

CITY OF KOTZEBUE

RESOLUTION NO. 26-34

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF KOTZEBUE SUPPORTING THE PREFERRED ALTERNATIVE FOR THE SWAN LAKE/LAGOON LOOP REPLACEMENT PROJECT.

WHEREAS, the City of Kotzebue is responsible for protecting the health, safety, and welfare of its residents and maintaining essential public infrastructure to the best of its ability with available fiscal resources from various state and federal agencies which the City has continuously sought over the years;

WHEREAS, the water main infrastructure serving the Swan Lake / Lagoon Loop area is some of the oldest infrastructure in the City and is in need of replacement to improve reliability, reduce the risk of water service interruptions, and support the long-term integrity of the City's water distribution system;

WHEREAS, in 2024, this aging water main infrastructure serving the Swan Lake Loop area suddenly and unexpectedly failed and the City of Kotzebue experienced a State-declared disaster in which the water loop froze, impacting nearly 700 residents, some of whom were left without running water and sewer services for a period of approximately eight weeks. This catastrophic disaster in the winter of 2023-2024 resulted in a flurry of emergency actions taken by the City including, *inter alia*, the passage of Resolutions 24-07, 24-08, 24-14, 24-16, 24-17, 24-18, 24-19, 24-23, 24-43, 24-69 and PW Purchase Order 24-031 for which the City is still pursuing disaster relief from the State of Alaska, AK-24-301, Kotzebue Waterline Freeze;

WHEREAS, this sudden, unexpected disruption demonstrated the urgent need to replace not only the Swan Lake Loop but also the antiquated Lagoon Loop water mains in order to prevent further service failures;

WHEREAS, in addition, after this disaster, Maniilaq Association has started multiple housing and hospital projects that will require water service from Lagoon Loop;

WHEREAS, the City of Kotzebue has identified the replacement of water mains in the Swan Lake / Lagoon Loop area as a priority infrastructure need; and

WHEREAS, the Preliminary Engineering Report for the Swan Lake / Lagoon Loop project has been completed and identifies the project scope and a preferred alternative as a replacement of Swan Lake Loop and Lagoon Loop with reconfiguration to balance the length of all of the City's loops.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Kotzebue hereby supports the preferred alternative as presented in the April 2026 Preliminary Engineering Report.

BE IT FURTHER RESOLVED that the City Council finds this project to be necessary to protect public health, safety, and welfare, and to improve the reliability and long-term sustainability of the City's water infrastructure.

BE IT FURTHER RESOLVED that the City Council directs City Staff and Consultants to pursue capital project funding to execute this important project.

PASSED AND APPROVED by a duly constituted quorum of the City Council of the City of Kotzebue, Alaska, this 6th day of August 2026.

CITY OF KOTZEBUE

Saima Chase
Mayor

ATTEST:

[SEAL]

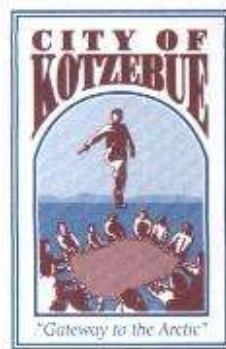
Donald Jones Jr
City Clerk

Attachments:

- **Exhibit A:** April 2026 Preliminary Engineering Report [64 pages]

KOTZEBUE, ALASKA WATER MAINS REPLACEMENT 95% PRELIMINARY ENGINEERING REPORT

PREPARED FOR:



CITY OF KOTZEBUE
602 THIRD AVENUE
KOTZEBUE, AK 99752

PREPARED BY:



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APRIL 2026

SEALS PAGE

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

Prepared by Chase Nelson, P.E.

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APPENDIX 6: Alternative 3 Capital Cost Estimate

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ACRONYMS AND ABBREVIATIONS

AAC.....	Alaska Administrative Code
ADD	Average Daily Demand
ADEC.....	Alaska Department of Environmental Conservation
ADOLWD	Alaska Department of Labor and Workforce Development
APE	area of potential effect
bgs.....	below ground surface
BIA	Bureau of Indian Affairs
City	City of Kotzebue
CSMP	contaminated sites management plan
District.....	Kotzebue Archaeological District
DOE	determination of eligibility
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA.....	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
gpd	gallons per day
HDPE	High Density Polyethylene
IC	institutional control
IHS.....	Indian Health Services
KEA	Kotzebue Electric Association
KIC	Kikiktagruk Inupiat Corporation
LF.....	linear feet
LS.....	lift station
NANA.....	Northwest Arctic Native Association
NEPA.....	National Environmental Policy Act
NHPA.....	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historical Places
NWAB.....	Northwest Arctic Borough
O&M.....	operations and maintenance
PER	Preliminary Engineering Report
PDD	Peak Day Demand
PHD	Peak Hour Demand
ROW	right-of-way
SDC.....	Seismic Design Category
SHPO	State Historic Preservation Office
UAS.....	Unmanned Aerial Systems
USACE.....	U.S. Army Corps of Engineers
USFWS.....	U.S. Fish and Wildlife Service
WO	work orders
WTP.....	water treatment plant

EXECUTIVE SUMMARY

DOWL has entered into an agreement with the City of Kotzebue (City) to provide an engineering analysis of alternatives for replacing the Swan Lake and Lagoon water main loops. The analysis is prepared in the Preliminary Engineering Report (PER) format that follows the guidance provided by the U.S. Department of Agriculture Rural Utilities Service Bulletin 1780-2 for water and wastewater.

The City of Kotzebue intends to replace Lagoon Loop and Swan Lake Loop circulating water mains and services due to additional demand being added from planned future development and the hydraulic advantage of balancing the existing circulating loops for improved service and longevity of the system. In addition, the loops are 30 and 35 years-old, pushing them past their original design life of 20 years. The mains and the services require frequent repairs and maintenance compared to the other newer loops. An extreme example of one of the repairs was in February 2024 when a section of Swan Lake Loop failed near the south end of Adams Street leaving approximately 160 homes (700 to 800 people) without water service and fire protection water for up to a month. The failure led to widespread freeze-ups in the main and service lines upstream and downstream of the failure point. As water was not circulating in this loop, sewer demand also dropped resulting in sewer service freeze-ups and more catastrophic damage and financial burden on the community. The 2024 repair of Swan Lake Loop cost the City nearly \$1 million to repair.

The three alternatives discussed in this PER include:

- Alternative 1 – No Action
- Alternative 2 – Replace Swan Lake and Lagoon Loop in the Original Location
- Alternative 3 – Replace Swan Lake and Lagoon Loop in Reconfigured Alignments

The preferred alternative is Alternative 3 – Replace Swan Lake and Lagoon Loops in reconfigured alignments and upsize all the existing 6-inch pipe to 8-inch HDPE. The preferred alternative is proposed in prioritized phases with the initial phase of work focusing on the design and construction of the highest priority areas of Lagoon Loop. The anticipated capital cost for the first phase is \$15.8 million.

1.0 PROJECT PLANNING

1.1 LOCATION

Kotzebue (Figure 1) is located on a 3-mile-long spit at the end of the Baldwin Peninsula in Kotzebue Sound just northeast of the Bering Strait, 549 miles northwest of Anchorage and approximately 26 miles north of the Arctic Circle. (Figure 2). The latitude is 66 degrees, 54 minutes north and longitude is 162 degrees, 38 minutes west. The spit varies from about 1,100 feet in width to 3,600 feet in width and is about 10 to 20 feet above sea level (Figure 3). The current “core” community is located on the land designated as a town site under the Alaska Native Townsite Act of 1926 and contained in four United States Surveys starting in 1952.



Figure 1: Photo of Kotzebue

Within the region there are 2,000-foot-high mountains, four river systems, bluffs, sand dunes, muskeg, swampy lowlands, and even desert characteristics. This geographic, geological, vegetative, and ecosystem diversity allowed people to inhabit the area for thousands of years, living off the resources that could be gathered locally. The land’s diversity has supported Kotzebue’s predominately subsistence lifestyle into the 21st century.

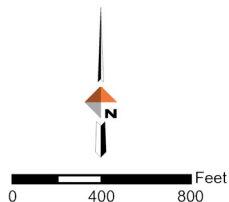
Kotzebue is a geographic gateway to the region, making it historically and currently the cultural hub of the region. The NANA Regional Corporation has conducted several Elder’s Conferences in Kotzebue over the past decade. These conferences provide important information on the regional and community history, culture, and changes over time. They also provide the vehicle for social identification and pride in heritage amongst the region’s native residents. A NANA museum located in Kotzebue capitalizes on this wealth of heritage and provides interpretation to visitors. The National Park Service (NPS) has an office in Kotzebue because the community offers a gateway to National Monuments and Parks.



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— Existing Water Loops



Topography

City of Kotzebue Water Mains Replacement PER



Date: April 2026

Figure 3

Exhibit A to Resolution 26-34 for RCCM August 6, 2026

1.1.1 TRANSPORTATION

Air is the primary means of transportation year-round. The state-owned Ralph Wien Memorial Airport supports daily jet service to Anchorage and several air taxis to the region's villages. It has a crosswind gravel runway. A seaplane base is also operated by the state just west of runway 18-36 (oriented North/South) on Isaac Lake. The shipping season lasts 100 days, from early July to early October, when Kotzebue Sound is ice-free. Due to river sediments deposited by the Noatak River four miles north of Kotzebue, its harbor is shallow. Deep draft vessels must anchor 15 miles out, and cargo is lightered to shore and warehoused. Crowley Marine Services and Alaska Marine Lines operate shallow draft barges to deliver fuel and cargo, respectively, to area communities. There are 26 miles of local gravel road used by cars, trucks, and motorcycles during the summer. Snow machines are preferred in winter for local transportation [1].

1.2 ENVIRONMENTAL RESOURCES PRESENT

1.2.1 LAND USE/OWNERSHIP

The City of Kotzebue is the local Municipal Government that was established pursuant to Alaska Statutes Title 29. Kotzebue is under jurisdiction of the Northwest Arctic Borough (NWAB) and as such is subject to NWAB Title 9 permitting (zoning and land use) (Figure 4). The regional corporation is NANA Regional Corporation, Inc. The corporate city limits of Kotzebue are classified as a "Village District" and as such, the proposed project meets the definition of a "major use" per 9.12.020 C.13 of NWAB code, which would require a public review of permit applications.

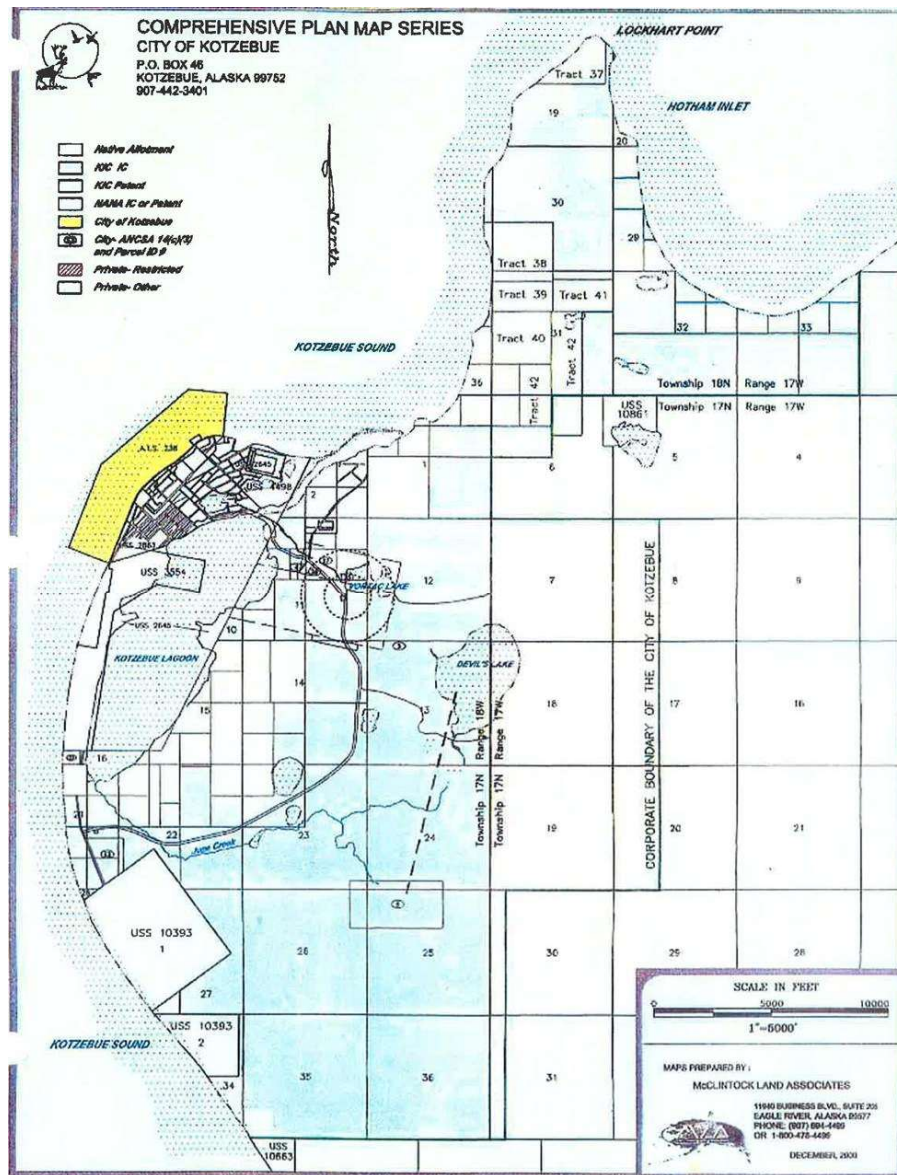


Figure 4: Kotzebue Municipal Boundaries and Land Ownership

The current Kotzebue Municipal Code identifies three categories of land use: General Use (KMC 17.16), Commercial Use (KMC 17.20), and Industrial Use (KMC 17.24), with a "grandfather" clause to allow for the continuation of existing uses (KMC 17.32). Additionally, an RS3477 Trail (RST 122 Kotzebue-Noatak Trail), is present as a "public highway" right-of-way for public lands according to Alaska law [2]. Figure 4 provides an overview of landownership and, to some extent, land use within the City of Kotzebue. The figure is from the City of Kotzebue Comprehensive Plan prepared in the year 2000. The map does not show specific use designations, boundaries, or districts, as none are currently defined or depicted for Kotzebue, despite Kotzebue Municipal Code (KMC) 17.12.010 indicating the existence of such a map.

1.2.1.1 KIC AND ANCSA 14(C) RECONVEYANCES

Most of the lands held by the Kikiktatruk Inupiat Corporation (KIC) have been transferred from the Bureau of Land Management (BLM) as Interim Conveyances (IC). These lands are subject to valid existing rights and subsequent surveys, meaning they are not identical to patents. One such valid existing right involves the Native Allotments, for which final boundaries have not yet been determined. Additionally, the ICs are issued under the statutory requirement for reconveyance to existing users as of 1971, as specified in ANCSA Sections 14(c)(1), (2), (3), and (4). These rights include those of occupants (as of 1971) of residences, businesses, churches, and similar structures (Sections 14(c)(1) and (2)), municipal expansion uses not to exceed 1,280 acres (Section 14(c)(3)), and existing airports (Section 14(c)(4)).

