EA4300

A First Nation Approach to Salmon Rebuilding: Eastern Vancouver Island and Johnstone Strait Mainland Inlets

Final Draft Report

Prepared for

Vancouver Island Salmon Committee
VISC

Prepared by

LGL Limited
environmental research associates

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A First Nation Approach to Salmon Rebuilding: Eastern Vancouver Island and Johnstone Strait Mainland Inlets

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EXECUTIVE SUMMARY

This document was prepared for the First Nations of the Vancouver Island Salmon Committee and presents an approach for rebuilding sustainable Pacific salmon populations and their freshwater and estuarine habitats. The details and specificity in the report are for the geographical region along the east coast of Vancouver Island to the Mainland Inlets across the Johnstone Strait. However, the approach presented is intended to be widely applicable and adaptable to other watersheds.

Successful rebuilding plans should contain five core phases that can be implemented sequentially or with some overlap:

1 Scoping Phase;
2 Assessment Phase;
3 Rebuilding Phase;
4 Evaluation Phase; and
5 Adaptive Management Phase.

This framework presents resources and guidance for each of the above steps that can be used to support VISC First Nations in creating sustainable restoration projects.

The VISC Nation territories have been impacted by forestry, agriculture, water withdrawals and development, among other anthropomorphic causes, including increasing threats from climate which bring with it associated hydrological and temperature changes and the potential for invasive species. Concurrent to the development of this rebuilding approach, a review of salmon abundance and associated data was undertaken in 2023. The state of Pacific salmon stocks in several watersheds within the territories of the VISC Member Nations have been extensively analysed through the Cowichan Assessment Unit Report Card and the A-Tlegay Member Nation Mainland Inlet Territory Escapement Report (Challenger et al. 2024a; Challenger et al. 2024b). These reports are discussed briefly herein and were used to help inform the Scoping and Assessment phases for future salmon rebuilding plan initiatives.

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LIST OF ABBREVIATIONS

The following abbreviations are used in this report:

ARIS	Adaptive Resolution Imaging Sonar
BC	British Columbia
BCSEE	BC Species and Ecosystems Explorer
BCSRIF	British Columbia Salmon Restoration and Innovation Fund
BEC	Biogeoclimatic Ecosystem
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSAS	The Canadian Science Advisory Secretariat
CU	Conservation Unit
CWT	Coded Wire Tag
DEM	Digital Elevation Model
DFO	Fisheries and Oceans Canada
DIDSON	Dual-Frequency Identification Sonar
ECCC	Environment and Climate Change Canada
EcoCat	Ecological Reports Catalogue
EIRS BDP	Biodiversity/Environmental Information Resources e-Library
EIRS EP	Environmental Protection Information Resources e-Library
EPAD	Enhancement Planning and Assessment Database
FHAP	Fish Habitat Assessment Procedure
FSC	Food, Social and Ceremonial
FSP	Fish Stock Provision
IFMP	Integrated Fisheries Management Plan
IK	Indigenous Knowledge
IMAWG	Island Marine Aquatic Working Group
IMW	Intensively Monitored Watershed
LBB	Lower Biological Benchmark
LGL	LGL Limited
LiDAR	Light Detection and Ranging
LRP	Limit Reference Point
MSF	Mark Selective Fishery
NuSEDS	New Salmon Escapement Database System
PA	Precautionary Approach Framework

PCIC	Pacific Climate Impact Consortium
PFMA	Pacific Fisheries Management Area
PNI	Proportionate Natural Influence
PSF	Pacific Salmon Foundation
QARS	Q'ul-lhanumutsun Aquatic Resources Society
RAMS	Risk Assessment Methodology for Salmon
RAPP	Riparian Assessment and Prescription Procedure
REE	Routine Effectiveness Evaluation
RVT	Riparian Vegetation Type
SARA	*Species at Risk Act*
SEP	Salmonid Enhancement Program
SMU	Stock Management Unit
TEK	Traditional Ecological Knowledge
VISC	Vancouver Island Salmon Committee
VRI	Vegetation Resource Inventory
WCVI	West Coast Vancouver Island
WSP	Wild Salmon Policy

1 Context

This document presents an approach for salmon rebuilding that is intended to inform Vancouver Island Salmon Committee (VISC) Member Nations' restoration plans. As such, the framework focuses on these nations whose territories include watersheds and salmon populations along Eastern Vancouver Island in the Strait of Georgia and both sides of southern Johnstone Straits (e.g., Cowichan Assessment Area and the Johnstone Straits Mainland Inlet Area). The need for a First Nation-led approach is predicated on the challenges that DFO- and BC-led processes have exhibited both in terms of scope and sustainable effort.

The Department of Fisheries and Oceans Canada is the federal body managing Pacific salmon in Canada which includes ensuring both the conservation concerns and economic potential for salmon populations are addressed. *Canada's Policy for the Conservation of Wild Pacific Salmon* (herein referred to as the Wild Salmon Policy) (WSP) was presented as the strategy to protect and conserve natural Pacific salmon populations (DFO 2005; Cohen 2012). The WSP has three stated objectives 1) Safeguard the genetic diversity of wild Pacific salmon; 2) Maintain habitat and ecosystem integrity; and 3) Manage fisheries for sustainable benefits. The policy does this by ensuring that conservation units (CUs) are representatively assessed for population diversity and abundance and then compared to calculated population abundance benchmarks such that genetic diversity is retained. The outcome of the population assessments to the Lower Biological Benchmark (LBB) results in a Red, Amber, or Green zone designation. These zones help inform the focus (conservation vs. economy) of the fisheries within them that DFO also manages (DFO 2005; DFO 2023).

Within fisheries management, stocks are designated into Stock Management Units (SMU) which are a group of one or more conservation units managed together as stock aggregates for informing the Integrated Fisheries Management Plans (IFMPs). Stocks are forecasted to provide information to harvest managers for potential harvest plan adjustments (DFO 2023). Under DFO's Precautionary Approach (PA) to fisheries management, the limit reference point (LRP) represents the point where serious harm could occur to the stock if abundance were allowed to decrease further. As such and given the similarities between the LRP and the LBB, these two measures can be considered equivalent. In order to be biologically impactful, the forecasts should be assessed against CU and sub-CU specific reference limits where available. Whilst, biological assessments are important, other objectives are also considered such as sustainable harvest, over-fishing, maintaining access and opportunity, and allocations. As such specific management targets vary. This results in instances where an SMU can be below its management target and under restriction but also well above the LRP or LBB. The reverse can also occur where an SMU could be above management targets but at the LRP (LBB) for some CU level stocks, or co-migration/stock mixing locations.

Under the Fish Stock Provisions (FSP) of the Fisheries Act, fish stocks may be prescribed. The FSP establish binding obligations on the Minister of Fisheries and Oceans to maintain major fish stocks at levels necessary to promote sustainability and develop and implement rebuilding plans for stocks that have declined to or below their limit reference point. Here, the limit reference point is the stock level below which productivity is sufficiently impaired to cause serious harm to the stock. These obligations only apply to stocks that have been prescribed in regulation (s. 6.3) under the FSP. Once a stock has been recognized as declining to or below the LRP, action is triggered, and a rebuilding plan is required within 24-months (DFO 2022b).

FSP rebuilding plans must legally contain stock status and stock trends, probable causes for decline, measurable rebuilding objectives (target and timeline), management measure and methods to achieve objectives and a periodic review (DFO 2021, DFO 2022a). As a result, where rebuilding needs to occur, the DFO approach under the Fish Stock Provisions of the *Fisheries Act* is conducted at 1) broad geographic scales (Management Units vs Conservation Units); 2) has a rebuilding objective of just meeting or exceeding a limit reference point (conservation focus); and 3) is not everlasting.

