Chandalar River United Management (CHUM)

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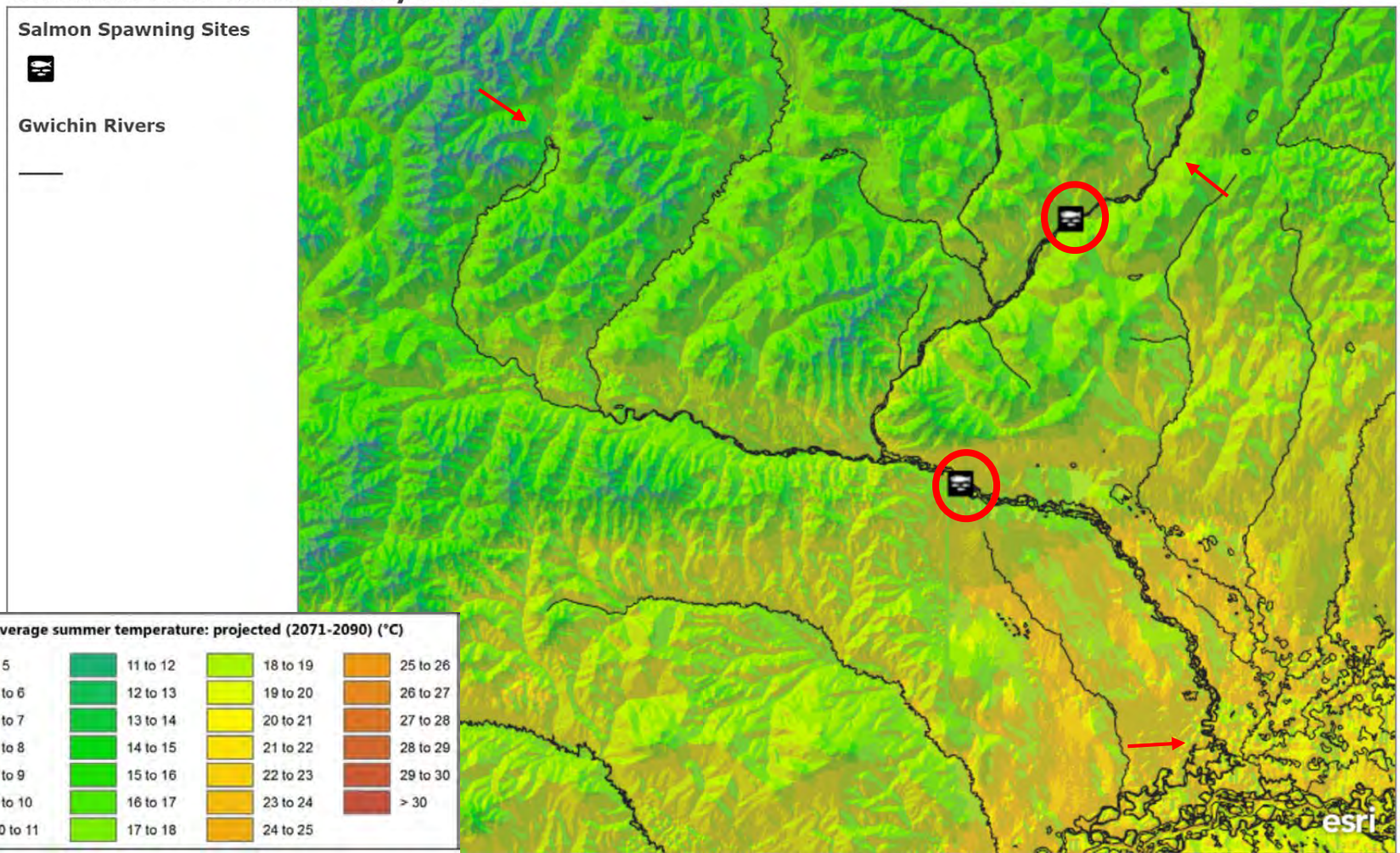
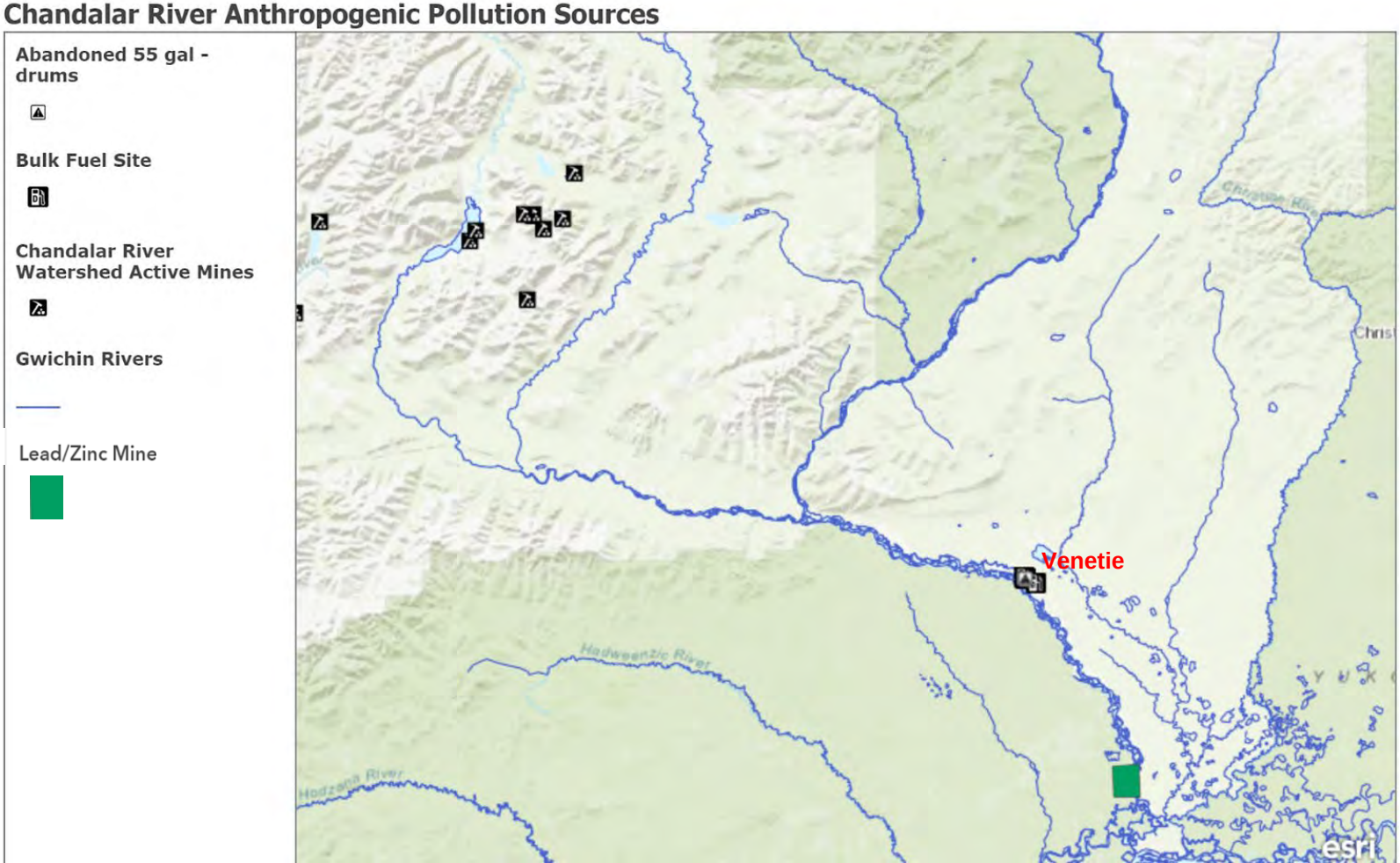
Background

