Attachment H

Bonanza Channel Placer Project Reclamation Plan, Revision 3

April 2024

Bonanza Channel Placer Project
Near Nome, Alaska

RECLAMATION PLAN

Revision 3

Revised April 2024

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ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADCP	acoustic Doppler current profiler
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
BC MoF	British Columbia Ministry of Forests
^oC	degrees Celsius
cm	centimeter(s)
CEM	Conceptual Ecological Model
CPUE	catch per unit effort
DMDS	dredge material disposal site(s)
DO	dissolved oxygen
EM	ecological memory
EPA	US Environmental Protection Agency
ft	foot (feet)
ft/sec	feet per second
km	kilometer(s)
m	meter(s)
m^2	square meter(s)
MHHW	mean higher high water
MLLW	mean lower low water
OEI	Otero Engineering, Inc.
plan	Reclamation Plan
ppt	parts per thousand
project	Bonanza Channel Placer Project
SAV	submerged aquatic vegetation
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USFWS	US Fish and Wildlife Service

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TABLES

1. INTRODUCTION

This Reclamation Plan Revision 3 (plan) is for the Bonanza Channel Placer Project (project), approximately 24 miles southeast of Nome, Alaska in the vicinity of Safety Sound. A project description and operations plan prepared by the project operator is provided in the U.S. Army Corps of Engineers (USACE) Public Notice of Application for Permit (POA-2018-00123). Revision 3 of the plan was prepared to address comments, requested content, and details described by USACE and other agencies.

The goal of the reclamation activities is to maintain existing hydrological processes and associated ecosystem services.

2. DESIGN AND CONSTRUCTION METHODOLOGY

The design and construction methodology described in this plan allows for reclamation of the mining channel morphology, and fluvial processes, which support the existing natural estuarine/lagoon functions. Design functions include flow conveyance, flood energy dissipation, and restoration of submerged aquatic vegetation (SAV).

3. SAFETY SOUND

The current geomorphology in the vicinity of Safety Sound is primarily a result of multiple glaciations (Kaufman and Calkin 1988). Glaciation in the area caused gouging of river valleys, deposition of glacial drift, and ultimately flooding of the Eldorado River delta. Barrier islands extend approximately 9.5 miles along the coast and isolate Safety Sound and the claims area from Norton Sound. Alaska Department of Fish and Game (ADF&G) (2020) describes the physical morphology of Safety Sound as follows:

> "The Sound [Safety Sound, SS] is oval-shaped, with the long axis (~12 km) running SW to NE and the short axis (~3 km) running NW to SE. Fresh water enters the Sound from the Eldorado/Flambeau River complex in the NW corner). and exits to Norton Sound about 6 km to the ESE via a narrow (~300 m wide) strait. Fresh water also enters Safety Sound from the SE corner of the sound via Bonanza channel, which contains approximately half the water from the Bonanza River. Water inflow from the Bonanza channel is much less than from the Eldorado River watershed, and fish biota from the Bonanza River are thought to contribute relatively little to Safety Sound. Safety Sound has uniformly shallow water depths (mean = 2 m) with a muddy and sandy bottom."

> "Salinity in SS was variable depending on location and seasonality, increasing on a gradient from the Eldorado complex inlet (1.2 to 4 ppt) to the outlet (26.0 to 27.0 ppt) at Norton Sound. Salinity in the eastern part of the Sound proximate to the claim area ranged from approximately 17 ppt to 23 ppt. Water temperature was closely correlated with air temperature and mid-summer water temperatures frequently exceeded 15°C."

3.1. Bonanza Channel

Bonanza Channel is a rectangular-shaped feature parallel to the coast, bound to the south by the barrier islands described above and low slope to the north. In the claim area, the channel is shallow, with a mean depth of 2.3 feet (ft). Deeper portions exist as a narrow channel that meanders north and south with the active channel along the southern shore at the western and eastern extents and along the northern shore. The deepest observed depth in the project area was 7.1 ft. Flow measurements reported in June 2020 indicate an average flow of 0.2 ft/sec (OEI 2021). Drill test results (American Assay Laboratories 2018) and OEI (2021) describe the substrate as poorly sorted gravelly sand overlain by 7 to 12 inches of silt clay and organic "muck." In 2020, measured salinity values throughout the project area were consistently uniform, ranging from 13 to 16 practical salinity units (psu) (OEI 2021). Conversely, salinities collected during late July and August 2021 averaged 2.5 psu, a 60% difference from 2020 (IPOP 2021a). Water temperatures during June and July 2020 averaged above 15 degrees Celsius (°C) with maximum temperatures over 22°C. Water temperatures in August averaged 13°C to 15°C, declining to less than 10°C in September (OEI 2021).

The geomorphology and hydrologic processes of Bonanza Channel are indicative of a lagoon environment, characterized by limited freshwater inputs, a shallow depositional environment, perpendicular orientation to the coast, low flow, and tide inundations of less than 1 ft. Flow in the project area appears to be additionally influenced by hydrostatic controls from Safety Sound and the Bonanza/Solomon rivers complex. In context of the surrounding area, the Bonanza Channel can be characterized as a sedimentary subsystem to Safety Sound (Odum 1971). Bonanza Channel exhibits characteristics of a physically stressed system with uniformly shallow depths (which amplifies winter and summer temperature extremes); minimal currents to facilitate nutrient subsidies and exchange; and salinities that are vary depending on environmental factors (e.g., weather).

3.1.1. Bonanza Channel Cross-Section Morphology

A bathymetric survey of the claim area was conducted in summer 2020 (OEI 2021). Cross-sections derived from this survey are provided and discussed below. Selection of individual cross-sections were biased to capture the deepest habitat features in the bed and the proposed Case Study channel. Current bathymetric cross-section data is provided in **Table 3-1.**

Table 3-1. Selected Bonanza Channel Bathymetric Cross-Section Data

Cross-Section Number*	1	2	3	4	5	6	7
Channel Width (ft)	1,450	1,450	2,600	3,250	750	750	3,000
Mean Depth (ft)	2.59	2.37	2.51	2.44	1.88	1.99	2.27
Maximum Depth (ft)	5.1	6.9	3.4	3.5	2.9	2.9	4.6
Width/Depth Ratio (ft)	560	611	1,035	1,331	398	376	1,321

*Cross-section locations are depicted on Figure 6-1. Selection of cross-section locations is biased to capture deepest channel bathymetry.

The cross-section data indicate a broad shallow channel with low mean depths and large width/depth ratios. Preliminary bed mobility calculations (EPA 2007) using drill log data, flow measurement, and cross-section data confirm there is no bedload sediment transport through the claim area under existing hydrologic conditions indicating a depositional feature. Cross-sections were biased to capture the deepest channel bathymetry. Assuming a nominal winter ice thickness of 3 ft, free water depth in these features during winter conditions is minimal. From the above data it can be inferred that, except for isolated areas of deeper morphology, most of the project area is bound by bottomfast ice during the winter months.

Figure 3-1 shows the locations of bathymetric cross-sections in Bonanza Channel and cross-sections 1 through 7 are shown in **Figure 3-2**. Location of Profile 2 and depiction of Profile 2 are in **Figure 3-3 and Figure 3- 4**, respectively. **Figure 3-5** shows bathymetry and location of Profile 1, with the profile shown in **Figure 3- 6**.