First Nation-led approaches can complement or replace other federal or provincial initiatives aimed at rebuilding salmon stocks. This approach is intended to address a First Nation desire for a 'place-based' more holistic and long-term approach that invokes First Nation principles related to stewardship and weaves strong cultural and community values into the rebuilding and restoration of the land, waters, and salmon for seven generations and beyond. Appendix A of this report lists a few examples of other salmon rebuilding initiatives as reference.

2 First Nation Principles and Objectives

First Nations have been stewards of their territories, watersheds, and resources since time immemorial. Many, if not all, take a 7-generation view of land and water stewardship so that their children and grandchildren will have an abundance of natural resources to depend on. Some VISC Member Nations have vision and/or mission statements related to land and resources management which are listed in the table below as extracted from their respective websites.

Nation	Statement
We Wai Kai First Nation	*We, the We Wai Kai embrace our language and culture to build a proud, healthy, safe, and self-sufficient community. We support and encourage each other to thrive through following the footsteps of our ancestral history, as stewards of our lands and waters, while balancing our role in modern day society.*
K'omoks First Nation	*The goal of the K'ómoks Guardian Watchmen is to protect and preserve the environment within our Traditional Territory. We are the eyes and ears of the land and sea, thriving to protect everything from the tops of the mountains to the bottom of the oceans, and everything in between.* *As stewards of our lands, resources, and the environment around us, we will honor our ancestors by adhering to our cultural laws and values, passed down generation to generation. We will move forward responsibly using accountability, transparency, environmental responsibility and K'ómoks cultures as the cornerstones of our land management practices. With the guidance of the Creator and our membership represented in our Lands Advisory Committee, we will protect our homelands to ensure environmental sustainability and integrity while building sustainable economic development on our lands.*

Nation	Statement
Q'ul-lhanumutsun Aquatic Resources Society (QARS) Cowichan Tribes Halalt First Nation Lyackson First Nation Penelakut Tribe Stz'uminus First Nation Ts'uubaa-asatx Nation	Respect: *Respect for each other and all living things and for the ways of life of the Hul'q'umi'num people.* Responsibility: *Accept the responsibility passed on by ancestors to manage and care for the lands and water and ensure that the hereditary knowledge and cultural teachings are passed onto future generations.* Giving and Receiving: *Giving and receiving is a respected practice, essential to all interactions between and amongst Coast Salish people, other First Nations, and all others with an interest in fisheries.* Utilize Traditional Ecological Knowledge and Contemporary Science: *Any resource management or scientific work must seek out the highest level of expertise and be defensible. All work must recognize the importance of ecosystems and ecosystem interactions.* Accountability: *Directors and Society staff must always be accountable to the community and their leadership.*
Penelakut First Nation	*It is important for our future generations to have access to resources; therefore, we will prioritize conservation so that we can continue to access our resources.* *We live off the ocean, and our water and land are clean and pristine.*
Stz'uminus First Nation	Our Mission: *Our sacred teachings guide us to provide support and inspire each other to help build a prosperous and healthy Nation for today and future generations.* Our Values: *Family, Respect, Courage, Humble, Integrity, Sacred Knowledge, Love, Honesty, Truth, Relationship.*

3 Relationships with the Crown

The current overarching (not Nation-specific) relationship with the governments of Canada and BC is founded on Indigenous knowledge, case law, and legislation and policy. Dependent on the circumstances, this relationship can be either a catalyst or a barrier to salmon rebuilding. The governments of Canada and BC have jurisdiction and decision-making roles over the unceded land and waters within the territories of VISC Member Nations and therefore must play a role in rebuilding. The local stewardship and cultural role of the VISC Member Nations and their aspirations to take a leadership role in salmon rebuilding must be acknowledged, respected, and supported by both Canada and BC.

The mechanisms for moving this relationship forward are varied and complex and each Nation may approach their relationship with other governments in salmon rebuilding in different ways. Treaties, Court Decisions, and Reconciliation Agreements are currently the three primary mechanisms by which Nations can achieve greater jurisdiction and decision-making over their lands and water. For fisheries, Aboriginal Fisheries Agreements are also potential mechanisms, but these agreements are usually limited in scope and decision-making powers.

Arrangements with other tenure holders on the land base such as forest companies and power companies, are also a potential and important mechanism to advance salmon rebuilding and restoration of damaged habitats.

4 Regulatory and Policy Context

Development and implementation of Indigenous-led Pacific salmon rebuilding requires an understanding of the federal regulatory measures and policies involved in the protection and management of Pacific salmon in British Columbia.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC): COSEWIC assesses the national status of wild species, subspecies, varieties, or other Designatable Units (DUs) that are considered to be at risk in Canada. COSEWIC was created in 1977 to provide a single, scientifically-sound classification of wildlife species at risk of extinction. Each year COSEWIC meets to assign risk categories for native species, including fish. As an independent, arms-length advisory panel to the Minister of Environment and Climate Change Canada, members are experts drawn from academia, government, non-governmental organizations, and the private sector. A new subcommittee was added in 2000 to ensure the inclusion of Indigenous Traditional Knowledge into the COSEWIC status assessment process. The COSEWIC process of species assessment is divided into three sequential steps, each of which has an outcome. Step 1 involves compilation of available data, knowledge, and information to develop a COSEWIC status report. Step 2 involves compilation of available data, knowledge, and information to develop a COSEWIC status report. Step 3 involves assessment of a species' risk of extinction or extirpation and subsequent designation (e.g., Endangered, Threatened, Special Concern) to develop a record of COSEWIC assessment results. Many species in Canada have not yet been assessed by COSEWIC but are suspected of being at some risk of extinction or extirpation. These species, referred to as 'candidate species' are identified by the species specialist subcommittees or by the Aboriginal Traditional Knowledge subcommittee as candidates for detailed status assessment. The subcommittee members use their expert knowledge and judgment to identify candidate species. Candidates may also include species already assessed by COSEWIC as not at risk or data deficient, but where new information suggests they may be at risk. Species on the candidate lists are ranked into three priority groups by the subcommittees to reflect the relative urgency with which each species should receive a COSEWIC assessment. Every 10 years, or earlier, if warranted, COSEWIC reassesses species previously designated in a category of risk with an update status report. The COSEWIC assessments do not take political, social, nor economic factors into account.

***Species at Risk Act* (SARA)**: SARA established COSEWIC as an advisory body. Under SARA, the government of Canada will take COSEWIC designations into consideration when establishing the official list of species at risk. Therefore, it is up to the federal government to legally protect species designated by COSEWIC. The SARA only applies to those species listed on the official SARA list to qualify for legal protection and recovery. The purposes of the SARA are to prevent Canadian species, subspecies, and distinct populations from becoming extirpated or extinct, to provide for the recovery of listed "Endangered" or "Threatened" species and encourage the management of other species to prevent them from becoming at risk. The SARA requires that the best available knowledge be used to 1) define long and short-term objectives in the development of a recovery strategy and a subsequent action plan; 2) create prohibitions to protect listed "Threatened" and "Endangered "species and their critical habitat (which needs to be defined for legal protection); and 3) be consistent with Indigenous and Treaty rights and respect the authority of other federal ministers and provincial governments.

Canada's *Policy for Conservation of Wild Pacific Salmon* or the Wild Salmon Policy (WSP): The WSP, as mentioned in the context section sets out the vision regarding the importance and role of wild Pacific salmon as well as a strategy for their protection. To communicate the work DFO is doing in support of the policy, Canada's Minister of Fisheries, and Oceans, and the Canadian Coast Guard released the Wild Salmon Policy Implementation Plan in 2018 (DFO 2018). This collaboratively developed plan lays out nine overarching approaches to implementation and specific activities that DFO would undertake. The plan is organized under three key themes: 1) assessment; 2) maintaining and rebuilding stocks; and 3) accountability. In 2023, DFO also released a five-year review of the implementation plan (DFO 2023).