The BLM's regulations and policies for implementing surveys of these reconveyances require the village corporation to hold public meetings to identify prospective 14(c) stakeholders or valid users. Once all stakeholders have been identified and agreed upon (such as through the City's 14(c)(3) Agreement completed in 1996), the information is to be placed on a Map of Boundaries, which is then filed with the BLM. The BLM enters this map into the public land records, officially notifying the public. After one year of notice, the BLM arranges for surveys of these tracts, and upon completion, the village corporation issues deeds to the appropriate parties. Although KIC has not yet filed the Map of Boundaries, it is believed that the identification of rights holders has been completed.

1.2.1.2 NATIVE ALLOTMENTS

Individual Native Allotments are managed under BLM until conveyed, after which the Bureau of Indian Affairs (BIA) and the Indian Reorganization Act (IRA) act as a "638" Contractor to assist in approving individual land uses. These lands, along with restricted townsite lots in the core area, are only subject to municipal ordinances if the government determines it is in the owner's best interest. This makes the enforcement of land use designations more complex.

There are as many as 94 Native Allotments in the vicinity, many of which lie within the municipal boundaries. Most of these allotments have now been adjudicated and surveyed to determine their precise boundaries. Once certificates are issued, the individual allotment holders, with assistance from the IRA and BIA, can more effectively manage their land for purposes such as homesites, leasing for development, gravel sales, land sales, subdivision, or subsistence use and protection.

1.2.1.3 RIGHTS OF WAY

The City owns the Rights of Way in the project area where the water mains are aligned.

1.2.2 WETLANDS

The National Wetlands Inventory (NWI), administered by the U.S. Fish and Wildlife Service (USFWS), has classified a significant area within the City of Kotzebue, south of Caribou Drive and 5th Avenue and east



of Bison Street, as freshwater emergent wetlands. Estuarine and subtidal wetlands are also mapped in Kotzebue, adjacent to waterbodies (Figure 5). Aerial imagery for the NWI map shows the project area is heavily developed.



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NW1 Wetlands		Existing Water Loops	
	Estuarine and Marine Deepwater		Lagoon
	Estuarine and Marine Wetland		Swan Lake
	Freshwater Emergent Wetland		
	Freshwater Pond		
	Riverine		

National Wetlands Inventory	
City of Kotzebue Water Mains Replacement PER	
	Date: April 2026
	Figure 5

Exhibit A to Resolution 26-34 for RCCM August 6, 2026

1.2.3 CLIMATE

Average monthly temperatures and precipitation for Kotzebue during the period between 1991 and 2020 from the National Oceanic and Atmospheric Administration (NOAA, 2025) are shown in Table 1. An additional climate summary is provided in Table 2.

Table 1: Average Monthly Temperatures and Precipitation (1991-2020)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Temperature (°F)	-1.9	1.4	1.5	16.3	33.1	47.5	55.3	52.1	43.1	26.9	10.8	2.4
Precipitation (inches)	0.62	0.85	0.52	0.56	0.44	0.60	1.60	2.13	1.42	1.07	0.82	0.73

Table 2: Climate Summary (1991-2020; NOAA 2025)

Climate Category	Value
Mean Annual Precipitation	11.4 in
Mean Annual Snowfall	64.2 in
Mean Maximum Temperature July	60.1 °F
Mean Maximum Temperature January	4.5 °F
Mean Minimum Temperature July	50.5 °F
Mean Minimum Temperature January	-8.4 °F
Average Annual Temperature	24 °F

1.2.3.1 TEMPERATURE

Kotzebue's transitional climate typifies arctic tundra and marine biomes. During the ice-free season, May through October, a maritime climate prevails. Skies are mostly cloudy, daily temperatures are relatively uniform, and the relative humidity is higher. The mean July maximum temperature from 1991 to 2020 is approximately 60.1 degrees Fahrenheit (F) (NOAA 2025). The warmest temperatures are usually observed in the month of July. When Kotzebue Sound freezes, the climate characteristics approach continental type. Daily temperatures vary, skies are cloudy only about half the time, and relative humidity drops/decreases. The mean minimum temperature in January (usually the coldest month) from 1991 to 2020 is -8 degrees F (NOAA 2025).

1.2.3.2 PRECIPITATION

The Kotzebue area receives only very light precipitation, with the total rainfall for normal years at approximately 11 inches (NOAA 2025). More than half of the yearly precipitation occurs in July, August, and September. The average annual snowfall is approximately 5.4 feet.

1.2.3.3 WIND

Winds in the Kotzebue area vary with the seasons. The prevailing annual wind direction is from the east (September through April). During the summer months westerly winds dominate. The average wind speed at the Kotzebue Electric Association's (KEA's) wind farm is 14.1 miles per hour (mph), with summer storms commonly producing wind speeds of 28 mph for six-hour periods. Winds in the winter can be even stronger. The ten-year high wind speed is estimated to be 64 mph, and winds greater than 55 mph have been recorded from all directions except the north and northeast.

1.2.4 GROUNDWATER

The average depth to water table in the summer months is 5 to 7 feet below ground surface (bgs) [3] perched above underlying permafrost which acts as an impermeable layer to underlying geologies (USGS 1995). The statement is supported by a geotechnical review of subsurface information performed specifically for this PER, provided in Appendix 1. Where permafrost is absent, groundwater could be hydraulically connected to the Kotzebue Sound and the Lagoon and susceptible to saltwater/brackish water intrusion as levels fluctuate with tides and storms. The general direction of groundwater flow likely changes based on the region of town if groundwater flow follows surface topography. Variable shallow permafrost conditions created by development impacts likely channelize groundwater in certain areas. In winter groundwater conditions change. Groundwater is found to be absent in many places as frost migrates down and joins the top of the permafrost and there is a lack of recharge to the subsurface. Groundwater levels have been measured in summer months at shallower depths (~1 feet bgs) in less developed areas that is likely attributed to shallower permafrost and less permeable soil deposits. In addition, historic summer groundwater level measurements available for review were concentrated in areas with higher ground surface elevations. Shallower groundwater levels may be observed further south and east in Kotzebue due to lower land surface elevations and proximity to water bodies.

1.2.5 GEOLOGY, VEGETATION, AND SOILS

1.2.5.1 GEOLOGY

The Baldwin Peninsula is composed of unconsolidated quaternary sediments. These sediments are primarily eolian, glacial, and marine in origin. Illinoian glaciers deposited till and outwash over marine sediments. Loess (windblown silt) was deposited over the glacial sediments during the retreat of the Illinoian glaciers. The sea level rose following the glacial retreat, and in some areas, marine sediments were deposited over the eolian silts.

Late Wisconsin and Holocene sediments, primarily re-transported loess and thaw-lake deposits, comprise the surface soils that cover virtually all of the Baldwin Peninsula and the surrounding lowlands. The oldest sediments exposed in the coastal bluffs of the peninsula are marine clays, silts, and fine sands upon which the glacial sediments were deposited.

1.2.5.2 VEGETATION

The predominant vegetation type on the Baldwin Peninsula is moist coastal tundra and tundra ecosystems usually form a complete ground cover and are extremely productive during the growing season. Variation includes almost continuous, uniformly developed cotton grass tussocks with sparse growth of other sedges and dwarf shrubs, to stands where tussocks are scarce or lacking and dwarf shrubs dominate. Within the project area, however, vegetation is noncontiguous due to development, gravel roads and other disturbances. Vegetation is characterized by willows and alders in disturbed area that is not subject to permanent or semi-permanent saturation. In low-lying areas between structures, adjacent to ponds and waterbodies, or in ditches, cottongrass and other sedges are present.

1.2.5.3 SOILS

A desktop review of historical geotechnical information within 100 feet of the project area was performed and summarized in a report provided in Appendix 1. Based on the review, the subsurface soils in developed areas near Lagoon and Swan Lake Water Loops are anticipated to consist of gravel fill

material 5 to 10 feet thick over native alternating layers of silty sand with gravel, silt with gravel, and silty sand to a depth of 60 feet. Layers of gravel with varying levels of sand and silt were observed in select locations near between 3rd and 5th Avenue southwest of Lagoon Street.

1.2.5.4 PERMAFROST

The Baldwin Peninsula is located within the zone of continuous permafrost (soils colder than 32 °F for multiple years). A review of air photos indicates wet tundra, thaw lakes, polygonal ground and beaded drainage which are all indicative of near surface permafrost. The depth of the bottom of permafrost is probably between 200 and 300 feet. A well drilled on the spit at Kotzebue in 1949 and 1950 encountered the bottom of permafrost at a depth of 238 feet. A well drilled near Nimiuk Point in 1974 encountered an interpreted bottom of permafrost at a depth of 284 feet.

Permafrost monitoring from 1986 to 2021 to a depth of 95 feet (29 m) below ground surface (bgs) indicates that the permafrost near Kotzebue is warming (Permafrost Laboratory 2022). Data is collected at a monitoring station operated by the University of Fairbanks Permafrost Laboratory and is located just south of the landfill. Measurements from 1986 show the temperature of the permafrost was approximately 24 degrees Fahrenheit from 5 to 95 feet bgs. A warming trend is observed in the publicly available data since 1986. Recent measurements performed in July of 2021 indicate that temperatures of the permafrost to the depth of monitoring now range from 24 to 26 degrees Fahrenheit with the greatest increase in temperature from 1986 observed around 32 feet (10 meters).

The active layer is likely 2 to 6 feet deep in undisturbed areas; however, in areas with dense development like the project area it may extend deeper due to the lack of insulation from organics and snow.

Permafrost is generally present near the project area at a depth of 8 to 13 feet bgs; however, it may be shallower in less developed areas. Some permafrost may be unbonded or appear thawed due to salinity. Salinity concentrations within the soil lowers the freezing temperature of water causing permafrost to be unbonded and soft. Generally, for every 1 parts per thousand (ppt) salinity the freezing point depression is approximately 0.1°F. The most recent salinity measurements taken from the area have ranged from 2.2 to 18.2 ppt with higher values often associated with depths below 15 feet.

1.2.6 EROSION, FLOOD, SEISMIC, AND TSUNAMI HAZARDS

1.2.6.1 FLOODING

The Federal Emergency Management Agency (FEMA) last mapped flood hazard areas in Kotzebue in 1983, as the City of Kotzebue participates in the National Flood Insurance Program [4]. Most areas within Kotzebue are classified as Zone C, which are identified as areas of minimal flooding and not within the regulatory floodplain (Figure 6). However, there are areas within the project area that are located in areas that are below the regulatory 100-year base flood plain (Zone A). The base flood plain elevation is however different depending on the location in Kotzebue. The 100-year base flood elevation is 9 feet MLLW along the north and northwest coast that borders Kotzebue Sound (Zone A4). The project area located in this zone is east of Wanda Street and Alice Street. The base flood elevation, however, is 7 feet MLLW along Kotzebue Lagoon (Zone A2). The project area located in this zone is just north of the airport east of 3rd Avenue and south of Otter Street. Construction in these areas may require City of Kotzebue planning approval.

This map illustrates the proposed development zones for the Rialto Beach area. The zones are labeled as follows:

- ZONE A**: Located in the central and southern parts of the map.
- ZONE B**: Located along the northern and western boundaries.
- ZONE C**: Located in the central part of the map, adjacent to Zone A.
- ZONE A2**: Located in the southern part of the map, near the lagoon.
- ZONE A4**: Located in the northern part of the map, near the beach.

The map also shows several streets, including Ocean Lane, Shore Lane, and various residential streets like 1st Street through 10th Street. A large body of water, labeled 'LAGOON', is situated to the east of the main landmass. A note at the bottom left indicates the 'LIMIT OF DETAIL STUDY'.

Kotzebue experienced significant flooding events in October 2024 and again in October 2025 due to a fall storm. The estimated flood extent 6.4 feet MHHW (7.1 MLLW) is shown in Figure 7 produced by the USGS. The flood extents are similar to those depicted in Figure 6. The areas that experienced storm flooding have also been identified as areas of seasonal flooding from snow melt. A study is in progress to estimate future impacts and develop recommended engineered drainage and control to limit future flooding in these areas.



Figure 7: Extent of flood water from October 22, 2024 storm

1.2.6.2 EROSION

Historically Kotzebue has observed both shore erosion and land surface erosion. A USACE Erosion Assessment (2009) identified linear extent of erosion along Shore Avenue, from Lake Street near the airport to Crowley Marine Dock and along the west side of town estimated an erosion rate of 1 to 3 feet per year. The Shore Avenue sheet pile seawall was constructed in 2011 has halted erosion along a portion of Shore Avenue; however, the areas between the existing seawall and the Crowley dock and

south between the riprap protecting Shore Avenue and the airport are still experiencing erosion, as is the north side of the city. The area to the north has been armored with barrels, gabion baskets, and boulders periodically since the 1980s, but still experiences shoreline damage due to sea ice rideup/pileup. A portion of the road has eroded, and sea ice has threatened and piled up within feet of the four residences. The areas threatened by erosion include a boat launch, boat storage and repair structures, and sites of significant cultural and archeological value.

Land surface erosion has resulted in the past from flowing water during rain, snowmelt runoff and receding flood waters. Kotzebue has a limited storm drain system and the existing ditches and culverts do not form a continuous drainage system and are inadequate to handle large runoff or snowmelt events. Roadway erosion has been primarily documented after being submerged in ponded water. The roadway material is transported into the ditches and culverts, further reducing capacity.

1.2.6.3 LIQUEFACTION AND SEISMICITY

Kotzebue is in Seismic Design Category (SDC) D, according to the 2003 International Building Code. While the risk of major seismic activity in Kotzebue is known to be low, structural design of significant buildings or other structures must comply with the requirements stipulated for this SDC rating.

Liquefaction could occur during a significant seismic event due to the granular soils and shallow groundwater table; however, again, the risk is low.

1.2.6.4 TSUNAMI RISK

Based on previous hazard planning conducted in 2014 and 2019, tsunami/seiche were not an applicable hazard for the City of Kotzebue. Kotzebue is not a community of interest according to the Tsunami Hazard Map and Tsunami Inundating Map from the State of Alaska (DOWL 2024)

1.2.7 CLIMATE CHANGE CONSIDERATIONS

Climate change in recent years includes a delayed onset of winter. The later formation of ice cover in Kotzebue Sound has resulted in severe erosion of the Kotzebue shoreline from waves generated by high seasonal winds out of the northwest in October and even as late as November. The impacts of climate change on sea ice around Kotzebue is being studied in detail by the Silkaagvik Sikukun research project that combines state-of-the-art geophysical observations from Unmanned Aerial Systems (UAS) with a community-engaged research approach.

Climate change is evidenced by an average annual air temperature increase of 3.1°F with most of the change (6.8 °F) occurring in the winter and 1.5°F occurring in the fall (ANTHC 2012). This increase has led to thawing permafrost, an increase in intense storms, rising sea levels, and a reduction in shorefast sea ice. This is leading to coastal erosion, more extreme flooding, small ponds drying up and more ground failure around waterbodies [5].

More extreme weather patterns are expected in general for the region.

1.2.8 HISTORY AND CULTURE

Kotzebue has been occupied by the Inupiat for at least 600 years. "Kikiktagruk" was the hub of ancient Arctic trading routes long before European contact, due to its coastal location near several rivers. The German Lt. Otto Von Kotzebue "discovered" Kotzebue Sound in 1818 for Russia. The community was named after Kotzebue Sound in 1899 when a post office was established. Since the turn of the century, expansion of economic activities and services in the area have enabled Kotzebue to develop relatively rapidly. The city was incorporated in 1958. An air force base and White Alice Communications System were later constructed.

