Lowell Creek Flood Diversion
Seward, Alaska
Appendix A: 404(b)(1) Evaluation

April 2021

US Army Corps
of Engineers®
Alaska District

Intentionally left blank.

404(b)(1) Evaluation

Integrated Feasibility Report and Environmental Assessment

Lowell Creek Flood Diversion

Seward, Alaska

Prepared By:

U.S. Army Corps of Engineers

Alaska District

April 2021

Intentionally left blank.

TABLE OF CONTENTS

FIGURES

Intentionally left blank.

1. PROJECT DESCRIPTION

1.1. Location

The Lowell Creek Flood Diversion System is located in the City of Seward, Alaska. Congress authorized the Lowell Creek tunnel in 1937, and construction was completed by the U.S. Army Corps of Engineers (USACE) in 1940. The system consists of four parts: diversion dam, emergency spillway, a 10-ft-diameter 2,070-ft-long tunnel, and an outfall. It reroutes Lowell Creek through Bear Mountain and bypasses Seward to enter Resurrection Bay (Figure 1). The City of Seward, with a population of 2,663 in 2016, lies immediately downstream of the flood diversion system near the head of Resurrection Bay on the Kenai Peninsula, approximately 125 highway miles south of Anchorage.

1.2. General Description

The 4.1 square-mile Lowell Creek drainage is found in the Kenai Mountain range, which lies along the south-central coast of Alaska. The Seward area averages 71.8 inches of annual precipitation, which peaks in September at 10.4 inches. Elevations within the Lowell Creek drainage range from 300 feet (ft) at the diversion tunnel entrance to 4,000-ft mountain peaks. Lowell Creek's gradient above the diversion structure is approximately 1,000 ft per mile and exhibits no defined pools or slack areas of surface water. Although there are no tributaries to Lowell Creek, very steep mountain drainage slopes indicate nearly sheet flow over solid rock into the mainstem (USACE 1978).

Historical water quality measurements for this site are exceedingly sparse, with only one formal measurement on record in the U.S. Geological Survey database (USGS 1992). Lowell Creek produces a significant amount of debris during flood conditions, once generating an estimated 10,000 cubic yards (cy) of debris in an 11-hour period (Stauffer 2010). The Lowell Creek alluvium is a prominent land feature in Resurrection Bay, and the creek's current depositional potential is apparent at the diversion discharge site where the new alluvium protrudes into the bay.

Significant portions of Seward's modern infrastructure are built upon the Lowell Creek alluvium. Jefferson Street lies on top of Lowell Creek's historic channel. The diversion of Lowell Creek in 1940 has played an important role in providing stability required to conduct long-term planning and infrastructure improvements in Seward. Although the implementation of the Lowell Creek diversion and tunnel has clearly had a long-term beneficial impact on the population and infrastructure of Seward, it is not possible to

quantify the benefits.

The purpose of the proposed project is to improve flood diversion capacity at Lowell Creek. The flood diversion system in Lowell Canyon does not adequately reduce risk associated with flood events, which present a threat to life, property, and critical infrastructure with little to no warning.

The tunnel inlet at Bear Mountain can transport relatively low flows (up to 2800 cfs) through the system and is prone to blockages from upstream debris. Either a higher flow event or tunnel blockage would divert flows immediately into downtown Seward. In addition, the tunnel outlet is prone to the accumulation of debris and sediments at the Lowell Point Road Bridge. During some of the floods of record, the bridge has been damaged, destroyed, and/or buried under as much as 20 ft of debris. This has led to isolation of Lowell Point to the south and to damaged critical infrastructure in south Seward.

1.3. Authority and Purpose

This General Investigation was authorized by Section 5032 of the Water Resources Development Act (WRDA) of 2007. Section 5032(a) of WRDA 2007 directs the Assistant Secretary of the Army, Civil Works (Secretary), to assume responsibility for the long-term maintenance and repair of the Lowell Creek tunnel until November 2022, or until an alternative method of flood diversion is constructed and operational, whichever is earlier.

Sections 5032(b) and (c) of WRDA 2007 direct the Secretary to study the feasibility of alternative methods of flood diversion in Lowell Canyon. If the Secretary determines that an alternative method of flood diversion in Lowell Canyon is feasible, then the Secretary shall subsequently carry out the alternative method.

Overall, USACE's planning objectives are to develop alternatives that reduce risk to public health, life, and safety from the flooding of Lowell Creek to the City of Seward; reduce flood damages to property and critical infrastructure; reduce the cost of emergency response and management; and reduce operation and maintenance costs.

1.4. General Description of Dredged or Fill Material

The proposed project would create a new, larger, rolled concrete diversion dam approximately 100 yards upstream of the existing diversion system. The diversion dam would route Lowell Creek's surface flows and bedload (approximately 25,000 cy of material per year) through a newly hewn, increased diameter, concrete-lined tunnel

in Bear Mountain, and discharge them via a pier-supported, elevated concrete flume over Lowell Point Road to the alluvium deposits that have accreted as a result of Lowell Creek's original diversion system.

