsis)		4.35			6.53	Moderate	6.53	6.53	6.53				4.17	4.72	7.22
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		3.35			2.51	Moderate	2.51	2.51	0.68				3.20	2.48	4.42
Stress Potential (STR) - *not used in subsequent calculations*		3.30			2.22	Moderate	2.22	2.22	0.96				2.89	1.72	4.13
						AVG w/o Social	with Social	selected Higher	normalized						
Overall Score (see Manual for explanation of how the spreadsheet calculates it):	5.36					6.39	7.60	7.60	5.36						
Overall Rating:	Moderate														

Group 2

Site Name or ID #:	**Angoon Airport**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	**0.60**
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month &	**No. Familiar with protocol and certified/trained in Oregon ORWAP and SFAM**
How many wetlands have you assessed previously using this protocol (approx.)?	**6.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):

Specific Functions or Values:	Function Score raw	Value Score raw	Function Score (normalized)	Function Rating	Value Score (normalized)	Value Rating	FV raw	FV Index	FV Index (normalized)	FUNCTION: Median of Normalized F Scores	FUNCTION: Thresholds for Function Rating (normalized score) Low is < or =	FUNCTION: Thresholds for Function Rating (normalized score) High is >	VALUE: Median of Normalized V Scores	VALUE: Thresholds for Value Rating (normalized score) Low is < or =	VALUE: Thresholds for Value Rating (normalized score) High is >
Surface Water Storage (WS)	6.06	7.78	5.54	Moderate	7.78	Higher	6.66	6.66	5.82	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	1.36	0.81	1.63	Lower	1.22	Lower	1.43	1.63	1.63	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	2.33	1.67	2.33	Lower	2.20	Moderate	2.27	2.33	1.79	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	5.93	0.62	5.93	Moderate	1.16	Lower	3.54	5.93	5.15	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization	5.00	3.60	3.64	Moderate	7.85	Higher	5.74	5.74	5.80	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	4.00	7.78	1.02	Lower	10.00	Higher	5.51	5.51	5.14	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	4.72	6.50	1.89	Lower	7.39	Higher	4.64	4.64	4.64	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	5.22		2.22	Lower			2.22	2.22	2.22	6.53	3.66	6.43			
Organic Nutrient Export (OE)	4.75	5.70	6.86	Moderate	5.73	Moderate	6.30	6.86	6.86	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	3.24	10.00	0.88	Lower	10.00	Higher	5.44	5.44	5.44	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	5.09	6.67	3.32	Lower	8.48	Higher	5.90	5.90	5.36	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	3.88	0.00	5.61	Moderate	0.00	Lower	2.80	5.61	5.61	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	5.83	8.89	7.20	Moderate	8.89	Higher	8.04	8.04	7.95	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	3.46	7.15	4.59	Moderate	9.58	Higher	7.08	7.08	6.89	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	4.75	9.53	3.24	Lower	9.44	Higher	6.34	6.34	5.81	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		3.06			4.09	Moderate	4.09	4.09	4.09				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		8.89			8.89	Higher	8.89	8.89	8.89				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		3.58			3.68	Lower	3.68	3.68	4.03				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		2.53			2.66	Lower	2.66	2.66	2.80				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		7.31			10.00	Higher	10.00	10.00	10.00				6.43	3.31	5.73
Summary Scores for Groups:								Group Score Not Normalized	Group Score Normalized	Group Rating					
HYDROLOGIC Group (WS)								5.82	5.82	Moderate	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								5.12	3.46	Lower	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								5.52	1.23	Lower	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								0.00	0.00	Lower	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								4.63	3.51	Lower	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								7.41	6.56	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								8.89	10.00	Higher	3.66	6.58			

			AVG w/o Soci	with Socia	selected higher	normalized
Overall Score (see Manual for explanation of how the spreadsheet	6.68		4.99	7.18	7.18	6.68
Overall Rating:	**Moderate**					

Group 3

Site Name or ID #:	**Angoon Airport**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	**0.93**
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month &	**No. Familiar with protocol and certified/trained in Oregon ORWAP and SFAM**
How many wetlands have you assessed previously using this protocol (approx.)?	**6.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):

Specific Functions or Values:	Function Score raw	Score raw	Score (normalized)	Function Rating	Value Score (normalized)	Value Rating	FV raw	FV Index	(normalized)	FUNCTION: Median of Normalized F Scores	FUNCTION: Thresholds for Function Rating (normalized score) Low is < or =	FUNCTION: Thresholds for Function Rating (normalized score) High is >	VALUE: Median of Normalized V Scores	VALUE: Thresholds for Value Rating (normalized score) Low is < or =	VALUE: Thresholds for Value Rating (normalized score) High is >
Surface Water Storage (WS)	3.11	1.81	2.19	Lower	1.81	Lower	2.00	2.19	0.24	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	5.83	1.44	7.00	Higher	2.16	Moderate	4.58	7.00	7.00	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	6.20	3.17	6.20	Higher	4.18	Moderate	5.19	6.20	5.93	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	6.25	3.68	6.25	Moderate	6.84	Higher	6.54	6.54	5.88	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization	3.27	0.42	1.43	Lower	0.57	Lower	1.00	1.43	0.00	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	4.61	1.15	1.92	Lower	1.16	Lower	1.54	1.92	1.26	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	4.63	3.13	1.74	Lower	3.29	Moderate	2.52	2.52	2.52	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	6.41		4.53	Moderate			4.53	4.53	4.53	6.53	3.66	6.43			
Organic Nutrient Export (OE)	5.60	6.67	8.09	Higher	6.71	Moderate	7.40	8.09	8.09	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	5.75	10.00	5.97	Higher	10.00	Higher	7.98	7.98	7.98	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	5.73	6.25	4.48	Moderate	7.72	Higher	6.10	6.10	5.59	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	2.84	0.00	4.10	Moderate	0.00	Lower	2.05	4.10	4.10	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	6.73	10.00	8.31	Higher	10.00	Higher	9.16	9.16	9.11	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	7.90	7.15	11.74	Higher	9.58	Higher	10.66	11.74	10.00	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	6.46	9.53	8.58	Higher	9.44	Higher	9.01	9.01	9.27	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		2.20			2.56	Moderate	2.56	2.56	2.56				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		10.00			10.00	Higher	10.00	10.00	10.00				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		5.05			8.74	Higher	8.74	8.74	10.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		5.65			5.95	Higher	5.95	5.95	6.26				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		4.90			7.30	Higher	7.30	7.30	10.00				6.43	3.31	5.73
Summary Scores for Groups:								Group Score Not Normalized	Group Score Normalized	Group Rating					
HYDROLOGIC Group (WS)								0.24	0.24	Lower	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								3.30	0.50	Lower	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								7.53	5.76	Moderate	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								0.00	0.00	Lower	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								4.41	3.23	Lower	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								9.73	9.64	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								10.00	10.00	Higher	3.66	6.58			

Overall Score (see Manual for explanation of how the spreadsheet	6.58	AVG w/o Soci	with Soci	selected higher	normalized
		6.43	7.10	7.10	6.58
Overall Rating:	Moderate				

Group 4

Site Name or ID #:	**Angoon Airport**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	**2.70**
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month &	**No. Familiar with protocol and certified/trained in Oregon ORWAP and SFAM**
How many wetlands have you assessed previously using this protocol (approx.)?	**6.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):

Specific Functions or Values:	Function Score raw	Value Score raw	Function Score (normalized)	Function Rating	Value Score (normalized)	Value Rating	FV raw	FV Index	FV Index (normalized)	FUNCTION: Median of Normalized F Scores	FUNCTION: Thresholds for Function Rating (normalized score) Low is < or =	FUNCTION: Thresholds for Function Rating (normalized score) High is >	VALUE: Median of Normalized V Scores	VALUE: Thresholds for Value Rating (normalized score) Low is < or =	VALUE: Thresholds for Value Rating (normalized score) High is >
Surface Water Storage (WS)	3.96	0.00	3.16	Moderate	0.00	Lower	1.58	3.16	1.44	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	6.71	1.40	8.05	Higher	2.10	Moderate	5.08	8.05	8.05	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	7.25	3.75	7.25	Higher	4.95	Moderate	6.10	7.25	7.05	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	4.43	5.85	4.43	Moderate	10.00	Higher	7.22	7.22	6.68	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization	4.94	2.46	3.56	Moderate	5.25	Moderate	4.41	4.41	2.56	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	6.61	3.38	4.92	Moderate	4.74	Moderate	4.83	4.92	4.51	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	5.35	6.17	2.86	Moderate	6.99	Higher	4.92	4.92	4.92	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	6.55		4.82	Moderate			4.82	4.82	4.82	6.53	3.66	6.43			
Organic Nutrient Export (OE)	7.05	6.67	10.18	Higher	6.71	Moderate	8.44	10.18	10.00	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	5.58	10.00	5.63	Higher	10.00	Higher	7.82	7.82	7.82	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	5.96	6.25	4.90	Moderate	7.72	Higher	6.31	6.31	5.83	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	4.05	0.00	5.85	Moderate	0.00	Lower	2.93	5.85	5.85	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	7.32	10.00	9.04	Higher	10.00	Higher	9.52	9.52	9.49	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	8.11	7.15	12.07	Higher	9.58	Higher	10.83	12.07	10.00	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	6.66	9.53	9.22	Higher	9.44	Higher	9.33	9.33	9.68	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		2.54			3.17	Moderate	3.17	3.17	3.17				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		8.89			8.89	Higher	8.89	8.89	8.89				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		4.41			6.53	Moderate	6.53	6.53	10.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		6.83			7.19	Higher	7.19	7.19	7.57				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		5.40			8.42	Higher	8.42	8.42	10.00				6.43	3.31	5.73
Summary Scores for Groups:								Group Score Not Normalized	Group Score Normalized	Group Rating					
HYDROLOGIC Group (WS)								1.44	1.44	Lower	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								4.56	2.54	Lower	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								8.96	8.97	Higher	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								0.00	0.00	Lower	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								4.87	3.81	Lower	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								9.86	9.82	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								8.89	10.00	Higher	3.66	6.58			

		AVG w/o Socia	with Socia	selected higher	normalized
Overall Score (see Manual for explanation of how the spreadsheet calculates it):	7.18	7.12	7.61	7.61	7.18
Overall Rating:	**Higher**				