***Fisheries Act*:** In 2019, the federal Fisheries Act was amended to include Fish Stock Provisions (FSPs) that relate to the management of fisheries. Guidelines for implementing the FSPs are provided in DFO's Guidelines for Implementing the Fish Stocks Provisions in the Fisheries Act (DFO 2022a). The FSP establishes legally binding obligations on DFO to 1) manage prescribed major fish stocks at levels necessary to promote sustainability; 2) develop and implement rebuilding plans for prescribed major fish stocks that have declined to or below their limit reference point (LRP) to grow the stock above that point; and 3) prescribe in regulation the fish stocks to which the provisions will apply. To meet these obligations, DFO will apply the A Fisheries Decision-Making Framework Incorporating the Precautionary Approach (DFO 2009) policy to fish stocks. The policy outlines DFO's method to apply the precautionary approach to set harvest levels and make decisions respecting harvest levels in fisheries on key harvested fish stocks managed by DFO. Guidelines on developing rebuilding plans are provided in DFO's Guidelines for Writing Rebuilding Plans per the Fish Stocks Provisions and A Fishery Decision-making Framework Incorporating the Precautionary Approach (DFO 2022b). Guidance covers four key topics including: trigger for rebuilding plans, regulated timelines for a plan's development, transition out of a rebuilding plan to an Integrated Fisheries Management Plan when the rebuilding target is reached, and engagement with modern treaty partners, Indigenous groups, and stakeholders.

Integrated Fisheries Management Plan (IFMP): The IFMP is a fishery management process specific to species and/or stocks. The primary goal of the IFMP is to provide a planning framework for the conservation and sustainable use of fisheries resources and the process by which a given fishery will be managed for a period. Guidelines on developing an IFMP are provided in DFO's Preparing an Integrated Fisheries Management Plan (IFMP) (DFO 2013). When developing the IFMP, it integrates the expertise and activities of various DFO sectors in fisheries management planning. It also allows for input from Indigenous groups, resource users, and other stakeholders into decision-making processes regarding management and conservation measures affecting a fishery. This can be accomplished through an advisory committee (e.g. Integrated Harvest Planning Committee), direct bilateral meetings between DFO and First Nations leadership, or via written feedback on the Draft IFMP during a 30-day consultation period. In areas subject to land claims agreements, it is important to consider the provisions of the different agreements. These agreements generally provide for fish harvesting rights and most agreements establish structures with functions related to the management of the fishery and may also set out processes to be followed. Integrated Fisheries Management Plans should be developed in a manner consistent with those agreements and consider fish harvesting rights under those agreements.

The Canadian Science Advisory Secretariat (CSAS): The CSAS coordinates the scientific peer review and science advice for DFO. The CSAS publishes departmental scientific advice and information on topics such as fish stock dynamics, species at risk, invasive species, ecology of marine and freshwater ecosystems, marine protected areas, aquaculture, and the use of living aquatic resources. The CSAS's work can analyze data and develop advice to inform rebuilding efforts, which can then be implemented through policy and Indigenous recovery efforts. It is well recognized that sound decision-making in management and policy formation must be based on the best available science. However, it is important to recognize that science-based information is only part of DFO policy formation and development of management approaches.

Provincial legislation and policy: While the Province of British Columbia is not involved in the management of Pacific salmon nor rebuilding efforts, an understanding of the provincial regulatory measures and policies involved in land use practices is required. This is in part to better understand which potential interventions are allowable under the provincial protection and sustainability focused acts. The following three acts are a selection of potentially influential acts and their subject matter jurisdiction. The ***Water Sustainability Act*** provides direction respecting potential impacts to aquatic habitat, including the identification of sensitive streams, due to water extraction, diversion, and several industrial and land use practices. The act includes requirements for addressing a stream's environmental flow, the volume and timing of water required for the proper functioning of the stream's aquatic ecosystem (BC 2021). The ***Riparian Areas Protection Act*** ensures protection of riparian areas while facilitating urban development through regulation. Site level assessments of proposed developments by qualified professionals are required to ensure that proper setbacks maintain riparian habitat and buffer the effects of surface run-off. Regulatory direction under the ***Forest and Range Practices Act*** (Government Actions Regulation) addresses the maintenance of stream conditions during road building and other works. The BC government Natural Resources Best Management Practices website provides regulatory guides for the above acts as well as other relevant legislative links (BC 2024a).

5 Components of a Rebuilding Plan

Rebuilding approaches can be broken down into five core phases: Scoping, Assessment, Rebuilding, Evaluation, and Adaptive Management.

Scoping Phase: Defining the scope of the project is an essential first step to guide effective efforts towards sustainable and achievable goals with measurable outcomes.

STEP 1: First and foremost, guiding principles should be decided upon that reflect what restoration means and looks like for each Nation. These could be broad and overarching themes or very specific to a key species of importance. Once an ideal vision has been established, the focus needs to be narrowed to pinpoint expected outcomes and action plans. In general, questions on scope should include considerations such as: Which species/populations are the intended target of the rebuilding? What is the state of the ecosystem as a whole, and how does that state affect restoration objectives? What baseline will be used to measure rebuilding against? Are you trying to achieve pre-colonization abundances, or abundances that were experienced during a more recent productive period? What natural and/or man-made barriers impede or may impede restoration efforts? In addition, spatial and temporal boundaries around both the physical and governance aspects need to be established.

STEP 2: GOVERNANCE – Once principles and objectives have been decided upon, governance should be established. Nations should consider such questions as who will be responsible for the financial and administrative side of the plan's execution. How much oversight to the project does the Nation wish to retain? What role will the federal and provincial bodies take in the plan's development and implementation? What is the regulatory and policy context in which the plan will be undertaken? Should an organizational body be established to provide technical oversight to the rebuilding plan? What will be the role of the community? Are there external processes that could enhance or limit the rebuilding?

Assessment Phase: Once guiding principles have been agreed upon and the scope of rebuilding has been clearly defined, an up-to-date assessment is required to understand the status of the targeted stock/populations and habitats. During the assessment phase the status of not only the key stock of concern, but also of other species using those waterbodies, should be characterized. This could take the form of a review of publicly available stock assessment data (i.e., New Salmon Escapement Database System [NuSEDS]) and published reports, conducting assessment studies, or by a combination of methodologies. Alongside stock assessments, information should be gathered on harvest, hatchery releases, juvenile production, watershed geology, hydrology, weather patterns, and other marine activities, along with current and future land use plans. It is also important to understand both the current status of the aquatic habitat in regard to fish passage, rearing and spawning, as well as estimates of potential available habitat for rebuilding.

During this process, several assessment tools such as RAMS (Risk Assessment Methodology for Salmon) can be applied to help identify potential limiting factors in the environment. Limiting factors in administrative areas of the rebuilding plan should also be part of this assessment. This can include but is not limited to topics such as availability of continued funding, infrastructure concerns, and political landscape. Once a clear understanding of the current status and potential limiting factors are known, identification of restoration options and setting of priority projects can begin.

Rebuilding Phase: For most Nations, it is anticipated that the overarching goal for rebuilding is to rebuild to a sustainable level that existed prior to the onset of watershed damage and fishing impacts. To achieve such a goal takes time and ongoing stewardship; hence the rebuilding phase, followed by evaluation and adaptive management, should be envisioned to last generations. During the rebuilding phase there are four broad areas to consider when identifying rebuilding strategies:

1) Harvest Management;
2) Habitat Restoration;
3) Hatchery Intervention; and
4) Watershed Management.

These are long and involved processes that require a large initial and ongoing investment, not only physically and financially, but also emotionally and spiritually; therefore a governance role in watershed management is an essential component. The rebuilding phase also requires pathways for continued evaluation and adaptation to be built into it to be responsive to unexpected elements such as prolonged drought periods or flooding events.