Generally, as the existing diversion project operates, Lowell Creek's bedload material begins to accrete in an area just downstream of the outfall structure. If allowed to follow natural depositional behavior, sediments would continually mound and deform, extending the alluvium further into the waters of Resurrection Bay. However, because critical infrastructure exists downstream of the outfall structure, namely the Lowell Point Road Bridge, the City of Seward employs bulldozers and excavators to disperse accreting sediments laterally into Resurrection Bay within the footprint of the existing alluvium, which is consistent with how natural deformation processes might affect sediment distribution.

For the purposes of this analysis, it is assumed that these accreting sediments would naturally encroach upon the waters of Resurrection Bay, whether throughout their historical distribution of the entire Lowell Creek alluvium, or if only concentrated at the southernmost portion of the alluvium.

1.4.1. General Characteristics of Material (grain size, soil type)

Other than the concrete utilized in the construction of each of the individual project elements, the material transported by Lowell Creek is almost entirely comprised of mechanically weathered greywacke, which is the dominant geological composition of the watershed. Grain size is variable and is generally characterized as boulders, cobbles, pebbles, and coarse sands.

1.4.2. Quantity of Material

The exact quantity of material required for the construction of the diversion dam will be determined by physical modeling yet to be completed.

The annual quantity of material that passes through the existing diversion structure and is directed towards Resurrection Bay is approximately 25,000 cy.

1.4.3. Source of Material

Concrete required for the construction of the diversion dam, tunnel lining, and outfall flume would be sourced locally to the greatest extent possible.

The source of Lowell Creek's bedload is the steep, talus-strewn mountainous terrain that defines its small watershed. All material is native to the Lowell Creek watershed.

There are no anthropogenic structures above the existing diversion system.

1.5. Description of Proposed Discharge Site

The new diversion dam would span the width of Lowell Creek at a point just upstream of the existing diversion system. Discharge of the Lowell Creek surface waters and bedload would occur on the seaward side of Lowell Point Road, approximately 200 ft south of the existing outfall.

Lowell Creek's current bedload discharge is so much that mechanical management of the sediment is required to prevent rerouting of the surface waters and the flooding of portions of south Seward. Manipulation of sediments is achieved by excavators and large bulldozers, often working in the water while Lowell Creek is actively discharging. Sediments in the active channel are cleared and are pushed to the extent of the ever-growing alluvium. This high level of disturbance precludes any vegetation establishment in the discharge area.

The Lowell Point Road Bridge, which spans the discharge surface waters of Lowell Creek during normal conditions and serves as the single land access route to Lowell Point, is commonly covered by sediment discharged during flood events. To alleviate this recurring condition, USACE's project design includes the installation of a pier-supported 150-ft elevated concrete flume that would direct the entirety of Lowell Creek's discharge to a point on the alluvium past Lowell Point Road.

1.5.1. Location

Lowell Creek is located immediately west of Seward, Alaska. The existing diversion dam is located just upstream of Seward. Surface waters and bedload are routed through Bear Mountain and discharged to Resurrection Bay via concrete flume (Figure 1).