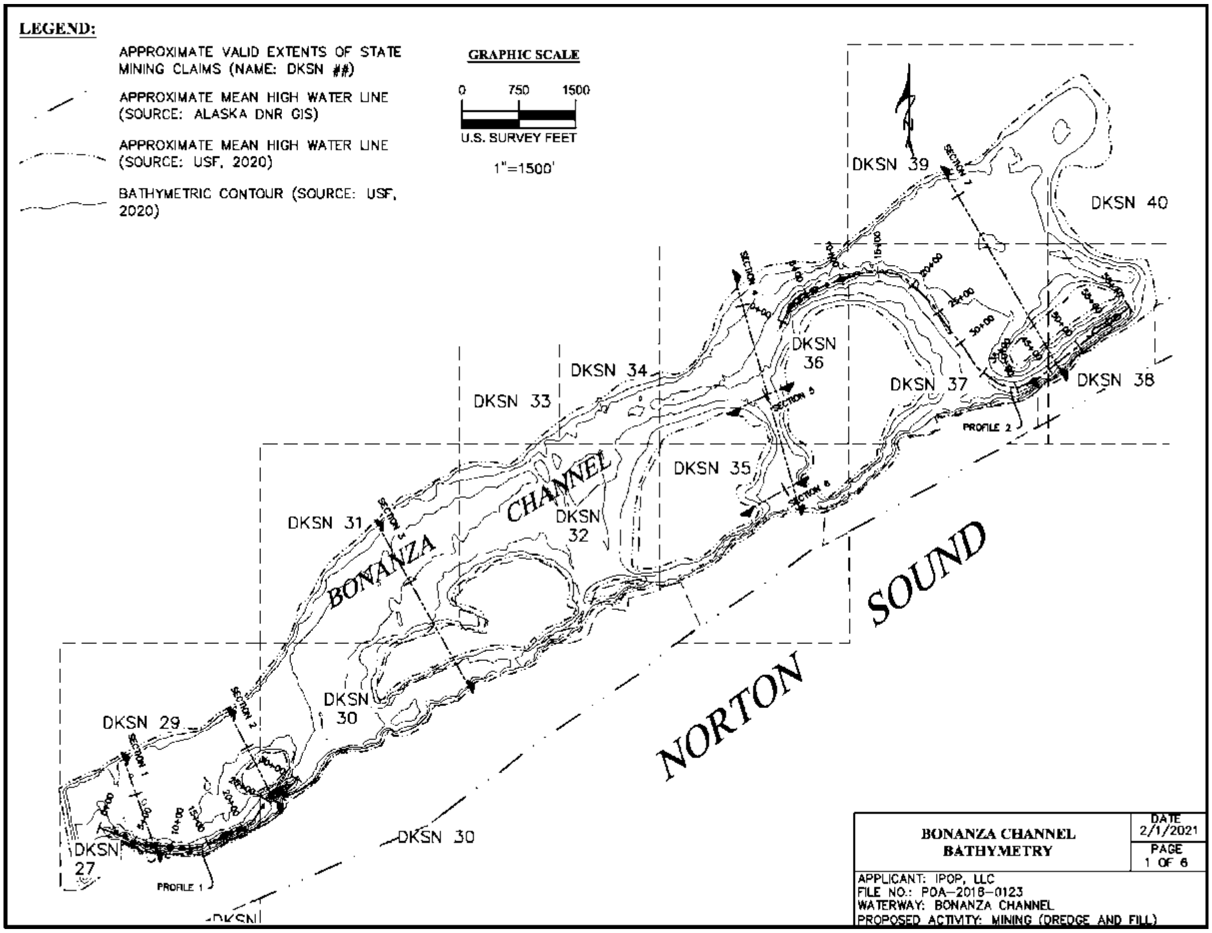


Figure 3-1. Bonanza Channel Bathymetry and Cross-Section Locations

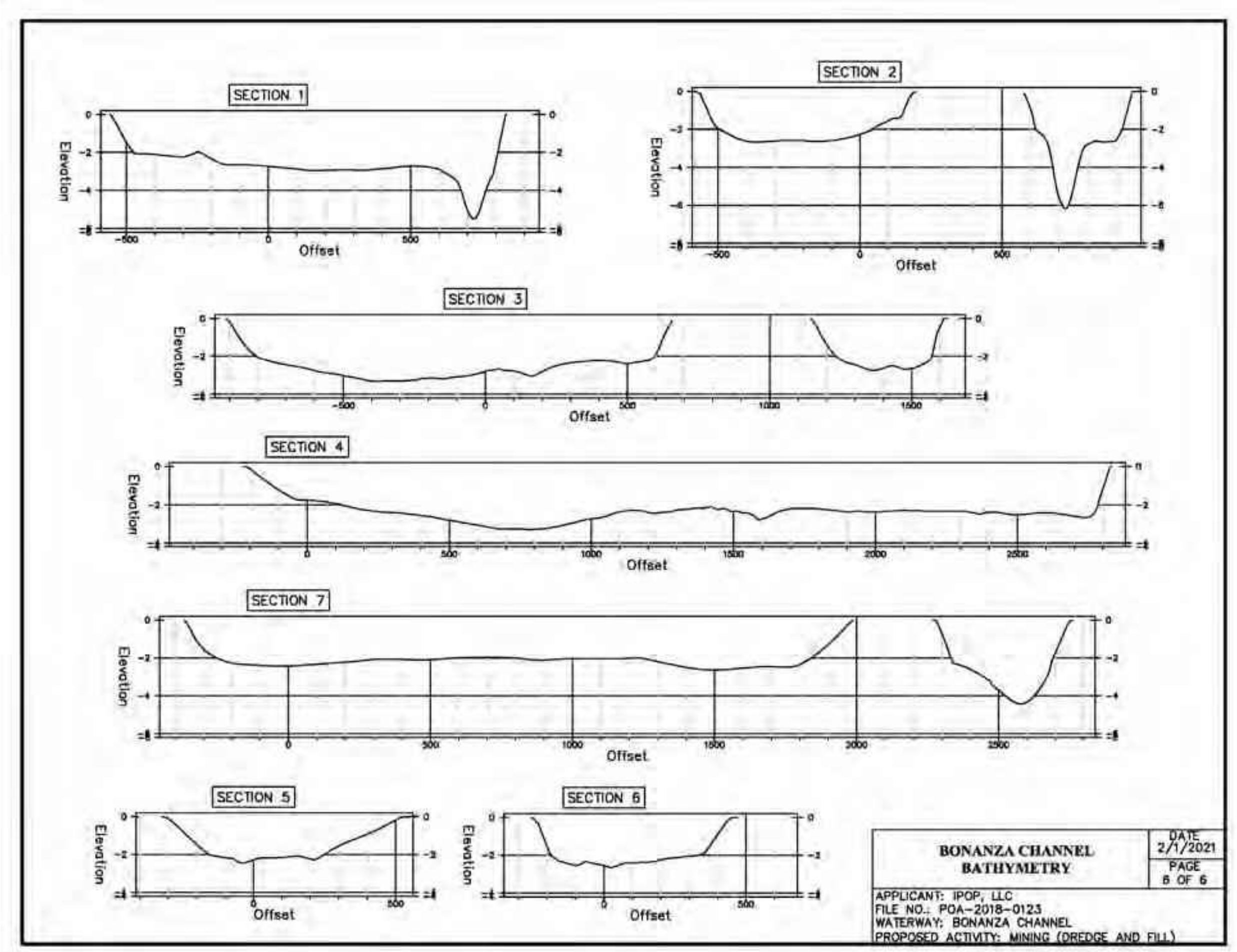


Figure 3-2. Bonanza Channel Bathymetry and Cross-Sections 1 through 7

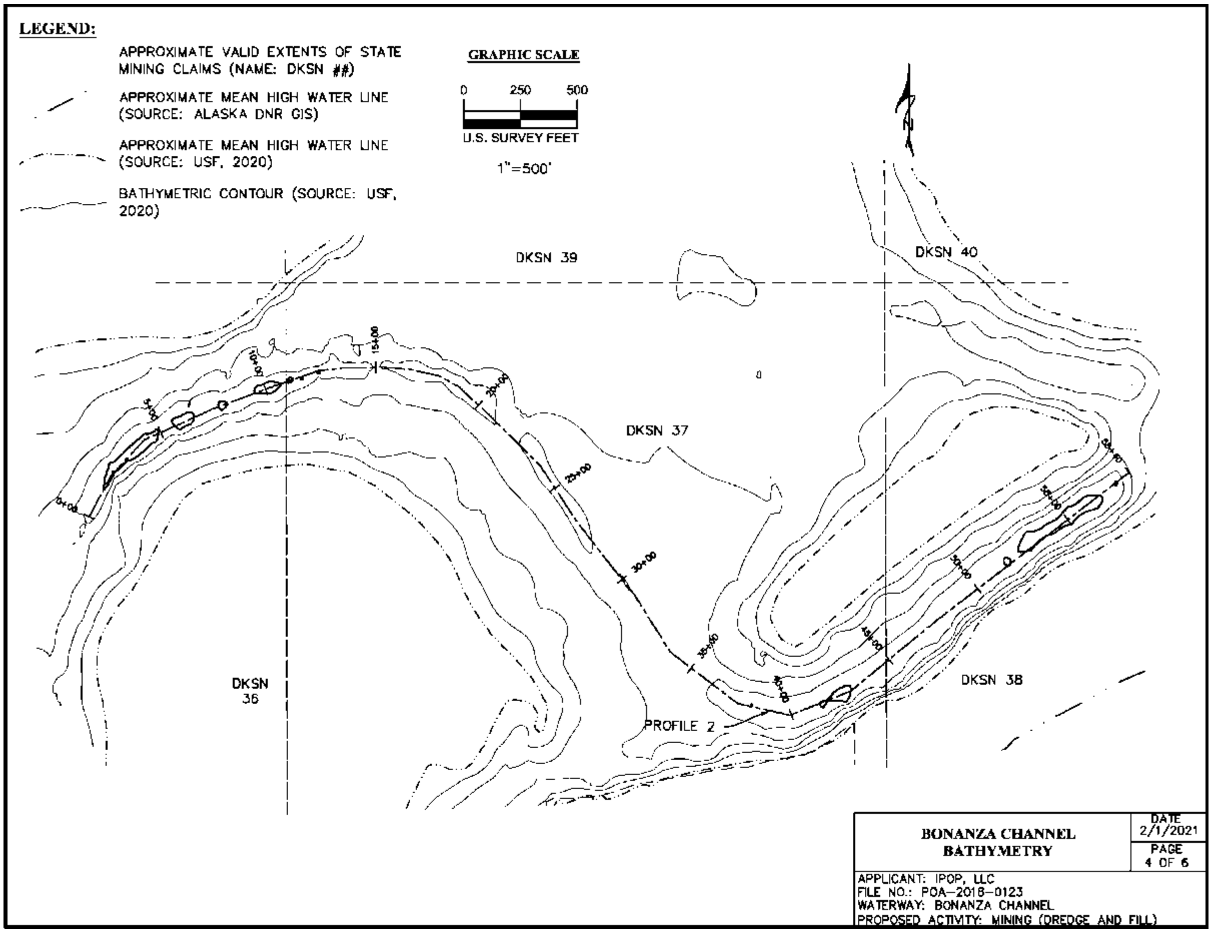
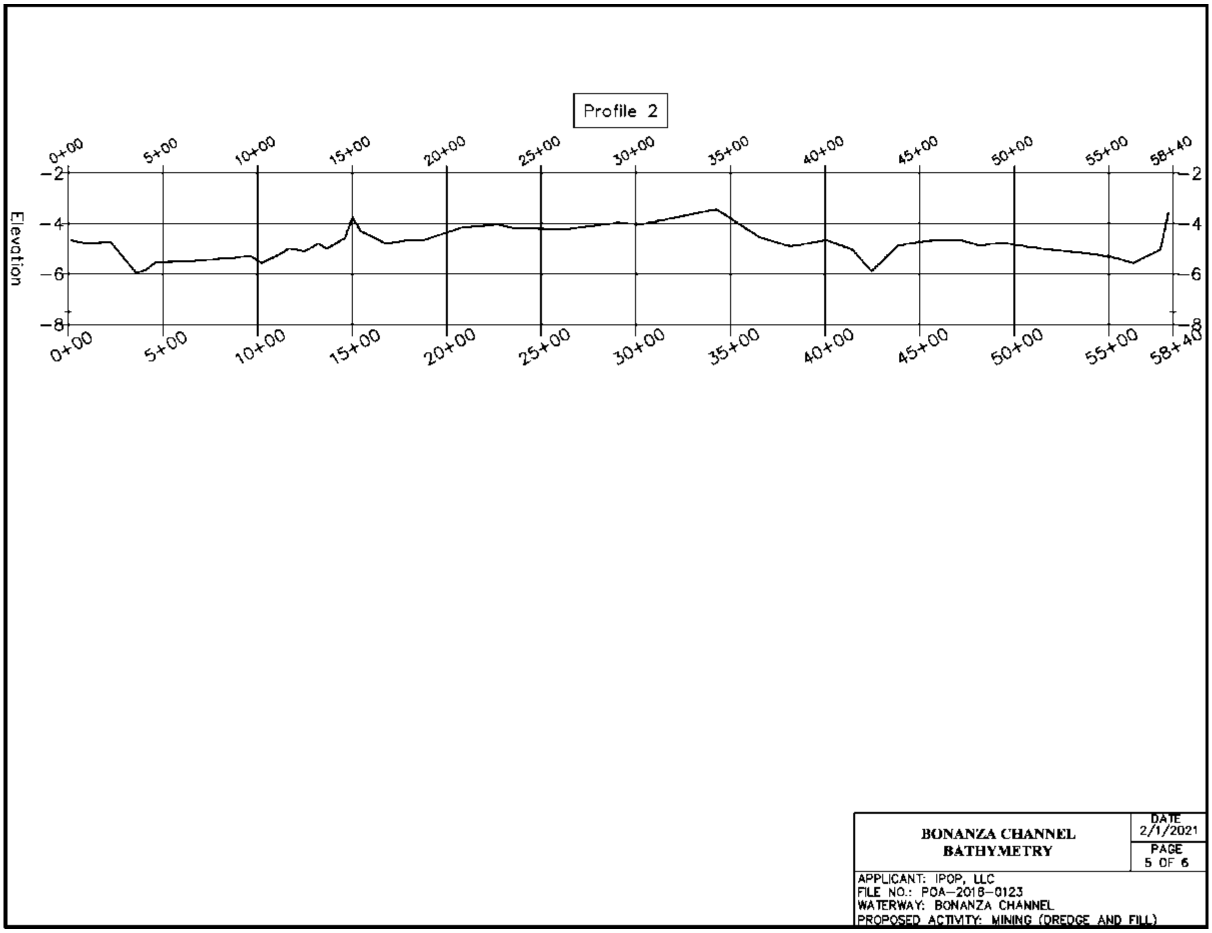


Figure 3-3. Bonanza Channel Bathymetry and Location of Profile 2



Note: Location of Profile 2 is shown on Figure 3-3.

Figure 3-4. Bonanza Channel Profile 2

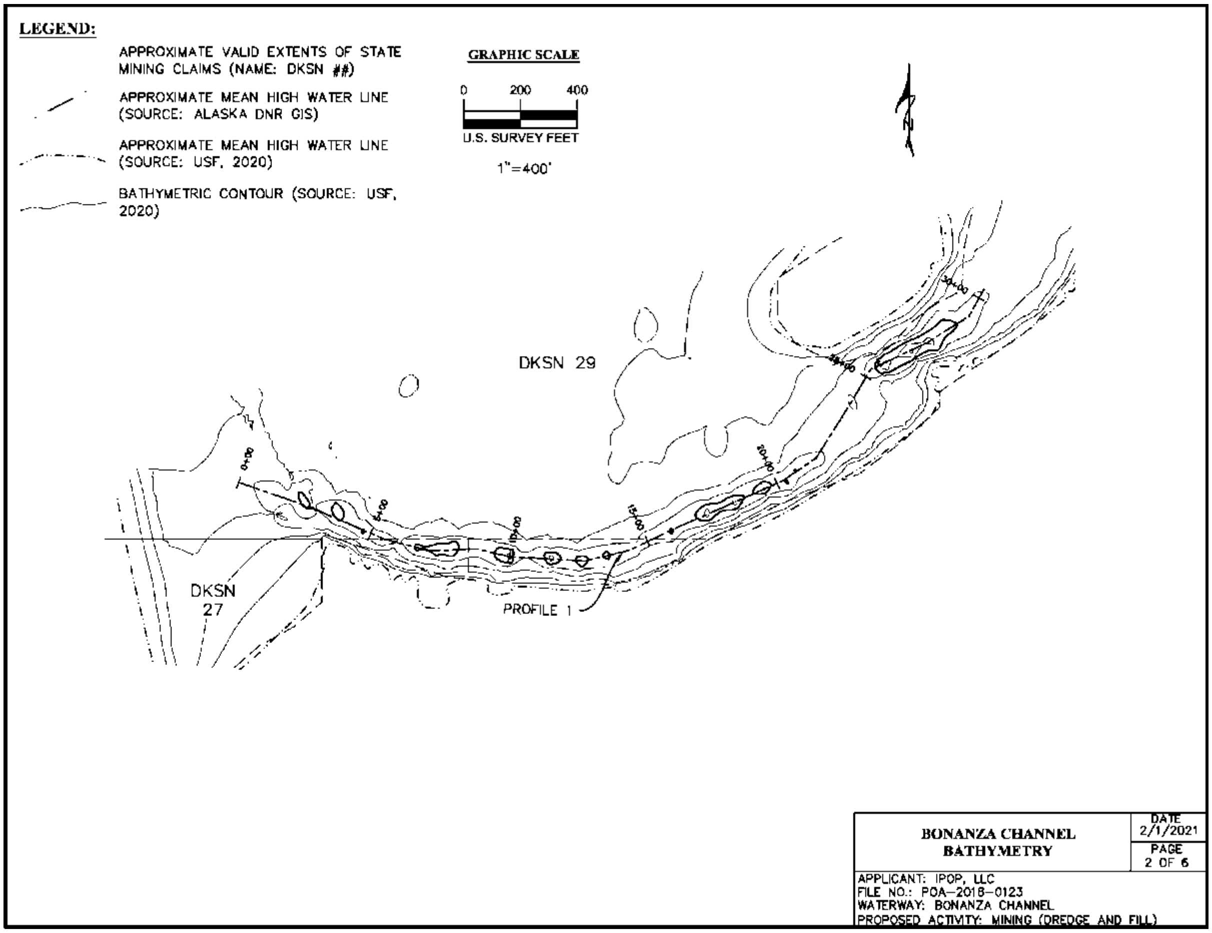
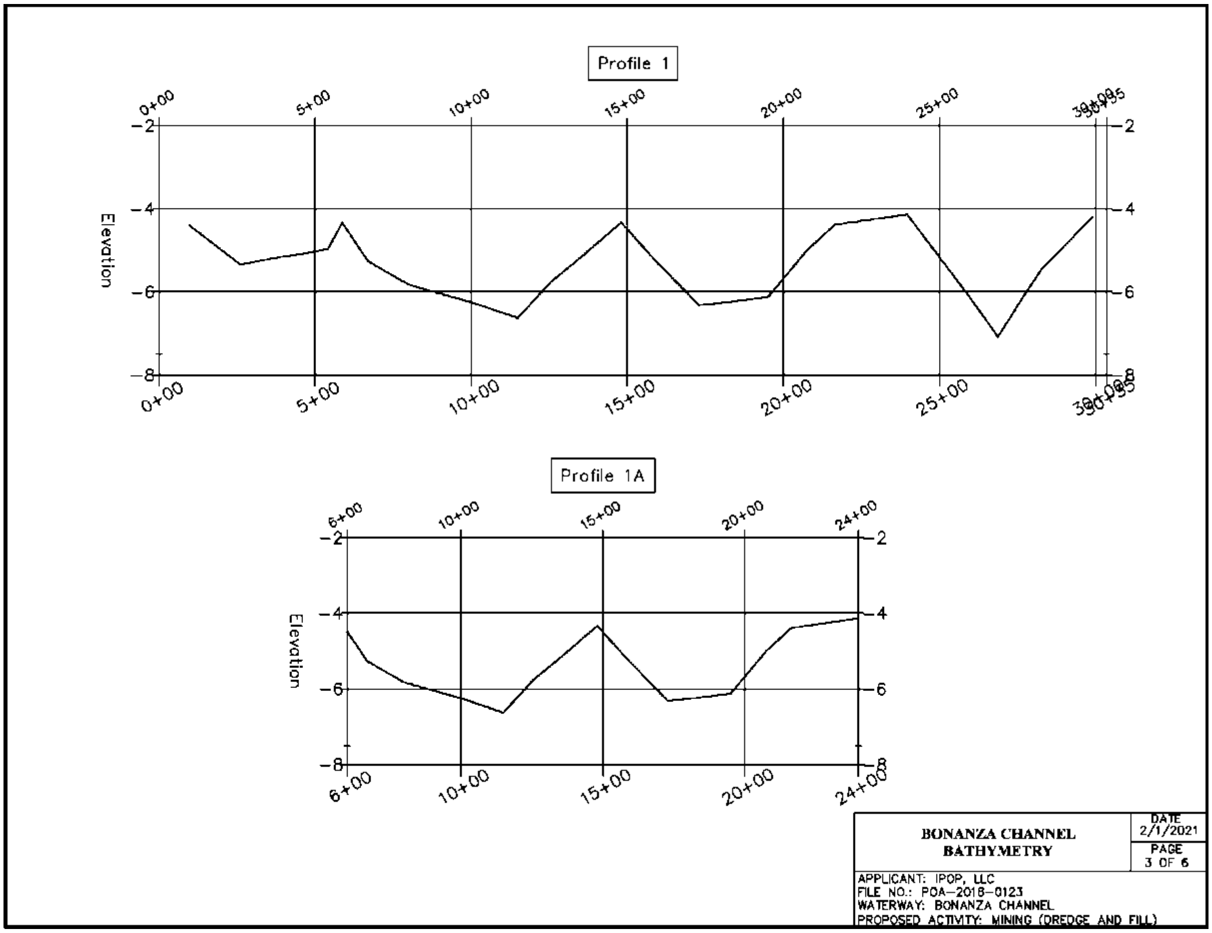


Figure 3-5. Bonanza Channel Bathymetry and Location of Profile 1



Note: Location of Profile 1 is shown on Figure 3-5. Profile 1A is a subset of Profile 1

Figure 3-6. Bonanza Channel Profiles 1 and 1A

4. SUBMERGED AQUATIC VEGETATION

4.1. Existing Conditions

4.1.1. Project Field Studies of SAV and Plant Communities

Field studies of SAV were conducted summers of 2020 and 2021 (Eilers 2020, 2021). Multiple methods were used to document observations of species composition and distribution of SAV in the Bonanza Channel. These methods included compiling maps of SAV occurrence using data derived from sonar, visual survey, and over 1,200 quadrant samples. Results of the SAV study are summarized below.