- Tributary of the Yukon River
  - 567 miles long
  - 15,407 square mile drainage area
- Flows through and connects to the Yukon in the Yukon Flats Wildlife Refuge
- Contains several fish species
  - Summer and Fall Salmon Runs
  - Humpback, Broad, and Round Whitefish
  - Arctic Grayling, Northern Pike, Chinook
- The watershed contains two villages
  - Venetie
  - Arctic Village

GIS Chandalar River Watershed Climate



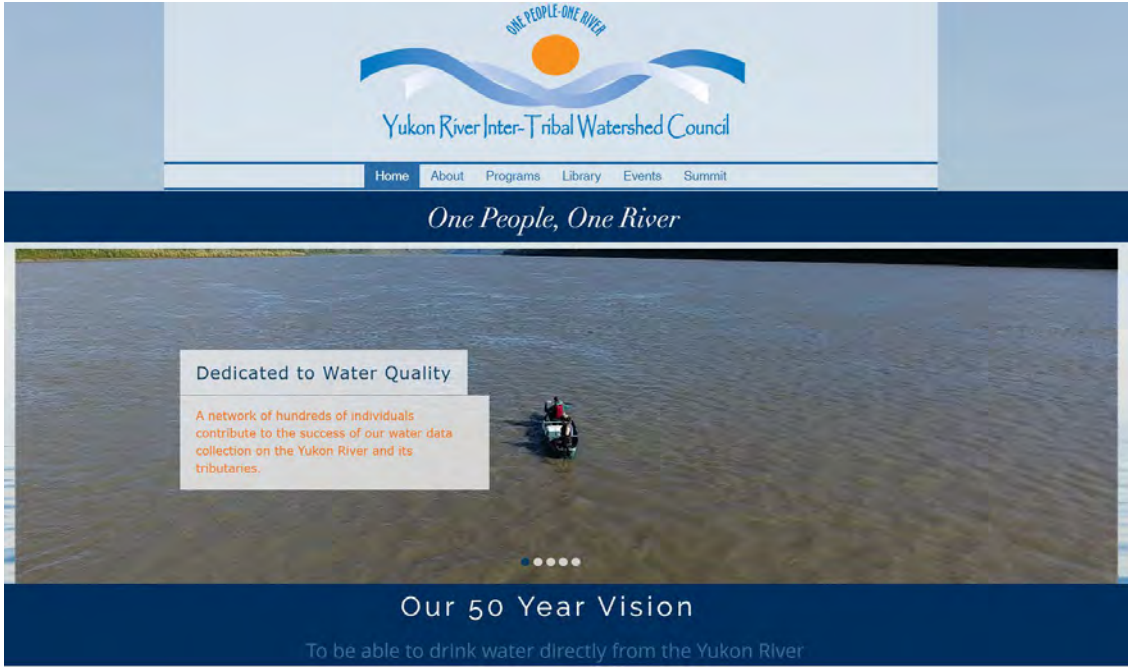
GIS Map Chandalar River Anthropogenic Impacts



History

- Its name came from the French term “Gens de Large,” meaning “nomadic people,” used to name the Kutchin Indians that lived along this stream. Early USGS field notes spelled it “Chand-da-larg,” creating Chandalar.
- The river has recently been renamed in 2015 to its traditional Gwich’in name, the Teedriinjik River, meaning “Luminous River” or “Shining River.”
- In 1905, miners set up camps in the area due to the gold rush, but they mostly left by 1910.
- The population is mostly descendants of the Neets’ai Gwich’in native people. They continue to practice subsistence activities involving caribou and fish for their daily lives and culture.