Evaluation Phase: Once the rebuilding phase is completed, or at appropriate intervals during rebuilding, the effectiveness of the restoration actions undertaken needs to be assessed. This may take the form of continued stock monitoring and population evaluations. Assessments of the effectiveness of habitat interventions should also be undertaken. The evaluation should also consider external factors that may have influenced the outcome of the restoration activities such as effects of climate change, marine and land use as well as other restoration efforts.

Adaptive Management Phase: Adaptive management takes the evaluation outcomes and reviews those outcomes against the proposed measurable objectives. Determination of what worked, what didn’t work, and any unforeseen consequences is an ongoing process. Research into new approaches and new science should also form part of adaptive management.

The following sections describe in more detail the key aspects of each of the five phases.

5.1 Scoping Phase

5.1.1 Plan Governance

Plan governance for salmon rebuilding within the purview of First Nations involves creating structures and management processes that ensures projects are led, informed, and evaluated by the communities they serve. This approach should respect sovereignty, acknowledge Indigenous knowledge, and leverages the intrinsic connection that First Nations have with the land and waters.

5.1.2 Nation Governance

Each Nation should decide the level of project oversight they wish to maintain. This may involve creating a steering committee comprised of First Nation community members, including Elders, youth, and leaders to ensure a diverse representation of perspectives and knowledge. It could also include representatives from relevant government agencies, non-governmental organizations, and academic institutions to provide additional expertise and support.

5.1.3 Technical

Consideration should be given to establishing a technical working group comprising of scientists, Indigenous knowledge holders and restoration experts to guide the project's scientific and cultural integrity. The technical working group would assist in developing methodologies, interpreting data, and suggesting adaptive management strategies based on ongoing project results.

5.1.4 Financial and Administrative

How the project will be funded needs to be determined and who will manage these resources. Strategies can be developed for funding that might include partnerships, grants, and community-based initiatives. Funding sources that do not impose conditions that conflict with the community values or objectives should be prioritized.

5.1.5 Federal and Provincial Role

The role and involvement of governmental bodies should be clarified, ensuring that their roles support and respect the community's autonomy and objectives. This may involve negotiating co-management agreements or other forms of collaboration.

5.1.6 Community Engagement

Community engagement plays a vital role in the successful rebuilding and conservation of salmon populations, especially within First Nation communities for whom salmon are often a vital cultural, spiritual, and economic resource. Engaging these communities in salmon rebuilding efforts not only leverages traditional knowledge and practices but also ensures that conservation efforts are aligned with the needs and values of the people most affected by these initiatives. Here are several types of community engagement strategies that can be effective:

1. *Collaborative Management and Co-governance*
   This approach involves creating management structures where First Nation communities and governmental or non-governmental organizations share decision-making powers and responsibilities for salmon conservation. This can include joint monitoring programs, shared research initiatives, and co-developed management plans that incorporate Indigenous Knowledge (IK) with scientific data.

2. *Community-based Monitoring and Research*
   Empowering communities to conduct their own monitoring and research can provide valuable data for salmon rebuilding efforts while also building local capacity and knowledge. This might involve training community members in scientific monitoring techniques, supporting community-led research projects, or developing citizen science programs where locals can contribute data on salmon populations and habitat conditions.

3. *Education and Capacity Building*
   Educational programs aimed at both youth and adults can raise awareness about the importance of salmon conservation, teach sustainable fishing practices, and share knowledge about traditional management practices that have sustained salmon populations for generations. Capacity-building initiatives can also provide the skills and resources needed for First Nations to take a lead role in salmon rebuilding efforts, such as training in habitat restoration techniques or sustainable aquaculture.

4. *Cultural Revitalization and Integration*
   Integrating cultural practices, values, and knowledge into salmon rebuilding efforts can foster a deeper connection to these initiatives among First Nation communities. This might involve incorporating traditional ceremonies or practices into conservation activities, using Indigenous languages in educational materials, or ensuring that management plans respect and reflect the cultural significance of salmon.

5. *Participatory Planning and Consultation*
   Ensuring that First Nation communities are actively involved in the planning and consultation processes for salmon rebuilding projects from the outset can help to identify community priorities, leverage local knowledge, and build trust. This might involve regular community meetings, workshops to co-develop management strategies, or the establishment of advisory committees that include community representatives.

6. *Economic Development and Livelihood Support*
   Supporting the development of sustainable economic opportunities related to salmon can engage communities in conservation efforts while also providing economic benefits. This could include supporting sustainable fisheries, developing eco-tourism related to salmon, or providing support for aquaculture projects that are environmentally sustainable and culturally appropriate.

Each of these engagement strategies can be tailored to the specific needs, values, and circumstances of First Nation communities to support the effective and respectful rebuilding of salmon populations. By working collaboratively and recognizing the deep connections that these communities have with salmon, conservation efforts can be more successful and sustainable in the long term.

5.1.7 Other External Influencing Processes

There are a number of external processes that could affect the salmon rebuilding process. These include fishery planning and management which often is not within the control of the First Nation. A clear understanding and strategy to work with DFO to manage fisheries in a manner that is compatible with rebuilding is essential. Land use planning can also support or impede salmon rebuilding depending on the watershed and the various stakeholders that are engaged in activities such as forestry, mining, power generation, etc. An integrated watershed plan is desirable for ensuring that these land use activities are supportive of salmon rebuilding. Marine spatial planning can be a useful tool to help manage marine ecosystems in a manner that supports salmon rebuilding by ensuring high quality nearshore environments especially. Finally, other initiatives of the First Nation may create capacity challenges (either financial or human resources) that could slow or impede salmon rebuilding.

5.2 Assessment Phase

5.2.1 Understanding Stock Status

Understanding of stock status requires information on historical and contemporary western science and Indigenous knowledge. Collectively this information can be used to identify trends, current understanding, and set future directions for a rebuilding plan. Western science and Indigenous knowledge of stock abundance, productivity, survival, harvest, and enhancement are all critical data needs to identify limiting factors of a stock. Data knowledge and analysis can inform which management actions or levers could be enacted to achieve rebuilding plan management objectives.

Developing a Pacific salmon rebuilding plan requires an understanding of the spatial scales of management. In the context of Pacific salmon, major fish species stocks are defined by DFO as Stock Management Units (SMUs), which are groups of conservation units (CUs) that are managed as a unit to achieve joint tracking status (Holt et al. 2023). A CU is defined as a "group of wild salmon sufficiently isolated from other groups that, if extirpated is very unlikely to recolonize naturally within an acceptable time frame, such as a human lifetime or a specified number of salmon generations" (DFO 2005). The status of individual CUs is inferred by comparing status indicators to biological benchmarks delineating three zones: Green, Amber, and Red. These zones represent increasing conservation concern from Green to Red requiring increasing management intervention. The lower benchmark, delineating the Red and Amber zones, is intended to be at the level to "ensure there is a substantial buffer between it and any level of abundance that could lead to a CU being considered at risk of extinction by COSEWIC" (DFO 2005). In practice, CUs in the WSP Red zone tend to align with "Endangered" or "Threatened" COSEWIC statuses, and Green with "Not at Risk" COSEWIC categories. It is important to note that CUs can represent major life-history variants of a species, such as ocean- and stream-type for Chinook Salmon, and individual populations from various watersheds are nested within CUs. While there are biological and management reasons for DFO assessing status at the CU scale, this scale is generally not as relevant to Indigenous interests at the population or watershed scale. It is at the population scale that terminal fisheries are conducted for food, social and ceremonial purposes, hatchery enhancement, and watershed restoration, stewardship, and planning.