Most of the study area is dominated by robust growth of a mixture of *Stuckenia pectinatus* (sago pondweed), *Zannichellia palustris* (horned pondweed) and *Ruppia maritima* (widgeon weed). Approximately 86.2% of the study area contains SAV. **Figure 4-1** depicts the Bonanza Channel SAV bed type (continuous, patchy, sparse, and SAV absent bed types).

Distribution of SAV in the claim area correlates with depth and observed substrate type. SAV is sparsely distributed in the littoral zone in water depths of less than 2 ft associated with mudflats. This may also correlate with local tidal influences. Distribution, density, and canopy height increased with depth to 7.1 ft below the water surface.

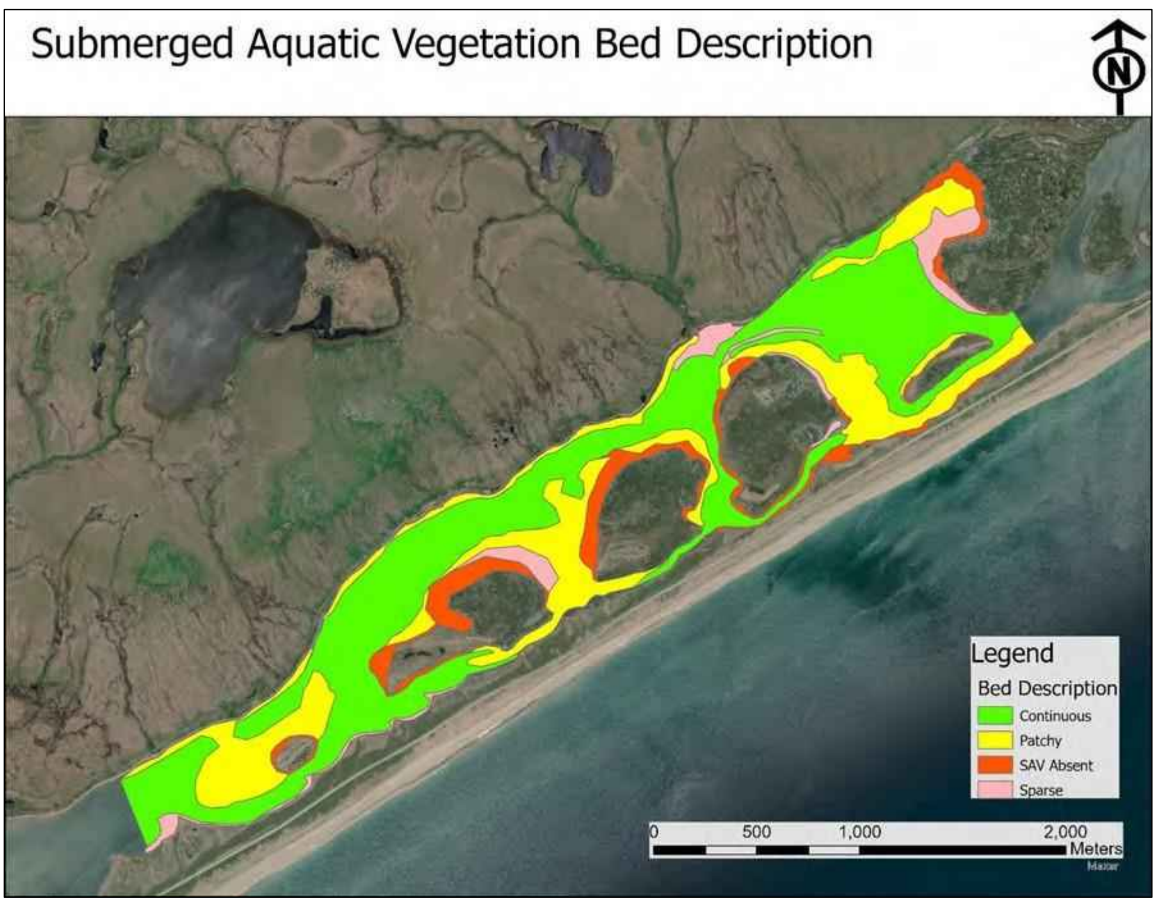


Figure 4-1. Bonanza Channel SAV Bed Type (summer 2020)

Zostera marina (eelgrass) was documented (Eilers 2020, 2021) in three locations in Bonanza Channel outside the project footprint and associated with deeper sections of a relict channel.

4.1.2. Bonanza Channel SAV Characteristics and Potential for Reestablishment

In the Bonanza Channel, disturbance maintains the SAV community in an early successional stage compared to the more stable *Zostera marina* (eelgrass) dominated SAV found in parts of Safety Sound. When compared to other locations within the distribution of these species, the climatic factors of the Bonanza Channel provide a dramatic amount of disturbance including extreme variations in water and air temperatures, salinity fluctuations, sunlight availability, physical disturbance by grounded ice. and seasonal herbivory by migrating water fowl). These disturbances lead to each species relying on their plasticity to not only survive but also thrive in this location.

There is a great volume of available research on the three dominant species of SAV in the Bonanza Channel. *Zannichellia palustris* (horned pondweed), *Stuckenia pectinata* (sago pondweed) (formally *Potamogeton pectinatus*, reclassified around 2006), and *Ruppia martima* (widgeon weed) each have a near-worldwide distribution. Each species can be found in alkaline fresh and brackish waters, standing and flowing waters, and waters of various trophic status. This wide ecological niche requires a great deal of plasticity in terms of life cycles, growth forms, and reproductive strategies. This plasticity is also responsible for each species r-selected abilities to re-establish following disturbances. R-selected species emphasize high growth rates and produce high numbers of offspring or reproductive structures such as seeds, achenes. and tubers to overcome the stresses of disturbance. These three species are often found together and are known competitors often leading to temporal shifts in dominance throughout seasons (Kantrud 1991). This temporal variation in species coverage and dominance is seen in the SAV community in the Bonanza Channel both within a season and between seasons (Eilers 2020, 2021). Tyler-Walters (2002) also mentions that *Stuckenia pectinata* replaces *Ruppia*-dominated beds when the salinity is consistently low as opposed to variable. All three of the principal species have specific characteristics that support such rapid recolonization. Idestam-Almquist (2000) shows a high colonization rate and tolerance to disturbance for most of the relevant species.

Adaptations

Each of these species have adaptations to continue one season to the next under the Bonanza Channel climate regime. Many of the adaptations result in an increased growth rate and creation of seed and tubers. One of the adaptations these species utilize is the alteration of life cycles from perennial form to an annual form. Van Wijk (1988) notes that in *Stuckenia pectinata* populations that experience frequent high disturbance from strong winds and profound winters had a very condensed growing season between May and July with the majority of above- and belowground plants gone by August, leaving only tubers in the sediments and achenes along the windblown shoreline. Pilon et al. (2003) showed how *Stuckenia pectinata* changes its growth form and strategy with high-latitude populations exhibiting an annual growth habit with higher production of smaller tubers and increased leaf production. In addition to the tubers borne along the rhizome, this species can also produce axillary tubers along the growing branches. These axillary tubers serve an important role in establishing populations elsewhere because they are transported together with the aboveground shoots shed at the end of the growing season (Kantrud 1990). *Stuckenia pectinata* is able to root from fragments of rhizome and stem, so that recovery from project dredging is expected to be rapid (Tyler-Walters 2002). *Stuckenia pectinata* also grows on a wide range of sediments (Tyler-Walters 2002) reducing concerns of unsuitable sediment texture postdredging.

In temperate regions, *Ruppia martima* typically persists as a weak perennial through multi-branched rhizomes; however, in climates that feature physical conditions that do not allow survival of vegetative plant parts during parts of the year (such as grounded ice) *Ruppia* survives as an annual. Verhoeven and van Vierssen (1978) note that *Ruppia* species in temperate climate dies back completely in winter and survives as seed in the sediments. To colonize and recolonize such areas, the plants possess a number of special properties. Detached vegetative parts of the plants remain floating for a long time; when they reach the bottom, rooting starts immediately on a wide range of sediments (Kantrud 1991). In the same manner, the ripe seeds can be transported by drifting plant parts. After desiccation, dried plant parts together with attached seeds can be transported by the wind over considerable distances. Further, several bird species (e.g., coot, teal, wigeon, mute swan, tufted duck) contribute to dispersal (Verhoeven 1979; Kantrud 1991). Seeds of *Ruppia* have a hard durable seed coat and form a persistent seed bank in sediments for up to three years.

Zannichellia palustris is an annual species which re-establishes each year from newly produced seed from the previous season. This species produces abundant seeds that require an extended period (>2 months) of below 4^{o}C in order to germinate. In addition, these seeds are tolerant to desiccation if exposed (common in temporary water bodies and in shallow littoral fringes) allowing them to germinate the following season.

Each of these species undergo abscission during the fall shedding their aboveground (and majority of belowground structures. The resulting drift of this material, along with attached achenes, seeds, tuber, turions, and viable rhizomes allows for the recolonization of the SAV community the following growing season (van Vierssen 1982; Verhoeven 1979; Van Wijk 1988). The usefulness of adjacent SAV beds in reestablishing vegetation has been demonstrated in a variety of contexts. Baastrup-Spohr et al. (2016) showed surprisingly high diversity and coverage only two years after reclamation of a Norwegian lake from farmland due to the deposition of seed and vegetative materials from surround populations.

Resiliency

The adaptations each of these species have to persist within the climatic conditions of the Bonanza Channel also lead them to be resilient in the habitat. Numerous studies show that *Zannichellia* and *Ruppia* are “fast colonizers” (Arnold et al. 2000; Stevenson et al. 1993). This is important because studies show a wide range of recolonization rates for various species when habitat is disturbed (e.g., Barrat-Segretain et al. 1998). *Zannichellia palustris* is also commonly known as a species identified as an indicator of habitat disturbance due to the ability to rapidly colonize open sediment (Hilgartner 1991). Vári and Tóth (2017) and Capers (2003) suggest that fragment rooting is the most important mechanism for recolonization, suggesting that redeposit of muck is highly likely to be effective. Henry and Amoros (1996) also refers to fragments as important for recolonization after dredging in a French river, with rapid reestablishment of numerous species. Although Spencer and Ksander (2002) showed that burial of Zannichellia *palustris* seeds more than 2 centimeters (cm) deep prevents germination, storms may stir up deeper seeds, making a viable seed bank. *Stuckenia pectinata* is often actively managed in reservoirs and moving water because its robust growth can slow water flows and increase sedimentation (Ganie et al. 2016).

Figure 4-2 depicts the upper soil horizon in the claim area containing both benthic and vegetative components is redistributed frequently during storm events and ice disturbance. Shallow benthic habitats that experience frequent wind and wave induced disturbances are typically inhabited by low diversity benthic assemblages that can readily reestablish themselves under conditions of high frequency disturbances (Dauer 1984; Clark and Miller-Way 1992; Ray and Clark 1999). These communities are naturally held in early successional stages, and therefore, can recover more rapidly compared to communities in deeper, more stable environments (Newell et al. 1998; Bolam and Rees 2003).

Figure 4-2. SAV Redistributed by High Water and Wind Action

4.2. Restoration Applications: Harvesting, Storage, and Installation of SAV

The adaptations and life cycle strategies of the three species of pondweed allow for the successful restoration method of: harvesting and storing EM (upper 6 inches of sediment) prior to dredging, storing the material on site, and redepositing the veneer as the final process after re-contouring the bathymetry. This upper 6 inches of organic veneer contains tubers, achenes, and seeds from the previous season as well as any viable rhizome material from the previous season's growth. The redepositing of the organic veneer also ensures that a suitable sediment texture is in place for the growth of these species. All three species show the ability to establish and grow in both soft organic sediment and sands. VanZomeren and Piercy (2020) and Wilbur (1992) provide a useful discussion on "thin layer placement of sediments for restoring ecological function to salt marshes" for restoring habitat functions. Each species specializes for rapid growth, production of seeds and tubers, and ability to regrow from rhizome fragments will allow for a high degree of success for revegetation following dredging activities in the Bonanza Channel. This will occur by the existing rhizomes, tubers, seeds, and achenes in the organic veneer after replacement and from recruitment from the robust SAV communities surrounding the dredging activity site.

Proxy analog procedures adapted from USDA (2008) and ADF&G Stream Bank Restoration Handbook (ADF&G 2005) to harvest, store, and install SAV material in the access channel are described below.

The soil horizon in Bonanza Channel is a 0.5 to 1 ft layer of sand, silt, and organic "muck" (OEI 2021). This layer is analogous to "charged overburden veneer" as described in the Alaska Coastal Revegetation and Erosion Control Guide (Wright and Czapla 2013) and USDA (2008, Chapter 650.1305) and contains the vegetation "ecological memory" (EM) of Bonanza Channel consisting of seeds, rhizomes, and other regenerative plant material. All SAV supporting material which may be impacted by dredging or dredge disposal areas will be removed and stockpiled to maximize regrowth.

Mechanical removal of EM material will be accomplished using the cutter-head dredge with a modified intake (no cutterhead attachment) for removal and stockpiling of SAV material.

The applied depth of the EM material layer would be determined in the field from a mass balance calculation between the disturbed area to treat and the volume of available donor material. Storage areas for EM (organic stockpile) within dredge material disposal sites (DMDS) for the five-year mining plan would be field-determined prior to each year of operations. Typical storage areas for are shown in **Figure 4-4, Figure 4-5, and Figure 4-6.** The EM will be stored below the MLLW elevation in a silt curtain or boomed containment storage.