The residents of Kotzebue are primarily Inupiat, and subsistence activities are an integral part of the lifestyle. Each summer, the North Tent City fish camp is set up to dry and smoke the season's catch.

1.2.8.1 CULTURAL RESOURCES AND HISTORIC SITES

The project lies within the Kotzebue Archaeological District (District). The boundary of the district includes the entire Kotzebue Spit, but very few features or concentrations of cultural resources within the district have been defined. The district has been determined eligible for the National Register of Historic Places. The District contains both historic and pre-contact Indigenous resources, with cultural affiliations to the Thule and Iñupiaq cultures. Based on the broad distribution of cultural resources within KTZ-00036, it is likely cultural resources will be encountered during the project.

Of 21 sites documented in the Alaska Heritage Resources Survey, four sites are eligible for inclusion in the National Register of Historic Places (NRHP) and 17 are not eligible.

1.2.9 ENDANGERED SPECIES

According to the USFWS, there are three species listed under Section 7 of the Endangered Species Act (ESA) that occur within the terrestrial areas of Kotzebue.

◆ Polar Bear (*Ursus maritimus*)

On May 15, 2008, the Service listed Polar bears as threatened (73 FR 28212). In 2016, the Ninth Circuit Court of Appeals upheld the Service's designation of 187,000 square miles of the Arctic Ocean, the Bering Sea, and Alaska's northern coast as critical polar bear habitat, in an effort to mitigate for future threats and impacts associated with climate change and declining Arctic Sea ice. Although Polar bears may occasionally pass through and their critical habitat includes Kotzebue, preferred Polar bear habitats, such as those used for denning, feeding, and resting are not present in town. Due to low densities of the species and the presence of existing infrastructure, impacts to habitat or bears as a result of the project are anticipated to be insignificant.

◆ Spectacled eider (*Somateria fischeria*) and Steller's eider (*Polysticta stelleri*)

The Service listed the spectacled eider as threatened on May 10, 1993 (58 FR 27474) and the Alaska-breeding population of the Steller's eider as threatened on June 11, 1997 (62 FR 31748). Although both spectacled and Steller's eiders may migrate through Kotzebue, neither species currently nests nearby. No risks to either eider is anticipated as the largest threat to their migration route is through collision with poles, towers, and other man-made structures.

1.2.10 CONTAMINATED SITES

Hazardous waste site databases managed by the DEC or the federal government were reviewed to determine if any documented active sites or sites within institutional controls are within 1,500 ft of the project. The search radius was based on DEC requirements for de-watering permits and approved contaminated sites management plan (CSMP) prior to construction.

There are 15 active sites within 1,500 feet of the project (one with a documented groundwater plume), three informational sites, and two sites that have a status of cleanup complete but have institutional controls (ICs)¹(ADEC 2024), as shown in Table 3.

Table 3: Contaminated Sites in the Project Area

Site Name	Hazard ID #	Status
Kotzebue Airport - ADOT&PF Maintenance Station	25111	Active
KEA Tank Farm	28016	Active
FAA Kotzebue Former Flight Station	814	Active
ADOT&PF MarkAir (Former Cargo Bldg.) - Kotzebue Airport	2497	Active
Residence - 1004 Otter Street	3252	Active
Nullagvik Hotel - Kotzebue	4221	Active
Hanson Trading Company UHOT	4504	Active
Kotzebue Airport - Alaska Airlines	24439	Active
Kotzebue Airport - Northwestern Aviation	24444	Active
Kotzebue Airport - Crowley	24895	Active
Maniilaq Association Family Crisis Center - Kotzebue	25371	Active
Kotzebue Airport - Lot M Block 1	25557	Active
Kotzebue Former IHS/BIA Hospital - School Pipeline Release	25558	Active
Kotzebue IRA Lagoon Street Bldg	26693	Active
Kotzebue Catholic Church	26930	Active
NANA Multi-Purpose Building	3829	Cleanup Complete - Institutional Controls
AT&T Alascom Kotzebue Earth Station	571	Cleanup Complete - Institutional Controls
City of Kotzebue Areawide	394	Informational
Kotzebue Areawide	25418	Informational
Kotzebue Airport Sitewide PFAS	27801	Informational

¹ Institutional controls (IC) are instituted when contamination remains above cleanup levels without an unacceptable risk to human health or the environment. Sites with ICs usually require coordination with ADEC if construction is on or immediately adjacent to the site boundary. Most ICs will have use restrictions and possible monitoring requirements, and these may include monitoring, groundwater use restrictions, and soil and groundwater removal restrictions.



Exhibit A to Resolution 26-34 for RCCM August 6, 2026

1.3 POPULATION TRENDS

Kotzebue's population was estimated at 3,102 people in the 2020 Census. The population decreased by approximately 3.1 percent, or 99 people, since the 2010 Census. The Alaska Department of Labor and Workforce Development (ADOLWD) estimated the 2024 population of Kotzebue to be 2,863. Since 1950 the population of Kotzebue has increased with the exception of the period between 2010 to 2024 (Table 4).

ADOLWD projects that the population of the Northwest Arctic Borough (NAB) will be fairly stable; however, declining at a rate of approximately -0.2% annually. Assuming a similar projection for Kotzebue, the projected population of Kotzebue in 2045 will be 2,745 people/residents (Table 4). A DOLWD projections do not account for anticipated Kotzebue developments as explained in the subsequent section.

Table 4: Kotzebue Population Historic and Projected

Year	Population	Average % Change/Year
1950	623	6.1
1960	1,290	10.7
1970	1,696	3.2
1980	2,054	2.1
1990	2,751	3.4
2000	3,082	1.4
2010	3,201	0.4
2020	3,102	(0.3)
2024*	2,863	(2.0)
2030**	2,829	(0.2)
2035**	2,801	(0.2)
2040**	2,773	(0.2)
2045**	2,745	-

*Population based on ADOLWD estimate

1.3.1 RECENT AND FUTURE ECONOMIC DEVELOPMENTS

The estimated growth of the population summarized above assumes that economic growth will continue in the region. The Red Dog Mine, the largest zinc mine in the world, is the largest economic driver for the region. The mine not only employs between 500 and 600 people in the NWAB, but also allows the local government to provide services and employment through taxes and fees. The mine also shares profits with NANA Regional Corporation (as well as the village corporation, KIC). The ADOLWD estimated that in 2019, prior to the start of the COVID-19 pandemic, mining, health care, and local government employed 73 percent of the workforce in Kotzebue. There is also a seasonal economy in the summer that is focused on tourism and hunting and fishing.

Red Dog Mine is currently evaluating development opportunities on adjacent underground prospects that could substantially extend the mine's life. The current mine is expected to operate until 2031 (NAB 2021).

In addition to the continued operation of Red Dog Mine, additional recent and future proposed developments that have potential to affect economic growth are listed below.

- ◆ Cape Blossom Road and Deep-Water Port – To reduce freight costs associated with lightering, a deep-water port and two-lane gravel road to the port was proposed starting as early as the 1980s. The first phase was completed in 2023 and included the section of road from Hillside Drive to Sadie Creek (DOT&PF 2021). The second phase of the road has been partially funded, and construction may begin in summer 2025. The City of Kotzebue is evaluating potential port sites in the Cape Blossom area as the USACE determined the original port site had unacceptable erosion risk.
- ◆ Ambler Access Project – A 211-mile road is proposed between multiple mineral deposits near Ambler, Alaska and the Dalton Highway. Kotzebue is located approximately 130 miles west of Ambler and future residents may benefit from employment generated by mining development made feasible by the road. The status of the road is in flux as state, federal, and private landowners (including NANA) work out permitting and access disagreements. The Bureau of Land Management and the National Park Service (NPS) granted the road a 50-year easement as of January 2021 (NPS 2021), which was rescinded in 2024.
- ◆ Maniilaq Association, the Regional Tribal Health Organization (THO) has multiple housing projects that will be constructed beginning in 2026. These projects include the 48-unit staff housing that will be served by Lagoon Water Loop, and the 45-unit patient housing that will also be served by Lagoon Loop. Both of these projects will increase water demand along this loop and at the water treatment plant (WTP). Maniilaq Association also has plans to expand the existing hospital to include the Allied Health Facility, which will improve patient services, but also add significant additional demand to Lagoon loop.

1.4 COMMUNITY ENGAGEMENT

Through an extensive process coordinated with City staff and the City Council, and subject to public feedback, the council develops a list of capital project priorities on an annual basis. In 2022, 2023, and 2024, the replacement of Swan Lake and Lagoon Loops was selected as one of the City's top priorities. The emergency in 2024 further raised the importance of the loop replacements, as indicated by its continued inclusion in the 2025 Capital Project Priorities.

DOWL met with the City in Kotzebue November/December of 2024 to kick off the project. A DOWL representative also attended a community council meeting on February 20, 2025, at the Kotzebue Boys and Girls Club where they presented a brief explanation of the project and informed them a DOWL team of two would be accessing residential property along Lagoon and Swan Lake Loops to document cursory conditions of how services enter the home. During the field work to document above ground service line conditions, DOWL staff interacted with a handful of property owners, the majority of which were happy to hear that a project was progressing to update the mains and services.

DOWL meets with City staff on a biweekly basis to discuss projects performed under DOWL's term contract for engineering services for capital projects management. The Swan Lake and Lagoon Loops is a standing agenda item and is discussed at each meeting.

2.0 EXISTING FACILITIES

2.1 RAW WATER SOURCE & CONVEYANCE

The primary water source is Devil's Lake, a natural 165-acre lake located approximately 2.5 miles southeast of the WTP. Submersible pumps located in an elevated intake structure, supported on pipe piles, extract water from the lake. Based on observations made by the City, Devil's Lake levels have continued to rise over the years, providing adequate supply to the City. Improvements to the intake structure are expected in 2026 to address raw water quality changes experienced in the winters of 2022-2024.

The secondary water source is Vortac Lake, an impounded lake located 1.5 miles southeast of the WTP. The lake is impounded by Vortac Lake Dam, which is an earthen dam designed to be frozen and supported by a permafrost foundation. The dam has been determined to be in danger of failure. The City has project to determine if Vortac Lake Dam can be rehabilitated. This project which is ongoing at the time of publishing this PER includes evaluation of the existing Vortac Dam and planning alternatives for repairing it in place or replacing it.

Water is conveyed to the WTP through approximately 2.7 miles (14,400 LF) of insulated 8-inch diameter water main, the majority of which is above ground. The raw water main parallels the Vortac Lake Access Road and then joins the Devil's Lake raw water main near the intersection with Ted Steven's Way. It then turns north and parallels Ted Steven's Way. The main crosses Kotzebue Slough via a suspension bridge and is then buried west of the crossing until the foot bridge. After the foot bridge the main is then buried again until it reaches the WTP.

2.2 WATER TREATMENT PLANT

Water is treated in the new 10,400-SF WTP is designed for a peak demand of 300 gpm using a treatment process of permanganate injection for oxidation before Ultrafiltration, Nanofiltration, and disinfection. A combination of multiple factors (raw water chemistry changes, commissioning challenges, etc.) has led to periods where the WTP was unable to meet the customer demand. Despite a design peak of 300 gpm, the WTP produced approximately 220 gpm. Additional ultrafiltration membranes were installed in May 2025; initial results indicated that water production increased.

The treatment plant includes a water distribution center that has independent circulation pumps for each water loop. The distribution center is further discussed in Section 2.4.

2.3 TREATED WATER STORAGE

Prior to entering the distribution system, treated water is stored in two water tanks, "New" and "Old". The "New" tank is a 1.5M Gallon water tank constructed in 2004 located in the Public Works Compound (PWC). The "Old" tank is also 1.5M gallons, originally constructed in 1970. The "Old" tank was rehabilitated and rewrapped in 2011.

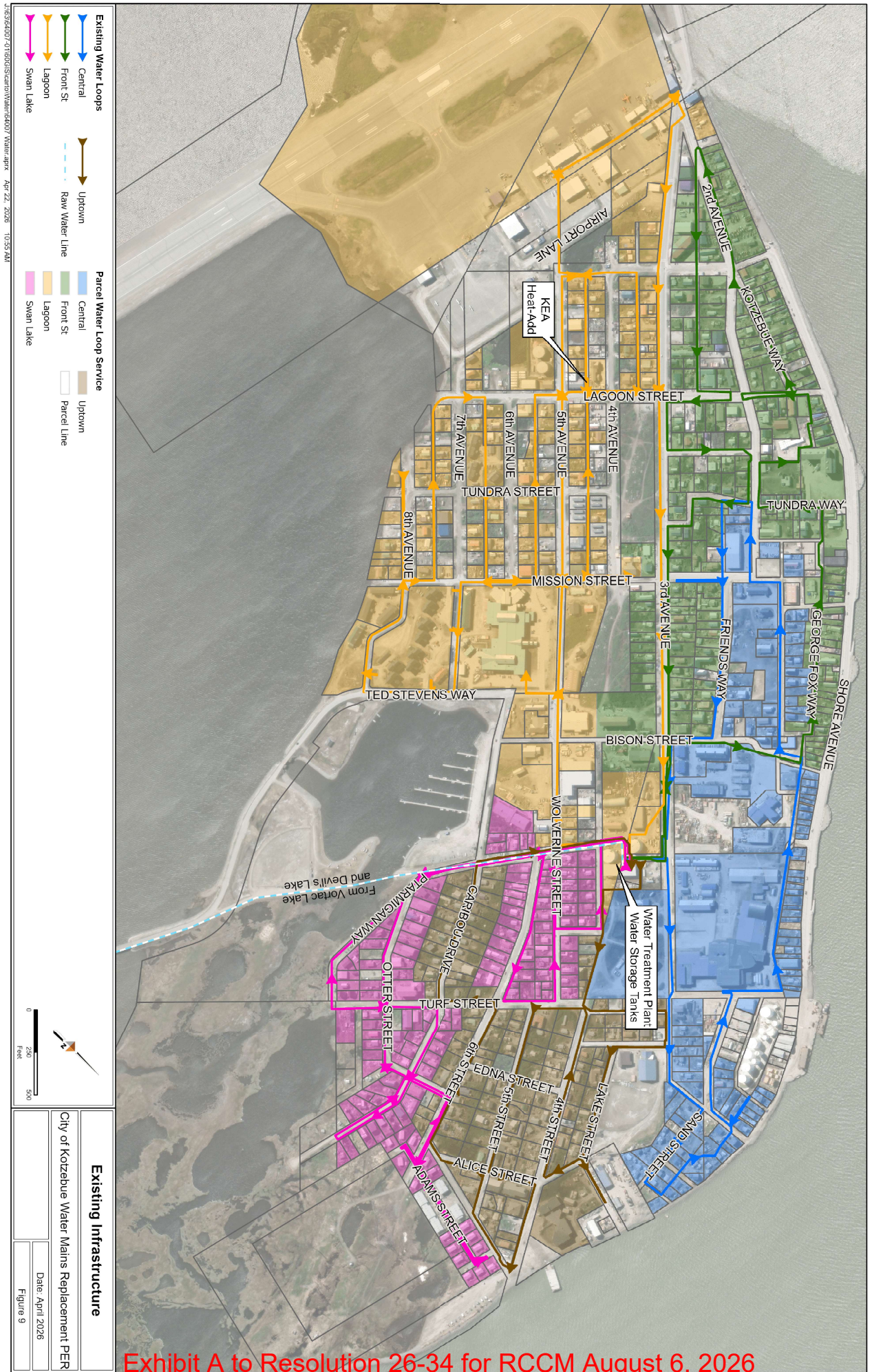


Exhibit A to Resolution 26-34 for RCCM August 6, 2026

2.4 WATER DISTRIBUTION SYSTEM

Water is distributed to the community in five buried water circulation loops with a total length of approximately 71,000 feet (Figure 9). In the WTP Distribution Center, Lagoon Loop has its own return and supply pump manifold due to its length and associated greater head loss. The other four loops distribute water from a shared supply and return manifold at the WTP. The loops have all been upgraded to 8-inch diameter insulated high density polyethylene (HDPE) pipe except for the majority of Swan Lake Loop and Lagoon Loop. An 800-foot section of Swan Lake Loop along Otter Street was upgraded to 8-inch diameter arctic HDPE pipe as part of a 2010 project and an additional 740-foot section was updated to 8-inch diameter arctic HDPE pipe along Caribou Drive and Turf Street as part of a 2021 project. The water is heated prior to distribution using diesel-fired boilers at the WTP and using waste heat provided by Kotzebue Electric Association (KEA) that is added to the system on the Lagoon Loop Return. An electric boiler powered by excess wind and solar power has been operational since late 2025.