Group 5

Site Name or ID #:	**Angoon Airport**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	**131.60**
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month &	**No. Familiar with protoocl and certified in ORWAP**
How many wetlands have you assessed previously using this protocol (approx.)?	**6.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):										**FUNCTION**			**VALUE**		
										Median of Normalized F Scores	*Thresholds for Function Rating (normalized score)*		Median of Normalized V Scores	*Thresholds for Value Rating (normalized score)*	
Specific Functions or Values:	Function Score raw	Score raw	**Score (normalized)**	**Function Rating**	**Value Score (normalized)**	**Value Rating**	FV raw	FV Index	**(normalized)**		Low is < or =	High is >		Low is < or =	High is >
Surface Water Storage (WS)	6.28	1.11	5.79	Moderate	1.11	Lower	3.45	5.79	4.73	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	8.33	2.80	10.00	Higher	4.21	Moderate	7.11	10.00	10.00	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	10.00	3.00	10.00	Higher	3.96	Moderate	6.98	10.00	10.00	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	10.00	5.24	10.00	Higher	9.75	Higher	9.88	10.00	10.00	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization	6.11	0.28	5.05	Moderate	0.25	Lower	2.65	5.05	4.12	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	7.67	1.54	6.51	Higher	1.79	Lower	4.15	6.51	6.23	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	5.38	3.17	2.90	Moderate	3.34	Moderate	3.12	3.12	3.12	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	8.12		7.88	Higher			7.88	7.88	7.88	6.53	3.66	6.43			
Organic Nutrient Export (OE)	4.93	5.70	7.12	Moderate	5.73	Moderate	6.43	7.12	7.12	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	5.21	6.67	7.21	Moderate	6.67	Moderate	6.94	7.21	7.21	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	5.98	10.00	6.45	Higher	10.00	Higher	8.22	8.22	8.22	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	4.79	6.25	2.77	Lower	7.72	Higher	5.25	5.25	4.62	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	5.14	10.00	6.34	Moderate	10.00	Higher	8.17	8.17	8.08	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	6.67	7.15	9.76	Higher	9.58	Higher	9.67	9.76	9.74	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	4.93	9.53	3.79	Lower	9.44	Higher	6.61	6.61	6.17	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		1.98			2.16	Lower	2.16	2.16	2.16				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		7.78			7.78	Higher	7.78	7.78	7.78				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		5.14			9.05	Higher	9.05	9.05	10.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		5.17			5.44	Higher	5.44	5.44	5.72				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		4.70			6.84	Higher	6.84	6.84	10.00				6.43	3.31	5.73
Summary Scores for Groups:								**Group Score Not Normalized**	**Group Score Normalized**	**Group Rating**					
HYDROLOGIC Group (WS)								4.73	4.73	Moderate	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								6.61	5.87	Moderate	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								9.53	10.00	Higher	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								5.41	5.41	Moderate	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								3.08	1.57	Lower	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								8.87	8.50	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								7.78	8.91	Higher	3.66	6.58			

		AVG w/o Socia	with Socia	selected higher	normalized
Overall Score (see Manual for explanation of how the spreadsheet calculates it):	7.89	8.01	8.21	8.21	7.89
Overall Rating:	**Higher**				

Group 6

Site Name or ID #:	**Angoon Airport**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	**147.70**
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month &	**No. Familiar with protoocl and certified in ORWAP**
How many wetlands have you assessed previously using this protocol (approx.)?	**6.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):										**FUNCTION**			**VALUE**		
										Median of Normalized F Scores	*Thresholds for Function Rating (normalized score)*		Median of Normalized V Scores	*Thresholds for Value Rating (normalized score)*	
Specific Functions or Values:	Function Score raw	Score raw	**Score (normalized)**	**Function Rating**	**Value Score (normalized)**	**Value Rating**	FV raw	FV Index	**(normalized)**		Low is < or =	High is >		Low is < or =	High is >
Surface Water Storage (WS)	3.96	1.11	3.16	Moderate	1.11	Lower	2.13	3.16	1.44	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	6.50	4.01	7.80	Higher	6.05	Higher	6.92	7.80	7.80	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	7.53	5.84	7.53	Higher	7.70	Higher	7.62	7.62	7.44	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	4.03	4.63	4.03	Moderate	8.61	Higher	6.32	6.32	5.61	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization	5.33	2.85	4.06	Moderate	6.14	Higher	5.10	5.10	4.24	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	6.99	4.68	5.48	Moderate	6.82	Higher	6.15	6.15	5.84	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	5.39	6.00	2.91	Moderate	6.78	Higher	4.85	4.85	4.85	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	6.66		5.04	Moderate			5.04	5.04	5.04	6.53	3.66	6.43			
Organic Nutrient Export (OE)	6.86	5.70	9.92	Higher	5.73	Moderate	7.83	9.92	9.92	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	5.01	4.71	6.53	Moderate	4.71	Moderate	5.62	6.53	6.53	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	5.93	6.67	8.20	Higher	6.67	Moderate	7.44	8.20	8.20	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	5.12	10.00	4.70	Moderate	10.00	Higher	7.35	7.35	7.35	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	5.72	6.25	4.45	Moderate	7.72	Higher	6.09	6.09	5.57	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	3.63	0.00	5.24	Moderate	0.00	Lower	2.62	5.24	5.24	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	7.37	10.00	9.10	Higher	10.00	Higher	9.55	9.55	9.53	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	7.94	7.15	11.81	Higher	9.58	Higher	10.69	11.81	10.00	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	6.48	9.53	8.65	Higher	9.44	Higher	9.04	9.04	9.31	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		1.98			2.16	Lower	2.16	2.16	2.16				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		7.78			7.78	Higher	7.78	7.78	7.78				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		4.46			6.72	Moderate	6.72	6.72	10.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		6.42			6.75	Higher	6.75	6.75	7.11				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		4.90			7.29	Higher	7.29	7.29	10.00				6.43	3.31	5.73
Summary Scores for Groups:								**Group Score Not Normalized**	**Group Score Normalized**	**Group Rating**					
HYDROLOGIC Group (WS)								1.44	1.44	Lower	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								5.41	3.93	Lower	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								8.77	8.54	Higher	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								7.79	7.79	Higher	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								4.59	3.45	Lower	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								9.81	9.74	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								7.78	8.91	Higher	3.66	6.58			
			AVG w/o Socia	with Socia	selected higher	normalized									
Overall Score (see Manual for explanation of how the spreadsheet calculates it)	7.64		7.78	8.00	8.00	7.64									
Overall Rating:	**Higher**														

Group 7

Site Name or ID #:	**Angoon Airport**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	**1.20**
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month &	**No. Familiar with protoocl and certified in ORWAP**
How many wetlands have you assessed previously using this protocol (approx.)?	**6.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):										FUNCTION			VALUE		
										Median of Normalized F Scores	*Thresholds for Function Rating (normalized score)*		Median of Normalized V Scores	*Thresholds for Value Rating (normalized score)*	
Specific Functions or Values:	Function Score raw	Score raw	**Score (normalized)**	**Function Rating**	**Value Score (normalized)**	**Value Rating**	FV raw	FV Index	**(normalized)**		Low is < or =	High is >		Low is < or =	High is >
Surface Water Storage (WS)	2.13	0.56	1.08	Lower	0.56	Lower	0.82	1.08	0.00	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	8.06	4.35	9.67	Higher	6.55	Higher	8.11	9.67	9.67	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	4.69	5.89	4.69	Moderate	7.77	Higher	6.23	6.23	5.96	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	6.90	5.29	6.90	Higher	9.84	Higher	8.37	8.37	8.05	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization	4.09	3.75	2.48	Lower	8.20	Higher	5.34	5.34	4.81	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	4.46	5.24	1.71	Lower	7.71	Higher	4.71	4.71	4.27	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	5.62	5.88	3.26	Moderate	6.63	Higher	4.95	4.95	4.95	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	5.23		2.23	Lower			2.23	2.23	2.23	6.53	3.66	6.43			
Organic Nutrient Export (OE)	3.80	6.67	5.50	Moderate	6.71	Moderate	6.10	6.10	6.10	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	5.11	6.80	6.67	Moderate	6.80	Higher	6.73	6.73	6.73	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	6.69	6.80	9.26	Higher	6.80	Moderate	8.03	9.26	9.26	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	5.59	10.00	5.66	Higher	10.00	Higher	7.83	7.83	7.83	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	7.02	6.25	6.83	Higher	7.72	Higher	7.27	7.27	6.92	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	6.80	4.22	9.37	Higher	5.48	Higher	7.42	9.37	10.00	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	7.01	8.60	10.12	Higher	8.60	Moderate	9.36	10.12	10.00	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	4.77	10.00	5.88	Moderate	10.00	Higher	7.94	7.94	7.84	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	6.10	7.15	8.84	Higher	9.58	Higher	9.21	9.21	9.15	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	6.19	9.53	7.74	Higher	9.44	Higher	8.59	8.59	8.73	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		2.12			2.41	Moderate	2.41	2.41	2.41				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		8.89			8.89	Higher	8.89	8.89	8.89				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		3.21			2.40	Lower	2.40	2.40	0.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		5.58			5.88	Higher	5.88	5.88	6.19				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		4.66			6.77	Higher	6.77	6.77	10.00				6.43	3.31	5.73
Summary Scores for Groups:								**Group Score Not Normalized**	**Group Score Normalized**	**Group Rating**					
HYDROLOGIC Group (WS)								0.00	0.00	Lower	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								4.51	2.45	Lower	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								8.60	8.15	Higher	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								8.63	8.63	Higher	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								9.49	9.56	Higher	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								8.86	8.49	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								8.89	10.00	Higher	3.66	6.58			
			AVG w/o Socia	with Socia	selected higher	normalized									
Overall Score (see Manual for explanation of how the spreadsheet	8.09		7.89	8.38	8.38	8.09									
Overall Rating:	**Higher**														