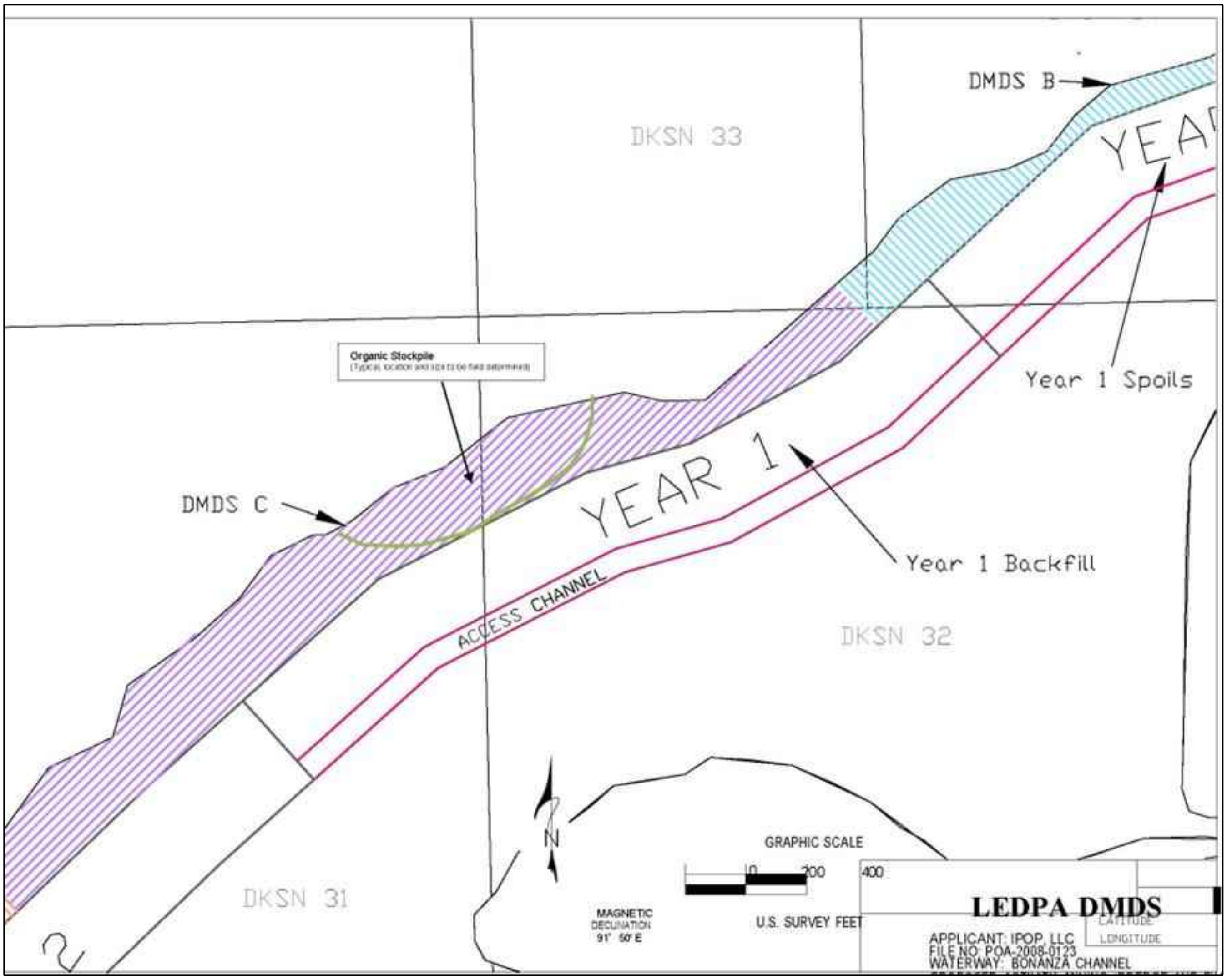


Figure 4-4. Year 1 – Organic Stockpile and Dredge Material Disposal Sites

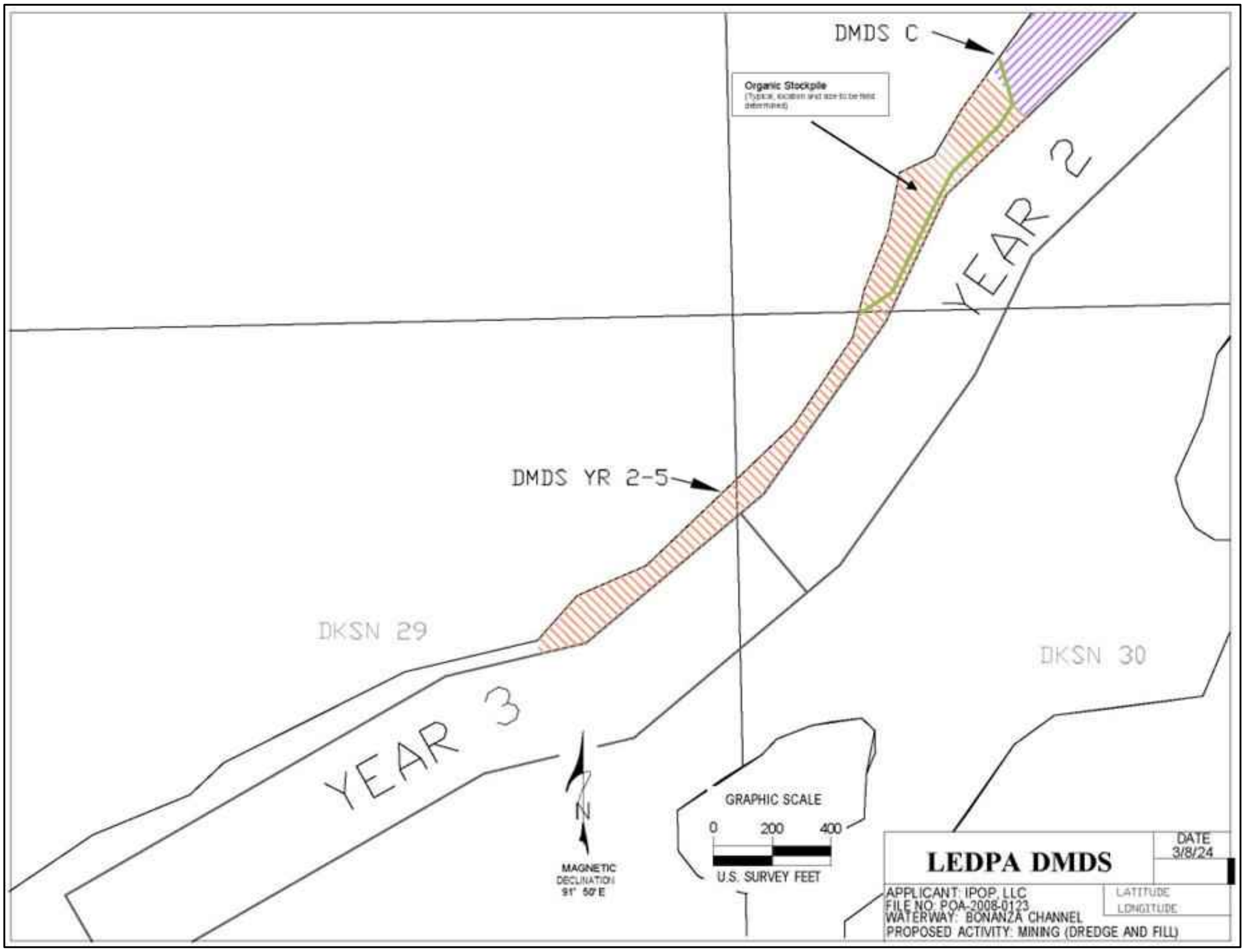


Figure 4-5. Years 2 and 3 – Organic Stockpile and Dredge Material Disposal Sites

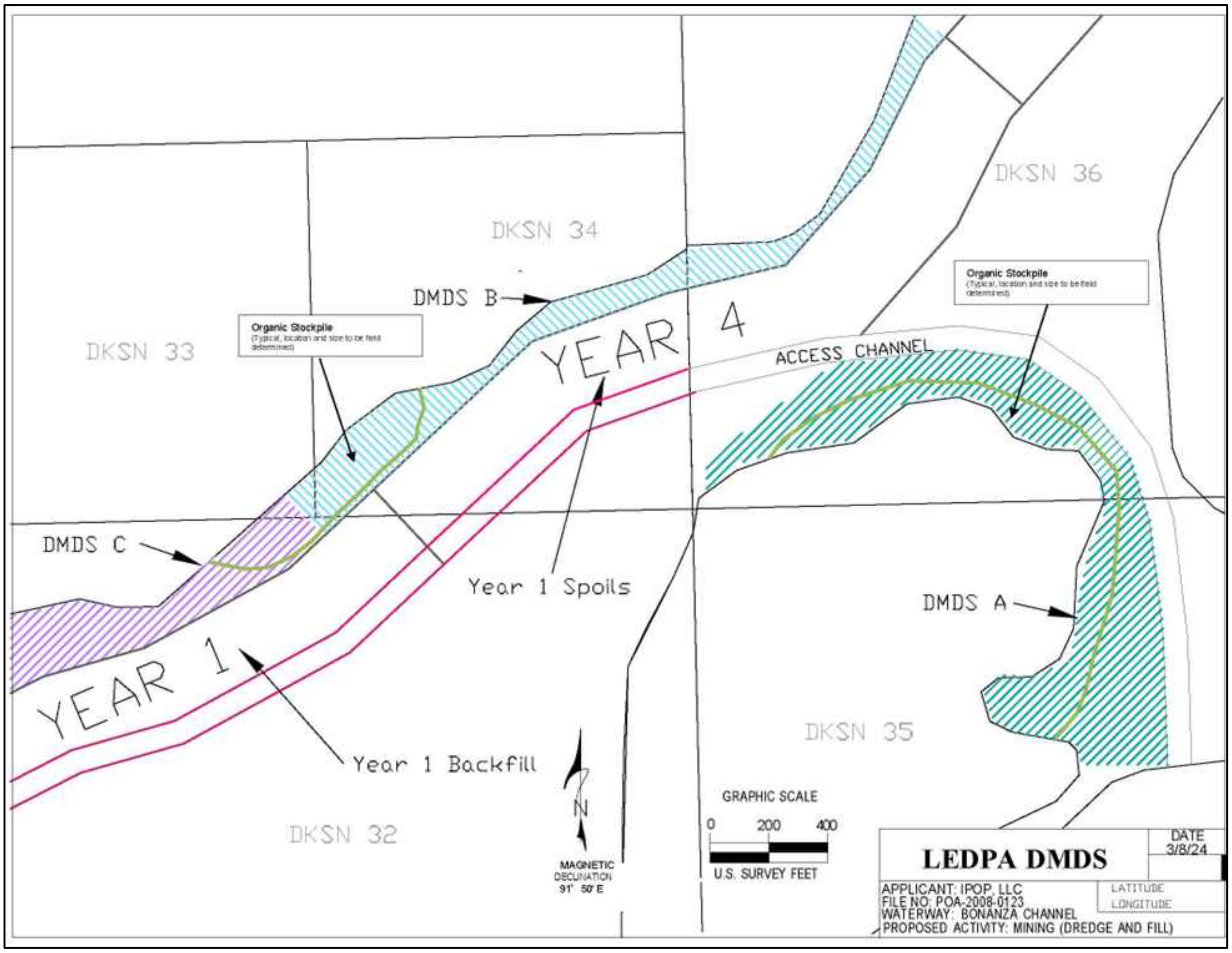


Figure 4-6. Year 4 – Organic Stockpile and Dredge Material Disposal Sites

A schematic drawing depicting typical SAV application is provided in **Figure 4-7**.

Figure 4-7 Proposed typical SAV application.

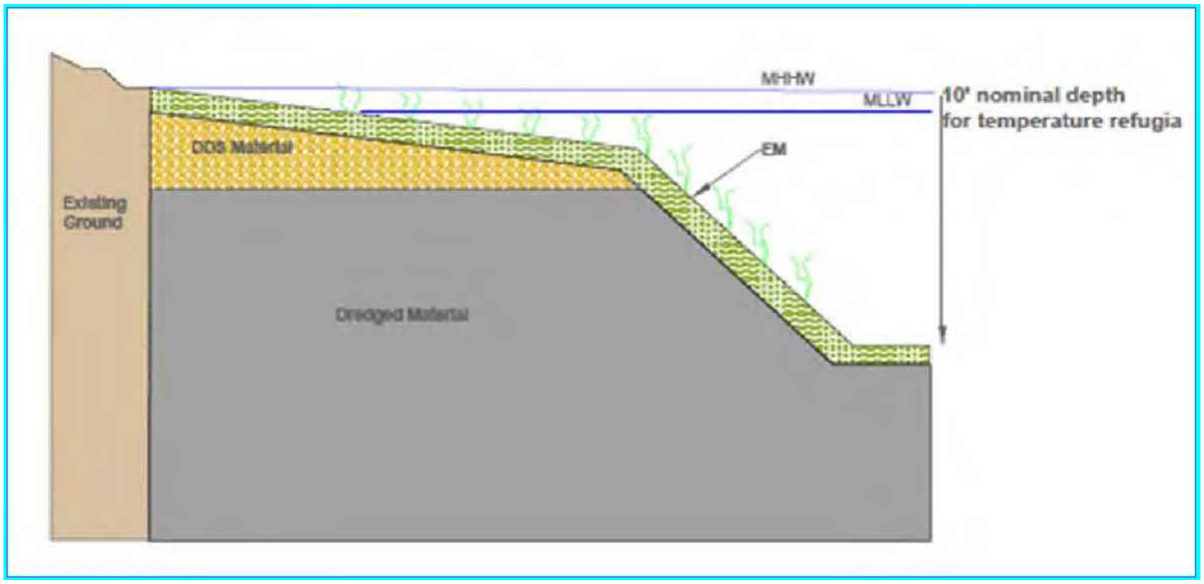


Figure 4-7. SAV Application – Typical (not to scale)

Application of EM material would occur in multiple locations during different phases of mining. EM material would be mechanically removed from the storage area and evenly dispersed within the disturbed areas. EM material would also be applied to recontoured features outside the channel footprint to the low tide mean higher high water (MHHW) elevation.

Ray (2007) stated that hydraulic applications of dredged material with appropriate soil depth and rhizome densities in salt marshes usually requires two growing seasons for plant establishment. However, direct observations of test pit locations (from the 2020 model dredge test) via underwater photo documentation October 2021 demonstrate that the particular SAV species here re-established in test dredge areas in one growing season (OEI 2021; IPOP 2021b). SAV re-establishment is likely to succeed for several reasons including:

- **Favorable low-flow and shallow environment** – The existing low-flow environment is not conducive to erosion and scour of placed EM. The relatively shallow water depths facilitate a favorable temperature range for SAV propagation. In addition, benthic recovery occurs more rapidly in shallow areas where resident species assemblages are already adapted to shifting environments.
- **The EM application will be inside the turbidity curtain.** Based on the dredge test, disturbed sediment inside the turbidity curtain settles out within two days. As described in Section 6.1.3 (Substrate), the EM (or "muck") is finer grained and denser with a moisture content several orders of magnitude greater than the underlying substrate. Once distributed and allowed to settle within the turbidity curtain, it is expected to remain *in situ* while being subjected to existing natural processes associated with the depth profile of the constructed habitat features.

- **Available regenerative material** – Applying the analysis and the decision matrix in USDA (2008, NRCS 650.1304.8.d.2 and Table 13-8), it is highly likely that there will be local recruitment. The vegetation EM contains the potential regenerative material (sago pondweed as most dominant in the claim area). Sago pondweed is a hardy, colonizing, survivor species with documented tolerance to disturbance. The material is available for harvest, ubiquitous, and prolific in the project area. It is successional vegetation and would match naturally occurring conditions. In addition, the proximate undisturbed areas would provide ample regenerative material for colonization.
- **Small percentage of sago beds would be affected**. Only a small percentage of the sago beds would be annually impacted over the operating season depending on location (variable degrees of growth density in some of the areas), or 0.007% of the E1UBL at any one time within the active operating area.
- **Practical and effective approach for reclamation**. The methods are cost-effective because of mechanical handling and application, local *in situ* donor sources, and no special collection or handling (e.g., willow cutting and storage, seed collection).

5. ADAPTIVE MANAGEMENT

5.1. Approach

Adaptive management is a process for continually improving management practices by learning from the outcomes of operational approaches (e.g., Bunnell et al. 2009; BC MoF 2013). ***A management plan is considered temporary, with possible revision based upon information garnered from ongoing monitoring and evaluation.*** Adaptive management promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Knowledge gained from monitoring and evaluating results is used to adjust and direct future decisions (USACE 2019). To be effectively implemented, adaptive management requires a prompt response to field observations of changing or unanticipated environmental conditions. Therefore, adaptive management is an ongoing process of monitoring, maintenance, assessment, and corrective actions.