Mains are buried underground approximately 2 to 5 feet deep. The service lines are located between the main and the arctic box on the house or enter the home from beneath. Water service connections run to each customer in buried supply and return lines, which allow the water to circulate between the house and the water main for freeze protection. Pit orifices installed in the water main and circulation pumps installed in many of the homes keep the water circulating in the water services. Along Swan Lake and Lagoon Loops, as-built records of construction exist for approximately half of the service lines; however, most of the as-builts are hand sketches with swing tie measurements which are not an accurate record of location. As-builts that were made available by the City of Kotzebue for this PER are included in Appendix 2.

A table of water main loop lengths, number of residential services on each loop, and major constructed details are provided in Table 5. Figure 9: Existing includes all water mains and the parcels that they serve.

Table 5: Summary of Water Mains

Water Distribution Loop	End Date of Construction (Upgrade)	Number of Residential Services	Construction Details
Swan Lake Loop	1990	134	13,300 LF (majority 6-inch diameter HDPE; total of 1,540 feet is updated 8-inch diameter HDPE)
Lagoon Loop	1995	161	23,461 LF (6-inch and 8-inch diameter HDPE)
Central Loop	2000	158	11,030 LF (8-inch diameter HDPE)
Front Street Loop	2008 (2012)	246	Southern Loop was incorporated into Front Street Loop in 2012, now 12,849 LF (8-inch diameter HDPE)
Uptown Loop	2011	141	11,155 LF (8-inch diameter HDPE)

2.4.1 ANTICIPATED REGULATORY CHANGES

The revisions to the Lead and Copper Rule are focused on strengthening public health protections against lead and include: inventory of lead based service lines, find and fix sources when a sample collected is above 15 parts per billion (ppb), reduction of the action level to 10 ppb, replacement of the utility owned portion of lead service lines when the customer portion is replaced, improved sampling procedures, notifying customers within 24 hours if a sample collected is above 15 ppb, and requiring samples be collected at schools and childcare facilities. The effective date was extended to December 16, 2021; the compliance deadline was extended to October 16, 2024.

Per the DEC Lead Service Line Map [6], the City does not have lead service lines; therefore, significant projects and associated costs resulting from the changes are not anticipated. Isolated parts of the City water system may have lead components (e.g., lead soldering for copper service lines); however, since 2011, routine testing has not identified lead levels over 6.1 ppb, with most test results below 3 ppb.

2.5 HISTORY

The water system was first constructed in the 1960s as part of an Alaska Area Native Health Service Project. This included a water transmission line from Vortac Lake, a 1.5-million-gallon water storage tank, and a significant amount of water distribution piping. The City has made numerous upgrades and expansions in the past decades. Table 6: Summary of Current Water Service Infrastructure summarizes the major components of the current water system, the date of the most recent construction/upgrade, and additional notes about the current condition.

Figure 10: Existing Lagoon and Front Loops and Figure 11 provide the existing Lagoon Loop and Swan Lake Loop configurations, size, and year constructed, respectively.

Table 6: Summary of Current Water Service Infrastructure

Component of Water System	End Date of Construction (Upgrade)	Note
New Water Treatment Facility	Operational since 2023	Expected completion of upgrades in 2026
"New" 1.5M-Gallon Water Tank	2004	Located in the Public Works Compound
"Old" 1.5M-Gallon Water Tank	1970, (2011)	- Rehabilitated and rewrapped in 2011 - Located in the Public Works Compound
Swan Lake Loop	1990	13,124 LF (6-inch and 8-inch diameter HDPE) - An 800-foot section of main along Otter Street between Ptarmigan Way and Turf Street was converted to 8" diameter in 2010 - A 740-foot section of main along Caribou Drive and Turf Steet was converted to 8" diameter in 2021
Lagoon Loop	1995	23,461 LF (6-inch and 8-inch diameter HDPE)
Central Loop	2000	11,030 LF (8-inch diameter HDPE)
Front Street Loop	2008 (2012)	Southern Loop was incorporated into Front Street Loop in 2012, now 12,672 LF (8-inch diameter HDPE)
Uptown Loop	2011	11,275 LF (8-inch diameter HDPE)
Vortac Dam and Pumping Infrastructure	1966	- Recently upgraded to a Class II (Significant Risk) dam - Vortac Lake Dam is deteriorating and the water in the lake is being kept low to avoid failure. The City pumps water from the lake to keep water levels low and the water is going to the Water Treatment Facility for use by the City. - Located southeast of Kotzebue.
Devil's Lake and Pumping Infrastructure	1976	- Pump house is roughly 400 square feet - The pumps are 7.5 and 15 hp - Signs were installed around the lake in 2021 to discourage residents from crossing the watershed with snow mobiles - The watershed was delineated and conveyed by the KIC to the City and declared by the city to be a protected area - A watershed protection plan was performed by Baker in 2018 - SCADA system in place as of 2012 - Located southeast of Kotzebue
Raw Water Main from Devil's Lake to Vortac Lake	Prior to 2005	6,300 LF of above ground 8-inch diameter HDPE pipe.
Raw Water Main from Vortac Lake to WTP	2012	8,100 LF of 8-inch diameter insulated pipe, the line crosses a main water channel via a suspension bridge and is buried west of the Kotzebue Slough crossing until the foot bridge (1350 LF)

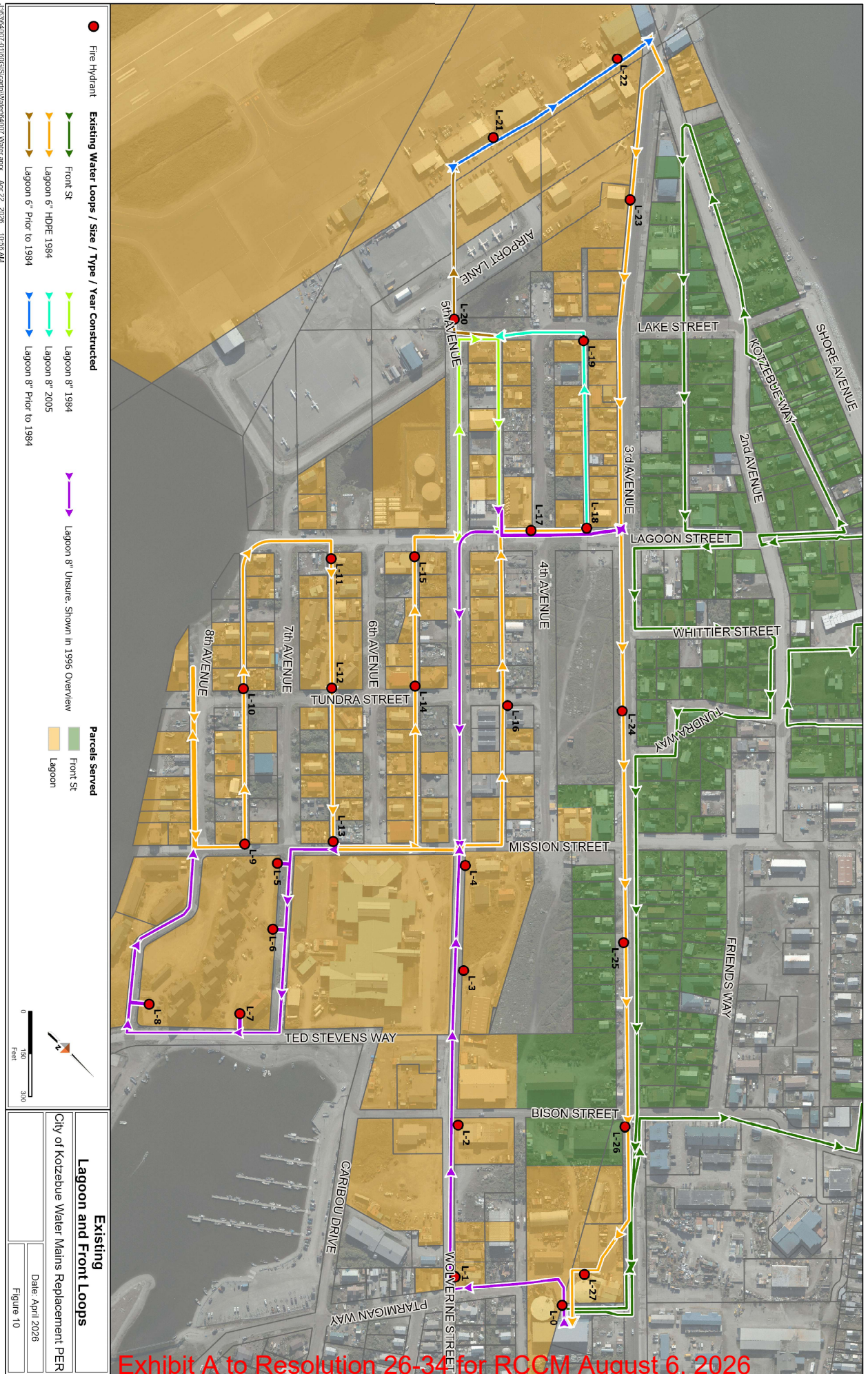
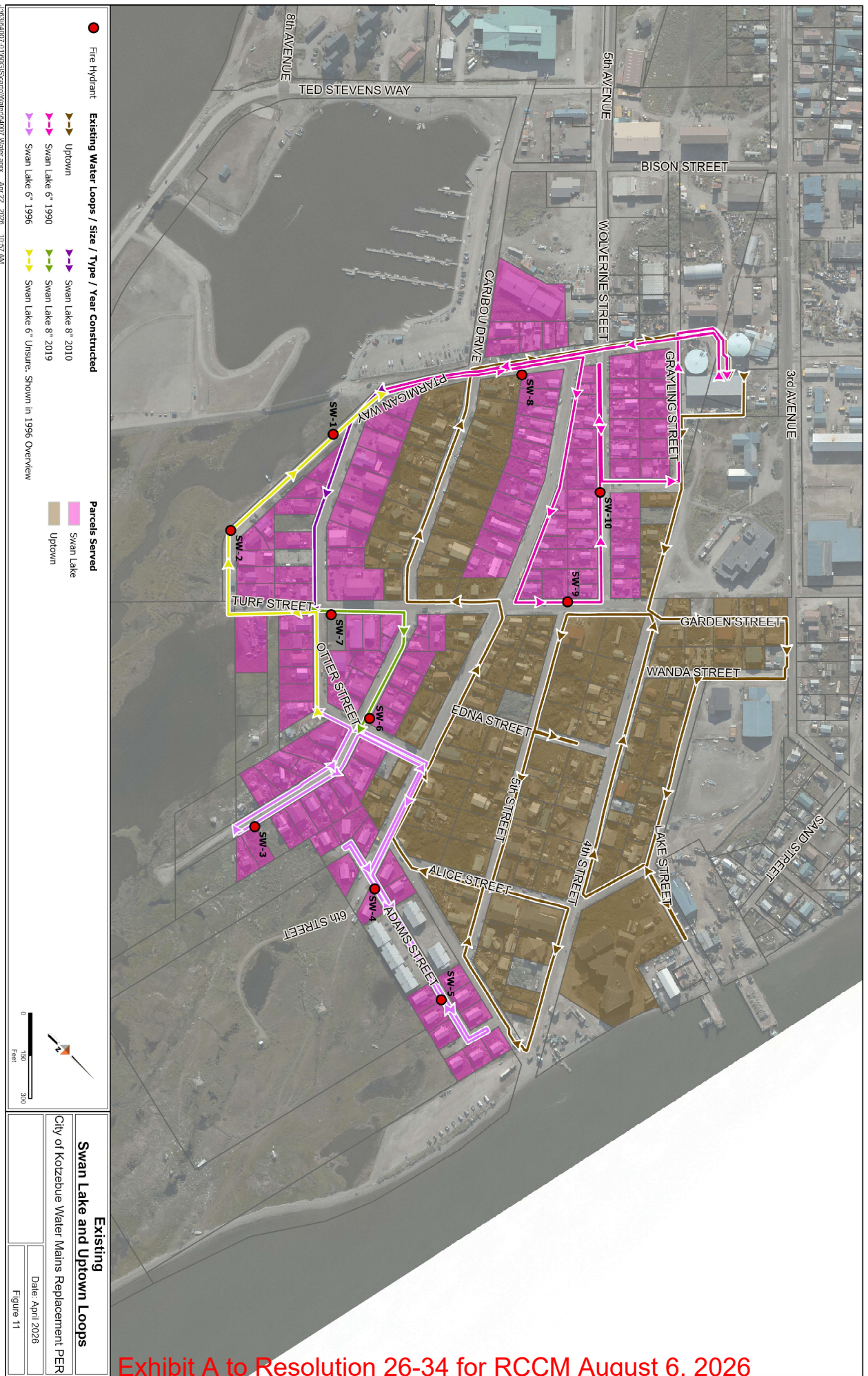


Exhibit A to Resolution 26-34 for RCCM August 6, 2026



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Existing	
Swan Lake and Uptown Loops	
City of Kotzebue Water Mains Replacement PER	Date: April 2026
Figure 11	

Exhibit A to Resolution 26-34 for RCCM August 6, 2026

2.5.1 WATER & SEWER PROJECTS IN PROGRESS

- ◆ **Water Treatment Plant:** The City of Kotzebue completed construction of the new WTP in 2023. The new plant was designed to improve treated water quality and increase production capacity to accommodate future projected demands. While substantially completed, the WTP has not been able to operate at the design capacity and has failed to meet water quality standards on multiple occasions. Upgrades to the raw water intake, water filtration, and operational systems are underway to improve the quantity and quality of water provided to customers.
- ◆ **Inflow & Infiltration (I&I) at Lift Stations (LS) 4, 6, and 8:** A PER has been developed to identify and reduce I&I. Recommendations include a phased project to replace and/or repair manholes, sewer mains, and service lines to prevent I&I in the Lift Station 4, 6, and 8 sewersheds.
- ◆ **Surface Water near Kotzebue Lagoon:** Snow melt and flooding frequently inundate the manholes around LS 8 and 9 and the area northeast of Swan Lake. The surface water overwhelms LS 8 and increases the amount of wastewater being treated in the sewage lagoons. DOWL is working with the City to improve existing and install new culverts to address snow melt in the spring. In the fall, the area is also frequently inundated by flooding. As no reasonable means exists to stop flooding in the area, many of the manholes have been raised and culverts will be designed to efficiently direct water out of the area.
- ◆ **Washeteria:** Kotzebue does not have a public laundromat. The City has received funding from the Denali Commission for the design and remodeling of a 1,200 sq ft former residential building into a community washeteria. Initial construction is expected to take place in 2026.
- ◆ **Vortac Lake Dam:** The Vortac Lake Dam impounds one of the City's two water sources. In 2022, the dam was determined to be unsafe by a Periodic Safety Inspection. The City has until June 2026 to determine if the dam can be made safe or if it needs to be breached. The City has a \$1M forgivable loan from the State Revolving Fund to do the investigation. Planning and engineering work is underway at the time of publishing this PER.
- ◆ **LS 8 and 9:** Upgrades to the two lift stations are being designed, with construction expected in 2026. LS 8 is expected to receive new pumps and a rerouted force main to relieve congestion caused by the current routing. LS 9 will be enclosed in a new building, receive new controls and pumps, and a refurbished wet well. This project is in response to the Maniilaq housing project which will overwhelm the sewer lift stations.