Current Governance: YRITWC



ONE PEOPLE-ONE RIVER

Yukon River Inter-Tribal Watershed Council

Yukon River Watershed Plan

August 2013

The Tribes and First Nations of the Yukon River, working together through the Yukon River Inter-Tribal Watershed Council, have developed the Yukon River Watershed Plan to protect and improve the water quality in the Yukon River. The Watershed Plan is meant to assure that the Yukon River will continue to sustain the coming generations of all the people, fish, wildlife and plants of the Yukon. The plan combines the best of modern science and policy with the traditional knowledge of the indigenous governments and people of the Yukon River, and includes specific, enforceable standards to protect the quality, quantity and flow of the water in the river.

The Watershed Council developed the Watershed Plan as the next step in its mission to protect and improve the water quality of the Yukon River. The goal is to achieve the Council's 50-year vision of a Yukon River once again clean enough from which to drink. Highlights of the Watershed Plan include:

- **Vision** for the Yukon River Watershed: Yukon River water of such quality that it sustains the health of the people, communities, fish, wildlife and plants important to the ways of life of the people.

- **Watershed Plan Objectives:** Water quality, water quantity and river flows that remain substantially unaltered from natural conditions, so as to:
  - Sustain the habitat conditions and ecological functions necessary for productive fish and wildlife populations in the Yukon basin.
  - Sustain the health of all the people and communities who drink or come into contact with any water in the Yukon watershed.
  - Sustain the traditional and subsistence uses of the watershed by the people of the Yukon River.

YRITWC Policies

The modest amount of flow regulation and withdrawals in the Yukon River existing as of 2012 is consistent with this standard. No further flow regulation or withdrawals of significance would be consistent with this standard in the absence of an amendment to this plan either altering the standard or recognizing the further changes as still consistent with the standard.

Temperature: The baseline standard is naturally occurring temperatures -- that is, the temperature standard is to avoid any measurable surface water temperature increase resulting from human activities. Local planning efforts may identify more specific temperature standards for specific river reaches, to be considered for adoption into the watershed plan upon sufficient documentation that the temperature standard is consistent with the designated uses. Even then, in no event shall a temperature standard allow temperatures to exceed a 7-day average of the daily maximum temperature values greater than 13°C in spawning and incubation areas and 15°C in rearing areas for key fish species.

Dissolved Oxygen:

In active spawning areas (and other areas identified later identified in local planning efforts), the seven-day mean minimum target level for total dissolved oxygen from spawning through fry emergence is to be at or above 11.0 mg/L. Even with that target, as long as the minimum intergravel dissolved oxygen concentration, measured as a spatial median, is determined to be 8.0 mg/L or greater, then the seven-day mean minimum dissolved oxygen standard for the waterbody as a whole may be as low as 9.0 mg/L but no lower. In any event, the spatial median intergravel dissolved oxygen concentration must not fall below 8.0 mg/L. ("Intergravel dissolved oxygen concentration" means the concentration of oxygen measured in the water within the stream bed gravels.) If conditions of barometric pressure, altitude, and temperature preclude attainment of either the 11.0 mg/L or 9.0 mg/L criteria, dissolved oxygen levels must not be less than 95 percent of saturation.

In all other areas of the river, all deemed suitable for cold-water aquatic life, under ordinary circumstances the total dissolved oxygen concentration may not be less than 8.0 mg/L. If conditions of barometric pressure, altitude, and temperature preclude attainment of the 8.0 mg/L, dissolved oxygen may not be less than 90 percent of saturation. On a case-by-case basis, upon demonstration that aquatic life will not be adversely affected, the dissolved oxygen standard in a particular stream reach may be revised so as to require that dissolved oxygen concentration not fall below 8.0 mg/L as a 30-day mean minimum, 6.5 mg/L as a seven-day minimum mean, and 6.0 mg/L as an absolute minimum.

Fecal Coliform Bacteria: In a 30-day period, the geometric mean may not exceed 20 colony-forming units/100 mL, and not more than 10% of the samples may exceed 40 colony-forming units/100 mL.

Total Dissolved Solids (salinity): Total dissolved solids from all sources may not exceed 250 mg/L.

pH: Human-induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0.

Radioactivity: Human activity should not cause radioactive materials to be present in surface waters in excess of natural quantities. Specific numerical standards for radiological substances are guidelines for determining potential impairment:

Gross alpha particle concentration	not exceed 15 picocuries/liter (pCi/L)
Gross beta particle concentration	not exceed 50 pCi/L -- 4 millirems annual dose equivalent
Radium 226 & 228 (combined)	not exceed 5 pCi/L
Radium 226	not exceed 3 pCi/L
Strontium 90	not exceed 8 pCi/L
Tritium	not exceed 20,000 pCi/L
Radon	not exceed 300 pCi/L

Turbidity: No increase above naturally occurring turbidity so as to threaten or impair designated uses or aquatic biota. As a guideline to impairment, turbidity levels should not exceed 5 nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU.