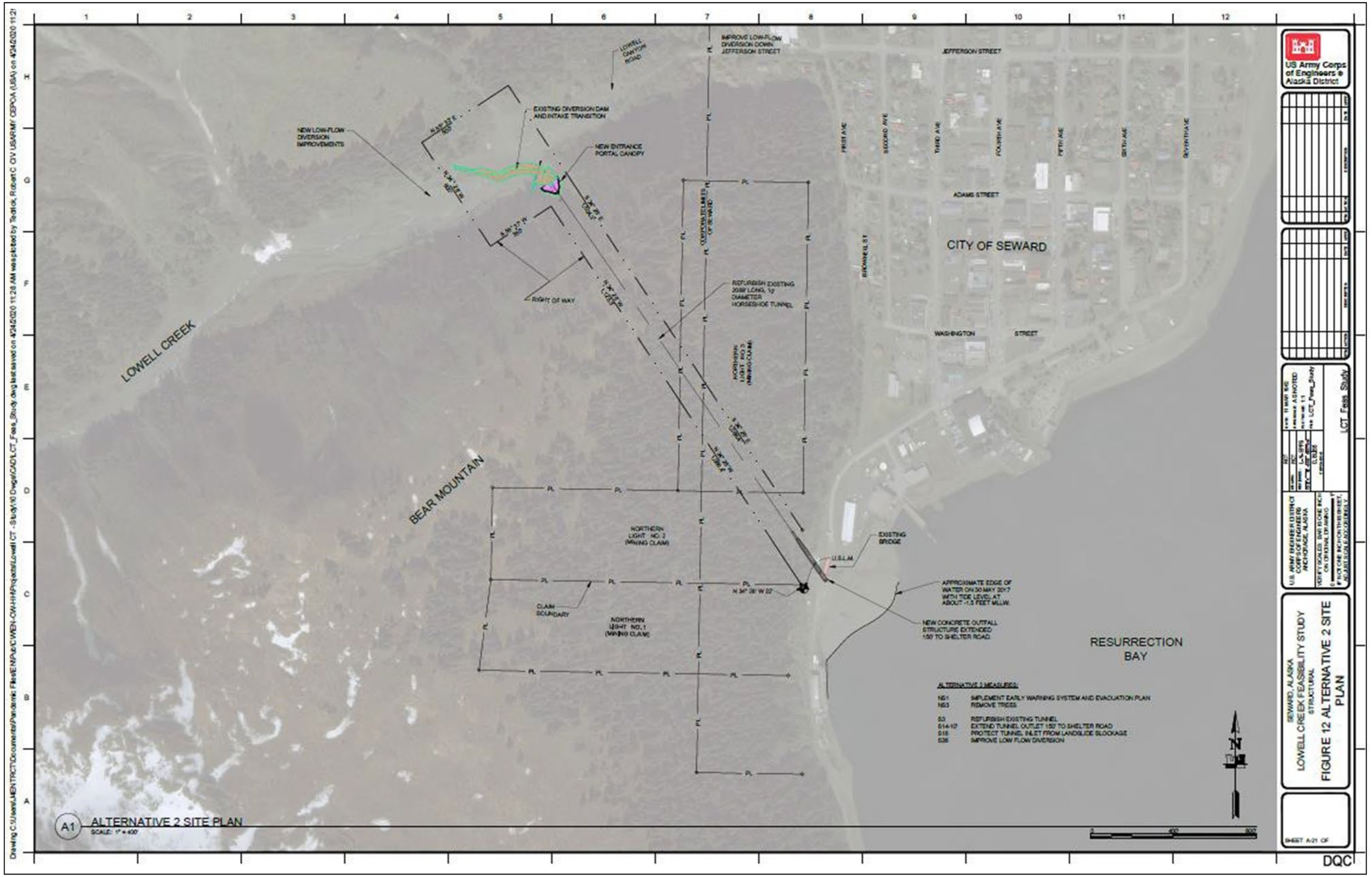

Figure 1. Project Location.

Intentionally left blank.

1.5.2. Size

The operational footprint of the diversion structure and tunnel entrance would be less than 1 acre. The footprint of the outfall flume would be less than 1 acre.

1.5.3. Type of Site

The area where the diversion dam and tunnel entrance would be constructed is characterized by the National Wetlands Inventory mapping tool as R3UBH: Riverine, Upper Perennial, Unconsolidated Bottom, and Permanently Flooded (USFWS 2020). The discharge site on land is Lowell Creek alluvium.

1.5.4. Types of Habitat

Vegetation characteristics for the Lowell Creek watershed are little different than previously described in 1978: “approximately 30% of the upland drainage exhibits vegetative cover, and is comprised of low growing alders, small shrubs, and isolated patches of scrub conifers” (USACE 1978). Vegetation does not occur upon the steeper portions of the surrounding slopes. It is limited to an area of transitional slope between creek bankfull and the boundary of the bare rock/scree zone that constitutes most of the watershed. The area of the proposed diversion dam structure is primarily comprised of a heterogeneous mix of boulders, cobbles, and gravel that is largely devoid of established vegetation (Figure 2).

Figure 2. Lowell Creek, Immediately Upstream of the Existing Diversion Structure.

The area beneath the tunnel discharge flume to the point where Lowell Creek's surface waters meet Resurrection Bay is completely devoid of vegetation. Discharge velocities and debris deposition in this section are sufficient to preclude vegetation establishment.

1.5.5. Timing and Duration of Discharge

Construction of the new diversion dam, tunnel, and elevated outfall flume would take multiple years to complete. Work conducted within the stream channel itself would only occur during the winter months, which comprise the lowest flow period of Lowell Creek's hydrograph. USACE has determined that the scouring flows that typify Lowell Creek hydrologic activity would create unsafe working conditions during the rest of the year.

1.6. Description of Disposal Methodology

Construction of the new dam diversion, tunnel, and elevated outfall flume would be consistent with industry standards for construction methodology. Construction would employ an in-stream diversion to route Lowell Creek's surface waters around the active construction area and through the existing tunnel system.

Sediments discharged to the alluvium by Lowell Creek's natural hydrologic processes would still have to be managed by currently employed methods to prevent sediment buildup and flooding in south Seward. Bulldozers and excavators would work to keep the main channel to Resurrection Bay open by spreading sediments to the edge of the alluvial fan.