2.6 CONDITION OF EXISTING FACILITIES

2.6.1 WATER MAINS CURRENT ISSUES

Lagoon Loop and Swan Lake Loop are past their original design life of 20 years by 15 and 10 years, respectively. The mains and the services require frequent repairs and maintenance compared to the other newer loops. An extreme example of one of the repairs was in February of 2024 when a section of Swan Lake Loop broke near the south end of Adams Street leaving approximately 160 homes (approximately 700 to 800 people) without water service and fire protection water for up to a month. The failure led to widespread freeze-ups in the main and service lines upstream and downstream of the failure point. As water was not circulating in this loop, sewer demand also dropped resulting in sewer service freeze-ups. The 2024 emergency repair of Swan Lake Loop cost the City nearly \$1 million. The Kotzebue Public Works department keeps a record of work orders called in by residents and businesses on the public water and wastewater systems. Of the 143 water distribution related orders called out over the years 2023-2024, 48% were on Swan and Lagoon Loops (40 on Swan Loop and 29 on Lagoon

Loop). Figure 12: Swan Lake Loop and Lagoon Loop Service Calls (2023-2024) provides a visual reference of the Line Maintenance Department work orders (WO) on Swan Lake and Lagoon Loops.

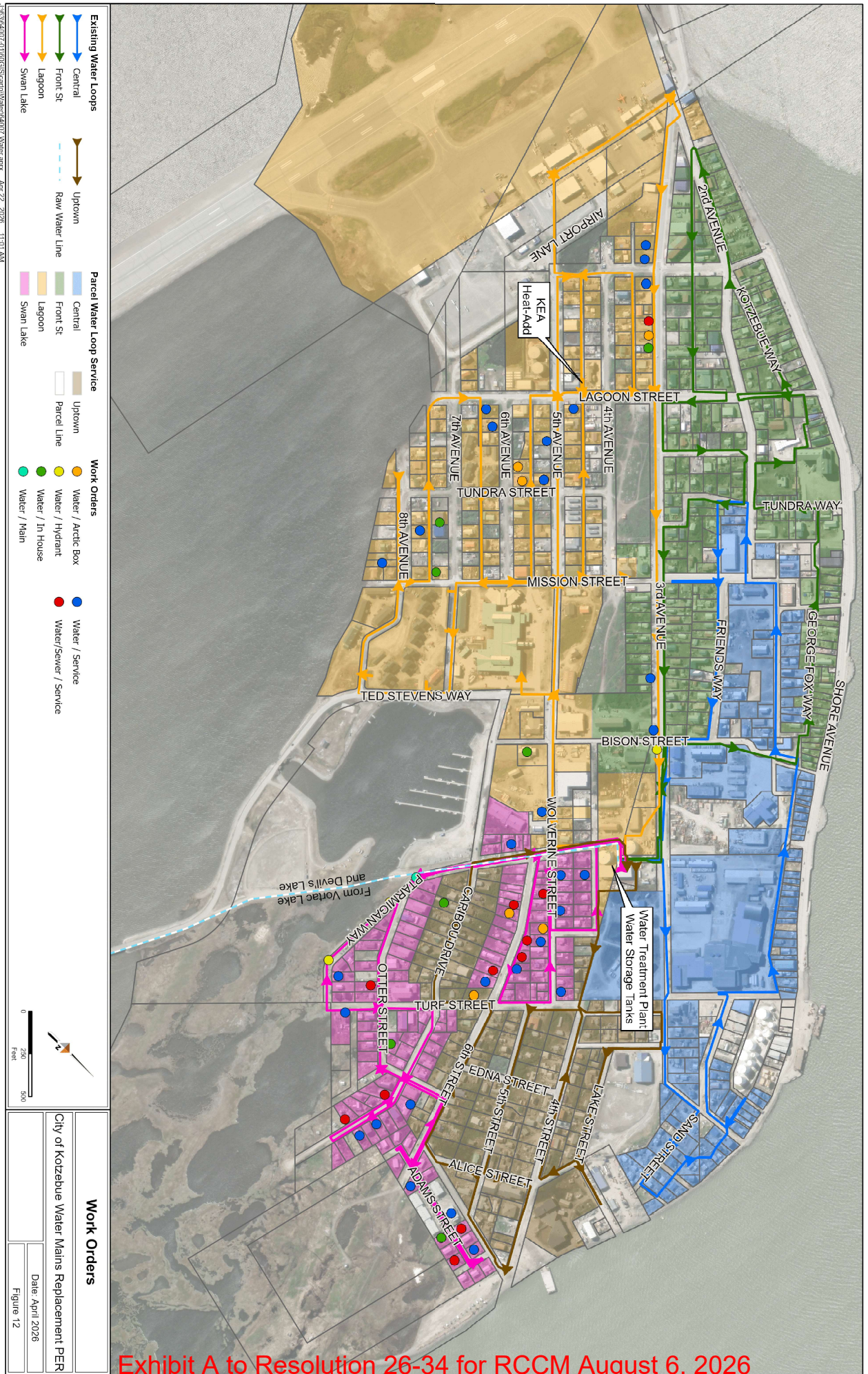


Exhibit A to Resolution 26-34 for RCCM August 6, 2026

2.6.2 WATER, ENERGY, AND WASTE AUDITS

Two energy audits were performed in 2016 on City infrastructure, but neither addressed aspects of this project. The “Comprehensive Energy Audit for Kotzebue Pump House and Lift Stations” and “Comprehensive Energy Audit for Kotzebue Water Treatment Plant” addressed energy consumption for the sewage lift stations and the now demolished WTP, respectively.

2.7 FINANCIAL STATUS OF EXISTING FACILITIES

2.7.1 FINANCIAL STATUS OF UTILITY MANAGEMENT AND SYSTEM ADMINISTRATION

The City is a well-managed second-class City with an appointed City Manager. Staff are accountable to the City Manager who is held accountable by an elected City Council.

The water, sewer, and solid waste utilities are managed as separate municipal enterprise funds. As such, the budgets and revenue are tracked separately. For the purpose of this PER, only the water enterprise fund financial data is provided.

2.7.2 FINANCIAL STATEMENTS

Financial statements from 2021-2024 had been provided for DOWL’s Utility Rate Study. They were also available through the State of Alaska’s Division of Community and Regional Affairs’ Financial Documents Delivery System (<https://www.commerce.alaska.gov/dcra/admin/Financial>). The statements are included in Appendix 3.

2.7.3 UTILITY REVENUE SOURCES

Starting in 2022, DOWL has assisted the City with an ongoing utility rate study, updating the recommendations annually before the City Council votes to increase utility rates. In 2024, due to projected shortfalls in the funds, the City Council voted to adjust rates for wastewater and refuse services. DOWL’s analysis has shown that the current rates for water service are adequate for the expected expenses through 2029. The analysis assumes that all major capital improvement projects, including the replacement of Swan Lake and Lagoon Loops, are grant funded.

The City expects to update the utility rate study annually for the foreseeable future. Table 7 shows the water rates by customer class for 2024.

Table 7: Water Utility Customer rates (2024)

Customer Class and Rate	2024 Rate
Commercial Water Flat Rate	\$232.18
Commercial Water Metered Rate	\$41.35
Commercial Water Minimum Rate	\$103.20
Multi Family Water Base Rate	\$103.20
Multifamily Water Metered	\$41.35
Residential Water Flat Rate	\$101.46
Residential Senior/Disables Flat Rate	\$40.58



As the hub city for the Northwest Arctic Borough, and unlike many areas in rural Alaska, Kotzebue has a sizeable commercial sector. More than 60% of the water utility's revenue comes from the commercial utility class, as seen in Table 8.

Table 8: Water Utility Revenue 2021-2025

	2021 (Actual)	2022 (Actual)	2023 (Actual)	2024 (Actual)	2025 (Budget)
Water Sales-Residential	\$652,242	\$653,819	\$662,933	\$395,683	\$700,000
Water Sales-Commercial	\$1,024,331	\$1,017,701	\$995,537	\$1,055,366	\$1,150,000
Water Delivery	\$6,940	\$12,700	\$8,862	\$11,976	\$10,000
TOTAL	\$1,683,514	\$1,684,221	\$1,667,332	\$1,463,024	\$1,860,000

2.7.4 UTILITY EXPENSES

Table 9 includes the expenses for the Water Utility—all expenses to deliver potable water to customers from the raw water source to the water treatment and delivery of the water. Wastewater collection and treatment is captured as a separate enterprise fund.

Table 9: Water Utility Expenses

	2021 (Actual)	2022 (Actual)	2023 (Actual)	2024 (Actual)	2025 (Budget)
Salaries & Wages	\$241,546	\$224,949	\$263,586	\$217,206	\$300,000
Overtime	\$20,419	\$34,143	\$52,829	\$54,780	\$27,000
Employee Benefits	\$81,648	\$38,776	\$102,062	\$95,931	\$114,000
Electricity	\$141,951	\$150,075	\$152,217	\$132,848	\$160,000
Heating Fuel	\$96,402	\$82,313	\$74,252	\$120,080	\$100,000
KEA Waste Heat	\$92,635	\$107,434	\$82,653	\$12,736	\$100,000
Building Maintenance	\$5,828	\$2,482	\$5,622	\$2,540	\$5,000
Clothing/Safety Equipment	\$2,279	\$2,316	\$1,315	\$1,545	\$2,000
Office Supplies	\$1,111	\$1,775	\$1,018	\$2,403	\$1,000
Small Tools	\$1,195	\$390	\$644	\$899	\$1,000
Chemicals	\$160,119	\$144,083	\$189,158	\$116,114	\$170,000
Pipe & Materials	\$23,041	\$2,617	\$19,565	\$53,201	\$25,000
Telephone	\$6,165	\$5,655	\$10,441	\$11,520	\$5,700
Travel/Lodging	\$0	\$1,645	\$1,557	\$541	\$4,000
Training	\$1,169	\$2,281	\$3,843	\$429	\$8,000
Dues & Membership	\$0	\$0	\$3,918	\$75	\$4,000
Professional Services	\$20,511	\$30,823	\$5,623	\$10,122	\$64,000
Insurance	\$4,954	\$5,148	\$7,146	\$7,300	\$14,000
Unleaded Gas/Diesel/Oil	\$2,714	\$3,251	\$2,546	\$2,356	\$3,750
Light Vehicle R & M	\$1,374	\$49	\$600	\$0	\$1,500
Vehicle & Equipment R & M	\$1,313	\$6,815	\$1,985	\$529	\$3,000
Service Charges			\$16,810	\$9,072	\$9,800
Postage			\$3,297	\$1,697	\$1,680
Gen Fund Admin Overhead			\$286,000	\$40,040	\$159,600
TOTAL	\$906,374	\$847,020	\$1,288,687	\$893,964	\$1,284,030

Especially as the replacement of the loops is expected to reduce O&M costs, the City current revenue sources are sufficient to cover the expected expenses of operating the current and proposed infrastructure.

3.0 NEED FOR PROJECT

3.1 AGING INFRASTRUCTURE

The design life of infrastructure in arctic regions is typically shorter than that of the same systems in more temperate climates and should also be based on local experience and quality of operation and maintenance. Table 2-5 in the Cold Regions Utilities Monograph, 3rd Edition states the design life for water distribution piping should be anywhere from 20 - 40 years, service connections from 10 - 30 years, and valves 10 – 20 years. Lagoon Loop and Swan Lake Loop are past their original design life of 20 years by 15 and 10 years, respectively. With the severity of the 2024 Swan Lake Loop break as a recent precedent, a similar failure on the Lagoon Loop would endanger some of the community's and region's most important facilities, such as the Maniilaq Health Center and the AC Store.

The proposed project will upgrade or provide facilities to address the following deficiencies not correctable by routine operation and maintenance:

- ◆ W2.1 An inability to properly operate the system due to facilities that do not meet applicable design standards† or facilities that are deteriorated (e.g. a systemic lack of operable hydrants, meters, and/or gate valves; pumps operating beyond their design capacity; telemetry control failures; pressure surges damaging facilities; **repeated water main breaks attributable to deteriorated pipe**; differing overflow elevations; additional water source or additional water storage required; **increased main size/looping needed to improve water supply quantity and/or pressure at homes**)

3.2 REASONABLE GROWTH

The population forecast in Section 1.3 does not account for Kotzebue's significant transient population that is providing or using the regional hub services. Health care is an example of one of the services in Kotzebue, provided by Maniilaq Association, the Tribal Health Organization. Maniilaq is proposing to construct a 48-unit and 45-unit housing complex, starting in 2026, to provide housing for transient staff and patients. The two proposed complexes will receive water service from Lagoon Loop. Maniilaq is also considering expanding the hospital which will also draw water from the Lagoon Loop. Each housing complex is estimated to use 4,800 gallons per day (gpd) and the hospital expansion is assumed to use an additional 2,000 gpd for a total future water use increase on Lagoon Loop of 11,600 gpd.

The Native Village of Kotzebue (NVOK) has also proposed the construction of a six-plex that will be located between 6th and 7th on Lagoon Street which will also draw water from Lagoon Loop. The unit is estimated to use an additional 1,800 gpd assuming an average of three people will occupy each unit.

4.0 ALTERNATIVES CONSIDERED

Three alternatives have been developed to improve water service

- ◆ **Alternative 1** – No Action
- ◆ **Alternative 2** – Replace Swan Lake and Lagoon Loop in the Original Location
- ◆ **Alternative 3** – Replace Swan Lake and Lagoon Loop in a Reconfigured Alignment

4.1 DESIGN CRITERIA, ASSUMPTIONS, AND SELECTION DISCUSSION

4.1.1 DESIGN CRITERIA

Table 10: Design Criteria

Design Criteria	Design Value
<i>General Conditions</i>	
Design Period	20 years
Residential Services	271
Commercial Services (All on Lagoon; Includes Proposed Developments)	27
<i>Environmental Conditions</i>	
100-Year Flood Elevation (MLLW)	7 to 10 feet
Mean Maximum Temperature July (1991 to 2020)	60.1 °F
Mean Minimum Temperature January (1991 to 2020)	-8.4 °F
Mean Annual Precipitation	11.4 inches
Mean Annual Snowfall	64.2 inches
<i>Water Distribution</i>	
Average Residential Water Demand	100 gallons per person per day
Hydrant Spacing	300 feet
Main Pipe Size	8-inch HDPE arctic pipe with a minimum of 3 inches of insulation
Service Line Size--Residential	1-inch Supply, ¾-inch Return
Minimum Flow Velocity	2 feet per second
Fire Flow Capacity	500 gpm at 20 psi delivery pressure at the most distant fire hydrant

4.1.2 REGULATIONS

Pertinent regulations for drinking water systems are included in 18 Alaska Administrative Code (AAC) 80. Listed below are a number of the regulations for water systems that are most significant for this PER.