Residues (including petroleum hydrocarbons, oil and grease): Residues are not allowed in surface waters in concentrations or amounts that impair designated uses, cause nuisance or objectionable conditions, result in undesirable or nuisance species, or produce objectionable odor or taste. All waters shall be free from visible oils, scum, foam, grease, and other floating and suspended substances resulting from other than natural causes. Residues from petroleum hydrocarbons, oil, and grease may not cause a visible sheen upon the surface of the water.

Sediment: No measurable increase in concentration of settleable solids above natural conditions. The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry is not allowed.

Toxic substances: Toxic substances may not be introduced above natural background levels in waters of the Yukon River basin in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, welfare, aquatic life, wildlife, or designated beneficial uses. This standard applies regardless of whether the toxicity is caused by a single substance or the additive or synergistic effect of multiple substances. Toxic substances include all substances that are persistent, carcinogenic, mutagenic, teratogenic, and/or bioaccumulate in concentrations producing detrimental physiological responses in human, plant, animal, or aquatic life, as determined by the most sensitive biota dependent upon those waters.

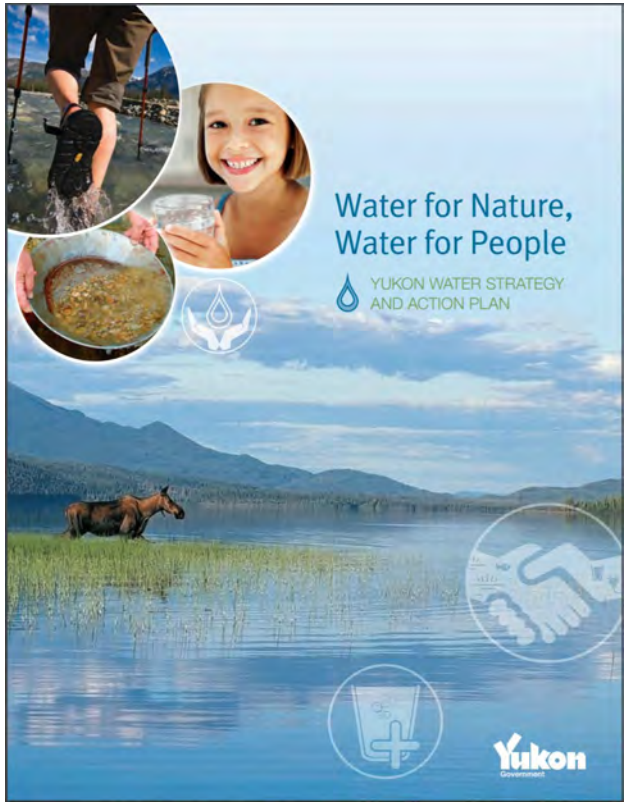
- A mixing zone shall be free from substances that settle to form objectionable objects; float as debris, scum, oil, or other nuisance matter; produce objectionable color, odor, taste, or turbidity; are acutely toxic; or produce undesirable or nuisance aquatic life.
- No discharges into mixing zones shall be permitted for pollutants which have the potential to settle, persist, bioaccumulate or bioconcentrate in the mixing zone or in the aquatic environment.
- Mixing zones are not allowed if they would significantly affect cultural, economic or recreational activities on nearby lands or waters.
- A mixing zone should not be relied upon as a substitute for wastewater treatment and control. All discharges must comply with all applicable treatment requirements in law and regulation.
- Conclusions, decisions and conditions applied to approve a mixing zone are subject to review and revision as further information related to the permitted mixing zone becomes available.

Anti-degradation policy: The objective of the Tribes and First Nations in this plan -- an objective also expressed in the general water quality standard that begins this section as well as in the rights and expectations of the individual Tribes and First Nations -- is that Yukon River be *substantially unaltered from natural conditions* in terms of quantity, *quality* and rate of flow, within normal environmental variation. This means the objective of this water quality plan is itself a statement of an anti-degradation policy, as the norm to expect across the entirety of the Yukon River basin.

This is the reason the specific water quality standards in this plan are as strict as they are -- as an expression of quality not to be substantially altered or impaired or degraded. The water quality standards and the principle of anti-degradation are to be read together, as a consistent approach to the quality of the water of the Yukon River. Among other things this means that all existing and proposed land and water activities should be evaluated as to whether they pose a threat to meeting the water quality standards -- and thus pose a threat to the degradation of the Yukon -- and if so, the degrading activities should be addressed (changed or ceased or conditioned or denied) to ensure the river's water quality is not substantially degraded.

For this reason the water quality standards in this plan do not include a complex anti-degradation policy, as is often the case in water quality standards under the U.S. Clean Water Act. Water quality in the Yukon River should be maintained, not degraded, and improved where below standards. The Tribes and First Nations of the Yukon River approve this plan with the understanding that in certain circumstances a decision may be made, on appropriate information, to allow a land or water activity that will promote important economic or social objectives in the region but will slightly impair water quality. Such decisions should be rare, and the Tribes and First Nations must participate in the decisionmaking. And in no event may degradation of Yukon River waters violate the specific water quality standards or interfere with or be harmful to public health or welfare, cultural and spiritual activities and values, fish and wildlife health, the health of domestic animals, or any other existing or designated uses.