2. FACTUAL DETERMINATION

2.1. Physical Substrate Determinations

In-channel substrates are a heterogeneous mix of greywacke boulder, cobbles, and gravels. There is very little, if any, established vegetation in Lowell Creek's scoured channel (Figure 2). Substrates at the point of discharge and throughout the alluvial fan are the same as those above the diversion system.

2.1.1. Substrate Elevation and Slope

All elements of the project, as proposed within the Lowell Creek Canyon, would occur between 160 and 240 ft elevation above sea level. Generally, the Lowell Creek watershed exhibits a 1,000-ft elevation change per mile.

2.1.2. Sediment Type

Substrate sediments are almost entirely comprised of mechanically weathered greywacke, which is the dominant geological composition of the watershed.

2.1.3. Dredged/Fill Material Movement

Substrate sediments beneath the diversion dam will not move as a result of the proposed project. Sediments discharged to the alluvial fan would require recurring manipulation and would continue to expand the existing alluvial fan.

2.1.4. Physical Effects on Benthic Invertebrates

Continuous disturbance along the intertidal and subtidal alluvial margin in the form of burial by clean, homogeneous sediments would result from USACE's proposed project. However, this would be similar to the existing condition. Lowell Creek's depositional rate would not be affected by the proposed project, and the continued growth of the alluvium would be expected.

2.1.5. Other Effects

No other effects on physical substrate are anticipated.

2.1.6. Actions Taken to Minimize Impacts

Seasonal restrictions on in-channel construction actions minimize impacts by reducing the overall risk to human health and equipment. Work would be conducted during winter months during the low flow period of Lowell Creek's hydrograph.

2.2. Water Circulation, Fluctuation, and Salinity Determinations

It is unknown if the continual deposition of Lowell Creek's sediments would affect water circulation in Resurrection Bay, or to what degree this would be detectible in the near term. Presumably, given Lowell Creek's propensity for vigorous alluvial deposition, its alluvial cone could encroach far enough into the waters of Resurrection Bay to disrupt water circulation. However, disruption of this type would be expected to occur only after centuries of continual deposition.

2.2.1. Water Quality

2.2.1.1. Salinity

Although salinity gradient data collections were not conducted during the feasibility phase of USACE's project, implementation of the proposed project would not be

expected to affect salinity gradients in Resurrection Bay. It is presumed that, because the proposed project would not change the discharge of Lowell Creek into Resurrection Bay, there would be no effect to the natural baseline.

2.2.1.2. Water Chemistry

Concrete used to construct the diversion system would be fully cured before it came into contact with water, therefore it would not affect the baseline water chemistry of Lowell Creek.

Similarly, it is presumed that because the proposed project would not change the discharge of Lowell Creek into Resurrection Bay, there would be no effect on the natural baseline.

2.2.1.3. Clarity

Water clarity would not be affected by the proposed project because the hardened concrete structures would not be expected to add to or reduce the system's existing sediment load. Similarly, it is presumed that because the proposed project would not change the discharge of Lowell creek into Resurrection Bay, there would be no effect on the natural baseline.

2.2.1.4. Color

Water color would not be affected by the proposed project elements because the hardened concrete structures would not be expected to add to the system's sediment load. Similarly, it is presumed that because the proposed project would not change the discharge of Lowell creek into Resurrection Bay, there would be no effect on the natural baseline.

2.2.1.5. Odor

Water odor would not be affected by the proposed project because the hardened concrete structures would not be expected to add to, or detract from, the system's odor profile. Similarly, it is presumed that because the proposed project would not change the discharge of Lowell creek into Resurrection Bay, there would be no effect on the natural baseline.

2.2.1.6. Taste

The taste of Lowell Creek's water would not be affected by the proposed project elements because the hardened concrete structures would not be expected to add to,

or detract from, the system's water's taste. Similarly, it is presumed that because the proposed project would not change the discharge of Lowell creek into Resurrection Bay, there would be no effect on the natural baseline.

2.2.1.7. Dissolved Gas Levels

Dissolved gas levels would not be affected by the proposed project because the hardened concrete structures would not be expected to add to or detract from the system's dissolved gas values. Similarly, it is presumed that because the proposed project would not change the discharge of Lowell creek into Resurrection Bay, there would be no effect on the natural baseline.

2.2.1.8. Nutrients

Aqueous nutrient levels would not be affected by the proposed project because the hardened concrete structures would not be expected to add to the system's sediment load. Similarly, it is presumed that because the proposed project would not change the discharge of Lowell creek into Resurrection Bay, there would be no effect on the natural baseline.

2.2.1.9. Eutrophication

Lowell Creek's propensity for eutrophic conditions would not be affected by the proposed project elements because the hardened concrete structures would be designed to direct flowing surface waters and not impound existing surface flows. Similarly, it is presumed that because the proposed project would not change the discharge of Lowell creek into Resurrection Bay, there would be no effect on the natural baseline.

2.2.1.10. Others as Appropriate

No other applicable water quality conditions were identified for evaluation.