The Pacific Salmon Foundation (PSF) has developed its own standardized assessment of stock status using DFO escapement data. Results of the PSF stock status assessments are publicly available on the Pacific Salmon Explorer website (PSF 2024). This assessment is based off the tenets of the *Wild Salmon Policy* (DFO 2005) with the inclusion of hatchery-production salmon. Generally, the available data is compared against one of two benchmarks broadly dependent on the quality of the data and the time scale it encompasses. Where multi-year, high quality CU-level spawner-recruitment data exists, it is compared to calculated expected spawner-recruitment upper and lower benchmarks. Where spawner-recruitment relationships are not available, the CU is assessed as data deficient unless the following is met; there is over 20 years of data, at least one CU-level spawner abundance estimate, and the CU is not experiencing low production or high exploitation. When these conditions are met, the CU is compared against high and low benchmarks calculated based on percentiles of historical spawner abundance. Based on either of these two benchmarks, a CU is designated as Good, Fair, Poor, or Data Deficient for spawner abundance and catch (PSF 2022).

Developing a Pacific salmon rebuilding plan requires an understanding of DFO limit reference points (LRPs). The *Fisheries Act* includes provisions that have legal obligations to identify LRPs for major SMUs. This provision created the need for the development of methodologies to estimate LRPs for assessment and management at the SMU level, while considering the need to maintain CUs within an SMU above their lower benchmarks under the WSP. The CU status based LRPs are calculated from the proportion of CUs within an SMU that are assessed as being above the Red zone. Methods for estimating LRP for Pacific salmon are diverse, often taking advantage of its anadromous life-history and limits on capacity in freshwater, and other population characteristics. The CU LRP status considers multiple metrics, either integrated through formal status assessments or through the DFO Pacific salmon status scanner tool. The status scanner tool provides status from a composite of metrics and benchmarks on spawner abundances, and long- and short-term trends in spawner abundances (Pestal et al. 2023).

Pacific salmon are unique among fish species due to their high levels of intraspecific diversity which gives rise to a large range in data availability, considerations, and approaches for assessments. The purpose of understanding Pacific salmon population status is to provide information on trends in abundance, productivity, survival, harvest, and enhancement, which are all required to inform and guide the decision-making process for developing rebuilding plans. This data is required to address issues related to conservation, fisheries management, biodiversity, fish habitat, and the effects of climate change.

A Pacific salmon rebuilding plan requires a suite of assessment data to gain an understanding of past trends to inform future rebuilding objectives for the specific population in question. Given this, the specific data that is required to inform plan development include (at a minimum):

- adult escapement abundance (natural/enhanced);
- juvenile production (natural/enhanced);
- freshwater survival;
- marine survival;
- harvest;
- hatchery enhancement; and
- fish habitat.

Each of these are discussed in detail below.

Escapement:

Escapement data can be obtained from the central DFO New Salmon Escapement Database System (NuSEDS; DFO 2024a). The New Salmon Escapement Database System stores individual spawner survey data records, spawner abundance estimates. Annual abundance estimates are maintained by population, as defined by freshwater location, and run timing. This database contains historic population data starting in the 1920s, however the historical data lacked the capacity to describe the number of observations, individual counts, or methods used to estimate the abundance of the population. In 1995, the database was re-written to include descriptive information for each abundance estimate, providing underlying data, and the estimation method(s).

Production:

Juvenile production data are annual abundance estimates from a population using a variety of assessment gear types such as rotary screw trap, inclined plane trap, fence, etc. Juvenile production data can be obtained from the regional DFO office and/or through a query of the public DFO library (DFO 2024b).

Freshwater and Marine Survival:

Freshwater survival (%) data, such as egg to fry or egg to smolt, are annual estimates derived from several primary data sources. These primary data sources include escapement abundance, female fecundity, and juvenile production abundance estimates. Freshwater survival data can be used to understand limitations or constraints to juvenile production and identify opportunities for restoration.

Marine survival (%) data are annual estimates derived from several primary data sources. Two common approaches to estimating marine survival are (1) dividing abundance of returning adult abundance by abundance of smolts from the same cohort; or (2) tagging a portion of the migrating smolts and estimating the return rate of tagged adults. Marine survival estimates can be obtained from the regional DFO office and/or through a query of the public DFO library.

Harvest Data:

Canadian recreational, commercial, and food, social, and ceremonial (FSC) harvest data can be obtained through a direct request to the DFO Catch Unit. The DFO catch data is summarized as kept or released (count) and effort (boat days) by species, gear type, and Pacific Fisheries Management Areas (PFMAs). Local FSC harvest data (e.g., kept, effort, species, location) can be obtained directly from each First Nation.

Hatchery Information:

Hatchery enhancement data can be obtained from the DFO Enhancement Planning and Assessment Database (EPAD), which represents releases associated with DFO's Salmonid Enhancement Program (SEP).

While hatchery releases may be used to rebuild populations and produce fish for harvest, there are also genetic risks associated with the release. As indicated in Canada's WSP, there is a critical need to maintain natural genetic diversity within the population to ensure fitness in current and future salmon populations. The proportionate natural influence (PNI) metric measures the relative degree of hatchery influence in a population ranging from 0 (all hatchery) to 1 (all wild) and whether gene flow favors hatchery or the natural environment. Existing PNI data for the population should be obtained from the regional DFO office.

5.2.2 Understanding Watershed Processes and Condition

A hydrologic and geomorphic assessment of the watersheds containing stocks of interest should be undertaken as part of the initial assessment phase. These assessments are normally completed by a geologist, geomorphologist, or geologic engineer. The purpose of this assessment is to consider the overall impacts in the watershed prior to focusing on one reach or population. The assessment will describe the present physical condition of the watershed and can look for evidence of past disturbance (natural or anthropogenic). This inventory can inform Nations' watershed renewal projects and provide guidance for forest management. The watershed assessment should be consistent with the joint Association of BC Forest Professionals/Engineers and Geoscientists BC professional practice guidelines for Watershed Assessment and Management of Hydrologic and Geomorphic Risk in the Forest Industry (Version 1.0, January 2020). These guidelines can help provide a scope of work suitable for the assessment.

Watershed assessments begin with evaluating and previous assessments of all or part of the watershed.

The following is a subset of resources where previous information on hydrologic and geomorphic process can be found online:

- Published background or baseline reports that have been commissioned by government, industry, or First Nations;
- Recent and historical satellite images (i.e., Google Earth);
- Provincial Vegetation Resource Inventory (VRI) (BC 2023);
- BC Government digital bedrock geology (BC 2022);
- BC Government surface geology (BC 2020);
- BC Government digital biogeoclimatic ecosystem (BEC) mapping (BC 2024b);
- UBC climate model (ClimateBC v7.30) (ClimateBC 2023);
- Pacific Climate Impact Consortium (PCIC 2024);
- Environment Canada Climate normals and hydrometric data (ECCC 2024).

After assessing previous work, several types of data need to be acquired. LiDAR (Light Detection And Ranging) data should be acquired for as much of the watershed as possible. LiDAR is a type of active remote sensing where laser beams are shot from a plane or drone to measure the distance between the aircraft and the earth's surface. Digital Elevation Models (DEMs) can be produced from LiDAR data. These models allow the vegetation in the watershed to be digitally removed so the land surface is visible. LiDAR data should include the hillslopes up to the ridgelines of the watershed. The province of BC has publicly available LiDAR for some areas (BC MOE 2024a). Forest tenure holders in the watershed may also have this type of data and may be willing to share it with First Nation partners. Historical air photos for stream reaches of interest should be purchased from the province (BC MOE 2024b).