Current Governance: Government of Yukon, Canada



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YUKON WATER STRATEGY AND ACTION PLAN

Yukon, Canada Policies

BETTER UNDERSTAND AND MANAGE YUKON'S GROUNDWATER

Groundwater is integral to the replenishment of surface water systems that support aquatic and terrestrial life. It is the primary source of drinking water for Yukoners and supports activities that are important for our economy. In order to protect Yukon's groundwater from contamination, improvements to our understanding, monitoring and management of this resource are essential. The actions government will undertake to advance this priority area will focus on formalizing and expanding its existing groundwater programs.

MAINTAIN/IMPROVE ACCESS TO SAFE DRINKING WATER

People want to know the state of their drinking water systems, that standards are being met and maintained, and what improvements are being made and why. Governments operate drinking water supply systems, make improvements to those systems, and construct new systems. The Yukon government regulates the provision of drinking water by large and trucked public systems. To advance this priority area, the government will focus on better protection of drinking water sources as well as enhancing its education and outreach activities.

Priorities

The Yukon government will work in six priority areas to address the strategy's goals:

PLAN FOR WATER NEEDS NOW AND IN THE FUTURE

Water systems will change in the future as a result of impacts from climate change, population growth, development and new land use activities. Agencies and proponents need baseline water quality, hydrology and meteorological data to consider new activities in undeveloped areas. To advance this priority, the government will focus on ensuring adequate water monitoring and research takes place across the territory and enhancing the use of best available science, traditional and local knowledge in decision making.

PROMOTE THE SUSTAINABLE USE OF WATER

Efficient water use helps maintain the health of aquifers and surface water systems and reduces impacts to the environment. Efficient and sustainable water use also means lower costs for water users, providers and taxpayers. Increased use of best management practices will help reduce impacts to the environment and ensure adequate water is available for businesses, communities and other users. The actions government will undertake to advance this priority area will focus on providing more guidance and advice to licensed and non-licensed water users.

IMPROVE WATER MANAGEMENT PROGRAMS

There are many Yukon government departments and agencies with water management responsibilities. The action plan identifies ways for them to improve collaboration and together identify and address water management areas that need improvement. The actions government will take to advance this priority area will focus on enhancing cooperation, coordination and collaboration among Yukon government water managers and strengthening their overall water management capabilities.

IMPROVE THE SHARING OF INFORMATION ABOUT YUKON'S WATER

Information regarding surface and groundwater supply and quality is essential when planning water use activities and assessing their impact on the ecosystem. Improved communication about available water information and data will enhance the ability of citizens, governments and partners to make decisions informed by shared knowledge. To advance this priority area, the government will focus on improving communication, education and outreach about the state of Yukon's water. It will also enhance the web-based tools now in place for sharing information and data with the public.

North Slope tundra and wetlands, Yukon

Water for Nature, Water for People YUKON WATER STRATEGY AND ACTION PLAN

Appendix II:

Other Agencies' Roles and Responsibilities

Federal Government	In Yukon, the federal government has jurisdictional responsibility for water in certain areas such as navigation, fisheries and boundary waters, and shares responsibilities in other areas such as agriculture and health. It is also responsible for managing water on federal lands (e.g., National Parks), First Nation reserves and in federal facilities.
Yukon First Nations	Yukon First Nations have rights in relation to water that are set out in Final Agreements. These include use and protection of water on Settlement Lands, and use of water in Yukon for trapping, non-commercial harvesting, and traditional heritage, cultural, and spiritual purposes. Eleven Yukon First Nations are self-governing. Each of these First Nations can make and enact laws in respect of its lands and citizens, including resources management, taxation, and municipal planning. First Nation governments play a large and growing role in Yukon. The Council of Yukon First Nations nominates one-third of the members of the Yukon Water Board. Many First Nation governments own and operate their own drinking water systems. Transboundary First Nations have rights in relation to water as set out in Yukon Transboundary Agreements (currently the Tetlit Gwich'in is the only one). The Yukon River Inter-Tribal Watershed Council (YRITWC), an organization made up of representatives from the governments of more than 70 First Nations and Tribes in the Yukon River basin also plays a significant role in protecting Yukon's water. The mission of the YRITWC is to assist in protecting and improving the water quality of the Yukon River and all its tributaries.

Champagne and Aishihik First Nations is developing its own water strategy. The strategy is intended to bring a culturally-based focus to the management and protection of water in its traditional territory. The development of partnerships is a key feature of the strategy.

For more information, please contact the Champagne and Aishihik First Nations or visit www.cafn.ca.

Mission Statement

CHUM’s mission is to guarantee that the river remains sustainably fishable until the year 2035 and beyond in order to protect the native fish species that occupy the river, which many communities within the river basin are dependent on, and fuel the local sportfishing industry. We also aim to improve overall water quality and mitigate freshwater input.