Conceptual Ecological Models (CEMs) are descriptions of an ecosystem used to communicate the important components of the system and their relationships (USACE 2019). CEMs are a representation of the current scientific understanding of how the system works and are provided for the project in OEI (2021) and IPOP (2021a), Booms (2021a), Eilers (2020, 2021) and FISHEYE (2021).

When properly implemented, adaptive management enables a cost- and time-effective hierarchical response to potential environmental issues. Best management practices, industry standard operating procedures, and a corresponding program of inspection, maintenance, and monitoring constitute the basis of construction environmental management planning. If the results of monitoring indicate that management measures are not adequately meeting performance objectives, the inadequacies should be identified and addressed promptly (correction actions). The adaptive management approach promotes proactive measures, with the caveat that contingency plans and materials should be in place prior to the initiation of work so that additional measures can be quickly implemented if needed.

Performance measures are physical, chemical, biological, or ecological measures used to assess progress towards achieving project/program goals and objectives. Performance measures can be used to help determine whether project response (e.g., slow, no, or decreasing performance trends) require adjustments through the adaptive management to improve success (USACE 2019).

5.2. Performance Standards

Performance standards are listed in **Table 5-1**.

Table 5-1. Performance Standards

Monitoring Plan	Performance Measure	Decision Trigger	Corrective Action	Reporting
Bathymetry	Within 20% of pre-mining bathymetry	Biannual	Evaluate change associated with natural processes and add or remove material if appropriate to maintain design elevation.	Annual
SAV/Benthic	80% recovery related to depth strata and reference reach data	Biannual	Seed deficient areas with material from donor sites.	Annual
Water Quality	Daily compliance with ADEC water quality standards (18 AAC 70) outside of turbidity curtain	Daily continuous monitoring	Operational protocols will be established in water quality permitting process to correct exceedances outside turbidity curtain.	As required by 18 AAC 70. Annual or as required by ADEC permit conditions, if any
Birds	None (derivative of bathymetry/SAV)	N/A	N/A	Annual
Fish	None (derivative of bathymetry & water quality (temperature)	N/A	N/A	Annual
Water depth and meteorology	None – Continuous monitoring to document baseline variability as related to bathymetry and biological components	N/A	N/A	Annual

5.3. Corrective Action

A Decision Trigger is a pre-defined commitment (population or habitat metric for a specific objective) that triggers a change in a management action (USACE 2019). The combined physical and biological data from monitoring will document the functional interrelationships among the ecological attributes and stressors to inform the effectiveness of the reclamation applications in relation to the performance standard and guide any needed adjustments to reclamation designs or applications. The adjustments will be implemented in phases to allow for course corrections based on future monitoring data (USACE 2019).

6. MONITORING AND REPORTING

6.1. Types of Monitoring

The planned types of monitoring include baseline monitoring and compliance monitoring. The purpose of baseline monitoring is to collect data that document the existing conditions of the Bonanza Channel. The purpose of compliance monitoring is to provide data and evidence that operations and reclamation activities are within permitted limitations and are effectively minimizing impacts to the environment.

6.2. Monitoring Plans

Monitoring plans have been developed and are included as appendices:

- Bathymetric Surveying and Monitoring – Appendix A
- SAV and Benthic Macroinvertebrate Monitoring - Appendix B
- Water Quality, Meteorology, and Visual Monitoring – Appendix C
- Fish Monitoring – Appendix D
- Wildlife Monitoring – Appendix E

6.3. Annual Reporting

An annual comprehensive monitoring report will be prepared and provided to USACE. Annual reporting will include the detailed bathymetric survey (as-builts) of all areas impacted by the dredge and fill operations, including those areas within the turbidity curtain but not dredged or filled. This information will include a comparison of pre-mining bathymetry, vegetation distribution, restoration details, volumes of material dredged (e.g., harvested organic material, dredged sediments), slope stability information , detailed cross-sections, weather data, turbidity data (both inside and outside the area contained by the turbidity curtain, tide and current data, water chemistry, equipment sound- monitoring data, and wildlife observation logs. The annual report will also include operational details such as number of man-days, hours of operations, fuel records, and reportable releases.

6.4. Surveying Equipment on the Dredge

IPOP will use HYPACK® software packages for hydrographic data collection, processing, and final products. HYPACK collects real-time bathymetric data in front of the dredge to determine existing conditions. DREDGEPACK® collects data real-time for management of ongoing dredge operations and is designed to work with cutter suction dredges among other types of operations. Both HYPACK® and DREDGEPACK® are USACE-certified. See Appendix B for more detail on the surveying equipment onboard the dredge and example product output.

7. FISH CAPTURE AND RELOCATION

Fish surrounded by the installed turbidity curtain will be removed as practicable by appropriate fishing methods and documented under conditions of an ADF&G collection permit. Dredging will be conducted inside the turbidity curtain anchored to the channel bottom, thus excluding fish from entrainment hazards. Fish were removed and monitored inside the turbidity curtain during the model test dredging with no observed mortality (OEI 2021, Section 2.7).

8. REFERENCES

Alaska Department of Fish and Game (ADF&G). 2021. http://www.adfg.alaska.gov/index.cfm?adfg=viewinglocations.nomecouncil14to34. Accessed January 2021.

ADF&G. 2020. www.adfg.alaska.gov/index.cfm?adfg=habitatrestoration.waterfowlenhancement.

Accessed: December 2020.

ADF&G. 2018. Fisheries Data Series No. 18-15. Use of Acoustic Tags to Examine Movement of Chum Salmon in Nearshore Marine Waters of Northern Norton Sound.

ADF&G. 2005. Streambank Revegetation and Protection: A Guide for Alaska. Revised 2005. www.adfg.alaska.gov/static/home/library/pdfs/habitat/98.03.pdf. Accessed: December 2020.

American Assay Laboratories. 2019. IPOP LLC Final Report, SP0126278. American Assay Labs, Sparks, Nevada.

American Assay Laboratories 2018. POA-2018-00123, Exhibit 8A

Arnold, R.R., J.C. Cornwell, W.C. Dennison, and J.C. Stevenson. 2000. Sediment-based reconstruction of submersed aquatic vegetation distribution in the Severn River, a sub-estuary of Chesapeake Bay. Journal of Coastal Research, 16(1). pp 188-195.

Baastrup-Spohr, L., T. Kragh, K. Petersen, B. Moeslund, J. Chr Schou, and K. Sand-Jensen. 2016. Remarkable richness of aquatic macrophytes in 3-years old re-established Lake Fil, Denmark. Ecological Engineering 95. pp 375-383.

Barrat-Segretain, M.H., G. Bornette, and A. Hering-Vilas-Boas. 1998. Comparative abilities of vegetative regeneration among aquatic plants growing in disturbed habitats. Aquatic Botany 60. pp 201-211.

BC MoF (British Columbia Ministry of Forests). 2013. BC Ministry of Forests – Defining Adaptive Management.

Bolam, S.G. and H.L. Rees. 2003. Minimizing impacts of maintenance dredged material disposal in the coastal environment: A habitat approach. Environmental Management 32. pp 171-188.

Booms, Travis. 2021a. July 2021 – Bird species occurrence, distribution, and abundance on State of Alaska lands near proposed dredging operations in the Bonanza Channel, east of Nome, Alaska. Report prepared by Booms Biological Services for IPOP, LLC. July 12, 2021. Booms Biological Services, 1245 Chili Pepper Court, Fairbanks, Alaska. 99709.

Bunnell, F.L., G.B. Dunsworth, D.J. Hugguard, and L.L. Krenmaster. 2009. Chapter 1: The problem. *In*: F.L. Bunnell and G.B. Dunsworth, editors, Forestry and Biodiversity: Learning how to sustain biodiversity in managed forests. Pp. 5 -15. Vancouver BC: University of British Columbia Press.

Capers, R.S. 2003. Macrophyte colonization in a freshwater tidal wetland (Lyme, CT, USA). Aquatic Botany, 77(4). pp 325-338.

Dauer, D.M. 1984. High resilience to disturbance of an estuarine polychaete community. Bulletin of Marine Science 34. pp 170-174.

Eilers, D. 2020. Bonanza Channel bathymetric mapping and seagrass study. August 2020.

Eilers, D. 2021. Bonanza Channel bathymetric mapping and submerged aquatic vegetation survey. August 2021.

FISHEYE Consulting. 2021. Essential Fish Habitat Assessment. Revised November 2021. Prepared for IPOP, LLC.

Ganie, A.H., Z.A. Reshi, and B.A. Wafai, B.A. 2016. Reproductive ecology of *Potamogeton pectinatus* L. (= *Stuckenia pectinata* (L.) Börner) in relation to its spread and abundance in freshwater ecosystems of the Kashmir Valley, India. *Tropical Ecology*, 57(4). pp 787-803.

Henry, C.P. and C. Amoros. 1996. Are the banks a source of recolonization after disturbance: an experiment on aquatic vegetation in a former channel of the Rhône River. *Hydrobiologia*, 330(2). pp 151-162.

Hilgartner, W.B. 1991. *Zannichellia Palustris*: a modern and paleoecological indicator of human disturbance in Chesapeake Bay. John Hopkins University.

Idestam-Almquist, J. 2000. Dynamics of submersed aquatic vegetation on shallow soft bottoms in the Baltic Sea. Journal of Vegetation Science 11: 425-432.

IPOP, LLC. 2021a. 2021 Field Survey and Desktop Study, Rev. 1. December 2021.

IPOP, LLC. 2021b. 2020 Model Dredge Test SAV Recovery Report. M. Shoulders, D. Eilers, and W. Burnett authors.

Isola, C.R., A. Colwell, O.W. Taft, , and R.J. Safran. 2000. Interspecific differences in habitat use of shorebirds and waterfowl foraging in managed wetlands of California's San Joaquin Valley. Waterbirds 25 (Suppl. 2). pp 196-203.

Kantrud, H. A. 1991. Wigeongrass (*Ruppia maritima* L.): A Literature Review. U.S. Fish and Wildlife Service, Fish and Wildlife Research 10. 58 pp.

Kantrud, H.A. 1990. Sago pondweed (*Potamogeton pectinatus L.*): A literature review. U.S. Fish and Wildlife Service. Resource Publication 176. Washington D.C. 89 pp.

Kaufman, D.S. and P. E. Calkin. 1988. Morphometric Analysis of Pleistocene Glacial Deposits in the Kigluaik Mountains Northwestern Alaska USA. Arctic and Alpine Research, Vol.20, No.3.

Ma, Z., Y. Cai, B. Li, and J. Chen. 2010. Managing wetland habitats for waterbirds: an international perspective. Wetlands 30. pp 15–27.

Newell, R.C., L.J. Seiderer, and D.R. Hichcock. 1998. The impact of dredging works in coastal waters. A review of the sensitivity to disturbance and subsequent recovery of biological resources on the seabed. Oceanography and Marine Biology: An Annual Review 36, 127-178

Odum, Eugene P. 1971. Fundamentals of Ecology, Third Edition, W.B Saunders Company, Philadelphia, PA.

Otero Engineering, Inc. (OEI) 2021. Model Dredging Program, Environmental Baseline Studies and Water Quality Monitoring During Model Dredging in the Bonanza Channel Near Nome, Alaska.

Pilon, J., L. Santamaría, M. Hootsmans, and W. van Vierssen. 2003. Latitudinal variation in life-cycle characteristics of *Potamogeton pectinatus* L.: vegetative growth and asexual reproduction. *Plant Ecology*, 165 (2), pp 247-262.

Ray, G. L. 2007. Thin layer disposal of dredged material on marshes: A review of the technical and scientific literature. ERDC/EL Technical Notes Collection (ERDC/EL TN-07-1), Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Ray, G.L. and D.G. Clarke. 1999. Environmental assessment of open-water placement of maintenance dredged material in Corpus Christi Bay, Texas. Final report. Waterways Experiment Station, Vicksburg, Mississippi. pp 1-203.

Spencer, D.F. and G.G. Ksander. 2002. Sedimentation disrupts natural regeneration of *Zannichellia palustris* in Fall River, California. *Aquatic Botany*, 73(2). pp137-147.

Stevenson, J.C., L.W. Staver, and K.W. Staver. 1993. Water quality associated with survival of submersed aquatic vegetation along an estuarine gradient. Estuaries 16 (2). pp 346-361

Tyler-Walters, H. 2002. *Stuckenia pectinata* community. Marine Life Information network: Biology and Sensitivity Key Information Reviews [online]. Plymouth: Marine Biological Association of the United Kingdom.

US Army Corps of Engineers (USACE). 2021a. USACE Engineering with Nature, Strategic Plan 2018-2023: Expanding Implementation. https://ewn.erdc.dren.mil/wp-content/uploads/2021/03/EWN-StrategicPlan2018-2023FINAL.pdf

USACE. 2019. A systems approach to ecosystem adaptive management. A USACE Technical Guide. ERDC/EL SR-19 9. November 2019.

USDA. 2008. NRCS Part 650 Engineering Field Handbook. Chapter 13, Wetland Restoration, Enhancement, or Creation. Issued April 2008.

U.S. Environmental Protection Agency (EPA). 2007. https://semspub.epa.gov/work/01/554360.pdf. Accessed December 2020.

VanZomeren, C.M. and C.D. Piercy. 2020. Thin layer placement of sediments for restoring ecological function to submerging salt marshes: A Quantitative Review of Scientific Literature.

van Vierssen, W. 1982. The ecology of communities dominated by *Zannichellia* taxa in western Europe. II. Distribution, synecology and productivity aspects in relation to environmental factors. *Aquatic Botany*, 13. pp 385-483.

Van Wijk, R.J., 1988. Ecological studies on *Potamogeton pectinatus* L. I. General characteristics, biomass production and life cycles under field conditions. *Aquatic Botany,* 31. pp 211-258.

Vári, Á. and V.R. Tóth. 2017. Quantifying macrophyte colonisation strategies—A field experiment in a shallow lake (Lake Balaton, Hungary). *Aquatic Botany*, 136. pp 56-60.

Verhoeven, J.T.A. and W. van Vierssen. 1978. Distribution and structure of communities dominated by *Ruppia, Zostera* and *Potamogeton* species in the inland waters of 'De Bol', Texel, The Netherlands. Estuarine and Coastal Marine Science, 6. pp 417-428.

Verhoeven, J.T.A. 1979. The ecology of *Ruppia*-dominated communities in Western Europe. I. Distribution of *Ruppia* representatives in relation to their autecology. Aquatic Botany, 6. pp 197-268.

Wilbur, P. 1992. Thin-layer disposal: concepts and terminology. US Army Research and Development

Wondzell, S.M and M.N. Gooseff. 2013. Fluvial Geomorphology. *In*: Shroder, J. (Editor in Chief), Sherman, D.J. (Ed.), Treatise on Geomorphology 9.13. Academic Press, San Diego, CA.

Wright, S. and P. Czapla. 2013. Alaska Coastal Revegetation and Erosion Control Guide. State of Alaska Division of Agriculture, Department of Natural Resources.