Once these data are acquired, a suite of mapping products are produced. The watershed boundary is defined, and the locations of stream networks are adjusted using the LiDAR data or DEMs produced by LiDAR. Maps of bedrock geology (BC MOE 2024c; geological bedrock layers) and geoclimatic ecosystems are produced for the watershed (BC Forest Service 2024). Longitudinal stream elevation profiles are created for streams of interest. The locations of changes in slope, confluences, and drainage structures are noted on these profiles. Finally, when possible, air photos should be stitched into a georeferenced orthomosaic photo. This will allow the historical channel locations to be traced with great accuracy.

Using these mapping products, various features affecting terrain stability can be identified. A landslide inventory should be created or updated and should include type, point of origin, length, area, area class, vegetation condition, contact with streams, year logged, and pre/post Forest Practice Code implementation. Floodplains, alluvial fans, and glacial deposits (e.g., fans, deltas, terraces) should be delineated. Roads should be examined and notes about their condition made, including drivability, location on steep slopes, ravelling or unstable road cuts, apparent ditch or stream erosion, segments crossing fans, and construction pre/post Forest Practice Code implementation. Finally, field verification of a subset of identified features is required.

5.2.3 Understanding Aquatic Habitat Condition

5.2.3.1 Fish Habitat Assessment Procedure (FHAP)

The Fish Habitat Assessment Procedure (FHAP), as described in Johnston and Slaney (1996), is a standardized fish habitat assessment. Following a standardized procedure allows habitat surveys to be repeated and changes over time to be observed. The assessment occurs in four phases to identify sites and methods for fish habitat rehabilitation.

Office-based overview assessment: review of any existing fish habitat assessment and fish distribution data. Historical stream descriptions and salmon escapement information can often be found in the Catalogue of Fish and Stream Resources series for the fishery management area of interest. These documents can be found through the Cross-Linked Information Resource library described below. Other resources include:

- HabitatWizard (BC MOE 2024d) – online map of fish observations and habitat features with links to provincial databases;
- Cross-Linked Information Resource library (BC MOE 2024e) – tool for searching the following databases:
    - BCSEE – BC Species and Ecosystems Explorer. Data and information about plants, animals, and ecosystems;
    - EcoCat – Ecological Reports Catalogue. Reports from a variety of disciplines on water quality and water quantity, reservoirs, floodplain mapping, groundwater, fish and fish habitat, wildlife and wildlife habitat, terrestrial information, soils, and vegetation;
    - EIRS BDP – Biodiversity/Environmental Information Resources e-Library. A range of environmental and natural resource information, including publications on British Columbia's species and their habitats;
    - EIRS EP – Environmental Protection Information Resources e-Library. A range of information on environmental protection in BC, including publications on air quality, water quality, climate change, solid and liquid waste, recycling, and product stewardship;
    - J.T. Fyles Natural Resources Library. A multiple ministry natural resource sector library;
- New Salmon Escapement Database System (NuSEDS, DFO 2024a) – DFO Pacific Region's central database that stores individual spawner survey data records;
- River discharge:
    - BC Water Tool (BC MOE 2024f) – river discharge and weather;
    - DFO PACFish (DFO 2024c) – river flow data on Vancouver Island;
    - Environment and Climate Change Canada (ECCC) Hydrometric Data (ECCC 2024) – river depth, discharge, and temperature.

Field-based overview assessment: In-stream habitat units are identified enabling and a random subsample of each type of habitat unit to be surveyed in detail.

Level 1 field-based assessment: Where detailed habitat measurements are recorded at all sites (complete coverage) or a subset of sites selected using the inventory of habitat units created during the overview field assessment.

Level 2 field-based assessment (as required): Further investigation at sites the level 1 assessment identifies as potentially impaired. Any additional information required to identify, plan, and design rehabilitation prescriptions.

Johnston and Slaney (1996) is an excellent resource for conducting an FHAP and can serve as a starting point for prescription selection. When selecting and identifying rehabilitation prescriptions current literature should be reviewed because river restoration is a rapidly changing area of research and practice. The restoration community has shifted from a focus on channel form and toward the restoration of fluvial processes (e.g., Kondolf 1998; Roni et al. 2002; Wohl et al. 2005; Bernhardt and Palmer 2007, 2011; Beechie et al. 2010, 2013; Wohl et al. 2015; Booth et al. 2016). In process-based restoration, managers iteratively redirect fluvial ecosystem trajectories toward a more complex and resilient condition (Ciotti et al. 2021). Additionally, a robust network of Intensively Monitored Watersheds (IMWs) was established across the Pacific Northwest in the early 2000s. Intensively Monitored Watersheds were established to assess whether restoration lead to improvements in watershed processes, habitat conditions, and salmonid population viability (Haskell et al. 2019). Key findings for discussed below, in Section 5.2.5 Identify Restoration Options and Priorities.

Though there are common tactics, actions must be selected in a unique plan for each watershed and reach that recognizes the narrow range of channel and riparian conditions that match its physiographic and climate environment (Beechie et al. 2010). Several reviews exist on selecting restoration methods (Roni et al. 2012) and adapting those methods to account for climate change (Beechie et al. 2013). Many of these studies have been performed in wide, depositional valley environments. The steep, narrow valleys of coastal British Columbia may present different challenges and opportunities for restoration.

5.2.3.2 Riparian Assessment and Prescription Procedure (RAPP)

Riparian areas provide a suite of ecological functions within terrestrial and aquatic ecosystems such as provision of large woody debris, creation of fish and wildlife habitat, sediment storage and transport, regulation of local flow, cooling stream temperature via shading, contributing to the aquatic food web, providing bank and channel stability, providing inputs of small organic debris, and regulating instream algal productivity. Removal of riparian vegetation from past harvesting activity can impair riparian area function. Restoration of native riparian vegetation communities is important not only for restoring ecological function, but for re-establishing the processes which maintain them and buffer them from further disturbance. Mature coniferous trees in particular are critical for providing bank stability, large woody debris inputs, creation, and maintenance of fish habitat, and regulating nutrient inputs and food webs.

A Riparian Assessment, as detailed by the Riparian Assessment and Prescription Procedure (RAPP; Koning 1999), provides clear protocols to assess the level of riparian functioning and develop prescription recommendations to restore riparian function in priority areas. The RAPP applies to areas within the watershed that have been previously harvested adjacent to fish bearing streams larger than 1.5 m wide (Bancroft and Zielke 2002). The Riparian Assessment occurs in three phases to identify areas for riparian restoration:

Office-based overview assessment: Identify harvested riparian areas within the watershed by performing a desktop (office) review of air photos, maps, forest data files, past assessment, restoration, and prescription reports, etc. The databases and provincial mapping resources listed above can also be used to provide background information on the assessment area. Harvested sites are prioritized for field visits.

Level 1 field-based reconnaissance: Assess the level of functioning and regeneration of vegetation in a subset of sites identified in the overview assessment. Collect information on overstorey vegetation (tree size, density, dominant species), understory vegetation (cover, height, dominant shrubs, herbs, and mosses), and soil conditions. Identify the Riparian Vegetation Type (RVT; Bancroft and Zielke 2002) and prioritize sites of concern due to impaired function (e.g., insufficient regeneration, overstocking, bank erosion) for a detailed assessment and/or prescription development.

Level 2 detailed field-based assessment (as required) and prescription development. Recommended silvicultural treatment prescriptions are provided for each RVT in Bancroft and Zielke (2002) along with general riparian restoration considerations.

A detailed discussion of these survey steps and approach to conduct a Riparian Assessment can be found in Koning (1999) and within the Riparian Area Protection Regulation Technical Assessment Manual (BC MFLNRORD 2019).

5.2.4 Identify Factors Limiting Rebuilding

The identification of factors limiting salmon production is a key outcome of the assessment phase. When considering limiting factors, the most common approach is to examine each life history stage for bottlenecks and impacts limiting survival. The key life stages for Pacific salmon species are:

- Adult migration from the marine environment to spawning locations;
- Egg deposition and survival;
- Freshwater survival of juveniles after emergence;
- Estuary survival of juveniles;
- Early (nearshore) survival; and
- Marine survival from nearshore areas to adulthood.