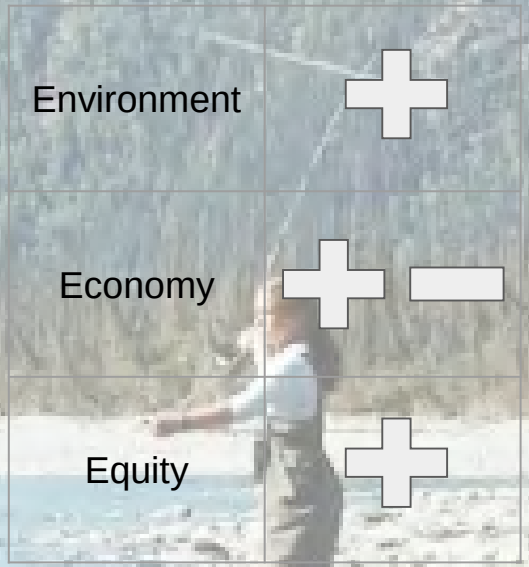
Problem 1: Water Quality

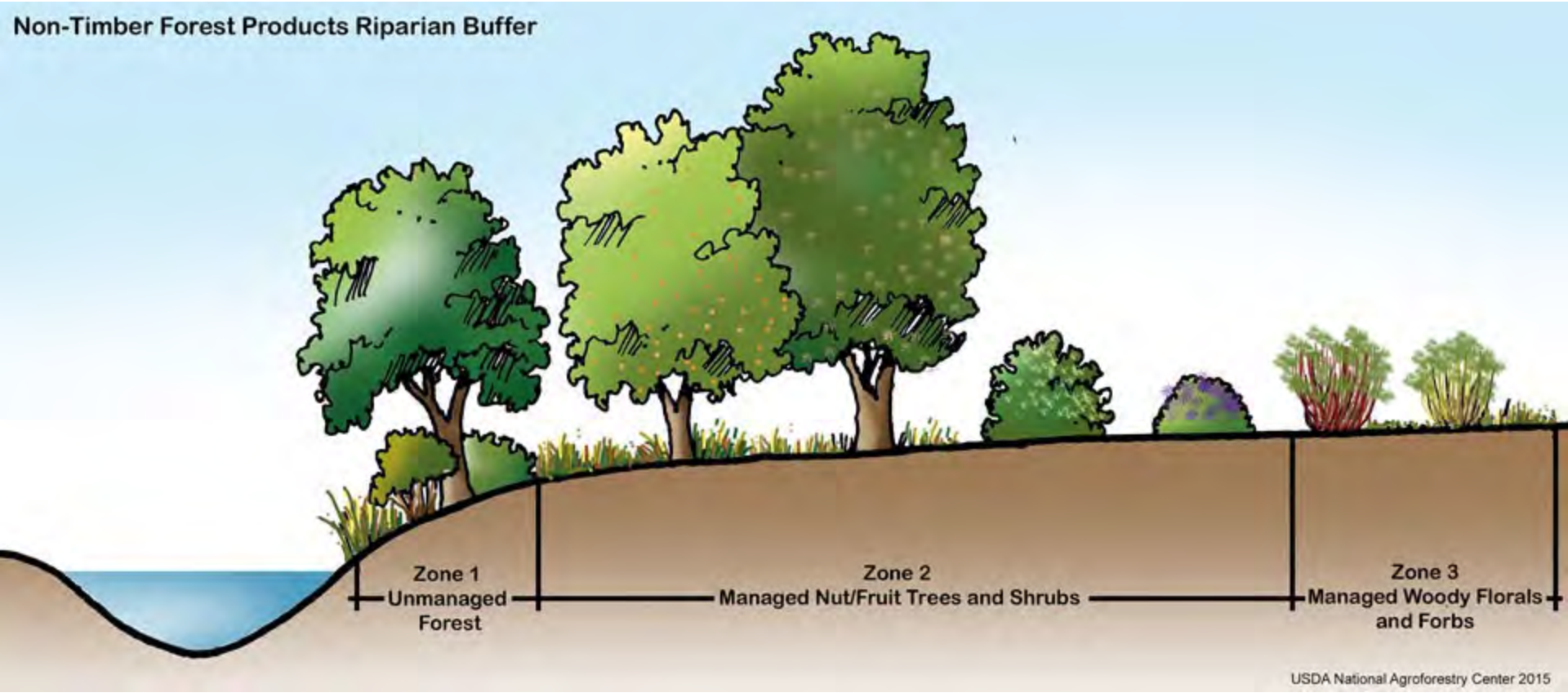
- Heavy metal persistence (Pb, etc.)
  - Gold and Lead/Zinc mining
  - Inconsistent and incomplete testing
- Continuously leaking bulk fuel tanks
  - Venetie - fails many basic requirements
- High sediment loads
- Hard water
- High freshwater input
- Low nutrients

Water Quality Indicator	Average Value	Analysis
Specific Conductance, uS/cm @ 25C	218.94 (Range: 147-308)	Relatively normal but a bit high for salmon, indicator of possible pollution
• pH • Alkalinity, mg/L CaCO3	• 7.9 • 105.4	• Ideal range for most fish is 6.5-8.5 so this is ideal • High buffer capacity, higher end indicates water hardness
Total dissolved solids, mg/L	151	Indicates hard water
• **Hardness, Ca, Mg, mg/L CaCO3** • Ca 2+ dissolved, mg/L	• 120 • 39	• Hard water range, high chemical weathering of rocks • 25> suggests high suitability for mollusks
Nutrients • Nitrate, mg/L as N • Orthophosphate, mg/L as PO4 • Potassium, mg/L	• 0.68 • 0 • 0.65	Low nutrients due to high freshwater input • Phosphate has been used up and is a limiting factor in biolife
Minerals • Silica, mg/L • Manganese, ug/L	• 2.8 • 16.5	• Significantly low, usually 5-25 mg/L. Necessary for plants • Indicates water hardness
Radiation • Alpha particles, pCi/L • Radium-226, pCi/L	• 2.95 • 0.03	• Maximum Contaminant Level (MCL) = 15 pCi/L, MCL goal (MCLG) = 0 pCi/L. Alpha particles are a ionized radiation form of Polonium-210 decay which is carcinogenic at 0.1 pCi/L so Po-210 should be tested • MCL = 3, MCLG = 0