Group 8

Site Name or ID #:	**Angoon Airport**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	**0.13**
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month &	**No. Familiar with protoocl and certified in ORWAP**
How many wetlands have you assessed previously using this protocol (approx.)?	**6.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):										**FUNCTION**			**VALUE**		
										Median of Normalized F Scores	*Thresholds for Function Rating (normalized score)*		Median of Normalized V Scores	*Thresholds for Value Rating (normalized score)*	
Specific Functions or Values:	Function Score raw	Score raw	**Score (normalized)**	**Function Rating**	**Value Score (normalized)**	**Value Rating**	FV raw	FV Index	**(normalized)**		Low is < or =	High is >		Low is < or =	High is >
Surface Water Storage (WS)	10.00	9.17	10.00	Higher	9.17	Higher	9.58	10.00	10.00	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	2.06	0.00	2.06	Lower	0.00	Lower	1.03	2.06	1.49	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	6.27	0.00	6.27	Moderate	0.00	Lower	3.13	6.27	5.55	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization	10.00	1.66	10.00	Higher	3.41	Moderate	6.71	10.00	10.00	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	10.00	7.78	10.00	Higher	10.00	Higher	10.00	10.00	10.00	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	10.00	3.58	10.00	Higher	3.85	Moderate	6.92	10.00	10.00	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	6.46		4.65	Moderate			4.65	4.65	4.65	6.53	3.66	6.43			
Organic Nutrient Export (OE)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	3.92	10.00	2.26	Lower	10.00	Higher	6.13	6.13	6.13	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	5.04	6.67	3.22	Lower	8.48	Higher	5.85	5.85	5.30	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	3.10	0.00	4.48	Moderate	0.00	Lower	2.24	4.48	4.48	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	5.31	8.89	6.56	Moderate	8.89	Higher	7.72	7.72	7.61	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	4.67	7.15	6.53	Higher	9.58	Higher	8.06	8.06	7.92	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	4.67	9.53	2.99	Lower	9.44	Higher	6.21	6.21	5.65	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		3.39			4.69	Moderate	4.69	4.69	4.69				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		8.89			8.89	Higher	8.89	8.89	8.89				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		4.54			6.98	Moderate	6.98	6.98	10.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		3.22			3.39	Moderate	3.39	3.39	3.57				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		8.93			10.00	Higher	10.00	10.00	10.00				6.43	3.31	5.73
Summary Scores for Groups:								**Group Score Not Normalized**	**Group Score Normalized**	**Group Rating**					
HYDROLOGIC Group (WS)								10.00	10.00	Higher	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								9.33	10.00	Higher	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								4.38	0.00	Lower	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								0.00	0.00	Lower	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								4.28	3.07	Lower	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								7.49	6.66	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								8.89	10.00	Higher	3.66	6.58			

		AVG w/o Socia	with Socia	selected higher	normalized
Overall Score (see Manual for explanation of how the spreadsheet calculates it):	7.45	7.48	7.84	7.84	7.45
Overall Rating:	**Higher**				

Group 9

Site Name or ID #:	**Angoon Airport**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	**6.90**
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month &	**No. Familiar with protocol and certified/trained in Oregon ORWAP and SFAM**
How many wetlands have you assessed previously using this protocol (approx.)?	**6.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):

Specific Functions or Values:	Function Score raw	Value Score raw	Function Score (normalized)	Function Rating	Value Score (normalized)	Value Rating	FV raw	FV Index	FV Index (normalized)	FUNCTION: Median of Normalized F Scores	FUNCTION: Thresholds for Function Rating (normalized score) Low is < or =	FUNCTION: Thresholds for Function Rating (normalized score) High is >	VALUE: Median of Normalized V Scores	VALUE: Thresholds for Value Rating (normalized score) Low is < or =	VALUE: Thresholds for Value Rating (normalized score) High is >
Surface Water Storage (WS)	10.00	1.67	10.00	Higher	1.67	Lower	5.83	10.00	10.00	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	7.67	0.00	7.67	Higher	0.00	Lower	3.83	7.67	7.50	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	3.93	0.00	3.93	Moderate	0.00	Lower	1.97	3.93	2.76	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization	10.00	0.30	10.00	Higher	0.31	Lower	5.15	10.00	10.00	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	10.00	6.67	10.00	Higher	10.00	Higher	10.00	10.00	10.00	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	10.00	3.25	10.00	Higher	3.44	Moderate	6.72	10.00	10.00	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	7.35		6.38	Moderate			6.38	6.38	6.38	6.53	3.66	6.43			
Organic Nutrient Export (OE)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	5.12	10.00	4.70	Moderate	10.00	Higher	7.35	7.35	7.35	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	5.75	6.25	4.52	Moderate	7.72	Higher	6.12	6.12	5.61	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	2.92	0.00	4.21	Moderate	0.00	Lower	2.11	4.21	4.21	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	6.59	10.00	8.13	Higher	10.00	Higher	9.07	9.07	9.02	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	7.73	7.15	11.47	Higher	9.58	Higher	10.52	11.47	10.00	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	5.82	9.53	6.59	Higher	9.44	Higher	8.01	8.01	7.98	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		2.22			2.59	Moderate	2.59	2.59	2.59				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		8.89			8.89	Higher	8.89	8.89	8.89				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		4.59			7.14	Moderate	7.14	7.14	10.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		8.92			9.39	Higher	9.39	9.39	9.88				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		5.11			7.77	Higher	7.77	7.77	10.00				6.43	3.31	5.73
Summary Scores for Groups:								Group Score Not Normalized	Group Score Normalized	Group Rating					
HYDROLOGIC Group (WS)								10.00	10.00	Higher	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								9.55	10.00	Higher	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								5.51	1.22	Lower	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								0.00	0.00	Lower	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								4.44	3.27	Lower	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								9.50	9.33	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								8.89	10.00	Higher	3.66	6.58			

			AVG w/o Socia	with Socia	selected higher	normalized
Overall Score (see Manual for explanation of how the spreadsheet	7.79		7.82	8.13	8.13	7.79
Overall Rating:	**Higher**					

APPENDIX D

Modified HGM Assessment Summary Tech Memo

memorandum

date	May 1, 2020
to	Jim Scholl, ADOT&PF Southcoast Region
cc	
from	Susan Cunningham, ESA Jeff Barna, ESA Luke Johnson, ESA
subject	Angoon Airport Wetland HGM Summary

HGM ASSESSMENT APPROACH

A total of 50 wetlands and 10 streams comprising 294 acres were delineated in the Proposed Project Area. Using the naming convention provided by the Final Environmental Impact Statement (FEIS) for the Proposed Project (FAA 2016), each wetland was classified as one of four types: bog forest, bog woodland, fen, or salt marsh (Table 1) (ESA 2019). For the wetlands determined to be jurisdictional (see ESA 2019, USACE 2019), an assessment of their quality is required to provide key mitigation metrics in the event they are impacted by the Proposed Project.

Wetland and stream quality was assessed using the hydrogeomorphic method (HGM)-based *Natzuhini Bay Mitigation Bank Riparian Zone Functional Assessment* (Sealaska Corporation Inc. [date unknown]), which is based on the *Wetland Functional Assessment Guidebook, Operational Draft Guidebook for Assessing the Functions for Riverine and Slope River Proximal Wetlands in Coastal Southeast and Southcentral Alaska Using the HGM Approach* (Powell et al. 2003). The Natzuhini Bay Mitigation Bank is the focus of this wetland and stream assessment because it may be used in the event that wetland mitigation is required as the result of impacts from the Proposed Project.

According to the *Regulatory In-lieu Fee and Bank Information Tracking System* (RIBITS) (USACE 2020), the Natzuhini Bay Mitigation Bank currently offers wetland credits for palustrine, palustrine streambed, and estuarine wetlands, which encompass all wetland types delineated within the Proposed Project Area. These wetland types are defined by Cowardin et al. (1979) as:

- **The Palustrine System** includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ‰. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m (6.5 feet) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ‰.

- **The Palustrine Streambed System,** as described in the Natzuhini Bay Mitigation Bank (Sealaska Corporation Inc. 2020), is not a classification defined by Cowardin et al. (1979). However, for the purposes of this memo, Palustrine Streambed is considered the same as the Riverine System as defined by Cowardin et al. (1979). The Riverine System includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergent, emergent mosses, or lichens; and (2) habitats with water containing ocean-derived salts of 0.5‰ or greater (Federal Geographic Data Committee [FGDC] 2013). The Riverine System is bounded on the landward side by upland, by the channel bank, or by wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. The lateral extent of the riverine subclass, as defined in the HGM Guidebook (Powell et al. 2003), includes the active channel and active floodplain out to the extent of the floodprone area. The floodprone area is defined by the projection of a plane at twice the bankfull thalweg depth.
- **The Estuarine System** consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines, there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (*Rhizophora mangle*) and eastern oysters (*Crassostrea virginica*), are also included in the Estuarine System.

With the exception of fen wetlands, or Slope Tidal wetlands as defined by the HGM classification, more than one wetland was delineated in the Proposed Project Area for each wetland type. In some cases, each delineated and stream wetland was assessed independently because of being unique to the Proposed Project Area. However, in other cases, more than one wetland or stream shared a diversity of characteristics, allowing them to be grouped and assessed by a single HGM assessment. These wetlands are generally part of larger wetland complexes, are the same wetland or stream type, and share characteristics (such as geography, geology, and hydrology). An example is Wetland A (Table 1), which is composed of 10 separately delineated wetlands that share numerous characteristics. The similarity across the 10 Wetland A wetlands allows them to be grouped for the HGM assessment, with a single representative wetland being evaluated, and output applied to all wetlands in that group.

To determine how the HGM assessment applies to the delineated wetlands and streams, each was aligned across the three classification systems used for the Proposed Project to date: the wetland category or “wet habitat” as defined by the FEIS (FAA 2016), Cowardin classification (Cowardin et al. 1979), and HGM classification (Powell et al. 2003). They were then matched to the wetland classes indicated by RIBITS for the Natzuhini Bay Mitigation Bank (USACE 2020) (Table 1): palustrine, palustrine streambed, and estuarine wetland types, as defined above. Because the wetlands delineated in the Proposed Project Area were either palustrine or estuarine wetlands, all were assessed using this method.

Wetland condition has degraded through time since the delineation initiated due to various environmental studies performed in support of the Proposed Project. This wetland assessment is based specifically on the condition of the wetlands prior to the start of the site being studied, and the output scores reflect their generally natural state.