- ◆ 18 AAC 80.205: Engineering plans for the construction of a new water source, storage, distribution system, water treatment, and related structures must be submitted to ADEC and approved prior to construction.
- ◆ 18 AAC 80.020: Water distribution mains must meet minimum separation distances from potential sources of contamination (i.e., wastewater lines).
- ◆ 18 AAC 80.210: Record drawings and supporting data are to be submitted to ADEC after construction to obtain approval to operate.

4.1.3 OTHER DESIGN CONSIDERATIONS

4.1.4 GRAVEL BORROW SITES

Affordable gravel is a prime concern for the development and expansion of Kotzebue, and sources need to be located (e.g., Hugo Mountain on the Noatak). KIC currently has the largest permitted gravel resources available, with permits pending for another 1.5 million cubic yards at Nimiuk Point and Arctic Circle locations. Drake Construction also has its own permitted gravel source in the area. All locations require material to be barged from the site to Kotzebue.

4.1.5 COMMON DESIGN ELEMENTS AMONGST ALTERNATIVES

Regardless of where the main and services will be replaced, the design will be similar. The primary mains will be constructed of 8-inch diameter SDR 11 HDPE pipe wrapped in a minimum of 3-inch insulation and protected by an external jacket. Soil cover over the top of the pipe will be no less than 1.5 feet unless there is a pipe crossing which will require 2.5 feet minimum soil cover. If top of pipe is less than 2.5-feet deep, 2-inch polystyrene will be placed in the trench. Backfill will be classified material under roads and within 10 feet of buildings compacted to 95% dry density. Non-structural areas can be backfilled with type IV unclassified material, compacted to 85% dry density. Water mains will be placed in the active layer above the permafrost.

Appropriate separation distances will be maintained with sewer services and sewer mains. Minimum horizontal separation between water and sewer pipelines of 10 feet and a minimum vertical separation of 1.5 feet.

The mains and services will be constructed adjacent to the existing to maintain water service during construction where possible. The existing mains will be abandoned in place. All other non-hazardous construction debris will be hauled to the local landfill and disposed of. No hazardous waste is anticipated.

Circulating buried service lines will connect to the main through a pit orifice. A 4-inch HDPE carrier pipe will house the service lines from the main to the arctic box. Service lines will consist of two water service pipes, one-inch HDPE for supply and 0.75-inch HDPE for return, and an electric heat trace inside the carrier pipe. The service line will come up from the ground near the structure and terminate at the house in an insulated plywood arctic box that is roughly 27 inches wide and 30 inches tall that slopes to the front. The service line will be connected to the arctic box with a flexible boot. If the previous service line did not terminate at an arctic box, an arctic box will be added and a tie in will join the under-house

entrance point and the new arctic box. It is assumed that 60% of the service lines currently enter the home from underneath and do not have an arctic box.

Commercial water services with sprinklers require 6-inch diameter HDPE water supply and 1-inch HDPE water return lines.

Fire hydrants will be replaced in similar locations as the current. Hydrants on the surface will have a 4.5-inch pump connector, two 2.5-inch hose connectors and a 5-inch valve box and will be protected by an insulated box and bollards. The subsurface connection to the hydrant will consist of a 6-inch X 15-inch HDPE arctic pipe hydrant leg that will extend laterally from the main. The riser will be an 8-inch HDPE arctic pipe with a minimum of 3-inch insulation.

4.2 ALTERNATIVE 1: DO NOTHING

4.2.1 DESCRIPTION

The City will continue to spend a considerable amount of money and effort on repairs for the Lagoon and Swan Lake circulating water main and services. Repairs include those associated with repairs of services and other portions of the main that did not fail but became frozen as a result of upstream breaks.

4.2.2 ENVIRONMENTAL IMPACTS

Significant breaks as a result of the ageing system may cause flooding and erosion that would otherwise be avoided in addition to temporary contamination of water within the mains and services.

4.2.3 LAND REQUIREMENTS

This alternative will require no new land.

4.2.4 POTENTIAL CONSTRUCTION PROBLEMS

This alternative will not include construction.

4.2.5 SUSTAINABILITY CONSIDERATIONS

As water distribution and services age to a certain point the maintenance burden becomes unsustainable for a community to afford and service outages are so numerous that customers default on payments because they consider the fee unreasonable for the level of service.

4.2.6 COST ESTIMATES

4.2.6.1 CAPITAL

Not applicable

4.2.6.2 ANNUAL O&M COSTS

The average cost to run the Kotzebue water utility from 2021 to 2024 was approximately \$910,000. For the purpose of this PER, the 2025 Budget of \$1,284,030 is used. The City of Kotzebue expects that water

main breaks, such as the Swan Lake Loop break, will become more common and will occur at a frequency of once every five years.

4.3 ALTERNATIVE 2: REPLACE SWAN LAKE AND LAGOON LOOP IN THE ORIGINAL LOCATION

4.3.1 DESCRIPTION

The Lagoon and Swan Lake circulating water loops will be replaced with an 8-inch diameter HDPE arctic pipe adjacent to the current location to cause minimal disruption in water service. The majority of the loops with the exception of a 800-foot section of main along Otter Street between Ptarmigan Way and Turf Street and a 740-foot section of main along Caribou Drive and Turf Steet was converted to 8-inch diameter in 2010 and 2021, respectively, will be converted to 8-inch insulated HDPE for a total replacement of 11,760 LF of pipe. This scenario will allow for additional capacity along the loops and reduce the frequency of repairs and maintenance along the loops. The deficiencies caused by an aging system will be addressed. Construction will be performed in stages over multiple years due to significant cost of the project and funding limitations. Proposed phasing includes the following:

- ◆ Phase 1 – Replace approximately 8,700 LF of Lagoon Loop between 4th and 8th Avenues
- ◆ Phase 2 – Replace approximately 6,100 LF of Lagoon Loop nearest the airport and along 3rd Avenue
- ◆ Phase 3 – Upsize and replace the remainder of Lagoon Loop from the water treatment plant to 8th Avenue tie-in
- ◆ Phase 4 – Replace about 6,000 LF of main adjacent to existing along Ptarmigan Way, Otter Street, and Adams Street
- ◆ Phase 5 – Replace the remainder of Swan Lake Loop, approximately 6,000 LF, from the water treatment plant to the Ptarmigan Way tie-in.

4.3.2 ENVIRONMENTAL IMPACTS

Environmental impacts are expected to be minimal for this alternative because mains and services will be buried and construction will take place adjacent to the existing main in already developed areas.

Wetlands: Work that involves ground disturbance in wetlands would require a USACE U.S. Army Corps of Engineers Section 404 Permit (Clean Water Act). Any trenching work conducted in support of the project would be considered temporary impacts if side cast material are refilled and brought back to existing elevations and any placement of fill would be considered permanent impacts. A nationwide permit (#57) would be available as the permitting mechanism if permanent fills do not exceed half an acre. If more than half an acre of impacts occurs, an individual permit would be required, which has a public review noticing period of 30 days and requires a more robust analysis of other impacts.

Without field verification, wetlands would be assumed to be present in all undisturbed, vegetated areas above mean high water in any area mapped by NWI as wetlands. The length of each circulating water distribution loop linear feet within assumed wetlands are shown in Table 11.

Table 11: Length of Water Mains within Assumed Wetlands – Alt 2

Proposed Loop	Not Within Wetlands (ft)	Within Wetlands (ft)
Lagoon	18,261	5,200
Swan Lake	10,200	3,100

Floodplains: The Water Main Replacement project consists primarily of buried components which do not extend above the ground surface, impacts to floodplains would therefore not occur as long as trenched components are at a sufficient depth to protect infrastructure from any flood-related erosion and also not affect the integrity of the floodplain.

Erosion: Shore erosion does not threaten the project area. Land surface erosion from significant rain events spring melt runoff and receding flood waters is evident but has not been observed at a magnitude that would undermine buried utilities.

Endangered Species: The three endangered species are likely to be addressed through minor, informal consultation with the U.S. Fish and Wildlife Service (USFWS) to determine the project may affect but not adversely affect listed species or critical habitat.

Contaminated Sites: Depending on depth of excavation required for the project, contaminated or hazardous materials may be encountered during construction, as multiple active contaminated sites exist in the project area (See Figure 8). Because most of the city is within 1,500 feet of an active contaminated site, a Contaminated Soils and Groundwater Materials Plan should be developed in conjunction with DEC if de-watering activities are planned to support the project. If contamination is encountered, all work in the vicinity of the contamination would be stopped and DEC will be consulted for guidance on how to proceed. Any contaminated material would be tested, handled, and if necessary, disposed of in accordance with DEC-approved procedures.

Cultural Resources: The project is subject to Section 106 of the National Historic Preservation Act (36 CFR 800.1[a]) and the Alaska Historic Preservation Act, Alaska State Statute AS 41.35.070. Early consultation and Section 106 initiation with the SHPO and the consulting parties will ensure that a sufficient level of identification is completed for the project, which may include background research, consultation, oral history interviews, sample field investigation, field surveys, and/or agreement document(s). Initiation should include a detailed description of the project and its components, outline the preliminary area of potential effect (APE), present data regarding known AHRS sites and other known cultural resources in the Project area, and if necessary, present a detailed field plan for archaeological and historic resources. The field plan will be drafted to present the planned approach for cultural resources investigations and will identify areas to be surveyed by DOWL's SOI qualified archaeologist and guidelines for results reporting and review process. Coordination with consulting parties should assist if any oral histories are needed and to coordinate field effort with Tribal representatives. Field survey will be completed as prescribed, with industry standard survey methodology and site recording requirements. Identified cultural resources will be researched and subject to a determination of eligibility (DOE) to assess their potential for listing in the NRHP. Only after the historic property identification effort is complete can an assessment of project effects be completed. Should the assessment result in a recommended finding of adverse effect to a historic property, DOWL will consult with SHPO and consulting parties on appropriate mitigations measures, which may include design changes to avoid historic properties.

4.3.3 LAND REQUIREMENTS

This alternative will require no new land. Temporary construction easements will be needed for installation of service lines on private properties.

4.3.4 POTENTIAL CONSTRUCTION PROBLEMS

The presence of permafrost and ice in poorly drained, fine-grained, and organic soils is challenging for construction and may result in disturbance of the thermal equilibrium of such materials. The thawing of permafrost may result in differential settlement, subsidence of the ground surface, and movement of the soil mass either laterally or down slope. These phenomena can severely damage structures such as roads, buildings, and utilities. During freeze up, such soils are also subject to severe frost heaving caused by the build-up of large masses of segregated ice within the active layer. To the maximum extent possible, water mains and services will be placed in the active layer above the permafrost and groundwater.

To address the identified construction problems with permafrost and high water table, the contractor will be required to

- ◆ Have and execute plans for dewatering areas as needed
- ◆ Have Non-frost susceptible fill for placement in areas of potential settlement

Since Kotzebue's solid waste landfill has limited space for construction and demolition waste, and to save time and expense of removing them, the existing mains will be abandoned in place. General construction debris will be collected and disposed of in the solid waste landfill.

4.3.5 SUSTAINABILITY CONSIDERATIONS

Sustainability of the water utility will be enhanced due to the decrease in O&M costs that are expected due to the replacement of the lines.

4.3.6 COST ESTIMATES

4.3.6.1 CAPITAL COSTS

The capital costs for Alternative 2 are summarized in Table 12. See Appendix 5 for the full cost estimate. Capital Cost Estimates will be updated with the Final PER phase.

Table 12: Alternative 2 Capital Costs

Expense Category	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	TOTAL
Design & Construction Admin (10% + 15% contingency)	\$1,134,566	\$877,617	\$1,087,435	\$863,445	\$863,543	\$4,826,606
Construction Manager (15% of construction)	\$1,701,849	\$1,316,426	\$1,631,153	\$1,295,167	\$1,295,315	\$7,239,910
Construction	\$8,510,862	\$6,583,379	\$8,157,315	\$6,477,067	\$6,477,807	\$36,206,430
Insurance & Bond (3.5%)	\$297,880	\$230,418	\$285,506	\$226,697	\$226,723	\$1,267,224
Overhead & Profit (12%)	\$1,057,049	\$817,656	\$1,013,139	\$804,452	\$804,544	\$4,496,840
Estimating Contingency (0%)	\$0	\$0	\$0	\$0	\$0	\$0
Inflation	\$874,359	\$1,196,116	\$2,037,972	\$2,002,633	\$2,375,202	\$8,486,282
Construction Contingency (15%)	\$1,479,869	\$1,144,718	\$1,418,394	\$1,126,232	\$1,126,361	\$6,295,574
TOTAL	\$15,056,434	\$12,166,330	\$15,630,914	\$12,795,693	\$13,169,495	\$68,818,866

4.3.6.2 ANNUAL O&M COSTS

Operating costs in Table 13 for Alternative 2 are based on the O&M for the water utility including surface water source, transmission main, WTP, and distribution system. Two sources of O&M reductions can be estimated by expected reductions in the frequency of catastrophic breaks and reduced water losses due. A similar project to replace the Front Street Loop resulted in an estimated 500,000 gallons per month in reduced water loss, an approximately 7% reduction for the entire system [7]. The combined length of Swan Lake and Lagoon Loops are approximately three times the length of Front Street Loop. For the purposes of this PER, a 20% reduction of water losses is assumed. The O&M line items to be reduced by improving the water loss are Heating Fuel, KEA Waste Heat, and Chemicals—leading to an estimated \$74,000 reduction in annual O&M over the No Action Alternative due to decreased water production, circulation, and heating needs.

Table 13: Alternative 2 O&M Costs

	2025 (Budget)
Salaries & Wages	\$300,000
Overtime	\$27,000
Employee Benefits	\$114,000
Electricity	\$160,000
Heating Fuel	\$80,000
KEA Waste Heat	\$80,000
Building Maintenance	\$5,000
Clothing/Safety Equipment	\$2,000
Office Supplies	\$1,000
Small Tools	\$1,000
Chemicals	\$136,000
Pipe & Materials	\$25,000
Telephone	\$5,700
Travel/Loding	\$4,000
Training	\$8,000
Dues & Membership	\$4,000
Professional Services	\$64,000
Insurance	\$14,000
Unleaded Gas/Diesel/Oil	\$3,750
Light Vehicle R & M	\$1,500
Vehicle & Equipment R & M	\$3,000
Service Charges	\$9,800
Postage	\$1,680
Gen Fund Admin Overhead	\$159,600
TOTAL	\$1,210,030

4.4 ALTERNATIVE 3: REPLACE SWAN LAKE AND LAGOON LOOP IN A RECONFIGURED ALIGNMENT

4.4.1 DESCRIPTION

Swan Lake and Lagoon Loops will be replaced in a reconfigured alignment with 8-inch diameter, arctic HDPE pipe, the majority of which will be constructed immediately adjacent to the current location to minimize disruption of water service. The reconfigured alignment will address the deficiencies associated with components that are past their design life and benefit the City by eliminating the replacement of 2,000 feet of main, balancing loop lengths, and reducing the amount of construction along 3rd Avenue, a paved and heavily trafficked road. Preliminary hydraulic modeling was performed to estimate if the low- and high-pressure manifolds that circulate and pressurize the loops would need to be redesigned because of the reconfiguration. Preliminary results indicate that the pressure manifolds can remain the same. A detailed memorandum summarizing the hydraulic modeling methods, results, and discussion is provided in Appendix 4.