Goal 1: Keep Water Quality at Fishable Standards

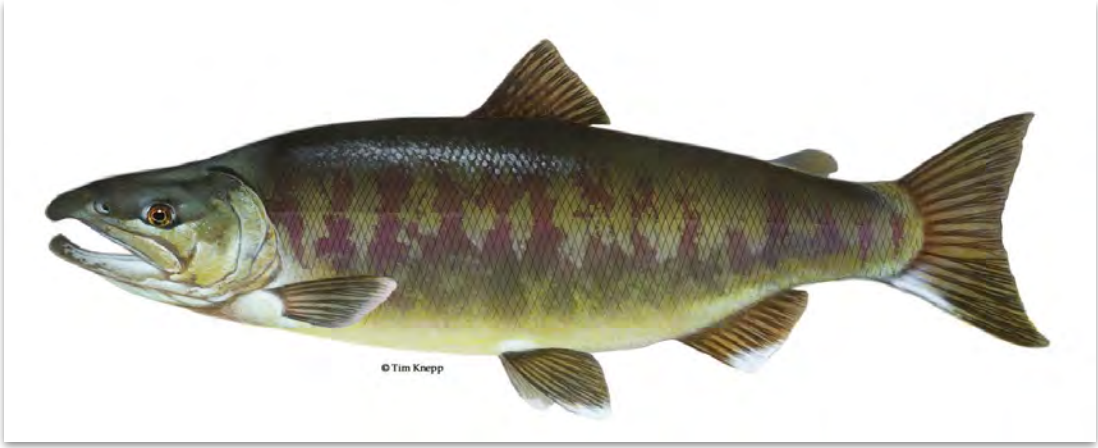
- Consistent water monitoring
  - Heavy metals and Po-210
- Decrease water hardness
  - Add water softener
- Increase water nutrients
  - Implement riparian buffer zone
- Control mine runoff
  - Safely close abandoned gold mines
- Improve bulk fuel safety, replace broken valves and leaking pipes/tanks
- Implement renewable energy sources
  - Wind, solar, and hydropower




Non-Timber Forest Products Riparian Buffer
Zone 1
Unmanaged
Forest
Zone 2
Managed Nut/Fruit Trees and Shrubs
Zone 3
Managed Woody Florals
and Forbs
USDA National Agroforestry Center 2015

Problem 2: Salmon Industry

- Important food source for residents
- Economic impact
- Catch records low
- Problems for chum:
  - Low water temperature
  - Low food abundance
  - Low water quality



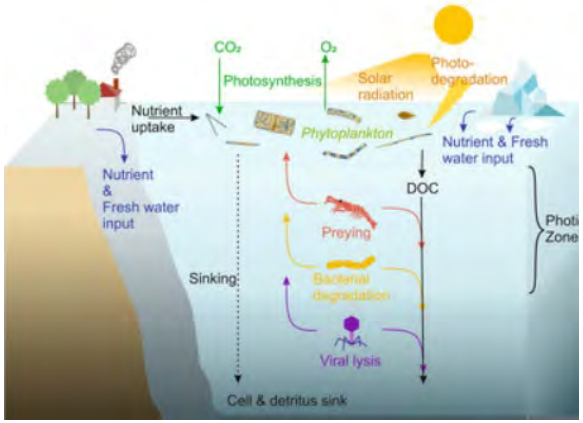
https://www.fws.gov/fisheries/freshwater-fish-of-america/chum_salmon.html

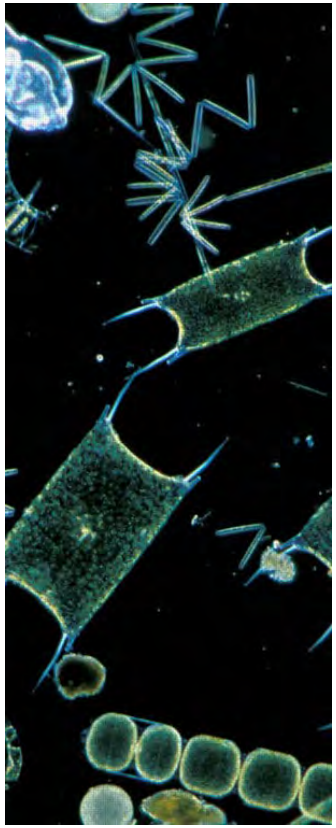
Goal 2: Salmon Hatchery

- First hatchery implemented in 1970 huge success
- Majority of salmon harvest and release in southeast
- A more convenient way to spawn
- Recirculating system to preserve heat
    - Produce 1 million eggs with only 10 liters of water/minute