Table 1. Summary of Delineated Wetlands within the Proposed Project Area

Wetland Name	Delineated Area (Acre)*	Wet Habitat**	Cowardin Class	HGM Class	WESPAK-SE Wetland Type***
A1–A10	2.15	Salt Marsh	E2EM1N	Estuarine Fringe Tidal	Tidal Marsh
B	0.1	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
C	0.006	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
D	1.0	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
E	0.2	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G1	66.5	Bog Woodland	PFO1B	Palustrine Slope Bog	Open Peatland
G2	2.7	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G3	0.6	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G4	0.2	Bog Woodland	PFO1B	Palustrine Slope Bog	Open Peatland
G5	2.7	Bog Forest	PFO4B	Palustrine Slope Bog	Forested Peatland
G6	14.3	Bog Woodland	PFO1B	Palustrine Slope Bog	Open Peatland
G7	9.6	Bog Woodland	PFO1B	Palustrine Slope Bog	Open Peatland
G8	1.2	Fen	PEM1H	Palustrine Slope Tidal	Fen/Marsh
G9–G15	119.05	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G16	24.5	Bog Woodland	PFO1B	Palustrine Slope Bog	Open Peatland
G17	0.7	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G18	0.3	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G19	2.7	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G20	14.4	Bog Woodland	PFO1B	Palustrine Slope Bog	Open Peatland
G21	10.1	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G22	1.5	Bog Woodland	PFO1B	Palustrine Slope Bog	Open Peatland
G23	0.1	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G24	0.6	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
G25	1.5	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
I	1.5	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
J	0.5	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
K	0.8	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
L	0.09	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
M	0.04	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
N	2.2	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
O	0.02	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
P	0.1	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
Q	1.2	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
R	0.5	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
S	3.0	Bog Forest	PFO4B	Palustrine: Slope Forest	Forested Peatland
Streams					
10MF	0.77	Stream	R2UB	Riverine	Floodplain

Wetland Name	Delineated Area (Acre)*	Wet Habitat**	Cowardin Class	HGM Class	WESPAK-SE Wetland Type***
10NF	0.17	Stream	R2UB	Riverine	Floodplain
10SF	0.54	Stream	R2UB	Riverine	Floodplain
11	0.16	Stream	R2UB	Riverine	Floodplain
12	0.01	Stream	R2UB	Riverine	Floodplain
13	0.00	Stream	R2UB	Riverine	Floodplain
14	0.00	Stream	R2UB	Riverine	Floodplain
15	0.01	Stream	R2UB	Riverine	Floodplain
16	0.03	Stream	R2UB	Riverine	Floodplain
17	0.05	Stream	R2UB	Riverine	Floodplain

* Some water resources extend outside of the Proposed Project Area; only portions within the Proposed Project Area are included.
** Water resource names used in FEIS (FAA 2016).
*** Manual for Wetland Ecosystem Services Protocol for Southeast Alaska (Adamus 2015).

RESULTS

Delineated wetlands and streams with shared characteristics were grouped into nine different groups that were used for the Natzuhini Bay Functional Assessment (NBFA) (Sealaska Corporation Inc. [date unknown]), as summarized in Table 2. Each wetland and stream group received one NBFA rating that represented all of the wetlands within that group.

Following an NBFA score for each group, outputs were produced that provide both quantitative and qualitative scores of wetland and stream quality. These scores are summarized in Table 3. Because more specific scores are also calculated that provide additional insight on the functions and values of each wetland and stream, a copy of the scoresheet for each group is provided in Attachment A. The Functional Index categories used to score each group are provided in Attachment B.

The NBFA tool was developed to measure changes in functional character over broad time spans. This tool does not provide metrics for determining a qualitative overall score of existing conditions. To determine mitigation credits, the Aggregate Functional Index (overall score) of current conditions is intended to be compared to a second overall score of an enhanced habitat condition. For the purposes of this memo, a rating key was developed for determining an overall qualitative score using a combination of the Aggregate Functional Index, the HGM score increments, and definitions provided in the HGM Guidebook (Powell et al. 2003). The process for determining the qualitative scores is summarized in Table 4.

Table 2. Wetlands Grouped with Shared Characteristics and HGM Wetland Class

Group Number	Grouped Wetlands	HGM Wetland Class
1	A (1–10)	Estuarine Fringe Tidal
2	B, J	Palustrine: Slope Forest
3	C, K, O, P	Palustrine: Slope Forest
4	D, E, I	Palustrine: Slope Forest
5	G1, G4, G6, G7, G16, G20, G22	Palustrine Slope Bog
6	G2, G3, G5, G9, G10, G11, G12, G13, G14, G15, G17, G18, G19, G21, G23, G24, G25	Palustrine Slope Forest*
7	G8	Palustrine Slope Tidal
8	L, M	Palustrine: Slope Forest
9	N, Q, R, S	Palustrine: Slope Forest
10	10NF, 12, 13, 14, 15, 16	Riverine**
11	11, 10SF	Riverine**
12	17	Riverine**
13	10MF	Riverine**

* Wetland G5 is the only Slope Bog HGM Wetland Class in this group of otherwise Slope Forest wetlands

** For the purposes of this memo, Riverine wetlands (as defined in HGM) are considered the same as Palustrine Streambed, as defined by the Natzuhini Bay Mitigation Bank.

Table 3. Summary of Functional Index and Aggregate Index Scores using NBFA

Group Number	Grouped Wetlands	Functional Index			Aggregate Functional Index	Qualitative Rating
		Nutrient Cycling & Transport	Maintenance of Habitat Structure	Dynamic Water Retention		
1*	A (1–10)	N/A	N/A	N/A	N/A	N/A
2	B, J	0.28	0.14	0.53	0.31	Low
3	C, K, O, P	0.88	0.94	0.75	0.85	High
4	D, E, I	0.94	0.88	0.81	0.88	Highest
5	G1, 4, 6, 7, 16, 20, 22	0.94	0.56	0.94	0.81	High
6	G2, 3, 5, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 21, 23, 24, 25	0.94	1.00	0.81	0.92	Highest
7	G8	0.69	0.63	0.69	0.67	High
8	L, M	0.28	0.09	0.40	0.25	Low
9	N, Q, R, S	0.81	0.88	0.69	0.79	High
10	10NF, 12, 13, 14, 15, 16	0.88	0.88	0.75	0.83	High
11	11, 10SF	0.88	0.94	0.88	0.90	Highest
12	17	0.88	0.88	0.88	0.88	Highest
13	10MF	0.88	0.94	0.88	0.90	Highest

* NBFA is focused on freshwater habitats and does not provide criteria for evaluating tidally influenced wetlands.

Table 4. Qualitative Rating Key Using the HGM Score Increments and Score Definitions

Aggregate Functional Index Range	HGM Index Score	Qualitative Rating	Definition
0.00 – 0.05	0.0	Not Recoverable	Severely disturbed and no potential for restoration.
0.06 – 0.17	0.1	Severely Disturbed	Severely disturbed and is recoverable through natural processes.
0.18 – 0.37	0.25	Low	Little diversity or complexity and is recoverable in time through natural processes.
0.38 – 0.62	0.5	Moderate	Moderate complexity and little evidence of recent human disturbance.
0.63 – 0.87	0.75	High	High complexity and little to no evidence of recent human disturbance.
0.88 – 1.0	1.0	Highest	Mature ecological functions, high complexity, and predominantly undisturbed.

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ATTACHMENT A

Scoresheets from each wetland group assessed with the HGM assessment are provided below in the order they appear in Table 2 and Table 3.

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	1

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	NA	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	NA	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	NA	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	NA	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	NA	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	NA	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	NA	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	NA	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**#VALUE!**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**#VALUE!**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**#VALUE!**	VSoilperm	VSurwat	VMicro	VDuff

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	2

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.10	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	1.00	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.10	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.10	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.25	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.10	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.28**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.14**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.53**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.31**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	3

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	1.00	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	1.00	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.75	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	1.00	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.88**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.94**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.75**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.85**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	4

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.50	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	1.00	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	1.00	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.94**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.88**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.81**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.88**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	5

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.25	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	1.00	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	1.00	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.25	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.94**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.56**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.94**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.81**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	6

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	1.00	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	1.00	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	1.00	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.94**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**1.00**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.81**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.92**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	7

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.25	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.50	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.75	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.50	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	1.00	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.69**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.63**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.69**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.67**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	8

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.00	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.10	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.25	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.10	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.28**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.09**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.40**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.25**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	9

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	1.00	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.50	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	1.00	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.81**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.88**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.69**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.79**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	10

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	1.00	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.50	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.88**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.88**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.75**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.83**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	11

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	1.00	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	1.00	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.75	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.88**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.94**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.88**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.90**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	12

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	1.00	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	1.00	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.50	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.88**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.88**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.88**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.88**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group:	13

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	1.00	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	1.00	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.75	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.88**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.94**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.88**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.90**				

ATTACHMENT B

Functional Index categories as defined in *Natzuhini Bay Mitigation Bank Riparian Zone Functional Assessment* (Sealaska Corporation Inc. [date unknown]).

Variables for Mitigation Bank

1) Riparian Shade (V_{SHADE})

Definition: Tree cover, shrub cover, and overhanging vegetation within and near the bankfull channel or shoreline at MHW.

Rational for Selection of Variable: Tree, sapling, and shrub cover provide shade that regulates water temperature and in-channel light interception. Overhanging vegetation provides potential food sources and habitat for aquatic dependent taxa.

Measurement Protocol: Measure percent of canopy cover over entire water surface as if the sun was directly overhead. Use aerial photos to estimate, or estimate how far trees and branches overhang the stream from each bank. In the Estuarine area consider the effects of shaded area from MHW out to the first 30 feet.

Scaling: V_{SHADE}

MEASUREMENT OR CONDITION FOR (V_{SHADE})	INDEX
40% - 60% vegetative shading of stream surface area. A mixture of conditions where some areas of water surface are fully exposed to sunlight and others receive various degrees of filtered light.	1.0
20% - 39% or 61% - 80% vegetative shading of stream surface area. Covered by sparse canopy, entire water surface receiving filtered light.	.50
1% - 19% or 81% - 100% vegetative shading of stream surface area. Water surface is approaching either complete vegetative shading or full exposure to overhead sunlight conditions.	.25
No vegetative shading of stream surface area. Variable is recoverable or sustainable through natural processes under current conditions (e.g., natural regeneration of riparian vegetation).	.10
No vegetative shading of water surface. Variable is not recoverable or sustainable through natural processes.	0.0

2) Soil Permeability ($V_{SOILPERM}$)

Definition: Permeability is defined as the ease with which gases, liquids or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. Where it can be observed, the type of soil parent material that makes up the stream bank below bankfull depth is a fair estimate of soil permeability.

Rational for Selection of the Variable: The type of soil in the bank of a stream will influence the rate of water gain or loss into a channel. In addition, the type of soil greatly influences the character of the plant communities growing on it. If the dominant size

fraction is coarse, the rate of loss/gain may be high, whereas if the material is fine (sand, clay, or sapric material), the rate will be much slower. This is a rough estimate of hydraulic conductivity and may play an important role in nutrient spiraling and organic carbon export as well as aquatic habitat functions. Stream banks also regulate the amount and size of the sediment. If the banks are sandy and unstable, the probability of having sand-sized sediment is high. That is in contrast to having clay banks, which can be unstable but, due to the small size of the clay particles, generally don't contribute to sediment loading.