Construction will be performed in stages over multiple years due to significant cost of the project and funding limitations. Proposed phasing includes the following:

- ◆ Phase 1 (1.1 & 1.2) – Replace approximately 4,500 LF of Lagoon Loop and connect the new housing and hospital services. Install and reroute about 1,400 LF of Lagoon Loop return line off 3rd Avenue, a busy paved road in the same trench as the supply until the two lines go separate ways on Mission Street.
- ◆ Phase 2 – Replace and transfer approximately 5,780 LF of water main from Lagoon to Front Loop.
- ◆ Phase 3 – Replace the remainder of Lagoon Loop adjacent to the existing piping.
- ◆ Phase 4 – Replace and upsize about 4,500 LF of existing 6-inch to 8-inch HDPE pipe along Ptarmigan Way, Turf Street, and Otter Street. Transfer about 2,100 LF and 22 services from Swan Lake Loop to Uptown Loop.
- ◆ Phase 5 – Reroute a portion of the Swan Lake Loop to eliminate about 700 LF of length and replace the remainder of the loop in place (about 5,000LF).

The design is described in Section 4.1.5 of this report. Refer to Figure 13 and Figure 14 for the Swan Lake and Lagoon Loops replacement, reconfiguration, and phasing.

4.4.2 ENVIRONMENTAL IMPACTS

Environmental impacts are expected to be minimal for this alternative because mains and services will be buried and construction will take place adjacent to the existing main in already developed areas. They would be expected to be less than Alternative 2 due to the reduced main length proposed.

Wetlands: Work that involves ground disturbance in wetlands would require a USACE U.S. Army Corps of Engineers Section 404 Permit (Clean Water Act). Any trenching work conducted in support of the project would be considered temporary impacts if side cast material are refilled and brought back to existing elevations and any placement of fill would be considered permanent impacts. A nationwide permit (#57) would be available as the permitting mechanism if permanent fills do not exceed half an acre. If more than half an acre of impacts occurs, an individual permit would be required, which has a public review noticing period of 30 days and requires a more robust analysis of other impacts.

Without field verification, wetlands would be assumed to be present in all undisturbed, vegetated areas above mean high water in any area mapped by NWI as wetlands. The length of each circulating water distribution loop linear feet within assumed wetlands are shown in Table 15.

Table 15: Length of Water Mains within Assumed Wetlands – Alt 3

Proposed Loop	Not Within Wetlands (ft)	Within Wetlands (ft)
<i>Lagoon Loop</i>		
Front Street	12,849	
Lagoon	12,617	1,176
Lagoon Abandon	3,498	114
Lagoon New Location	3,361	
Lagoon to Front Street	5,778	
<i>Swan Lake Loop</i>		
Swan Lake	8,732	
Swan Lake Abandon	2,888	
Swan Lake New Location	789	
Swan Lake to Uptown	2,100	
Uptown	11,155	

Floodplains: The Water Main Replacement project consists primarily of buried components which do not extend above the ground surface, impacts to floodplains would therefore not occur as long as trenched components are at a sufficient depth to protect infrastructure from any flood-related erosion and also not affect the integrity of the floodplain.

Erosion: Shore erosion does not threaten the project area. Land surface erosion from significant rain events spring melt runoff and receding flood waters is evident but has not been observed at a magnitude that would undermine buried utilities.

Endangered Species: The three endangered species are likely to be addressed through minor, informal consultation with the U.S. Fish and Wildlife Service (USFWS) to determine the project may affect, but not adversely affect, listed species or critical habitat.

Contaminated Sites: Depending on depth of excavation required for the project, contaminated or hazardous materials may be encountered during construction, as multiple active contaminated sites exist in the project area (See Figure 8). Because most of the city is within 1,500 feet of an active contaminated site, a Contaminated Soils and Groundwater Materials Plan should be developed in conjunction with DEC if de-watering activities are planned to support the project. If contamination is encountered, all work in the vicinity of the contamination would be stopped and DEC will be consulted for guidance on how to proceed. Any contaminated material would be tested, handled, and if necessary, disposed of in accordance with DEC-approved procedures.

Cultural Resources: The project is subject to Section 106 of the National Historic Preservation Act (36 CFR 800.1[a]) and the Alaska Historic Preservation Act, Alaska State Statute AS 41.35.070. Early consultation and Section 106 initiation with the SHPO and the consulting parties will ensure that a sufficient level of identification is completed for the project, which may include background research, consultation, oral history interviews, sample field investigation, field surveys, and/or agreement document(s). Initiation should include a detailed description of the project and its components, outline the preliminary area of potential effect (APE), present data regarding known AHRs sites and other known cultural resources in the Project area, and if necessary, present a detailed field plan for archaeological and historic resources. The field plan will be drafted to present the planned approach for cultural resources investigations and will identify areas to be surveyed by DOWL's SOI qualified archaeologist and guidelines for results reporting and review process. Coordination with consulting parties should assist if any oral histories are needed and to coordinate field effort with Tribal

representatives. Field survey will be completed as prescribed, with industry standard survey methodology and site recording requirements. Identified cultural resources will be researched and subject to a determination of eligibility (DOE) to assess their potential for listing in the NRHP. Only after the historic property identification effort is complete can an assessment of project effects be completed. Should the assessment result in a recommended finding of adverse effect to a historic property, DOWL will consult with SHPO and consulting parties on appropriate mitigations measures, which may include design changes to avoid historic properties.

4.4.3 LAND REQUIREMENTS

This alternative will require no new permanent easements because mains fall within existing ROWs. Water service installations will require Temporary Construction Easements on private property.

4.4.4 POTENTIAL CONSTRUCTION PROBLEMS

The presence of permafrost and ice in poorly drained, fine-grained, and organic soils is challenging for construction and may result in disturbance of the thermal equilibrium of such materials. The thawing of permafrost may result in differential settlement, subsidence of the ground surface, and movement of the soil mass either laterally or down slope. These phenomena can severely damage structures such as roads, buildings, and utilities. During freeze-up, such soils are also subject to severe frost heaving caused by the build-up of large masses of segregated ice within the active layer.

To address the identified construction problems with permafrost and high water table, the contractor will be required to

- ◆ Have and execute a dewatering plan
- ◆ Remove Frost Susceptible Material in the trench section

Since Kotzebue's solid waste landfill has limited space for construction and demolition waste, and to save time and expense of removing them, the existing mains will be abandoned in place. General construction debris will be collected and disposed of in the solid waste landfill.

4.4.5 SUSTAINABILITY CONSIDERATIONS

Sustainability of the water utility will be enhanced due to the decrease in O&M costs that are expected due to the replacement of the lines. Alternative 3 will be more sustainable than Alternative 2 due to the reduced amount of pipe to maintain.

4.4.6 COST ESTIMATES

4.4.6.1 CAPITAL

The capital costs for Alternative 3 are summarized in Table 16. See Appendix 6 for the full cost estimate.

Table 16: Alternative 3 Capital Costs

Expense Category	Phase 1.1/1.2	Phase 2	Phase 3	Phase 4	Phase 5	TOTAL
Design & Construction Admin (10% + 15% contingency)	\$910,152/ \$283,158	\$896,059	\$963,542	\$686,328	\$962,099	\$4,701,338
Construction Manager (15% of construction)	\$1,365,228/ \$424,738	\$1,344,089	\$1,445,313	\$1,029,492	\$1,443,149	\$7,052,009
Construction	\$6,827,438/ \$2,124,092	\$6,721,722	\$7,227,940	\$5,148,439	\$7,217,114	\$35,266,745
Insurance & Bond (3.5%)	\$238,961/ \$74,343	\$235,260	\$252,978	\$180,195	\$252,599	\$1,234,336
Overhead & Profit (12%)	\$847,968/ \$263,812	\$834,838	\$897,710	\$639,436	\$896,366	\$4,380,130
Estimating Contingency (0%)	\$0/\$0	\$0	\$0	\$0	\$0	\$0
Inflation	\$701,413/ \$218,218	\$1,221,251	\$1,805,783	\$1,591,836	\$2,646,282	\$8,184,783
Construction Contingency (15%)	\$1,187,155/ \$369,337	\$1,168,773	\$1,256,794	\$895,211	\$1,254,912	\$6,132,182
TOTAL	\$12,078,315/ \$3,757,698	\$12,421,993	\$13,850,061	\$10,170,938	\$14,672,520	\$66,951,525

4.4.6.2 ANNUAL O&M COSTS

Operating costs in Table 16 for Alternative 3 are based on the O&M for the water utility including surface water source, transmission main, WTP, and distribution system. Two sources of O&M reductions can be estimated by expected reductions in the frequency of catastrophic breaks and reduced water losses due. A similar project to replace the Front Street Loop resulted in an estimated 500,000 gallons per month in reduced water loss, an approximately 7% reduction for the entire system [7]. The combined length of Swan Lake and Lagoon Loops are approximately three times the length of Front Street Loop. For the purposes of this PER, a 20% reduction of water losses is assumed. The O&M line items to be reduced by improving the water loss are Heating Fuel, KEA Waste Heat, and Chemicals—leading to an estimated \$74,000 reduction in annual O&M over the No Action Alternative due to decreased water production, circulation, and heating needs.

Table 17: Alternative 3 O&M Costs

	2025 (Budget)
Salaries & Wages	\$300,000
Overtime	\$27,000
Employee Benefits	\$114,000
Electricity	\$160,000
Heating Fuel	\$80,000
KEA Waste Heat	\$80,000
Building Maintenance	\$5,000
Clothing/Safety Equipment	\$2,000
Office Supplies	\$1,000
Small Tools	\$1,000
Chemicals	\$136,000
Pipe & Materials	\$25,000
Telephone	\$5,700
Travel/Loding	\$4,000
Training	\$8,000
Dues & Membership	\$4,000
Professional Services	\$64,000
Insurance	\$14,000
Unleaded Gas/Diesel/Oil	\$3,750
Light Vehicle R & M	\$1,500
Vehicle & Equipment R & M	\$3,000
Service Charges	\$9,800
Postage	\$1,680
Gen Fund Admin Overhead	\$159,600
TOTAL	\$1,210,030

5.0 SELECTION OF AN ALTERNATIVE

5.1 LIFE CYCLE COST ANALYSIS

A life cycle cost analysis was performed to compare the net present value (NPV) of each alternative. The NPV identifies the cost of owning and operating an asset for the entirety of its lifespan. The equation used to derive NPV has several variables and uses the following equation:

$$NPV = C + USPW(O\&M) - SPPW(S)$$

The variables in the equation are as follows:

- ◆ C = Estimated capital cost of the alternative
- ◆ USPW = Uniform Series Present Worth Factor, which is applied to O&M
- ◆ O&M = Estimated annual O&M cost of each alternative, including both utility and customer expenses
- ◆ SPPW = The Single Payment Present Worth factor, which is applied to S
- ◆ S = Estimated Salvage value of each alternative, which is assumed to be zero

The USPW is a function of the Office of Management and Budget (OMB) “real” discount rate (i) and the lifespan of the asset (n). For a 20-year life (n=20), the November 2024 real discount rate is 2.2%.

The estimated life cycle cost for each alternative can be seen in Table 21. In addition to the O&M included in Table 9 for the Do Nothing Alternative, the annual O&M assumes that a catastrophic break, such as the 2024 incident on Swan Lake Loop, costing \$1 million is expected to occur once every five years. An additional \$200,000 is included in the Annual O&M for Alternative 1 to account for this assumption.

Based on previous practice for setting user rates, it is not expected that the utility would adjust the monthly user cost.

Table 18: Life-Cycle Cost Analysis Calculations

	Monthly User Cost	Annual O&M	Capital Costs	Net Present Value
Alternative 1: Do Nothing	\$101.46	\$1,484,030	\$0	\$23,804,116
Alternative 2: Replace in Place	\$101.46	\$1,210,030	\$68,818,866	\$88,227,972
Alternative 3: Reconfigured Replacement	\$101.46	\$1,210,030	\$66,951,523	\$86,360,629

5.2 NON-MONETARY FACTORS

In addition to the life-cycle cost analysis, non-monetary factors are considered to evaluate the alternatives. Non-monetary factors under consideration are:

- ◆ Community disruption during construction
- ◆ Ease of operation and maintenance
- ◆ Consequence of loop failure
- ◆ Others identified by the community

Not reflected in the Life Cycle Cost Analysis is the negative value of a major failure. The 2024 Swan Lake Loop Failure cost the City \$1 million, but 160 households (700-800 people) were without water and sewer service for over a month in the middle of winter, a cost to public and environmental health that is not reflected in the Life Cycle Cost Analysis.

An important consideration with the selection of an alternative will be the consequence of loop failure. The existing Lagoon Loop serves some of the community's most important facilities, and the largest number of residents. A failure on this loop would compromise the community's ability to provide water to the hospital and impact the largest percentage of households. Providing more balance between the loops will balance the risk and reduce the consequence of a single loop failure. Table 19 shows the average day percentage of water usage per loop based on demands calculated from existing metered flow data on the return and supply side at the WTP. The reconfiguration suggested in Alternative 3 shows a much more balanced percentage of each loop's demand, thus improving hydraulic performance and reliability in the system and reducing the likelihood and consequence of loop failure.

Table 19: Percent Water Usage per Loop

Loop	Average Day (Existing)		Future Design Demand (Alt 3)	
	gpm	gpm/total	gpm	gpm/total
Lagoon	42	24%	46	24%
Front	23	13%	28	15%
Swan Lake	28	16%	23	12%
Uptown	60	34%	69	37%
Central	23	13%	23	12%
TOTAL	176	100%	189	100%

5.3 HYDRAULIC ADVANTAGE

Modeling of the current system indicates that Lagoon Loop can meet the additional demands predicted for the housing complexes and hospital addition, but increasing the pipe diameter would improve system performance and efficiency. The hydraulic model results for each alternative are shown in Table 20. Fire flow results are based on a 20 psi residual in the system while maintaining future design demands.