Environment	−
Economy	+
Equity	+

Problem 3: Increased Freshwater Input

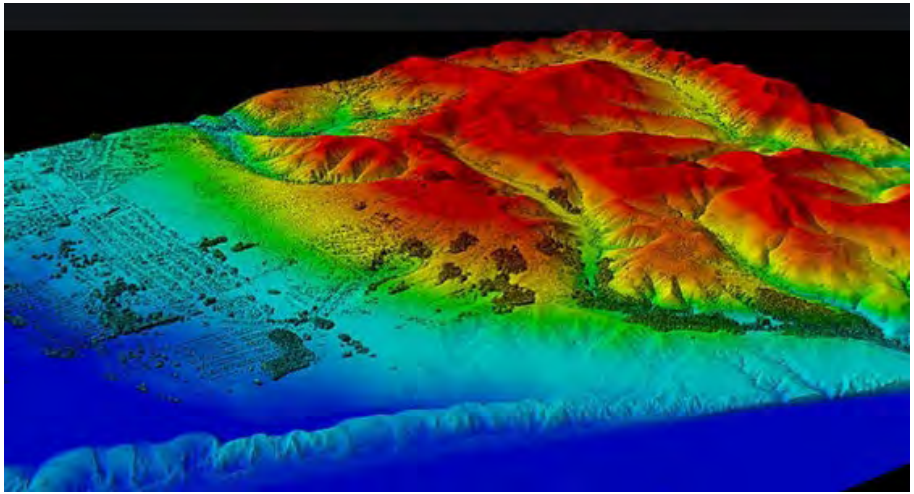




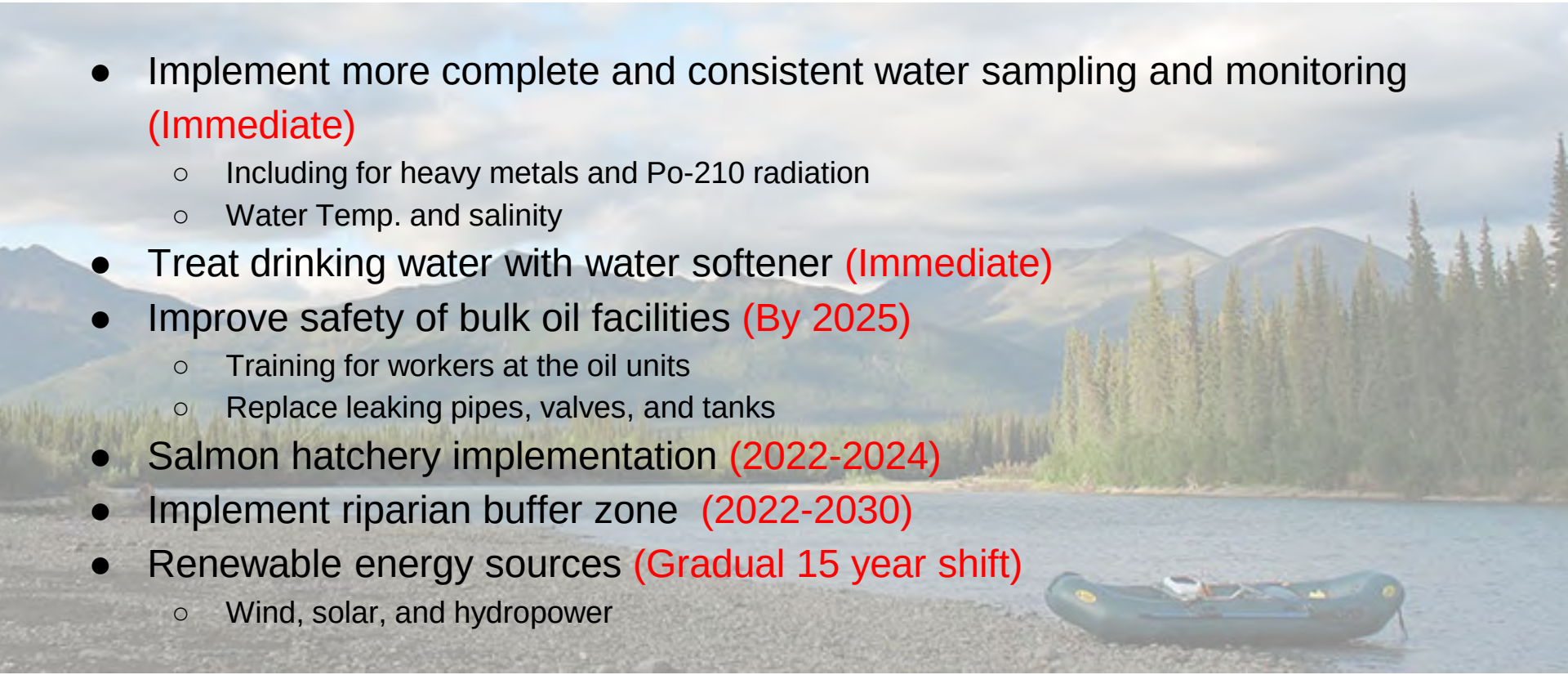
- Result of
  - Glacial melting (and overall climate change)
  - Increased development
- Negatively affects
  - Summer and fall Chum Salmon populations (lowering of water temperatures)
  - Plankton communities
  - Downstream estuarine ecosystems at mouth of Yukon River (decrease in salinity)
  - Natural nutrient cycling processes

Goal 3: field and computational-based scientists to work on water temperature and salinity, glacial mass balance, and policy making

Environment	+
Economy	+ −
Equity	+



Concluding Recommendations



- Implement more complete and consistent water sampling and monitoring (Immediate)
  - Including for heavy metals and Po-210 radiation
  - Water Temp. and salinity
- Treat drinking water with water softener (Immediate)
- Improve safety of bulk oil facilities (By 2025)
  - Training for workers at the oil units
  - Replace leaking pipes, valves, and tanks
- Salmon hatchery implementation (2022-2024)
- Implement riparian buffer zone (2022-2030)
- Renewable energy sources (Gradual 15 year shift)
  - Wind, solar, and hydropower

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Questions?