It is not always possible to assess each of these stages in detail but by examining freshwater, estuarine, and nearshore marine habitat condition, and relying on field studies or literature, one can usually narrow the limiting factors. Primary factors limiting production could include high harvest levels or habitat impairment.

A key finding from the IMW program showed that populations with evidence of density dependence in freshwater are most likely to benefit from increased habitat availability via restoration (Bilby et al. 2022). Monitoring of spawning adult migration and juvenile outmigration of the target species will allow practitioners to determine if the population shows density dependent constraint.

5.2.4.1 Risk Assessment Methodology for Salmon (RAMS)

The Risk Assessment Methodology for Salmon (RAMS) was developed to provide a series of tools to understand salmon interactions with critical habitat. The methods were adapted from *Ecological Risk Assessment for the Effects of Fishing* and pull information gathered from the stock, watershed, and habitat assessments to score the limiting factor based on the needs and impact to the target population (Hobday et al. 2011). The RAMS assessment is scalable and can be applied from individual life stages to large scale population aggregates (CU, group of CUs, stream, watershed, river basic or eco region) (DFO 2018).

Scoping: Initial scoping phase to determine the CU/population of interest, set objectives for the assessment and collect background information provided by assessments (i.e. stock assessments, hydrogeologic reports, FHAP and RAPP).

Expert Panel: Workshop with a small group of key experts to review the background information collected and provide an initial analysis of risk.

Community Engagement: 1) Results of the expert panel risk assessment are shared with the wider community and 2) A secondary workshop is held to with the wider community to discuss the initial scores. Here, potential mitigation options are identified and evaluated. Based on the medium and high-risk factors identified, action plans are developed. During this step, any further key data and research gaps are identified.

Implementation: Implementation of action plans, mitigation options, research, and studies to address high risk limiting factors.

5.2.5 Identify Restoration Options and Priorities

Restoration options should be identified to address limiting factors by salmon life. For many watersheds that have been severely impacted by development, a multi-pronged approach of upslope, road crossings, riparian, and aquatic restoration is warranted. Administrative constraints (e.g., funding or technical capability) can also be a driver for identifying priority restoration activities and developing a multi-year restoration strategy. Additional factors to consider in restoration planning include the risk of ongoing adverse impacts, including climate change, to the habitat features identified for restoration and the impact of out-of-basin factors influencing target populations.

Habitat restoration activities will not usually result in immediate or near-term increases in salmon production, although that can sometimes be achieved. In severely impacted systems, in-stream construction can provide some immediate habitat improvements for the target species while practitioners work toward the restoration of river and watershed processes. The IMW program showed that the removal of longitudinal barriers such as culverts, those blocking upstream-downstream movement, consistently provided positive responses (Bilby et al. 2022). Enabling access to floodplain or delta habitats through removal of lateral barriers, such as dikes, or the installation of water and sediment retention structures such as Beaver Dam Analogues generally also produced positive responses (Bilby et al. 2022).

Though fish population responses to in-stream restoration structures have been shown to be positive in meta-analyses (Foote et al. 2020), the target population responses to wood placement in IMWs varied (Bilby et al. 2022). Effective wood placement projects were extensive, covering greater than 20% of accessible fish habitat. Effective projects were also intensive, installing very large quantities of wood, sometimes with repeated applications. Returning to two other key take aways, effective wood placement projects were in watersheds with clear evidence of density dependence in the target fish species and the installations enhanced connections between the channel and floodplain.

In situations where the continued existence of a population is in question, enhancement intervention may be a consideration to jump start rebuilding. Any enhancement intervention needs to be carefully evaluated for benefits versus risk to wild salmon stocks with particular focus on competition and gene flow.

Harvest impacts must also be considered in rebuilding. If harvest impacts are too high, then the benefits of habitat restoration or enhancement interventions may not be attainable. Increased monitoring of the adult returns of the target species will allow the development of more reliable biological reference points, which could lead to more precise management of stocks of interest.

5.3 Rebuilding Phase

This is when the work occurs to implement activities targeting salmon rebuilding. In a typical rebuilding program, the activities would include habitat restoration, mitigation of past and ongoing impacts to habitat, harvest controls, and potential enhancement.

5.3.1 Habitat Restoration

The primary components of habitat restoration for Pacific salmon include addressing limiting factors in freshwater and estuarine environments such as fish passage issues, spawning habitat limitations, rearing habitat limitations, and adult migration limitations. Nutrient limitations may also be considered. There is a multitude of restoration practices in the literature to draw from and utilizing local expertise and the new DFO Restoration Unit are good places to begin.

5.3.2 Mitigating Impacts

All of the hard work to recover damaged habitats and rebuild salmon populations can be hampered if there are lingering and ongoing impacts in a watershed from human activity such as forestry, mining, and power development. These activities need to be sustainably managed to promote recovery of salmon if the recovery is to be successful.

5.3.3 Harvest Controls

Ensuring that harvest rates on the salmon population that is targeted for rebuilding are sufficiently low to enable rebuilding is essential. Setting harvest rates that promote rebuilding or maintain a salmon population at a sustainable level of productivity requires an understanding of the population's productivity and survival rates and what the current harvest rate is. This is often done through 'proxy' by more intensively monitored indicator salmon populations. Unfortunately, many indicator populations are enhanced and may not be representative of wild or natural salmon populations. Direct study may be required where it is believed that the enhanced population does not adequately represent the population targeted for rebuilding.

5.3.4 Enhancement

In some instances, hatchery interventions may be necessary to kick start and sustain rebuilding until the salmon population can sustain itself.

5.3.5 Marine Environments

Our understanding of the impact that degraded marine habitats can have on Pacific salmon is less understood than for the freshwater environment and how to address those potential impacts is even less known. Nevertheless, there may be opportunities to restore impacted areas such as historical log sorts or where shoreline modifications have been undesirable, and these opportunities should not be overlooked. There may also be water quality impairments near outfalls, salmon farms, marinas, or other developments that could be addressed.

5.4 Evaluation and Phase

Restoration and rehabilitation projects require considerable effort and input from identifying the need, to organizing funding and carrying out the work. It is difficult to assess the cumulative effects of individual projects within a watershed on habitat condition when a Nation has little control over other development activities. This can lead to challenges with isolating and measuring effects of one single project. There are guidelines available to help determine the most effective evaluation methods.

5.4.1 Monitor for Effectiveness of Restoration Activities and Habitat Condition

5.4.1.1 Routine Effectiveness Evaluation

One of the ways in which the effectiveness of a restoration activity is assessed is through a Routine Effectiveness Evaluation (REE). REEs are guidelines for the evaluation of the performance of instream habitat structures and constructed off-channels and assess the physical and biological performance of a specific restoration measures. This is done by examining the current conditions at each restoration site. REEs are a low intensity, standardized procedure meant to be broad scale and low cost. The evaluation procedure compares the realised performance to the planned performance, as specified by the original watershed- and site-level objectives in the restoration design reports (BC 2003). Provincial guidelines for performing an REE can be found here: [Guidelines for In-stream and Off-Channel Routine Effectiveness Evaluation (gov.bc.ca)](#).