2.2.2. Current Patterns and Circulation

The entirety of Lowell Creek's surface flow is diverted through Bear Mountain and discharged to Resurrection Bay. The proposed project would not affect the final location of Lowell Creek's surface flows into Resurrection Bay. Similarly, the effects to the waters of Resurrection Bay would not change from the existing condition.

2.2.2.1. Current Patterns and Flow

The proposed project does not include actions that may affect current patterns and flow.

2.2.2.2. Velocity

The proposed project does not include actions that may affect velocity.

2.2.2.3. Stratification

The proposed project does not include actions that may affect stratification.

2.2.2.4. Hydrologic Regime

The proposed project does not include actions that may affect the hydrologic regime.

2.2.3. Normal Water Level Fluctuations

The proposed project does not include actions that may affect normal water level fluctuations.

2.2.4. Salinity Gradients

The proposed project does not include actions that may affect salinity gradients.

2.2.5. Actions That Will Be Taken to Minimize Impacts (refer to Subpart H)

Best management practices would be utilized and a spill response plan would be developed for in-stream construction activities.

2.3. Suspended Particulate/Turbidity Determinations

Resurrection Bay is a dynamic system that is ringed by mountainous and glacial watersheds. It receives large inputs of sediments that can occlude its waters for hours to days following precipitation events.

2.3.1. Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site (consider items in sections 230.11(c) and 230.21)

USACE does not expect that the proposed project would alter the existing conditions in the vicinity of the discharge site (Figure 3).

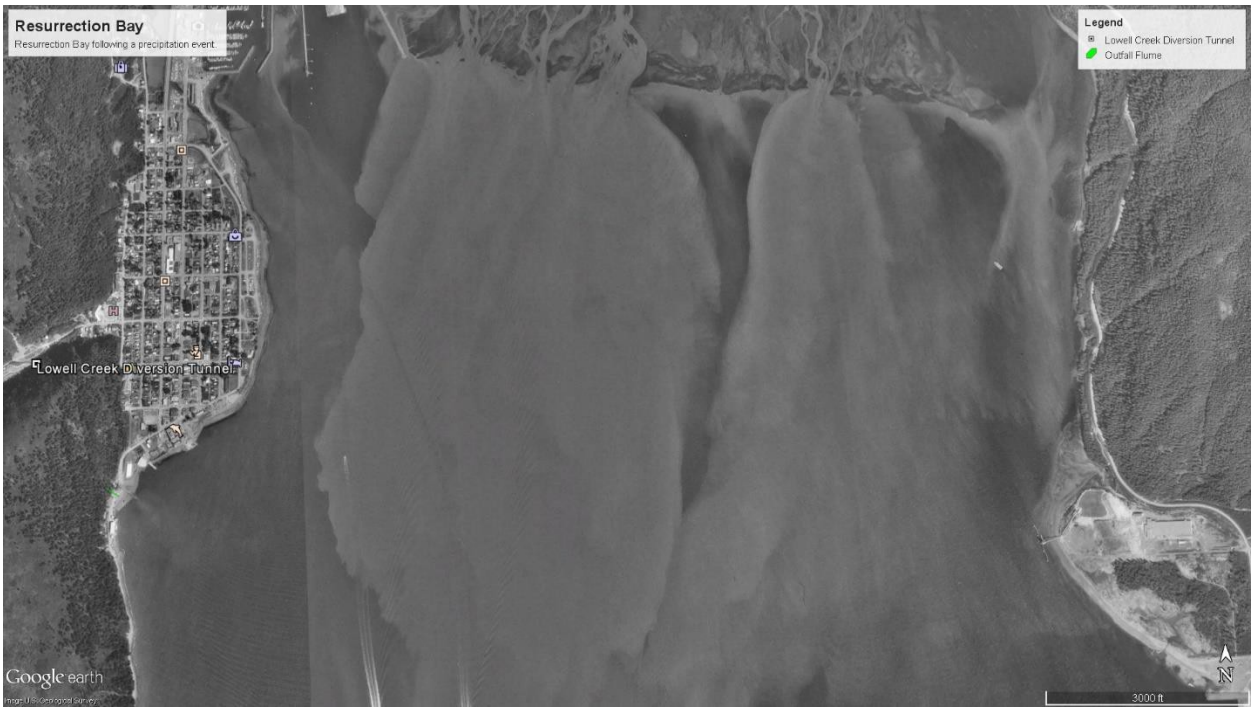

Figure 3. Resurrection Bay Following a Precipitation Event.

2.3.2. Effects on Chemical and Physical Properties of the Water Column

Implementation of the proposed project is not expected to affect the chemical or physical properties of the water column of Resurrection Bay because it would not change the discharge of Lowell Creek into Resurrection Bay.

2.3.2.1. Light Penetration

The proposed project does not include actions that may affect light penetration.

2.3.2.2. Dissolved Oxygen

The proposed project does not include actions that may affect dissolved oxygen.