Measurement Protocol: Observe soil in embankments, cuts at the stream edge and in the riparian area. If unsure, dig a soil pit, at least 18 inches deep, close to the stream bank and determine if the soil material is organic, mineral or a mixture of organic/mineral layers. Pay attention to indicators that will help the observations of permeable depth such as, areas of standing water (whether or not water is present at the time), stunted plant growth, Obligate and Facultative Wet plant species, subsurface to surface flow (upwelling), surface channels, etc. In addition, determine the dominant size fraction of the mineral (e.g., clay, silt, sand, gravel, stones). Estimate the proportion of each type of soil within the bank riparian area and factor into the scaling.

Scaling: $V_{SOILPERM}$

INDIRECT MEASURE FOR ($V_{SOILPERM}$)	INDEX
Sandy or gravelly material has porosity and is able to transmit water either into or from the channel. Organic soil is dominated with fibric- sized material.	1.0
Silty soil material that has limited porosity and not likely to transmit much water into or from a channel. Organic soil is dominated with hemic-sized material.	.5
Clay soil material that has no porosity and not able to transmit water into or from a channel. Organic soil is dominated with sapric-sized material.	.1
No natural stream banks (e.g., concrete) or impervious channel liner.	0

3) Presence and Structure of the Duff Layer (V_{DUFF})

Definition: Duff is the surface fibric zone commonly called the Oi soil horizon. It serves as a permeable layer for the overland flow of water. Surface water transport is enhanced with an intact duff layer. A healthy system is indicated with a thick, well-developed surface fibric layer. This is the acrotelm layer in a jurisdictional wetland.

Rationale for Selection of the Variable: The duff is the litter layer horizon in soils. This organic layer is porous, oxygen rich, and not saturated with water. These are sites of most of the nutrient exchanges, habitat for soil biological communities, and where the

roots of most of the plants abound. The lateral movement of water through this layer is quick and efficient. Water movement downslope is unimpeded through the duff and acts as the source for many of the small streams and pools found in soils throughout Southeast Alaska.

Measurement Protocol: Evaluate the depth range of the Oi horizon (Usually the duff layer). Kick the organic layer with your boot to determine the thickness, or grab a handful and rip it from the ground making sure that the sample reached mineral soil. The scaling variables are quite broad so that a visual measurement should be sufficient. Do this in a variety of places to determine an average for the whole riparian area in the bank.

Scaling: V_{DUFF}

MEASUREMENT OR CONDITION FOR (V_{DUFF})	INDEX
Oi present at the soil surface and has a depth greater than 4.0 inches. The lateral movement of water is unimpeded.	1.0
Oi present with a minimum depth of 2.5 inches and the lateral movement of water is unimpeded. Or, the Oi is greater than 2.5 inches depth, but the flow of water through the Oi layer has been disrupted. The function is recoverable with restoration efforts.	.5
Oi absent or damaged and recoverable after decades of being undisturbed. The Oi is either absent or disrupted to such an extent that the function is not operational.	.1
There is no soil present on the site.	0

4) Number of Vegetative Strata (V_{STRATA})

Definition: The average number of vegetation strata present within the bank area. Vegetation strata were defined as follows: trees (single-stem, woody species >10 ft tall); small trees (single-stem, woody species > 3 to 10 ft (>1 to < 3 m tall); shrubs (multiple-stem, woody species); herbs, including forbs, graminoids, ferns and fern allies; and mosses, lichens, and liverworts.

Rationale for Selection of the variable: The number of strata is an indicator of the development and maintenance of native plant communities. In addition, the number of strata represents the presence of the habitat structure and complexity necessary to support faunal assemblages. Similarly, the numbers and types of vegetation strata represent the diversity of habitat niches, as well as the types and amount of food and cover resources available.

Measurement Protocol: Determine the dominant vegetation class (i.e., the species controlling the bank area environment) and record the number of strata present within that class. Forested wetlands are dominated by woody vegetation that is 6 meters tall or

taller. Scrub/shrub wetlands are dominated by woody vegetation less than 6 meters tall, including true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Herbaceous (emergent) wetlands are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. The vegetation is usually perennial and present for most of the growing season in most years. If the dominant vegetation is herbaceous, record the number of vegetation strata at 10 ft (3-meter) intervals along a 100 ft (30.5-meter) transect in the project assessment area (Figure 63 in the Guidebook). The average number of strata is calculated for the transect, and rounded to the nearest integer to yield an estimate for the Project Assessment Area.

Scaling: V_{STRATA}

CONDITIONS FOR (V_{STRATA})	INDEX
Three or more forest strata present and dominated by native plant species.	1.0
Three or more forest strata present and dominated by native plant species (i.e., foot trails, selective cutting).	.75
Two or three forest strata present and dominated by native plant species (tree removal for ROW).	.50
One forest strata present and may include native and non-native plants.	.25
Site historically forested but no forest strata present and site significantly altered by human activity. The variable is recoverable and sustainable through natural processes.	.10
Site historically forested but no forest strata present and site significantly altered by human activity. The variable is **NOT** recoverable to reference standard conditions or sustainable through natural processes.	.00

5) Microtopographic Features (V_{MICRO})

Definition: Small scale topographic relief in the form of pit-and-mound or hummock-and-hollow patterns that occur in the wetland.

Rationale for Selection of the Variable: Microtopographic features contribute to surface roughness, which influences how water flows through the riparian area. These features are important components of several hydrologic, biogeochemical, and habitat functions. For example, small depressions provide areas for temporary storage of surface water, which provides sinks conducive to elemental cycling and organic soil development. Microtopographic relief also provides for more diverse vegetation communities by creating topographic complexity and varying substrates which, in turn, creates more diverse habitat structure for wildlife.

Measurement Protocol: After reviewing in the field the microtopographic character of the riparian area, choose at least two transects that parallel the topographic relief and either by pacing or using a 100 foot measuring tape, at every ten feet determine if there is a 50 cm (20 inches) deflection from the general soil surface or forest floor. Include depressions hummocks, old logs and stumps in various levels of decay, outcrops, etc.

Scaling: V_{MICRO}

MEASUREMENT OR CONDITION FOR (V_{MICRO})	INDEX
The project assessment area is characterized by complex microtopographic relief (e.g., 50->80% of observed features are non-planar) AND assessment area is predominantly undisturbed, native soils, and plant communities.	1.0
The project assessment area is characterized by moderately complex microtopographic relief (e.g., 25-50% of observed features are non-planar) AND assessment area is predominantly undisturbed, native soils, and plant communities.	0.75
The project assessment area is characterized by moderately complex microtopographic relief (e.g., 25-50% of observed features are non-planar) AND assessment area is predominantly disturbed, native soils, and/or plant communities.	0.50
The project assessment area is characterized by some microtopographic relief (e.g., 1-25% of observed features are non-planar) AND assessment area is predominantly disturbed or undisturbed, native soils, and/or plant communities.	0.25
Microtopographic features are absent.	0.0

6) Presence of Surface Water (V_{SURWAT})

Definition: Detention of water in surface features. Sources include precipitation and subsurface and surface flow into the riparian area. Mechanisms for storage are position and depth of depressions and depth to the water table.

Rationale for Selection of the Variable: Surface water ponding, short and long term storage of surface water, and shallow subsurface water augments accumulation of organic matter in surface horizons, establishes a variety of substrates and hydrologic regimes for vegetative communities, and provides areas for invertebrate production. Exchange of water between surface and shallow subsurface components facilitates biogeochemical processes associated with elemental cycling and organic carbon export and contributes to subsurface flow out of the wetland and/or recharge to the water table.

Measurement Protocol: Conduct a visual reconnaissance or measured 100 ft transect, of the assessment area and determine the percent cover of ponds and other depressions that store water. When there has been no rain for a while, look for depressions that contain no

vegetation, black colored organic material, old waterlines, "muddy" material, and any other indicators that are clues that water is present a large part of the growing season.

Scaling: V_{SURWAT}

MEASUREMENT OR CONDITION FOR (V_{SURWAT})	INDEX
Observations or evidence of surface water or ponds in >50% or more of the assessment area, project assessment area is either predominantly undisturbed soils and native plant communities OR Observations or evidence of surface water or ponds in >50% or more of the assessment area, minor anthropogenic modifications may be present but no substantial impact to site topography is apparent (e.g., vegetation clearing, foot paths, wooden walkways, etc.).	1.0
Observations or evidence of surface water or ponds in 10-50% of the assessment area, project assessment area is predominantly undisturbed soils and native plant communities OR Observations or evidence of surface water or ponds in 10-50% of the assessment area, minor human disturbances or modifications may be present but no substantial impact to site topography is apparent (e.g., vegetation clearing, foot paths, wooden walkways, etc.).	.75
Observations or evidence of surface water or ponds in <10% of the assessment area, minor human disturbances or modifications may be present but no substantial impact to site topography is apparent (e.g., vegetation clearing, foot paths, wooden walkways, etc.)	.50
No observations or evidence of surface water or ponds within assessment area, project assessment area is predominantly undisturbed soils and native plant communities.	.25
No observations or evidence of surface water or ponds within assessment area, project assessment area is predominantly disturbed by human activities but recoverable through natural processes.	.10
No observations or evidence of surface water or ponds within assessment area, variable is not recoverable through natural processes.	.00

7) Log Decomposition (V_{DECOMP})

Definition: Number of decomposition classes of logs present (up to 5 feet) in assessment area.

Measurement Protocol: Count the number of logs using a point-center quarter (PCQ) method. The plot center should be located beyond thirty feet from the bankfull width of the stream channel. After identifying a log, use the chart below to identify the class of decay for the log. Then count the number of classes and scale according to the Scaling chart below.

Rationale For Selection of the Variable: Logs in various stages of decomposition provide a continuous source of refractory organic carbon.

COARSE WOOD DECAY CLASSES	Y /N
1. Logs Recently fallen, bark attached, leaves and fine twigs present.	
2. Logs with loose bark, no leaves/fine twigs, fungi present.	
3. Logs w/o bark, few stubs of branches, fungi present.	
4. Logs w/o branches or bark, heartwood in advanced decay state.	
5. Logs decayed into the ground and covered.	