Table 20: Hydraulic Model Results

Alternative 1 – Do Nothing (Existing)				
Loop	Length (ft)	Supply/Return Pressures ADD (psi)	Fire Flow Available (gpm)	Fire Flow Pressure (psi)
Lagoon	23,461	70/40	642	70
Front	12,849	67/41	553	70
Swan Lake	13,300	67/40	635	70
Uptown	11,155	67/50	807	70
Central	11,030	67/55	890	70
Alternative 2 – Replace & Upsize				
Loop	Length (ft)	Supply/Return Pressures ADD (psi)	Fire Flow Available (gpm) at most distant hydrant	Fire Flow Pressure (psi)
Lagoon	23,461	70/54	856	70
Front	12,849	67/41	690	70
Swan Lake	13,300	67/57	912	70
Uptown	11,155	67/50	807	70
Central	11,030	67/55	890	70
Alternative 3 – Replace & Reconfigure				
Loop	Length (ft)	Supply/Return Pressures ADD (psi)	Fire Flow Available (gpm) at most distant hydrant	Fire Flow Pressure (psi)
Lagoon	16,266	70/55	886	70
Front	19,042	69/44	528	70
Swan Lake	9,500	69/60	855	70
Uptown	13,200	69/44	771	70
Central	11,030	67/55	890	70

Hydraulically, the benefits of reconfiguring Lagoon, Front, Swan, and Uptown Loops and upsizing all the pipes in the system to 8-inch HDPE , as proposed in Alternative 3, will provide better pressure to the services, increase the longevity of the system and pumps, and increase capacity for future growth. The length of pipe between the loops is better balanced and the fire flow available increases by over 200 gpm in Lagoon and Swan Lake Loops with minimal decrease in Front and Uptown Loops due to the increase in their length. See Appendix 4 for more details on hydraulic modeling methods and results.

6.0 PROPOSED ALTERNATIVE

Alternative 3 – Replace Swan Lake and Lagoon Loop in a Reconfigured Alignment is the preferred alternative. This alternative is supported by the City as it provides the best hydraulic service to the residents of Kotzebue and is the most financially efficient due to reduced O&M costs. The proposed project is based on the design criteria outlined in Table 10.

6.1 LAGOON LOOP

Construction will be performed in stages over multiple years due to significant cost of the project and funding limitations. The assumed material amounts and project phasing are provided in Figure 13.

- ◆ Phase 1: Replace approximately 8,000 linear feet of existing 8-inch arctic HDPE pipe from the WTP along Wolverine and Mission Streets and Ted Stevens Way. A 2,600-foot section of Lagoon Loop currently located along 3rd Avenue will be rerouted to 4th Avenue and 5th Avenue/Wolverine Street to avoid construction along 3rd Avenue, which is a paved, major road. The proposed route also has the potential to save on construction costs by using a shared trench for supply and return sections of Lagoon Loop along 5th Avenue/Wolverine Street. Phase 1 will be broken down further to help mitigate the significant cost:
 - Phase 1.1: Replace approximately 4,500 LF of existing 8-inch supply line from the WTP to the 8th Avenue tie-in. Lay approximately 2,200 LF of 8-inch HDPE return pipe in shared trench as supply for connection to WTP during later phase.
 - Phase 1.2: Replace and reroute approximately 1,400 LF of return pipe from 3rd Avenue to 4th Avenue and Mission Street.
- ◆ Phase 2: A 5,780-foot section of Lagoon Loop, between 3rd Avenue and 5th Avenue and the airport and Mission Street, will be transferred to Front Street Loop to decrease the length and number of services on Lagoon.
 - 54 services will be transferred from Lagoon Loop to Front Street Loop
 - The length of Lagoon Loop will be decreased by a length of 6,698 feet for a total reduction in circulating water main length of 300 feet that will not get transferred to Front Street Loop.
- ◆ Phase 3: Replace the remainder of Lagoon Loop with 8-inch arctic HDPE pipe. New pipe will be routed the same as existing between 5th and 8th Avenues and Lagoon and Mission Streets. Abandon existing pipe in place.

6.2 SWAN LAKE LOOP

- ◆ Phase 4: Replace and upsize existing 6-inch pipe to 8-inch arctic HDPE along Ptarmigan Way, Turf Street, and Otter Street. A 2,100-foot section of Swan Lake Loop along Adams Street with approximately 22 services will be transferred to Uptown Loop. The transfer will:
 - Eliminate the need to replace approximately 1,000 feet of the existing Swan Lake Loop.
 - Will increase Uptown Loop to approximately 13,200 feet and decrease Swan Lake loop to 9,500 feet and is not expected to cause an imbalance in the shared pressure head manifold.
- ◆ Phase 5: Replace and upsize existing 6-inch pipe to 8-inch arctic HDPE from the WTP between Grayling Street and 6th Streets and Ptarmigan and Turf Streets. Swan Lake Loop will be re-routed to eliminate a total of approximately 700 feet. The re-route will remove sections along Ptarmigan Way,



Otter Street, and 6th Street. A new section will be added along Turf Street between 6th Street and Caribou to create an overall decrease in length.

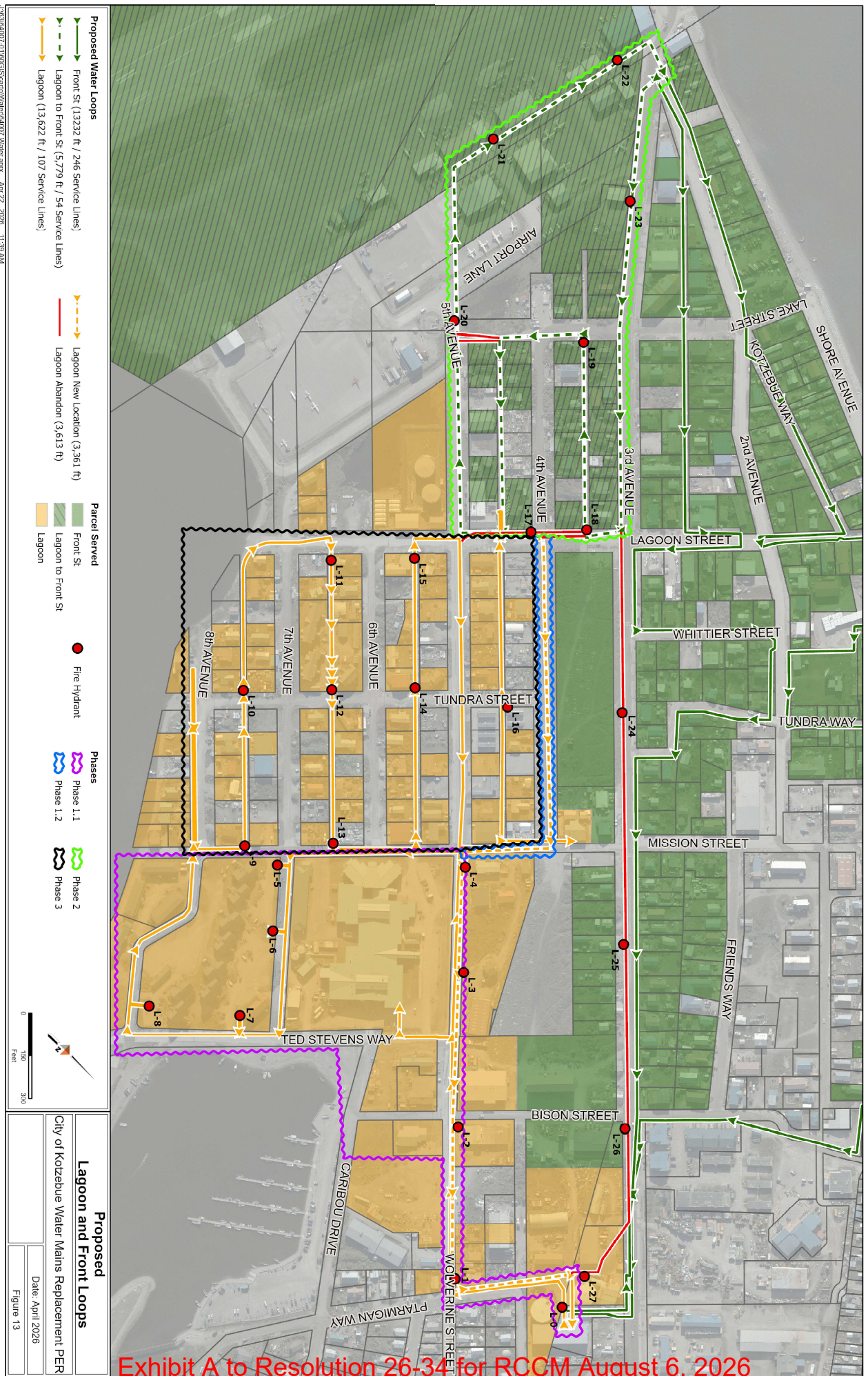


Exhibit A to Resolution 26-34 for RCCM August 6, 2026

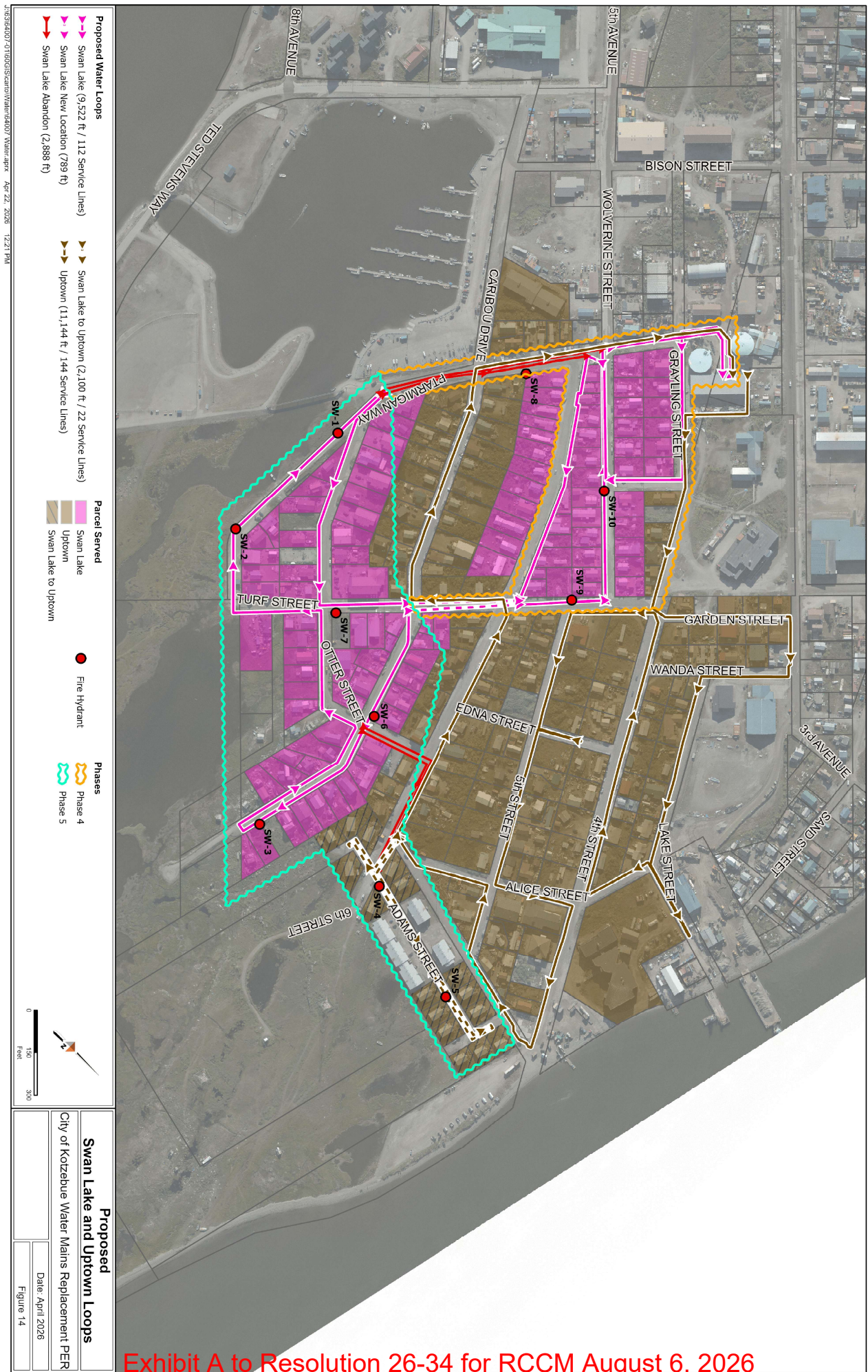


Exhibit A to Resolution 26-34 for RCCM August 6, 2026

Table 21: Replace Swan Lake and Lagoon Loop in Reconfigured Alignment

Phase	Year	LF	# of Services	# of Fire Hydrants	LF of Paving (asphalt)	LF of Concrete cut and Patch (5' wide)
<i>Lagoon Loop</i>						
Phase 1.1: Replace supply pipe, connect new housing and hospital services	2026	4,500	47	5	2,400	0
Phase 1.2: Replace and reroute pipe along 3 rd Ave to 4 th Ave and Mission St	2026	1,400		4	300	
Phase 2: Switch section of Lagoon Loop to Front Loop & upsize 6-inch to 8-inch arctic HDPE	2027	5,780	54	11	2,600	500
Phase 3: Replace and upsize remaining Lagoon Loop	2028	6,718	60	7	1,940	0
Subtotal		22,762	161	27	7,240	500
<i>Swan Lake Loop</i>						
Phase 4: Adams Street transfer, Ptarmigan Way, Turf, and Otter Street replace and upsize	2029	5,049	46	5	0	0
Phase 5: Replace and upsize remaining Swan Lake, re-route along 6 th to Turf Street	2030	5,015	59	5	922	0
Subtotal		10,082	124	10	922	0
Total		32,844	285	37	9,271	500

6.3 PERMIT REQUIREMENTS

Table 22: Permit Requirements

Permit or Approval	Description and Considerations	Public Review
National Environmental Policy Act (NEPA) (42 USC 4321)	USDA as the project funding/authorizing agency will likely require a Categorical Exclusion (CE) and Environmental Report.	No
National Historic Preservation Act (NHPA) (54 USC 100101) and State Historic Preservation Office (SHPO) Concurrence	Prepare Initiation Letter (based on approved project description) followed by City review (typically 2-3 weeks) and then submit to SHPO for 30-day SHPO comment period. Once impacts are assessed, a findings letter can be drafted and again sent to the City for review and then to SHPO for a final 30-day comment period. Tribal consultation would likely be conducted by the City.	No
U.S. Army Corps of Engineers (USACE) – Regulatory (Clean Water Act (CWA) Section 404	Once consultations are complete, the USACE permit would take 60 days to finalize.	Nationwide Permit – No; Individual Permit - Yes
Alaska Department of Environmental Conservation (DEC) – Division of Water (Section 402 CWA)	The Stormwater Pollution Prevention Plan (SWPPP) describes all planned controls to prevent or minimize erosion and sedimentation from construction activities. A SWPPP would be developed as part of the construction planning process and will be required under the Construction General Permit. Construction contractor obtains permit prior to the start of construction.	No
Contaminated Soils and Groundwater Materials Plan	Document coordination with ADEC; support de-watering permits (if needed)	No
Northwest Arctic Borough (NAB) – Title 9	The Title 9 permit is a review by the NWAB that the proposed development is in accordance with Title 9 land use policies and the NAB Comprehensive Plan	Yes

7.0 CONCLUSIONS AND RECOMMENDATIONS

The preferred alternative project will improve the reliability and overall water service capabilities to the residents of Kotzebue while reducing O&M costs. While doing nothing is an option, new 8-inch arctic HDPE pipe replacements and reconfigured loops will reduce the number of emergency call-outs and work orders to people's homes, improve the operation of the system hydraulically, increasing the life span of the pipes and equipment, and make room for growth in the community by increasing hydraulic capacity in the loops.

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