2.3.2.3. Toxic Metals and Organics

The proposed project does not include actions that may affect toxic metals and organics.

2.3.2.4. Pathogens

The proposed project does not include actions that may affect pathogens.

2.3.2.5. Aesthetics

The proposed project does not include actions that may affect aesthetics.

2.3.2.6. Others as Appropriate

No other applicable chemical and physical properties of the water column were identified for evaluation.

2.3.3. Effects on Biota

Lowell Creek naturally exhibits a particularly low degree of biological diversity because of the recurring physical scouring of the in-stream sediments. Lowell Creek is completely devoid of fish. Similarly, it is presumed that because the proposed project would not change the discharge of Lowell creek into Resurrection Bay, there would be no effect on the biota of Resurrection Bay.

2.3.3.1. Primary Production, Photosynthesis

Implementation of the proposed project would not affect primary production or photosynthesis in Lowell Creek's surface waters. Similarly, the proposed project would not affect primary production or photosynthesis in Resurrection Bay because it would not change the discharge of Lowell Creek into Resurrection Bay.

2.3.3.2. Suspension/Filter Feeders

The proposed project does not include actions that may affect suspension/filter feeders.

2.3.3.3. Sight Feeders

The proposed project does not include actions that may affect sight feeders.

2.3.4. Actions Taken to Minimize Impacts

The proposed project does not require actions be taken to minimize impacts on suspended particulate/turbidity.

2.4. Contaminant Determinations

Cured concrete would be exposed to surface waters and sediments as a normal course of their purpose but would not be expected to function as a conduit for contaminant exposure of those waters and sediments. According to the State of Alaska's Department of Environmental Conservation's contaminated site tracking tool, there are no contaminated sites in the vicinity of Lowell Creek.

2.5. Aquatic Ecosystem and Organism Determinations

Implementation of the proposed project would not affect the scour-restricted aquatic ecosystem in Lowell Creek. Similarly, the proposed project would not affect the aquatic ecosystem in Resurrection Bay because it would not change the discharge of Lowell Creek into Resurrection Bay.

2.5.1. Effects to Plankton

The proposed project would have no effect on plankton.

2.5.2. Effects on Benthos

The proposed project would have no effect on benthos.

2.5.3. Effects on Nekton

The proposed project would have no effect on nekton.

2.5.4. Effects on Aquatic Food Web

The proposed project would have no effect on the aquatic food web.

2.5.5. Effects on Special Aquatic Sites

There are no designated Special Aquatic Sites at either the proposed point of diversion or in the vicinity of the outfall discharge.

2.5.5.1. Sanctuaries and Refuges

There are no sanctuaries and refuges in the vicinity of the proposed project.

2.5.5.2. Wetlands

Placing the concrete diversion dam would affect less than an acre of heavily disturbed streambed, which may be waters of the United States.

2.5.5.3. Mud Flats

There are no mudflats in the vicinity of the proposed project.

2.5.5.4. Vegetated Shallows

There are no vegetated shallows in the vicinity of the proposed project.

2.5.5.5. Coral Reefs

There are no coral reefs in the vicinity of the proposed project.

2.5.5.6. Riffle and Pool Complexes

Only those riffles and pools that might exist during moderate flow conditions between the proposed project and the existing project would be affected by the implementation of the proposed project. Waters that might support those habitats would be diverted by the new diversion dam. However, because of Lowell Creek's scouring flows, these habitats are likely never permanent in nature and do not support high levels of biodiversity.

2.5.6. Threatened and Endangered Species

The USACE has coordinated with both the U.S. Fish and Wildlife Service and the National Marine Fisheries Service and has determined that its project would result in a no effect determination for threatened and endangered species.

2.5.7. Other Wildlife

Wildlife may be deterred from utilizing some habitats in the lower Lowell Creek watershed during periods of construction, but this would be minimized by the requirement for wintertime construction.

2.5.8. Actions to Minimize Impacts

To minimize aquatic ecosystem and organism impacts, construction efforts would occur during the low flow period of Lowell Creek's hydrograph.

2.6. Proposed Disposal Site Determinations

The proposed project does not include actions that require disposal site determinations.

2.7. Mixing Zone Determination

The proposed project does not include actions that require mixing zone determinations.

2.8. Determination of Compliance with Applicable Water Quality Standards

The proposed project complies with all applicable water quality standards.

2.9. Potential Effects on Human Use Characteristic

2.9.1. Municipal and Private Water Supply

Lowell Creek is not utilized as a municipal or private water supply.

2.9.2. Recreational and Commercial Fisheries

Lowell Creek is devoid of fish, and there is no recreational fishery that would be influenced by the implementation of the proposed project. Similarly, Lowell Creek does not support a commercial fishery.

2.9.3. Water Related Recreation

There is no water related recreational uses of Lowell Creek. Implementation of the proposed project would not affect the existing condition of water related recreation in Lowell Creek.