Scaling: V_{DECOMP}

MEASUREMENT OR CONDITION FOR (V_{DECOMP})	INDEX
Greater than or equal to three decomposition classes present with in the assessment area AND assessment area is predominantly undisturbed, native soils and plant communities.	1.0
Two decomposition classes present within the assessment area AND assessment area is predominantly undisturbed, native soils and plant communities.	0.50
One Decomposition class present with in the assessment area AND assessment area is predominantly disturbed, native soils and/or plant communities.	0.25
No logs present within assessment area and coarse woody debris sources have been altered/eliminated by human disturbance, variable is recoverable nor sustainable through natural processes under current conditions.	0.10
No logs present within assessment area and coarse woody debris sources have been altered/eliminated by human disturbance, variable is NOT recoverable nor sustainable through natural processes under current conditions.	0.0

8) Large Woody Debris Recruitment ($V_{LWDRECRUIT}$)

Definition: Trees are defined as single-stem, woody species >10-ft tall.
Measurement Protocol: Visually choose a combination of dominant and codominant species of Sitka spruce, western hemlock, cedar species. Use red alder if conifer species are insufficient on the photo sample plot. Use photo measurement techniques or, if samples are made on the ground, use a clinometer or similar instrument to measure tree height from the estimated root crown. This sample should ***not*** include very wet areas with trees exhibiting impaired growth due to saturated soils for all, or close to all, of the growing season. Projected growth will be based on determining the site index range and applying it to tree species growth in the Southeast Alaska Prognosis model available from the Forest Service Laboratory.

Rationale for Selection of the Variable: LWD recruitment is largely dependent upon number of trees per acre, height of the dominant and codominant trees, the diameter of the dominant and codominant trees, and their distance from a stream bank. In managed stands, tree height is a reasonable indicator of tree diameter, likeliness of falling into a stream to provide LWD, ability to modify stream flow and bedload conditions, ability to add to stream complexity, and likelihood of providing habitat for some indigenous animal and bird species. Generally, the closer a tree is to the stream bank, the greater is the chance that it will fall into the stream and provide in-channel LWD.

Condition ($V_{LWDRECRUIT}$)

MEASUREMENT OR CONDITION FOR ($V_{LWDRECRUIT}$)	INDEX
Dominant and codominant conifer trees exceed 75 feet in height. For each 66 feet of stream bank an average of 2.5 trees are within 33 feet of the stream bank or shoreline.	1.0
Dominant and codominant conifer trees exceed 60 feet in height. For each 66 feet of stream bank an average of 2.5 trees are within 33 feet of the stream bank or shoreline.	.75
Dominant and codominant conifer trees exceed 45 feet in height. For each 66 feet of stream bank an average of 2.0 trees are within 33 feet of the stream bank or shoreline.	.50
Dominant and codominant conifer trees exceed 30 feet in height **or** a combination of red alder and conifer species exceed 40 feet in height. For each 66 feet of stream bank an average of 1.5 trees are within 33 feet of the stream bank or shoreline.	.25
Tree species exceed 10 feet in height and trees are the dominant occupants of the zone, or the site is temporarily devoid of trees, but there are seed sources, the soil can support natural regeneration, and potential seedlings have the ability to grow to LWD size.	.10
Site historically rock covered by a thin organic mantle or very wet and largely supports scrub trees, brush and herbaceous species. A lack of, or very few, stumps indicates that large trees have not existed in the zone for many tree generations.	.00

APPENDIX E

Post-project WESPAK Scores for Altered Wetlands

Site Name or ID #:	**Angoon Airport - Post-project Conditions for Bog Forest, Groups 4 and 6**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018; Post-project conditions assessed August 2020 based on 95% plans**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month & year.	**No. Familiar with protoocl and certified in ORWAP**
How many wetlands have you assessed previously using this protocol (approx.)?	**10.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):										**FUNCTION**			**VALUE**		
											Thresholds for Function Rating (normalized score)			*Thresholds for Value Rating (normalized score)*	
Specific Functions or Values:	Function Score raw	Value Score raw	**Function Score (normalized)**	**Function Rating**	**Value Score (normalized)**	**Value Rating**	FV raw	FV Index	**FV Index (normalized)**	Median of Normalized F Scores	Low is < or =	High is >	Median of Normalized V Scores	Low is < or =	High is >
Surface Water Storage (WS)	1.56	4.86	0.43	Lower	4.86	Moderate	2.65	2.65	0.81	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	9.00	0.00	9.00	Higher	0.00	Lower	4.50	9.00	8.93	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	10.00	0.00	10.00	Higher	0.00	Lower	5.00	10.00	10.00	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization (SR	4.88	0.96	3.48	Moderate	1.82	Lower	2.65	3.48	0.32	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	5.53	6.67	3.31	Moderate	10.00	Higher	6.65	6.65	6.38	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	4.87	4.17	2.12	Lower	4.56	Moderate	3.34	3.34	3.34	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	3.52		0.00	Lower			0.00	0.00	0.00	6.53	3.66	6.43			
Organic Nutrient Export (OE)	5.12	5.70	7.39	Moderate	5.73	Moderate	6.56	7.39	7.39	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	5.58	6.67	7.72	Higher	6.67	Moderate	7.19	7.72	7.72	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	4.97	10.00	4.39	Moderate	10.00	Higher	7.20	7.20	7.20	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	6.44	6.25	5.76	Moderate	7.72	Higher	6.74	6.74	6.31	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	3.79	4.34	5.23	Moderate	5.64	Higher	5.43	5.43	5.35	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	4.65	8.55	5.73	Moderate	8.55	Higher	7.14	7.14	7.00	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	4.11	7.30	5.64	Higher	9.78	Higher	7.71	7.71	7.55	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	5.44	9.73	5.40	Moderate	9.70	Higher	7.55	7.55	7.39	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		2.23			2.61	Moderate	2.61	2.61	2.61				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		7.22			7.22	Higher	7.22	7.22	7.22				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		3.00			1.67	Lower	1.67	1.67	0.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		3.94			4.15	Moderate	4.15	4.15	4.37				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		7.06			10.00	Higher	10.00	10.00	10.00				6.43	3.31	5.73
Summary Scores for Groups:								**Group Score Not Normalized**	**Group Score Normalized**	**Group Rating**					
HYDROLOGIC Group (WS)								0.81	0.81	Lower	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								4.44	2.35	Lower	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								8.35	7.60	Higher	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								5.79	5.79	Moderate	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								5.10	4.09	Moderate	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								7.43	6.58	Higher	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								7.22	8.22	Higher	3.66	6.58			
			AVG w/o Social	with Social	selected highe	normalized									
Overall Score (see Manual for explanation of how the spreadsheet calculates it):	6.04		6.07	6.64	6.64	6.04									

Site Name or ID #:	**Angoon Airport - Post-project Conditions, Group 5 Bog Woodland**
Investigator Name:	**Environmental Science Associates (ESA)**
Date of Field Assessment:	**13-22 Aug, 2013; 15-22 June, 2017; 6-14 June, 2018; Post-project conditions assessed August 2020 based on 95% plans**
Nearest Town:	**Angoon, Alaska**
Latitude (decimal degrees):	**57.475520°**
Longitude (decimal degrees):	**-134.553167°**
HUC12 Watershed # (from UAS web site):	**19010204.00**
Approximate size of the Assessment Area (AA, in acres)	
AA as percent of entire wetland (approx.)	**100.00**
Tidal phase during most of visit:	**Low**
What percent (approx.) of the **wetland** were you able to visit?	**100.00**
What percent (approx.) of the **AA** were you able to visit?	**100.00**
Have you attended a training session for this protocol? If so, indicate approximate month & year.	**No. Familiar with protoocl and certified in ORWAP**
How many wetlands have you assessed previously using this protocol (approx.)?	**10.00**

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

WESPAK-SE version 2 scores for this NON-tidal Wetland Assessment Area (AA):											**FUNCTION**			**VALUE**		
												Thresholds for Function Rating (normalized score)			*Thresholds for Value Rating (normalized score)*	
Specific Functions or Values:	Function Score raw	Value Score raw	**Score (normalized)**	**Function Rating**	**Value Score (normalized)**	**Value Rating**	FV raw	FV Index	**(normalized)**	Median of Normalized F Scores	Low is < or =	High is >	Median of Normalized V Scores	Low is < or =	High is >
Surface Water Storage (WS)	1.56	4.86	0.43	Lower	4.86	Moderate	2.65	2.65	0.81	2.95	2.89	6.34	3.06	1.85	5.00
Stream Flow Support (SFS)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	3.17	2.67	6.13	3.33	1.45	4.48
Streamwater Cooling (WC)	9.00	0.00	9.00	Higher	0.00	Lower	4.50	9.00	8.93	4.00	3.36	5.87	1.98	2.11	5.49
Streamwater Warming (WW)	10.00	0.00	10.00	Higher	0.00	Lower	5.00	10.00	10.00	5.42	3.33	6.80	2.78	2.78	6.63
Sediment & Toxicant Retention & Stabilization (SR	4.74	0.96	3.31	Lower	1.82	Lower	2.57	3.31	0.00	3.13	3.36	6.52	0.84	2.05	5.86
Phosphorus Retention (PR)	5.49	6.67	3.25	Moderate	10.00	Higher	6.62	6.62	6.35	3.34	3.06	6.17	1.27	2.45	5.73
Nitrate Removal & Retention (NR)	4.46	4.17	1.48	Lower	4.56	Moderate	3.02	3.02	3.02	2.33	2.19	4.64	3.25	2.17	4.94
Carbon Sequestration (CS)	3.52		0.00	Lower			0.00	0.00	0.00	6.53	3.66	6.43			
Organic Nutrient Export (OE)	5.12	5.70	7.39	Moderate	5.73	Moderate	6.56	7.39	7.39	7.68	0.00	7.59	7.00	0.00	7.00
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	0.00	2.93	7.23	0.00	0.63	6.67
Resident & Other Fish Habitat (FR)	5.58	6.67	7.72	Higher	6.67	Moderate	7.19	7.72	7.72	0.00	0.00	7.43	0.00	1.50	7.76
Aquatic Invertebrate Habitat (INV)	4.41	10.00	3.26	Moderate	10.00	Higher	6.63	6.63	6.63	3.92	2.48	5.04	2.22	2.50	6.43
Amphibian Habitat (AM)	6.38	6.25	5.65	Moderate	7.72	Higher	6.69	6.69	6.25	4.40	3.59	6.74	4.21	2.43	5.19
Waterbird Feeding Habitat (WBF)	3.79	4.34	5.23	Moderate	5.64	Higher	5.43	5.43	5.35	4.60	0.00	5.68	2.53	0.85	4.07
Waterbird Nesting Habitat (WBN)	0.00	0.00	0.00	Lower	0.00	Lower	0.00	0.00	0.00	4.58	0.00	6.44	6.90	1.67	8.70
Songbird, Raptor, & Mammal Habitat (SBM)	4.31	8.55	5.32	Moderate	8.55	Higher	6.94	6.94	6.78	8.05	0.00	7.35	4.22	2.50	5.63
Pollinator Habitat (POL)	2.44	7.30	2.95	Moderate	9.78	Higher	6.37	6.37	6.12	4.94	2.45	5.38	4.15	2.65	5.83
Native Plant Habitat (PH)	5.38	9.73	5.20	Moderate	9.70	Higher	7.45	7.45	7.26	5.24	4.52	6.51	3.78	3.78	6.46
Other Values or Attributes:															
Public Use & Recognition (PU)		2.23			2.61	Moderate	2.61	2.61	2.61				2.91	2.32	5.59
Subsistence & Provisioning Services (Subsis)		7.22			7.22	Higher	7.22	7.22	7.22				5.00	0.00	6.67
Wetland Sensitivity (Sens) - *not used in subsequent calculations*		3.00			1.67	Lower	1.67	1.67	0.00				5.91	5.03	7.46
Wetland Ecological Condition (EC) - *not used in subsequent calculations*		2.69			2.84	Moderate	2.84	2.84	2.99				4.15	2.79	5.08
Stress Potential (STR) - *not used in subsequent calculations*		7.06			10.00	Higher	10.00	10.00	10.00				6.43	3.31	5.73
Summary Scores for Groups:								**Group Score Not Normalized**	**Group Score Normalized**	**Group Rating**					
HYDROLOGIC Group (WS)								0.81	0.81	Lower	3.08	5.91			
WATER QUALITY Group (max+avg/2 of SR, PR, NR, CS)								4.34	2.19	Lower	4.23	6.75			
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC, WW)								8.30	7.47	Higher	4.07	6.60			
FISH Group (max+avg/2 of FA, FR)								5.79	5.79	Moderate	2.52	5.83			
AQUATIC HABITAT Group (max+avg/2 of AM, WBF, WBN)								5.06	4.04	Lower	4.04	6.82			
TERRESTRIAL HABITAT Group (max+avg/2 of SBM, PH, POL)								6.99	5.99	Moderate	3.61	6.32			
SOCIAL GROUP (max+avg/2 of PU, Subsis)								7.22	8.22	Higher	3.66	6.58			
			AVG w/o Social	with Social	selected higher	normalized									
Overall Score (see Manual for explanation of how the spreadsheet calculates it):	5.96		5.93	6.57	6.57	5.96									
Overall Rating:	**Moderate**														