Zou, Ye-Ai, Ping-Yang Zhang, Si-Qi Zhang , Xin-Sheng Chen, Feng Li , Zheng-Miao Deng, Sheng Yang, Hong Zhang, Fei-Yun Li , Yong-Hong Xie. 2019. Crucial sites and environmental variables for wintering migratory waterbird population distributions in the natural wetlands in East Dongting Lake, China.

APPENDIX A – BATHYMETRIC SURVEYING AND MONITORING

BATHYMETRIC SURVEYING AND MONITORING

Bathymetric surveying methods will be used to establish conditions prior to in-water project activities and to monitor bathymetry of dredged areas, water depth, slope stability, and areas of fill.

Establish Reference Datum and Survey Methods

An initial project reference datum will be established.

1. **Establish elevation/depth reference**. Using either existing reference data, or by observing current water levels over time, a reference datum will be established by practical surveying means. This datum will be used as the basis for elevation/depth measurements throughout the duration of the depth monitoring activities.
2. **Establish baseline data of existing bathymetry.** Within the regions of interest for long-term monitoring, a grid of locations will be selected. Each grid location will be repeatably occupied over time using appropriate GPS or optical measurement equipment. At each location, depth measurements will be observed and referenced to the aforementioned project datum.
3. **Measure material deposition.** Selected grid locations will be re-surveyed and depths measured to the bathymetric surface existing at that time. These measurements will be referenced to the project datum and added to a project database. Repeated measurements at the various grid locations will be used to develop a time-series dataset of the characteristics of deposited material.

Navigation and Surveying Capability Onboard the Dredge

The IPOP cutterhead dredge is equipped with a state-of-the-art, computerized navigation system (HYPACK® software packages for hydrographic data collection, processing, and final products). The system has capability to continuously record the bathymetry and bathymetric profile of pre- and post- dredge and fill areas. The location of the dredge is determined using differential GPS together with real- time water level information from instruments in the water and on shore. The dredge log is digitally recorded on the vessel and transmitted in real-time to the shore-based operations office. Vessel tracklogs from the dredge will be reviewed daily to verify that dredging is carried out within approved dredging areas. An annual as-built will be provided to the USACE at the end of each operations year.

Sidescan sonar, sub-bottom, ADCP (acoustic Doppler current profiler), and magnetometer collection and processing modules are standard features of HYPACK MAX®. This HYPACK® includes everything needed to design a survey, software will single-beam data, process it, and generate real-time and final as-bult bathymetric products such as contours, plotting sheets, output for CAD, fly-through views, cross sections, and volumes calculations. These data will be used to document existing conditions for reclamation applications and inform operational adjustments related to reclamation goals. The sidescan sonar,

subbottom, ADCP (acoustic Doppler current profiler), and magnetometer collection and processing modules are standard features of HYPACK MAX®.

With DREDGEPACK® for cutter suction dredging, data is loaded into a color-coded matrix. Survey data can come from single-beam data, multibeam data, or multiple transducer data. DREDGEPACK® monitors the exact position and depth of the digging tool and keeps track of an “as dredged” surface. The system allows a real-time view of where the cutterhead is in plan-view and in profile view in addition to the channel design depth and channel over depth in profile view.

For a cutter suction dredge, typical inputs to DREDGEPACK® are a directional DGPS and an inclinometer to determine the angle of the ladder arm. DREDGEPACK® integrates to several commercially available inclinometers or can read existing equipment using OPC Network interfaces or analog/digital cards.

Product information is available at https://www.hypack.com/products/hypack. **Figure A-1** Depicts the type of data and products that can be produced.

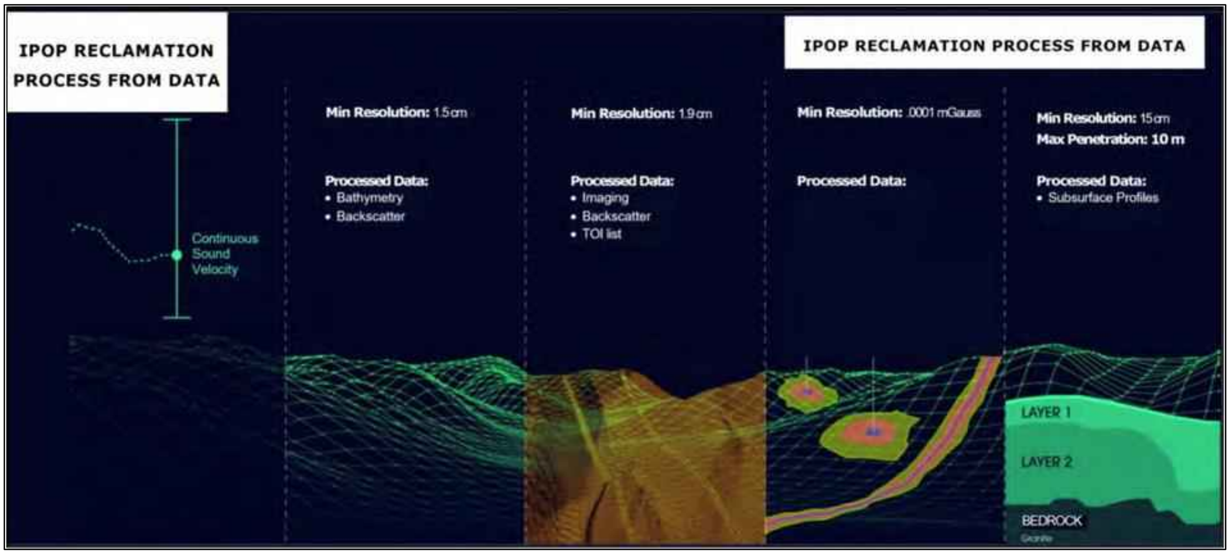


Figure A-1. Depiction of Types of Imagery Derived from Processed Data with HYPACK® software

Performance Standards

Performance standards for slope stability would be within 20 percent of the design elevation and slope. If such changes are detected, IPOP would evaluate the degree to which they were the product of natural forces, and whether corrective action is appropriate to add or remove material and recontour the area to original bathymetry by conclusion of the five-year mining plan.

APPENDIX B – SAV AND BENTHIC MACROINVERTEBRATE MONITORING

SUBMERGED AQUATIC VEGETATION AND BENTHIC MACROINVERTEBRATE MONITORING PLAN

Bonanza Channel Placer Project, Alaska
March 2022

The monitoring of restoration areas after anthropogenic disturbances plays a vital role in ensuring the biologic communities of the affected areas return to pre-disturbed conditions in terms of ecosystem structure and function. In the case of the proposed mining location in the Bonanza Channel, the existing communities of submerged aquatic vegetation (SAV) and benthic macroinvertebrates are characterized by species associated with high levels of natural disturbance (e.g., temperature, salinity, available sunlight, herbivory). These communities are dominated by species capable of rapidly recolonizing each year. As typical with communities of this type, variation in relative percentages of species and species dominance are expected to fluctuate year to year based on the success of the prior years' population to create viable offspring.

Submerged Aquatic Vegetation

The monitoring of the SAV will occur annually at the beginning (typically May) and during the end of the growing season (typically August) prior to the arrival of migratory waterfowl and subsequent herbivory. The sampling method will utilize a series of 5 fixed monitoring transects with quadrat samples being analyzed at each 20-meter (m) interval along the transect. At each quadrat sampling location, a 1 square-meter (m^2) weighted, PVC frame quadrat will be deployed and all species rooted inside the quadrat will be identified. Each species will be assigned a modified Braun- Blanquet cover score representing each species percent cover range using the following classifications shown in **Table B-1**. A 10 centimeter (cm) X 10 cm square quadrat will be randomly placed inside the 1 m^2 weighted, PVC frame quadrat and rooted shoot counts will be made for each species present and 5 shoot lengths of each species will be measured. At each deployment, a GPS-enabled GoPro Hero 8 Black (or similar device) mounted to an extension pole or by snorkeling will be utilized to take a photograph centered above the quadrat. Physical water quality parameters will be collected using a YSI Pro DSS in the beginning (10 m from shoreline), middle of each transect, and end of transect (10 m from shoreline). At each quadrat the following will be recorded:

- Date and time of the sample
- GPS coordinates of the sample
- Depth at the time of sampling
- Photograph of sample
- Observation of dominant sediment type (e.g., silt, sand, gravel, shell)
- Observation of epiphyte coverage (e.g., absent, light, moderate, heavy)
- Species of SAV present
- Modified Braun-Blanquet cover score for each species
- Shoot counts by species inside 10 cm X 10 cm subsample

Table B-1. Modified Braun-Blanquet Cover Scores

Score	Cover
0	Taxa absent from quadrat
0.1	Taxa represented by a solitary shoot, <5% cover
0.5	Taxa represented by a few (<5) shoots, >5% cover
1	Taxa represented by many (>5) shoots, <5% cover
2	Taxa represented by many (>5) shoots, 5 - 25% cover
3	Taxa represented by many (>5) shoots, 25 - 50% cover
4	Taxa represented by many (>5) shoots, 50 - 75% cover
5	Taxa represented by many (>5) shoots, 75 - 100% cover

Six reference transects spread throughout the greater Bonanza Channel project area shown in **Figure B-1**. Restoration goals will be achieved if 80% of the samples inside of the restoration show the expected species assemblages related to reference reach data and percent cover ranges appropriate to its depth strata. Once mining concludes and recontouring on an annual mining region is completed, monitoring will commence during the following peak of growth. Each of the annual mining regions will have five transects. **Figure B-2** shows the arrangement of typical mining channel transects within the five-year mining channel and the reference transects. If the SAV community has failed to meet target criteria after two growing seasons, additional restoration efforts will commence during the third growing season by seeding the restoration area with material from adjacent donor beds. The donor bed locations will be chosen based on the annual dominant species during that season.

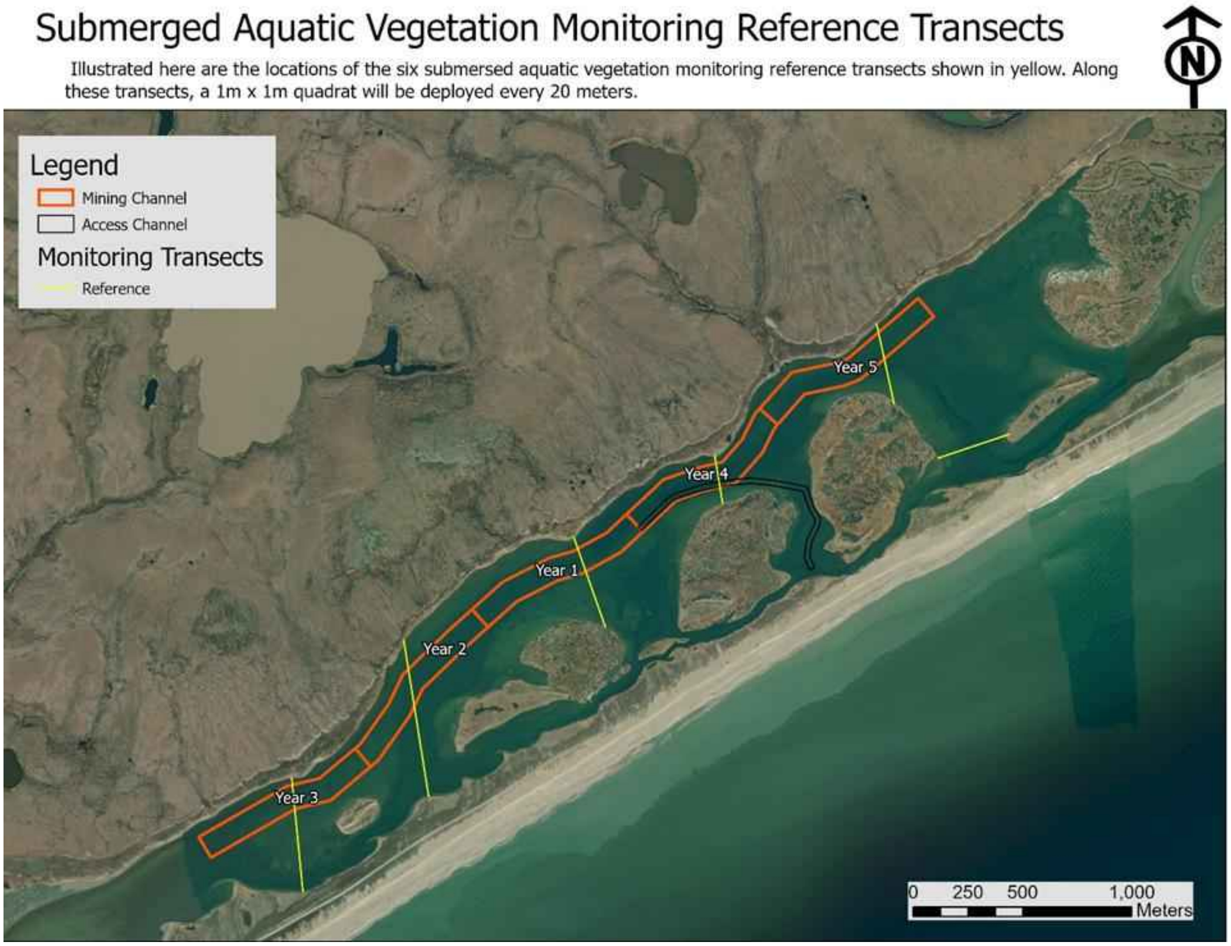


Figure B-1. Locations of Reference Transects for SAV

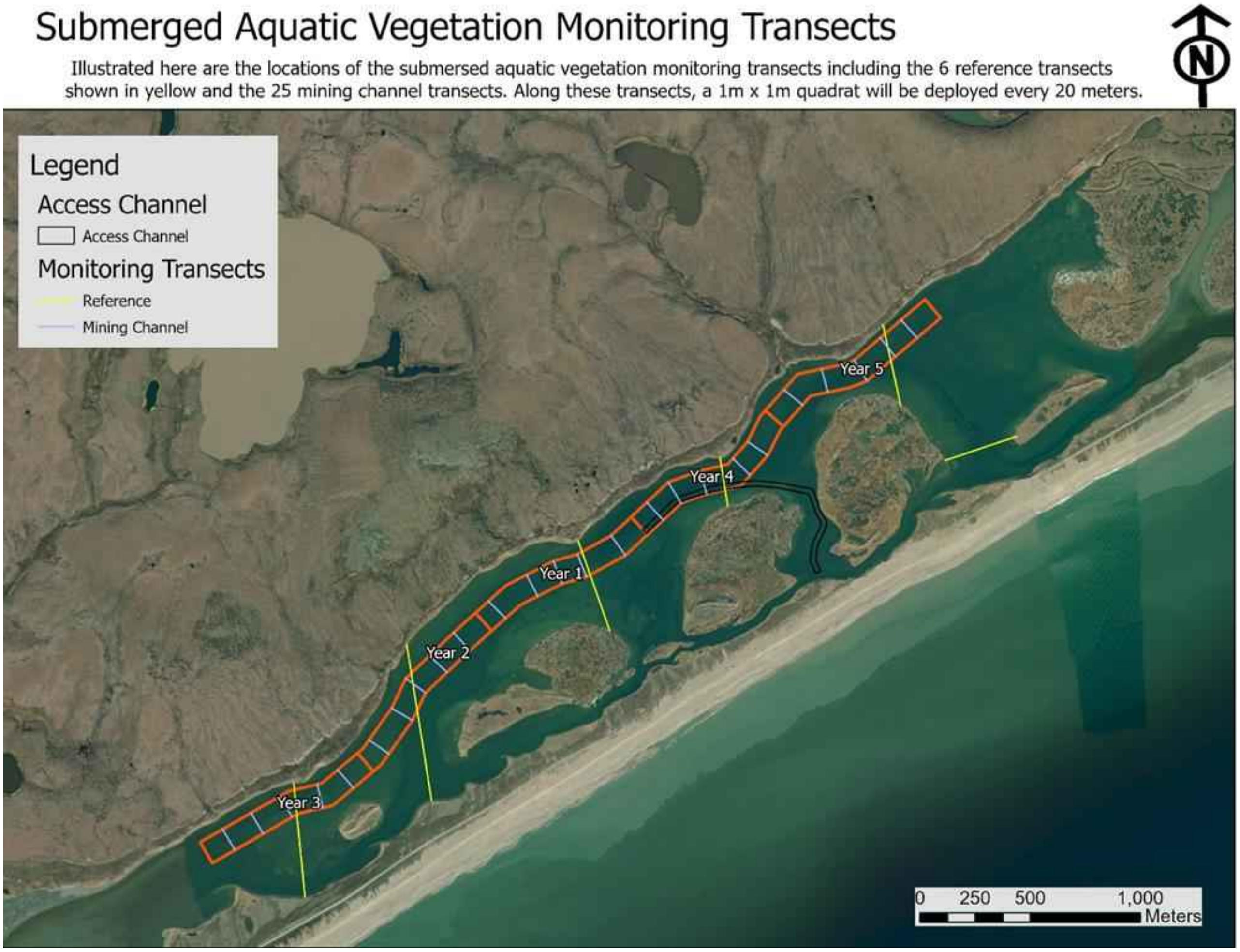


Figure B-2. Locations of SAV Monitoring Transects in the Five-Year Mining Channel and Reference Transects

Benthic Macroinvertebrates

Benthic macroinvertebrates fill an important role in the food web for species of migratory birds and fish. Benthic macroinvertebrates will be sampled during the same time periods as the SAV monitoring for the mining channel (annually at the beginning [typically June] and during the end of the growing season [typically August]).