2.9.4. Aesthetics

Almost the entirety of the existing project is located within Lowell Canyon and inside Bear Mountain and is not visible to the general public or would take significant effort to observe. Also, several safety features such as exclusionary fencing and signage on the crest of the diversion dam have been erected specifically to prevent accidents from people getting too close to the tunnel entrance invert.

The point of outfall is readily observable in south Seward and forms a somewhat scenic waterfall feature that attracts attention from tourists and residents alike. Implementation of the elevated flume component of the proposed project would move this feature across the road but the effect on aesthetic resources would be insignificant.

2.9.5. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

Implementation of the proposed project would not impact parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, or similar preserves.

2.10. Determination of Cumulative Effects on the Aquatic Ecosystem

Cumulative effects resulting from USACE's previous actions and the proposed project are limited to those facilitated by the establishment and continued expansion of the alluvium at the point of discharge. Mechanical manipulation of the sediments has been a requirement established by the original project and would be required in perpetuity under the proposed project. The operation of mechanical equipment in the waters of Lowell Creek or Resurrection Bay carries the risk of inadvertent release of environmentally persistent compounds such as fuels, oils, and lubricants. Over time, the risk of inadvertent release of environmentally persistent compounds increases because the avenue for exposure is not alleviated.

2.11. Determination of Secondary Effects on the Aquatic Ecosystem

Secondary effects on the aquatic ecosystem would not be expected as a result of the implementation of the proposed project. The proposed project would not change the result of the existing condition.

3. FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

3.1. Adaptation of Section 404(b)(1) Guidelines to this Evaluation

The proposed project complies with the requirements set forth in the Environmental Protection Agency's Guidelines for the Specification of Disposal Sites for Dredged or Fill Material with no adaptations.

3.2. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem

The Integrated Feasibility Report and Environmental Assessment (IFR/EA) analyzed six practicable alternatives for addressing flood risk on Lowell Creek, including a No Action alternative. Although USACE determined that no nonstructural alternatives,

alone or in combination, would achieve the goal of reducing flood risk to the community of Seward, all alternatives presented below include nonstructural components such as selective tree removal. Nonstructural components are not included in this analysis because they would have no effect on the aquatic environment of Lowell Creek or Resurrection Bay. None of the practicable alternatives would alter the result of Lowell Creek's full discharge to Resurrection Bay including its deposition of alluvium.

- Alternative 1 is the No Action alternative.

- Alternative 2 would refurbish the existing tunnel and install a canopy above the tunnel entrance and invert to protect it against blockage from a localized debris slide.

- Alternatives 3a and 3b would enlarge all elements of the existing system, diversion dam, tunnel diameter (3a is 18-ft diameter, and 3b is 24-ft diameter), and 150-ft elevated concrete outfall flume. Ultimately, this alternative was rejected because it would have taken far too long to construct as the structure would have to be operational during most of the year.

- Alternatives 4a and 4b would construct a new diversion dam, tunnel, and 150-ft elevated concrete outfall flume just upstream of the existing structure. Alternative 4a, the preferred alternative, incorporates an 18-ft diameter tunnel, while Alternative 4b would incorporate a 24-ft diameter tunnel. Construction of most elements would occur year-round, and the existing diversion system would be used to divert flows around active construction at the project site. The existing diversion system would also function as a redundant system should the new system fail or become overwhelmed. Alternative 4a was selected because it provided a greater cost to benefit ratio than Alternative 4b. Similarly, because of its reduced overall tunnel excavation footprint in comparison with Alternative 4b, and with the implementation of environmental conservation measures, the USACE has determined that Alternative 4a represents the least environmentally damaging practical alternative evaluated under this assessment. Two other alternatives, 4c and 4d, similar in all other aspects to 4a and 4b, had tunnel diameters of 14-ft and 16-ft, respectively. Despite their relative effectiveness in reducing flood risk, there exists only a low incremental cost associated with a larger tunnel diameter for a project of this scale.

- Alternative 5 would create a 25,000-cy debris basin above the existing diversion structure. Theoretically, this basin would be excavated on an annual basis in the wintertime and would be able to absorb the quantity of material

estimated to be currently discharged at the alluvium of the outfall point. This alternative was determined to have the greatest impact to the aquatic environment of all the alternatives.

- Alternative 6 would address flood risk to through means other than diversion of Lowell Creek's surface flow through Bear Mountain. 6A would create a diked floodway through town immediately downstream of the mouth of Lowell canyon. 6B would reduce risk to critical structures by relocating all structures from the mouth of Lowell Canyon to a northern location along the Seward Highway. 6C would reduce risk to most structures in proximity to the mouth of Lowell Creek, but would leave the hospital. 6D would only relocate residential structures in immediate proximity to the mouth of Lowell Canyon.