APPENDIX F

Post-project Modified HGM Scores for Altered Wetlands

Variables for Mitigation Bank

1) Riparian Shade (V_{SHADE})

Definition: Tree cover, shrub cover, and overhanging vegetation within and near the bankfull channel or shoreline at MHW.

Rational for Selection of Variable: Tree, sapling, and shrub cover provide shade that regulates water temperature and in-channel light interception. Overhanging vegetation provides potential food sources and habitat for aquatic dependent taxa.

Measurement Protocol: Measure percent of canopy cover over entire water surface as if the sun was directly overhead. Use aerial photos to estimate, or estimate how far trees and branches overhang the stream from each bank. In the Estuarine area consider the effects of shaded area from MHW out to the first 30 feet.

Scaling: V_{SHADE}

MEASUREMENT OR CONDITION FOR (V_{SHADE})	INDEX
40% - 60% vegetative shading of stream surface area. A mixture of conditions where some areas of water surface are fully exposed to sunlight and others receive various degrees of filtered light.	1.0
20% - 39% or 61% - 80% vegetative shading of stream surface area. Covered by sparse canopy, entire water surface receiving filtered light.	.50
1% - 19% or 81% - 100% vegetative shading of stream surface area. Water surface is approaching either complete vegetative shading or full exposure to overhead sunlight conditions.	.25
No vegetative shading of stream surface area. Variable is recoverable or sustainable through natural processes under current conditions (e.g., natural regeneration of riparian vegetation).	.10
No vegetative shading of water surface. Variable is not recoverable or sustainable through natural processes.	0.0

2) Soil Permeability ($V_{SOILPERM}$)

Definition: Permeability is defined as the ease with which gases, liquids or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. Where it can be observed, the type of soil parent material that makes up the stream bank below bankfull depth is a fair estimate of soil permeability.

Rational for Selection of the Variable: The type of soil in the bank of a stream will influence the rate of water gain or loss into a channel. In addition, the type of soil greatly influences the character of the plant communities growing on it. If the dominant size

fraction is coarse, the rate of loss/gain may be high, whereas if the material is fine (sand, clay, or sapric material), the rate will be much slower. This is a rough estimate of hydraulic conductivity and may play an important role in nutrient spiraling and organic carbon export as well as aquatic habitat functions. Stream banks also regulate the amount and size of the sediment. If the banks are sandy and unstable, the probability of having sand-sized sediment is high. That is in contrast to having clay banks, which can be unstable but, due to the small size of the clay particles, generally don't contribute to sediment loading.

Measurement Protocol: Observe soil in embankments, cuts at the stream edge and in the riparian area. If unsure, dig a soil pit, at least 18 inches deep, close to the stream bank and determine if the soil material is organic, mineral or a mixture of organic/mineral layers. Pay attention to indicators that will help the observations of permeable depth such as, areas of standing water (whether or not water is present at the time), stunted plant growth, Obligate and Facultative Wet plant species, subsurface to surface flow (upwelling), surface channels, etc. In addition, determine the dominant size fraction of the mineral (e.g., clay, silt, sand, gravel, stones). Estimate the proportion of each type of soil within the bank riparian area and factor into the scaling.

Scaling: $V_{SOILPERM}$

INDIRECT MEASURE FOR ($V_{SOILPERM}$)	INDEX
Sandy or gravelly material has porosity and is able to transmit water either into or from the channel. Organic soil is dominated with fibric- sized material.	1.0
Silty soil material that has limited porosity and not likely to transmit much water into or from a channel. Organic soil is dominated with hemic-sized material.	.5
Clay soil material that has no porosity and not able to transmit water into or from a channel. Organic soil is dominated with sapric-sized material.	.1
No natural stream banks (e.g., concrete) or impervious channel liner.	0

3) Presence and Structure of the Duff Layer (V_{DUFF})

Definition: Duff is the surface fibric zone commonly called the Oi soil horizon. It serves as a permeable layer for the overland flow of water. Surface water transport is enhanced with an intact duff layer. A healthy system is indicated with a thick, well-developed surface fibric layer. This is the acrotelm layer in a jurisdictional wetland.

Rationale for Selection of the Variable: The duff is the litter layer horizon in soils. This organic layer is porous, oxygen rich, and not saturated with water. These are sites of most of the nutrient exchanges, habitat for soil biological communities, and where the

roots of most of the plants abound. The lateral movement of water through this layer is quick and efficient. Water movement downslope is unimpeded through the duff and acts as the source for many of the small streams and pools found in soils throughout Southeast Alaska.

Measurement Protocol: Evaluate the depth range of the Oi horizon (Usually the duff layer). Kick the organic layer with your boot to determine the thickness, or grab a handful and rip it from the ground making sure that the sample reached mineral soil. The scaling variables are quite broad so that a visual measurement should be sufficient. Do this in a variety of places to determine an average for the whole riparian area in the bank.

Scaling: V_{DUFF}

MEASUREMENT OR CONDITION FOR (V_{DUFF})	INDEX
Oi present at the soil surface and has a depth greater than 4.0 inches. The lateral movement of water is unimpeded.	1.0
Oi present with a minimum depth of 2.5 inches and the lateral movement of water is unimpeded. Or, the Oi is greater than 2.5 inches depth, but the flow of water through the Oi layer has been disrupted. The function is recoverable with restoration efforts.	.5
Oi absent or damaged and recoverable after decades of being undisturbed. The Oi is either absent or disrupted to such an extent that the function is not operational.	.1
There is no soil present on the site.	0

4) Number of Vegetative Strata (V_{STRATA})

Definition: The average number of vegetation strata present within the bank area. Vegetation strata were defined as follows: trees (single-stem, woody species >10 ft tall); small trees (single-stem, woody species > 3 to 10 ft (>1 to < 3 m tall); shrubs (multiple-stem, woody species); herbs, including forbs, graminoids, ferns and fern allies; and mosses, lichens, and liverworts.

Rationale for Selection of the variable: The number of strata is an indicator of the development and maintenance of native plant communities. In addition, the number of strata represents the presence of the habitat structure and complexity necessary to support faunal assemblages. Similarly, the numbers and types of vegetation strata represent the diversity of habitat niches, as well as the types and amount of food and cover resources available.

Measurement Protocol: Determine the dominant vegetation class (i.e., the species controlling the bank area environment) and record the number of strata present within that class. Forested wetlands are dominated by woody vegetation that is 6 meters tall or

taller. Scrub/shrub wetlands are dominated by woody vegetation less than 6 meters tall, including true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Herbaceous (emergent) wetlands are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. The vegetation is usually perennial and present for most of the growing season in most years. If the dominant vegetation is herbaceous, record the number of vegetation strata at 10 ft (3-meter) intervals along a 100 ft (30.5-meter) transect in the project assessment area (Figure 63 in the Guidebook). The average number of strata is calculated for the transect, and rounded to the nearest integer to yield an estimate for the Project Assessment Area.

Scaling: V_{STRATA}

CONDITIONS FOR (V_{STRATA})	INDEX
Three or more forest strata present and dominated by native plant species.	1.0
Three or more forest strata present and dominated by native plant species (i.e., foot trails, selective cutting).	.75
Two or three forest strata present and dominated by native plant species (tree removal for ROW).	.50
One forest strata present and may include native and non-native plants.	.25
Site historically forested but no forest strata present and site significantly altered by human activity. The variable is recoverable and sustainable through natural processes.	.10
Site historically forested but no forest strata present and site significantly altered by human activity. The variable is **NOT** recoverable to reference standard conditions or sustainable through natural processes.	.00

5) Microtopographic Features (V_{MICRO})

Definition: Small scale topographic relief in the form of pit-and-mound or hummock-and-hollow patterns that occur in the wetland.

Rationale for Selection of the Variable: Microtopographic features contribute to surface roughness, which influences how water flows through the riparian area. These features are important components of several hydrologic, biogeochemical, and habitat functions. For example, small depressions provide areas for temporary storage of surface water, which provides sinks conducive to elemental cycling and organic soil development. Microtopographic relief also provides for more diverse vegetation communities by creating topographic complexity and varying substrates which, in turn, creates more diverse habitat structure for wildlife.