Once mining concludes and recontouring on an annual mining area is completed, monitoring will commence during the following season during the peak of growth. Each of the annual mining regions will have a composite sample taken to generate monitoring data inside the mining channel. The composite sample will be split among the habitats present in the mining channel (vegetated, bare) In the case of the mining channel, the majority of the bottom type is vegetated so this composite sample will consist of 10 sweeps (0.3 meter x 0.5 meter) of vegetated benthic habitat. An additional composite sample will be taken in the area immediately adjacent to the mining channel to generate additional reference data for that year's mining channel. An example of this for the mining channel in Year 5 is shown in **Figure B-3.** Restoration goals will be met when measures of taxa richness and diversity (Shannon's Diversity Index and Simpsons Diversity Index) are not significantly different from referenced datasets.

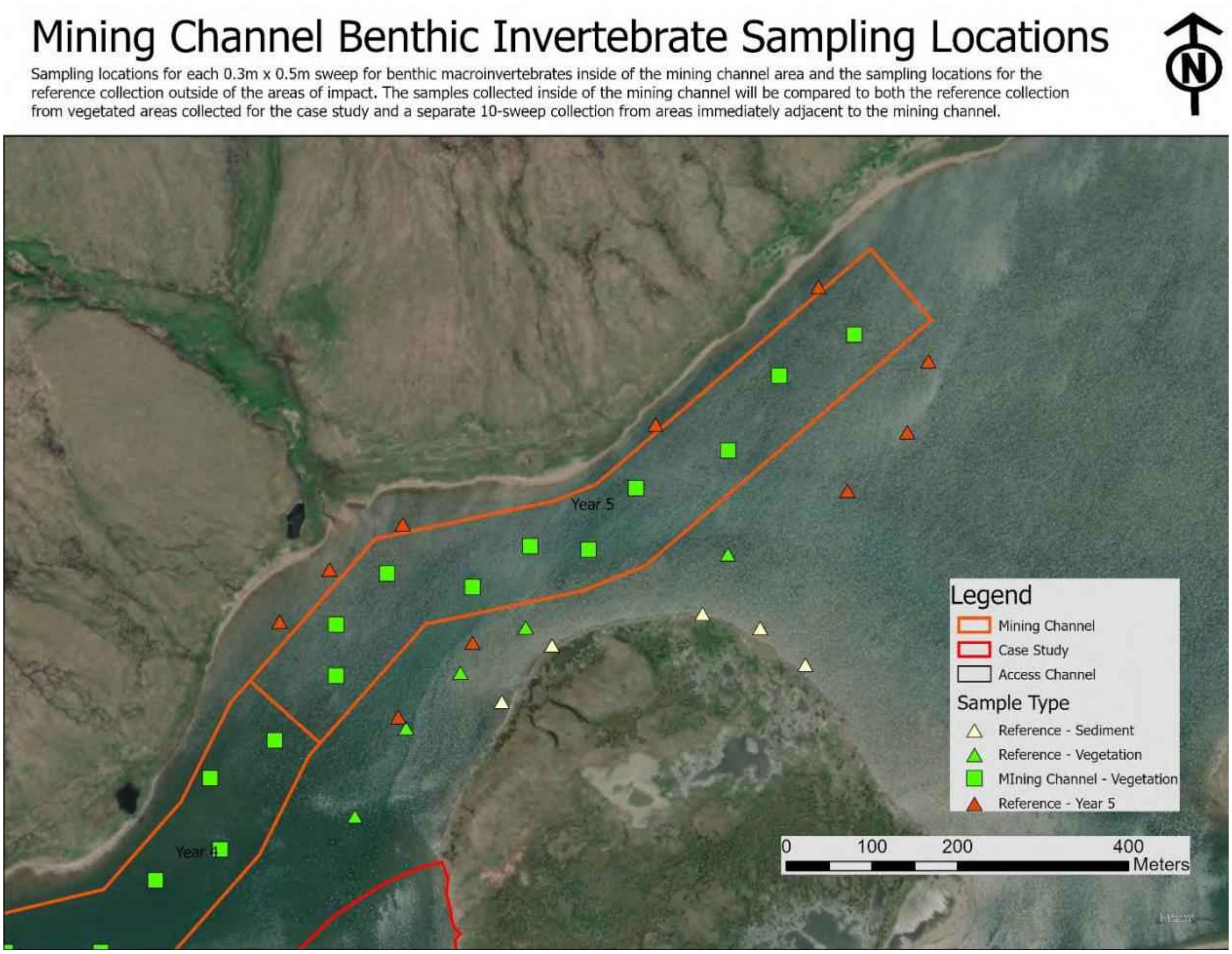


Figure B-3. Year 5 Mining Channel Benthic Macroinvertebrate Sampling Locations and Reference Collection Locations

Water Quality

The water quality of Bonanza Channel follows the dynamic nature of the local climate with seasonal and event-based fluctuations in temperature, salinity, turbidity, flow, and water level beyond the normal tidal variances. To collect a more robust dataset with the goal of better understanding the variances in the Bonanza Channel, continuous monitoring stations will be established using a YSI Pro DSS or equivalent multiparameter data sonde to collect temperature, salinity, pH, ORP, turbidity and water level data. Water quality monitoring is further described in Appendix C, Water Quality, Meteorology, and Visual Monitoring.

APPENDIX C – WATER QUALITY, METEROLOGY, AND VISUAL MONITORING

Water Quality Monitoring

Continuous, real-time monitoring of tidal influence, currents, pH, temperature, conductivity, weather patterns, and turbidity during the mining period will inform future operations and provide useful data to the regulatory agencies regarding both background water quality and water quality during operations. The baseline water monitoring program will focus on the areas nearest and up gradient of the dredging operation. Monitoring down gradient of the operation will collect data to monitor and minimize potential impacts from the mining operation. Additionally, monitoring will be conducted inside of the turbidity curtain.

Monitoring will be accomplished with the use of floating buoys, bottom-mounted tripod monitoring stations, and gauge stations along the shores. A single background monitoring station will be established up current of the operation and one or two stations will be down current of the operation. A YSI Pro DSS or equivalent multiparameter data sonde will be used to collect temperature, salinity, pH, ORP, turbidity and water level data. The monitoring stations will upload real-time continuous data to the Cloud via Wi-Fi telemetry. One of the monitoring stations will include a meteorological sensor that measures wind speed, wind direction, air temperature, barometric pressure, and location using GPS. A real-time current meter also with Wi-Fi telemetry and sensors for water level, temperature, and possibly bi-directional velocity in multiple cells may also be installed.

Additionally, the project has handheld sampling units with sensors for temperature, conductivity, salinity and turbidity, and a separate handheld unit for measuring water current. The handheld device will be used periodically to monitor turbidity inside of the containment area. Water quality with respect to SAV/Benthic monitoring is described in Appendix B.

Performance measures for water quality will include daily compliance with ADEC water quality standards (18 Alaska Administrative Code [AAC] 70) outside of the turbidity curtain. Operational protocols will be established to address exceedances outside the turbidity curtain as required by 18 AAC 70.

Visual Monitoring

Visual monitoring and inspection of the turbidity curtain will be conducted on a continual basis by the operational staff and noted in daily logs. Operation personnel will be instructed to look for unusual signs such as changes in shape of the containment or escaping turbidity as well as any unusual water color or sheens. The monitor will watch for filter sections that need cleaned, for effectiveness of the turbidity control devices and request additional controls or notify the operation to slow or cease dredging when turbidity rises above acceptable levels. Visual monitoring will also be conducted daily along the access channel from the boat ramp to the mining area, and around the camp site as a matter of “housekeeping” such as for proper waste management and evidence of reportable releases.

APPENDIX D – BIRD MONITORING

BIRD MONITORING

Goal: Assess potential changes in bird distribution and abundance in and around IPOP dredging operations before and after dredging.

Objectives: Assess changes in bird distribution and abundance before and after dredging during breeding and fall migration seasons:

1) on islands near field operations
2) on the northern shoreline immediately adjacent to field operations
3) at dredge material disposal sites
4) throughout the Bonanza Channel area, especially for swans during fall migration.

__Approach__

Objective 1 – Islands (Figure C-1). Replicate avian spot mapping surveys conducted in 2021 (pre-field operations) once monthly June-August on state lands contained within west, east, and barrier islands and compare results across years and months. This will provide direct comparisons of bird distribution and abundance before and after field operations if done consistently (though not necessarily annually) throughout the life of the project and after the project ends.

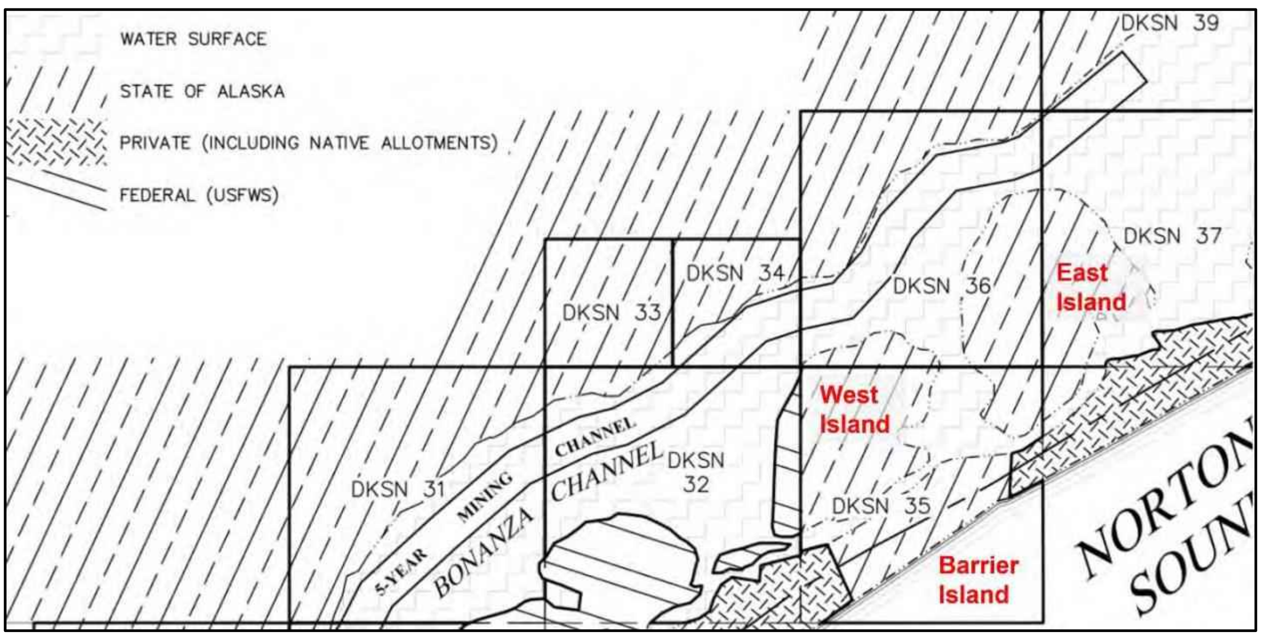


Figure C-1. Mining Channel and State Lands on Three Islands, referred to as the West, East, and Barrier, in the Bonanza Channel

Objective 2 – Northern Shoreline (Figure C-2). Conduct a shorebird and waterfowl survey along the length of the shoreline immediately north of the five-year mining channel. Survey methods will be based on Andres et al. (2019) and PRISM (2018) for non-breeding behaviors (in this case, feeding and loafing). An observer will walk the entire length of the shoreline (approximately 5 kilometers, **Figure C-2**) counting the number of shorebirds and waterfowl detected as a census from the mean high-water mark to 100 m beyond the waters' edge. The observer will use a spotting scope on a tripod to locate, identify, and count birds far in front of the observer before they are flushed. Movements of birds will be monitored during the survey to minimize double counting. Observer will also occasionally scan the open waters beyond 100 meters to note and count waterfowl present in the Bonanza Channel, recording bird locations. The width of the survey area from mean high water to 100 meters beyond the water's edge is anticipated to be 100 to 200 meters wide, which should allow for nearly 100% detection probability.