3.3. Compliance with Applicable State Water Quality Standards

The proposed project is not expected to have an appreciable adverse effect on water supplies, recreation, growth, and propagation of fish, shellfish, and other aquatic life, or wildlife. It is not expected to introduce petroleum hydrocarbons, radioactive materials, residues, or other pollutants into waters of the United States.

On 21 December 2020, in accordance with Section 401 of the Federal Clean Water Act and the Alaska Water Quality Standards (18 AAC 70), ADEC issued a Certificate of Reasonable Assurance to the USACE, Alaska District for placement of dredged and/or fill material in waters of the U.S. including wetlands and streams in association with improving flood diversion capacity at Lowell Creek, in Seward, Alaska.

3.4. Compliance with Applicable Toxic Effluent Standard or Prohibition under Section 307 of the Clean Water Act (CWA)

No toxic effluents that would affect water quality are associated with the proposed project. Therefore, the proposed project complies with the toxic effluent standards of Section 307 of the CWA.

3.5. Compliance with the Endangered Species Act (ESA) of 1973

The proposed project is compliant with the ESA.

3.6. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972

There are no designated marine sanctuaries in the vicinity of the project site.

3.7. Evaluation of the Extent of Degradation of the Waters of the United States

The proposed project would not affect water quality in either Lowell Creek or Resurrection Bay.

3.7.1. Significant Adverse Effects on Human Health and Welfare

3.7.1.1. Municipal and Private Water Supplies

The proposed project would have no effect on municipal and private water supplies.

3.7.1.2. Recreation and Commercial Fisheries

The proposed project would have no effect on recreation and commercial fisheries.

3.7.1.3. Plankton

The proposed project would have no effect on plankton.

3.7.1.4. Fish

The proposed project would have no effect on fish.

3.7.1.5. Shellfish

The proposed project would have no effect on shellfish.

3.7.1.6. Wildlife

The proposed project would have no effect on wildlife.

3.7.1.7. Special Aquatic Sites

The proposed project would have no effect on special aquatic sites.

3.7.2. Significant Adverse Effects on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems

The proposed project would have no significant adverse effects on life stages of aquatic life and other wildlife dependent on aquatic ecosystems.

3.7.3. Significant Adverse Effects on Aquatic Ecosystem Diversity, Productivity, and Stability

The proposed project would have no significant adverse effects on aquatic ecosystem

diversity, productivity, and stability.

3.7.4. Significant Adverse Effects on Recreational, Aesthetic, and Economic Values

A slight modification of the aesthetic properties of the outfall waterfall would occur as a result of the implementation of the proposed project. No effects to recreational or economic values are expected as a result of the proposed project.

3.8. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem

In-stream construction activities would be conducted during the lowest flow period of Lowell Creek's hydrograph.

Similarly, best management practices would be utilized and a spill response plan would be developed for in-stream construction activities.

4. FINDING OF COMPLIANCE FOR LOWELL CREEK FLOOD DIVERSION IFR/EA

1. No significant adaptations of the guidelines were made relative to this evaluation.

2. Six alternatives were evaluated as part of the IFR/EA of reducing flood risk to the community of Seward from Lowell Creek.

3. The planned emplacement of fill material in the Lowell Creek channel will not violate any applicable state water quality standards. Implementation of the proposed project will not violate the Toxic Effluent Standards of Section 307 of the CWA.

4. Implementation of the proposed project will not affect any endangered species or their critical habitat.

5. The proposed implementation of fill material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected.

6. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values will not occur.

7. Steps to minimize potential adverse impacts of the proposed project on aquatic systems include seasonal construction and developing best management practices.

8. Based on the guidelines, the proposed project is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

5. REFERENCES

Stauffer, C.
2010. Learning to Live with Water: A History of Flooding in Seward, Alaska: 1903–2009. Seward/Bear Creek Flood Service Area.

U.S. Army Corps of Engineers (USACE)
1978. Lowell Creek Dam, AK00060 Seward, Alaska; Phase I Inspection Report National Dam Safety Program. Prepared by the Alaska District, U.S. Army Corps of Engineers, for the State of Alaska and City of Seward. November.

U.S. Fish and Wildlife Service (USFWS)
2020. National Wetlands Inventory Wetlands Mapper. Online document, https://www.fws.gov/wetlands/data/mapper.html.

U.S. Geological Survey (USGS)
1992. Water Quality Samples for Alaska: USGS 15238500 Lowell C at Seward AK. Online document, http://nwis.waterdata.usgs.gov/ak/nwis/qwdata/?site_no=15238500&agency_cd=USGS&inventory_output=0&rdb_inventory_output=file&TZoutput=0&pm_cd_compare=Greaterthan&radio_parm_cds=all_parm_cds&format=html_table&qw_attributes=0&qw_sample_wide=wide&rdb_qw_attributes=0&date_format=YYYYMMDD&rdb_compression=file&submitted_form=brief_list