Measurement Protocol: After reviewing in the field the microtopographic character of the riparian area, choose at least two transects that parallel the topographic relief and either by pacing or using a 100 foot measuring tape, at every ten feet determine if there is a 50 cm (20 inches) deflection from the general soil surface or forest floor. Include depressions hummocks, old logs and stumps in various levels of decay, outcrops, etc.

Scaling: V_{MICRO}

MEASUREMENT OR CONDITION FOR (V_{MICRO})	INDEX
The project assessment area is characterized by complex microtopographic relief (e.g., 50->80% of observed features are non-planar) AND assessment area is predominantly undisturbed, native soils, and plant communities.	1.0
The project assessment area is characterized by moderately complex microtopographic relief (e.g., 25-50% of observed features are non-planar) AND assessment area is predominantly undisturbed, native soils, and plant communities.	0.75
The project assessment area is characterized by moderately complex microtopographic relief (e.g., 25-50% of observed features are non-planar) AND assessment area is predominantly disturbed, native soils, and/or plant communities.	0.50
The project assessment area is characterized by some microtopographic relief (e.g., 1-25% of observed features are non-planar) AND assessment area is predominantly disturbed or undisturbed, native soils, and/or plant communities.	0.25
Microtopographic features are absent.	0.0

6) Presence of Surface Water (V_{SURWAT})

Definition: Detention of water in surface features. Sources include precipitation and subsurface and surface flow into the riparian area. Mechanisms for storage are position and depth of depressions and depth to the water table.

Rationale for Selection of the Variable: Surface water ponding, short and long term storage of surface water, and shallow subsurface water augments accumulation of organic matter in surface horizons, establishes a variety of substrates and hydrologic regimes for vegetative communities, and provides areas for invertebrate production. Exchange of water between surface and shallow subsurface components facilitates biogeochemical processes associated with elemental cycling and organic carbon export and contributes to subsurface flow out of the wetland and/or recharge to the water table.

Measurement Protocol: Conduct a visual reconnaissance or measured 100 ft transect, of the assessment area and determine the percent cover of ponds and other depressions that store water. When there has been no rain for a while, look for depressions that contain no

vegetation, black colored organic material, old waterlines, "muddy" material, and any other indicators that are clues that water is present a large part of the growing season.

Scaling: V_{SURWAT}

MEASUREMENT OR CONDITION FOR (V_{SURWAT})	INDEX
Observations or evidence of surface water or ponds in >50% or more of the assessment area, project assessment area is either predominantly undisturbed soils and native plant communities OR Observations or evidence of surface water or ponds in >50% or more of the assessment area, minor anthropogenic modifications may be present but no substantial impact to site topography is apparent (e.g., vegetation clearing, foot paths, wooden walkways, etc.).	1.0
Observations or evidence of surface water or ponds in 10-50% of the assessment area, project assessment area is predominantly undisturbed soils and native plant communities OR Observations or evidence of surface water or ponds in 10-50% of the assessment area, minor human disturbances or modifications may be present but no substantial impact to site topography is apparent (e.g., vegetation clearing, foot paths, wooden walkways, etc.).	.75
Observations or evidence of surface water or ponds in <10% of the assessment area, minor human disturbances or modifications may be present but no substantial impact to site topography is apparent (e.g., vegetation clearing, foot paths, wooden walkways, etc.)	.50
No observations or evidence of surface water or ponds within assessment area, project assessment area is predominantly undisturbed soils and native plant communities.	.25
No observations or evidence of surface water or ponds within assessment area, project assessment area is predominantly disturbed by human activities but recoverable through natural processes.	.10
No observations or evidence of surface water or ponds within assessment area, variable is not recoverable through natural processes.	.00

7) Log Decomposition (V_{DECOMP})

Definition: Number of decomposition classes of logs present (up to 5 feet) in assessment area.

Measurement Protocol: Count the number of logs using a point-center quarter (PCQ) method. The plot center should be located beyond thirty feet from the bankfull width of the stream channel. After identifying a log, use the chart below to identify the class of decay for the log. Then count the number of classes and scale according to the Scaling chart below.

Rationale For Selection of the Variable: Logs in various stages of decomposition provide a continuous source of refractory organic carbon.

COARSE WOOD DECAY CLASSES	Y /N
1. Logs Recently fallen, bark attached, leaves and fine twigs present.	
2. Logs with loose bark, no leaves/fine twigs, fungi present.	
3. Logs w/o bark, few stubs of branches, fungi present.	
4. Logs w/o branches or bark, heartwood in advanced decay state.	
5. Logs decayed into the ground and covered.	

Scaling: V_{DECOMP}

MEASUREMENT OR CONDITION FOR (V_{DECOMP})	INDEX
Greater than or equal to three decomposition classes present with in the assessment area AND assessment area is predominantly undisturbed, native soils and plant communities.	1.0
Two decomposition classes present within the assessment area AND assessment area is predominantly undisturbed, native soils and plant communities.	0.50
One Decomposition class present with in the assessment area AND assessment area is predominantly disturbed, native soils and/or plant communities.	0.25
No logs present within assessment area and coarse woody debris sources have been altered/eliminated by human disturbance, variable is recoverable nor sustainable through natural processes under current conditions.	0.10
No logs present within assessment area and coarse woody debris sources have been altered/eliminated by human disturbance, variable is NOT recoverable nor sustainable through natural processes under current conditions.	0.0

8) Large Woody Debris Recruitment ($V_{LWDRECRUIT}$)

Definition: Trees are defined as single-stem, woody species >10-ft tall.
Measurement Protocol: Visually choose a combination of dominant and codominant species of Sitka spruce, western hemlock, cedar species. Use red alder if conifer species are insufficient on the photo sample plot. Use photo measurement techniques or, if samples are made on the ground, use a clinometer or similar instrument to measure tree height from the estimated root crown. This sample should ***not*** include very wet areas with trees exhibiting impaired growth due to saturated soils for all, or close to all, of the growing season. Projected growth will be based on determining the site index range and applying it to tree species growth in the Southeast Alaska Prognosis model available from the Forest Service Laboratory.

Rationale for Selection of the Variable: LWD recruitment is largely dependent upon number of trees per acre, height of the dominant and codominant trees, the diameter of the dominant and codominant trees, and their distance from a stream bank. In managed stands, tree height is a reasonable indicator of tree diameter, likeliness of falling into a stream to provide LWD, ability to modify stream flow and bedload conditions, ability to add to stream complexity, and likelihood of providing habitat for some indigenous animal and bird species. Generally, the closer a tree is to the stream bank, the greater is the chance that it will fall into the stream and provide in-channel LWD.

Condition ($V_{LWDRECRUIT}$)

MEASUREMENT OR CONDITION FOR ($V_{LWDRECRUIT}$)	INDEX
Dominant and codominant conifer trees exceed 75 feet in height. For each 66 feet of stream bank an average of 2.5 trees are within 33 feet of the stream bank or shoreline.	1.0
Dominant and codominant conifer trees exceed 60 feet in height. For each 66 feet of stream bank an average of 2.5 trees are within 33 feet of the stream bank or shoreline.	.75
Dominant and codominant conifer trees exceed 45 feet in height. For each 66 feet of stream bank an average of 2.0 trees are within 33 feet of the stream bank or shoreline.	.50
Dominant and codominant conifer trees exceed 30 feet in height **or** a combination of red alder and conifer species exceed 40 feet in height. For each 66 feet of stream bank an average of 1.5 trees are within 33 feet of the stream bank or shoreline.	.25
Tree species exceed 10 feet in height and trees are the dominant occupants of the zone, or the site is temporarily devoid of trees, but there are seed sources, the soil can support natural regeneration, and potential seedlings have the ability to grow to LWD size.	.10
Site historically rock covered by a thin organic mantle or very wet and largely supports scrub trees, brush and herbaceous species. A lack of, or very few, stumps indicates that large trees have not existed in the zone for many tree generations.	.00

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group: Group 5_Temp_Impacts

Step 1

	Characteristic	Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.25	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.50	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.75	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.50	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.10	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.63**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.40**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.63**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.55**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group: Group 6_Temp_Impacts

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.25	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.50	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.75	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.50	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.10	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.63**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.40**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.63**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.55**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group: Groups10-13_Temp_imp

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.25	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.50	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.75	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.50	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.10	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.63**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.40**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.63**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.55**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group: Group10_St12_Temp_im

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.50	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	1.00	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	1.00	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	1.00	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.50	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.88**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.75**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.75**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.79**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group: Group10_perm_impact

Step 1

	Characteristic	Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.10	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.25	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.50	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.10	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.10	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.46**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.24**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.56**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.42**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group: Group11_Perm_impact

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.10	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.25	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.50	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.10	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.10	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.46**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.24**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.56**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.42**				

Step 1 - Fill in the "Index" column (column D) for all 8 variables by using the variable index values found in the completed field collection sheets from Appendix 5; see scoring tables on the right

Step 2 - The Functional Capacity Index is automatically calculated for each of the 3 wetland functions

Group: Group13_Perm_impact

Step 1

Characteristic		Index	Index Score Catagories					
VShade	Riparian / Streamside Shade	0.25	1.00	NA	0.50	0.25	0.10	0.00
VSoilperm	Soil Permeability	0.50	1.00	NA	0.50	NA	0.10	0.00
VDuff	Duff Horizon	0.50	1.00	NA	0.50	NA	0.10	0.00
VStrata	Num. of Vegetation Strata	0.25	1.00	0.75	0.50	0.25	0.10	0.00
VMicro	Microtopographic Features	0.50	1.00	0.75	0.50	0.25	NA	0.00
VSurwat	Surface Water	0.75	1.00	0.75	0.50	0.25	0.10	0.00
VDecomp	Log Decomposition	0.50	1.00	NA	0.50	0.25	0.10	0.00
VLWDrecruit	LWD Recruitment	0.10	1.00	0.75	0.50	0.25	0.10	0.00

Step 2

Riparian Zone Ecological Functions	Functional Capacity Index	Additive Components			
Nutrient Recycling and Transport	**0.56**	VDuff	VSurwat	VMicro	VDecomp
Maintenance of Habtiat Structure	**0.28**	VMicro	VStrata	VLWDrecruit	VShade
Dynamic Water Retention	**0.56**	VSoilperm	VSurwat	VMicro	VDuff
Aggregate Functional Index	**0.47**				