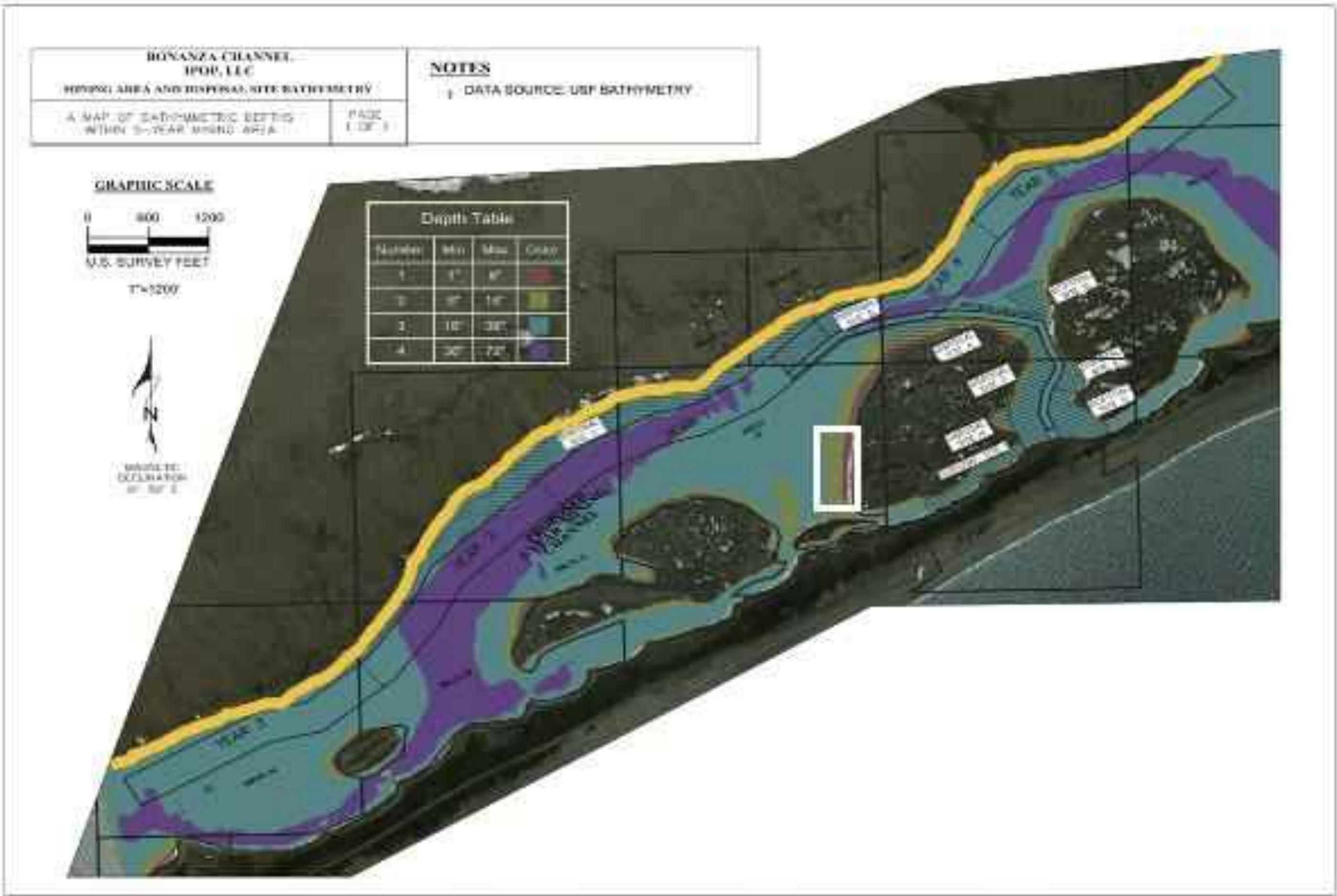


Figure C-2. Shorebird and Waterfowl Shoreline Survey (in yellow) Immediately North of the Five-Year Mining Channel along the Northern Shoreline of the Bonanza Channel.

NOTE: The water depth profile reference area described in Objective 3 (below) is noted in the white box located on the western shoreline of West Island.

Objective 3 – Dredge Material Disposal Sites (DMDS). DMDS are designed to create mudflats and waterfowl foraging habitat after dredging as part of the reclamation plan.

Instantaneous scan sampling (Altman 1974; Hepworth and Hamilton 2001) will quantify the frequency and behavioral use by waterfowl and shorebirds in these areas. Instantaneous scan sampling consists of an observer taking regular scans of an area via binoculars or spotting scope to count birds, identify them to species (or species group), and documenting their behavior at the instant the observer first sees each bird. Open water and mudflats are excellent habitats for this type of survey because detection probabilities can be close to 100%.

Marine mammal observers will be on site daily and trained on site by an experienced ornithologist to bird survey protocols and identification prior to data collection. Observations will be made prior to creating new habitat to document use of the area and will be ongoing during the placement of material in the

DMDS, with emphasis during the fall migration and staging seasons when feeding demands for birds and use of similar areas is highest. Timing of the scans will be based on a pre-determined daily schedule to reduce potential bias. Species identification may be difficult, so birds will be classified to the lowest taxonomic category reasonable (e.g., swan, goose, duck, large shorebird, and small shorebird). Behavior will be classified into two states: feeding and not feeding. An experienced ornithologist will conduct duplicative observations using a spotting scope concurrent with a subset of the marine mammal observers' surveys during related birds surveys described in Objectives 1 and 2.

Water Depth Reference Area. During previous observations, swans, geese, and ducks regularly used the area in the white box in Figure E-2, especially during fall migration. This water depth reference area has a benthic slope profile that approximates the targeted depths and slopes desired in reclamation. This reference area is therefore a useful example of what reclamation should represent in terms of bird use. The area is visible from the Council Highway and will be surveyed monthly from a truck using a scan sampling approach similar to that described above to determine waterfowl and shorebird abundance and quantify behaviors. These measures can be used to compare undisturbed vs reclaimed areas with similar benthic slope profiles.

Objective 4 – Bonanza Channel Area. IPOP will replicate road-based swan and waterfowl counts done in August and September 2021 again in 2022 and conduct observational waterfowl surveys by onboard marine mammal observers during field operations. Counts will occur monthly and include spatial information about where and how many swans, geese, and ducks occur. For onboard surveys during field operations, marine mammal observers will follow a scan sampling protocol (see Objective 3 methods above), documenting the number of swans, geese, and ducks visible from the dredging platform, as well as the proportion of time spent feeding and not feeding. Marine mammal observers will be trained on bird identification and their observations evaluated by an experienced ornithologist via independent replicate observations to assess accuracy of observations.

<u>**Seasonal Bird Use of the Areas and Survey Timing**</u>

Winter – The area is frozen, snow-covered, and wind-swept. Bird diversity is low as is abundance except for flocks of ptarmigan and buntings that may occasionally use the area. No winter bird monitoring is proposed.

Spring – Gulls and seabirds are the first to return to the greater Safety Sound area following breakup in the Bering Sea. Waterfowl typically arrive in May, followed quickly by shorebirds, songbirds, and other birds. The spring migration period is relatively brief with birds motivated to get to their breeding grounds and initiate nesting. There is much less staging, feeding, and loafing than in the fall and as such, the spring migration period is compressed, with waves of birds quickly moving on and dispersing to nesting areas. For these reasons, although the area remains important to spring birds, it is relatively less important for feeding and refueling than in the fall. Also, accurately capturing and quantifying the use of this area by migratory birds is much more difficult than during other seasons because the timing of use is highly variable and dependent upon weather conditions. Timing of ice breakup, which strongly influences bird presence and use of the area's habitats, can vary by up to a month. This adds to the unpredictability of the timing of spring migration. For these reasons, a spring migration survey will be conducted in 2022 as requested by the USFWS. However, the focus will be associated with summer and fall seasons to quantify bird use, abundance, and distribution of the area.

Summer – The USFWS classifies the nesting season of the Seward Peninsula area as May 10 – July 20. Given Safety Sound is immediately adjacent to the Bering Sea which keeps the area cooler than inland habitats, the actual nesting season of the area is likely a little later. Regardless, the area is used by a wide variety of birds including waterfowl, shorebirds, passerines, gulls, raptors, and other groups for nesting and foraging from May to early August.

Fall – The Safety Sound area, including the Bonanza Channel is a well-known staging area for fall-migrating birds, especially waterfowl. Though variables such as weather and nesting success influence when birds arrive, bird abundance usually starts increasing in mid-August and tapers off in late-September. Departure dates are heavily influenced by freeze-up of surrounding waters. If freeze-up occurs early, birds will likewise often depart earlier.

Survey Timing – Each survey area identified in Objectives 1 through 4 vary seasonally in their importance to birds. Hence, emphasis will be placed on accomplishing each objective based on the discussion above.

Performance Standards Considerations

Bird abundance and distribution in and around the Bonanza Channel are influenced by many variables at multiple scales, from local to regional. These variables that can differ across years, seasons, or even days and include but are not limited to nest success rates, fledgling survival rates, amount of precipitation, water levels, wind, temperature (especially freeze-up date), disturbance by humans (especially hunters), and food abundance and availability. Hence, though important, isolating the amount of influence from dredging and reclamation on bird abundance and distribution will likely be challenging.

A more consistent, measurable, and perhaps more meaningful performance standard will be associated with final grade bathymetry contours in the DMDS and the occurrence, distribution, abundance, and/or availability of submerged aquatic vegetation and invertebrates upon which most waterfowl and shorebirds rely. These measures would likely be affected by fewer variables unrelated to dredging activities than bird abundance and distribution and hence, could be a more accurate assessment of reclamation efforts. Further, these measures will directly influence the abundance and distribution of birds because they depend on submerged aquatic vegetation and invertebrates for food, especially during the fall staging and migration.

Therefore, no bird-count related performance measures are proposed.

LITERATURE CITED

Altmann, J. 1974. Observational study of behaviour: sampling methods. Behaviour 49:227-267.

Hepworth, G and AJ Hamilton. 2001. Scan sampling and waterfowl activity budget studies: design and analysis considerations. Behaviour 138:1391-1405.

Andres, B, F Angulo, J Garcia Walther, and N. Senner. 2019. Shorebird Survey Manual. Western Hemisphere Shorebird Reserve Network.

https://whsrn.org/wp-content/uploads/2019/05/coastalshorebirdsurvey_manual_latam_english.pdf

Program for Regional and International Shorebird Monitoring (PRISM). 2018. Standards for Monitoring Nonbreeding Shorebirds in the Western Hemisphere. Unpublished report, Program for Regional and International Shorebird Monitoring (PRISM).

https://www.shorebirdplan.org/science/program-for-regional-and-international-shorebird-monitoring/.

APPENDIX D – FISH MONITORING

STUDY AREA

The study area includes the extent of the project footprint in Bonanza Channel as shown in **Figure D-1.**

Figure D-1. Bonanza Channel Study Area

INTRODUCTION

The existing documented fish assemblages in the study area are characterized by species associated with high levels of natural variances (e.g., temperature, salinity, dissolved oxygen and substrate). The assemblage is dominated by three-spine stickleback which is ubiquitous throughout Alaska and exhibits tolerance to a wide range of environmental conditions. Based on results of fisheries studies in adjacent waters, the project area has been federally designated as Essential Fish Habitat for Marine Immature Adult Chum Salmon, even though this life stage is not documented in the project footprint, likely due to limiting environmental factors. Implementation of the fish monitoring plan will provide baseline data of existing fisheries use within the project footprint and document utilization of constructed habitat features associated with the operational access channel. As typical with existing habitats in the project area, variation in relative percentages of species and species dominance are expected to fluctuate year to year based on local environmental conditions.

OBJECTIVES

The primary objectives of the fish monitoring plan are:

- Document fish species using habitats in the project area.
- Further characterize habitat conditions in the project area.
- Document fish presence and utilization of pool features incorporated into the access channel.
- Document fish species and abundance during fish relocation associated with installation of the turbidity curtain prior to mining.

METHODS

Site Selection

Sampling locations will include the eastern and western extent of the project footprint

Figure D-2. Fish Sampling Locations

Sampling Equipment

The shallow depths of the project area limit the options of passive sampling equipment as suggested by NMFS (March 4, 2022) to underwater video cameras and precludes the use of hydroacoustic methods. The project will deploy *Smolt Spy* underwater cameras enclosed in waterproof PVC housings fabricated by FishBio in Chico California (**Figure D-3**). Cameras will be placed in the deepest part of the project footprint adjacent to monitoring locations as shown on **Figure D-2**.

Beach seines will be 50 ft x 4 ft x ¼ inch knotless mesh attached at the ends to vertical supports to aid in deployment The seines will be deployed at the locations shown on **Figure D-2**, with each set sampling approximately 3,500 square feet. Two techniques will be used depending on conditions:

- In the first technique, the net starts out fully extended on the shoreline. One vertical support remains close to shore still while the net is slowly deployed in a half circle until extended on into the channel. Net ends are then gathered and closed.
- The second technique will be used in deeper water where the net fully expanded perpendicular to shore and both ends walked at a slow pace to cover approximately 75 linear ft, then the net is gathered and brought to shore.

Figure D-3. FishBio Underwater Video Camera

Data Collection

Fish Sampling: Video data will be stored in external hard drives associated with the cameras and collected on a weekly basis. Beach seining will be conducted three times during the open water season (late May – early June, July, and September) in proximity to the camera locations to provide baseline data and for calibration to assess camera efficiency.

Water Quality: Continuous water quality monitoring as described in Appendix C of the Reclamation Plan Revision 2 will be correlated to observations and catch data to document limiting factors associated with salinity, temperature, DO, and turbidity.

Data Processing

- Underwater video will be viewed and analyzed monthly by an experienced fisheries biologist. Fish will be speciated to the lowest taxonomic level practicable and relative abundance will be documented.
- Beach seine data will be collected in the field following accepted fish sampling protocols to include speciation, fork length, and relative abundance.
- Continuous monitoring of water quality conditions will be documented by sampling time and date.
- Catch per unit effort (CPUE) will be calculated. All fish captured or observed will be enumerated by species and life stage. Life stages will be differentiated based on length frequency analysis.
- Data comparisons will be used to determine:

  1) relative abundance associated with different monitoring sites and

  2) relative abundance between the monitoring sites and constructed pool habitat associated with the operations access channel.

REPORTING

Annual fish monitoring reports will be submitted to USACE, NMFS, and ADF&G as required by permitting.

Performance Standards

The goal of the reclamation is to increase the diversity of fish habitat in the project footprint by constructing “deep water” thermal refugia habitat features in association with the operations access channel. Because the constructed pools associated with the access channel will be new habitat features (do not currently exist within existing bathymetric profiles), the performance standard will be progressive, to include:

- occupation by existing species as indicated by baseline and monitoring data
- eventual utilization of the constructed habitat by salmonid life stages not currently documented within the project footprint.
- No specific fish-abundance-based performance standards are proposed.

TRIGGER POINTS

No specific trigger points for corrective action are proposed.

APPENDIX E – WILDLIFE MONITORING

The project will conduct daily monitoring of wildlife. Specific areas that will be monitored on a continuous basis are the dredging containment (within turbidity curtain), shallows constructed by the operation, and the access channel between camp and the dredging area. A log will also be maintained of wildlife sightings in the project area that include bear, moose, caribou, seals, and furbearers, as required by the Corps permit. Operations personnel will also log birds or other smaller wildlife typically observed in the project area.).

All project employees will be instructed to report unusual wildlife encounters and mortalities of fish, birds, or other wildlife to the operations manager. Wildlife mortalities that occur within the general project area will be reported to US Fish and Wildlife Service (USFWS), National Marine Fisheries, ADF&G, and Alaska Department of Natural Resources (ADNR) Office of Habitat Management and Permitting, Fairbanks office, and ADEC. All carcasses can be made available for collection by the USFWS or ADF&G, if required by the agencies. Any wildlife mortalities due to defense of life and property will be recorded in a log maintained with the operations manager and reported to the ADNR Office of Habitat Management and Permitting, Fairbanks, Alaska and ADF&G (per State reporting requirements).