5.4.2 Monitor Change in Stock Status

5.4.2.1 Escapement Abundance

One of the critical elements of monitoring Pacific salmon is a count of adult fish returning to spawn, known as escapement. Reliable estimates of escapement are required to establish sustainable harvest limits, forecast future run sizes, assess the impacts of management decisions, and evaluate the success (or failure) of rebuilding efforts (Parsons and Skalski 2010). There are a variety of field methods used to estimate escapement, and each has their own limitations and biases. Many field methods are described in *Salmonid Field Protocols Handbook: Techniques for Assessing Status and Trends in Salmon and Trout Populations* (Johnson et al. 2007) and other publicly available documents. The data collected in the field are then used to estimate escapement, which can be grouped into the following quantitative escapement technique categories: passage count, peak count, carcass count, redd count, area-under-the-curve estimate, and mark-recapture estimate (Parsons and Skalski 2010).

Passage counts using weirs are generally regarded as the most accurate method available to quantify escapement as the result is an absolute count. The absolute counts obtained at the weir can be significantly better than modeled estimates, which can deviate as much as 50–60% or more from actual counts (Zimmerman and Zabkar 2007). Weirs also provide the opportunity to capture fish for observation and sampling of biological characteristics (e.g., sex, age, length) and tissues (e.g., genetic, marks); they may also serve as recapture sites for basin-wide, mark-recapture population estimates. Weirs are useful in monitoring wild populations as well as for capturing broodstock for artificial propagation. The use of weirs is generally restricted to streams and small rivers because of construction expenses, formation of navigation barriers, and the tendency of weirs to clog with debris, which can cause flooding and collapse of the structure. Given this constraint the other field methods are often used.

Passage counts using sonar equipment are another relatively accurate method available to quantify escapement. Widely used sonar equipment to assess escapement includes dual-frequency identification sonar (DIDSON) and adaptive resolution imaging sonar (ARIS). The use of sonar is typically not subjected to in-river restrictions as for weirs, although incorporating partial weirs to direct fish into the sonar's field of view may be required depending on site specific conditions. Fish passage through the sonar field of view are recorded and subsequently enumerated. Fish length measurements can also be obtained from sonar imagery. If multiple species co-migrate and are similar in size, then estimating salmon abundance using sonar requires a method to apportion the sonar counts to species. Field methods to apportion the sonar estimates to species and gather biological data (e.g., length, sex) typically include drift gillnetting and beach seining.

Snorkel surveys are widely used on Vancouver Island to estimate escapement. When snorkel surveys are correctly applied, they generally require less equipment and infrastructure, and less time and resources to complete compared to weir field methods (DFO 2015). Additionally, they are a non-invasive method for surveying spawning populations and are useful for observing habitat, in addition to fish. However, they are significantly less precise than passage counts at weirs. The data collected from snorkel surveys can be used to estimate escapement using peak count and area-under-the-curve estimates. Snorkel surveys can be used to estimate abundance using mark-recapture techniques. The use of snorkel surveys for mark–recapture estimates provide a calibration factor for the counting efficiency of snorkel surveys (O'Neal 2007).

Carcass counts are often done in conjunction with snorkel and foot-based visual counts of spawning fish and with redd counts. Combined with redd counts and live fish counts, carcass counts can be used to assess escapement, but they are significantly less precise than passage counts at weirs (Crawford et al. 2007). Salmon carcasses provide important information to Fisheries Managers, including scales, tissue samples, length measurements, and population sex composition data. Scales and otoliths are used to determine age and offer insights into the population's age characteristics. Marks (fin clips and/or tags) provide key information on the fish's origins and assist in coded wire tag (CWT) recovery. With marked fish, carcass recoveries offer a mechanism to support mark-recapture population assessments. Carcasses are also a means to assess the relative number of wild versus hatchery-based fish in the system. By estimating the numbers of spawning fish in a live fish or redd count, one may determine the number of carcasses that need to be sampled to evaluate key demographic and genetic aspects of hatchery and supplementation programs.

5.4.2.2 Juvenile Abundance and Survival

Monitoring stock status requires information on juvenile abundance, freshwater survival, and marine survival. In many watersheds, population abundance is only monitored during the adult (spawner) stage. Additional monitoring of juvenile/smolt abundance is a particularly powerful tool using inclined plane screen traps and rotary screw traps. These gear types have long been used by Fisheries Managers to capture downstream migrating juvenile salmonids from small to large-sized streams and rivers. While estimating smolt abundance is the most common reason for operating an inclined plane screen trap or screw trap, the capture of downstream migrants has wide utility (Volkhardt et al. 2007). Traps can be used to monitor the effects of river management on wild stocks, such as the effectiveness of diversion, lock, and dam management. They are powerful tools for validating assumptions regarding the effects of watershed restoration programs and land-use policies. They can also be used to assess survival between life stages because it enables partitioning survival between the freshwater life stages (egg-to-smolt) and marine life stages (smolt-to-adult). Smolt-to-adult survival estimates can be developed for wild populations by coded wire tagging smolts that are captured in traps and estimating the escapement and fishery impacts on the tagged population.

In addition to serving as a tool to monitor wild populations, inclined plane screen traps and screw traps are useful for evaluating hatchery programs and hatchery/wild fish interactions (Volkhardt et al. 2007). Such studies may include evaluating the instream survival of hatchery production following release and evaluating treatments such as rearing strategy, release timing, release location, and flow manipulation on groups of hatchery fish. These latter uses can be applied to evaluate a variety of projects or actions, ranging from hatchery supplementation strategy to avoidance of hatchery and wild fish interactions. In addition to abundance estimates, investigators use inclined plane screen traps and screw traps to collect samples of downstream migrants for purposes such as genetics sampling, fish disease research, predation (gut content) evaluations, and wild stock marking and tagging projects.

Operating a downstream migrant trap allows Fisheries Managers to sample wild Pacific salmon produced in a watershed or tributary over time (Volkhardt et al. 2007). The fish sample is valuable because it documents the presence/absence of migrating juveniles and enables determination of age and size at migration, condition, timing, species, and genetic characteristics.

Most importantly, smolt trapping can also be used to create estimates of total freshwater production by use of mark–recapture methods to estimate abundance (Volkhardt et al. 2007). The rationale is that the proportion of marked fish appearing in a random sample is an estimate of the marked proportion in the total population. The proportion captured (trap efficiency) is estimated by conducting a series of trap efficiency experiments throughout the trapping season.

5.4.2.3 Harvest

Monitoring stock status requires information on harvest. Canadian recreational, commercial, and First Nation harvest data can be tracked over time to understand catch, harvest, and effort by location.

5.5 Adaptive Management Phase

Rebuilding salmon populations and restoring their habitats is a long-term responsibility and there can be many factors that occur along the way that may result in a course adjustment or changing priorities. It is vital that the Evaluation Phase described above be robust and inform any adjustments that may be needed to keep the rebuilding process on track. Ideally this should be an annual process and no less frequent than every five years.

6 Status of Plan Area Salmon

The following are executive summaries from the A-Tlegay Member Nations Mainland Inlet Territory Escapement Report (Challenger et al. 2024b) and the Cowichan Assessment Unit Report Card (Challenger et al. 2024a). These reports are representative of those produced during the assessment phase information gathering and show the status of Pacific salmon within the A-Tlegay Member Nations Territory.

6.1 Mainland Inlets Assessment Area

The A-Tlegay Member Nations (AMN) consist of the We Wai Kai Nation, Wei Wai Kum First Nation, Kwiakah First Nation, Tlowitsis Nation, and K'ómoks First Nation, who are all proud stewards of marine areas and waterbodies of the northern Gulf of Georgia and Johnstone Strait regions. Pacific salmon are foundational to the spiritual, cultural, subsistence, and economic practices of Indigenous peoples throughout the Pacific coastal region of British Columbia (Garibaldi and Turner 2004; Chalifour et al. 2022). The watersheds within the Mainland Inlet Territory support all five key Pacific salmon species, Chinook (*Oncorhynchus tshawytscha*), Coho (*O. kisutch*), Chum (*O. keta*), Pink (*O. gorbuscha*), and Sockeye (*O. nerka*) salmon. Maintaining these strong, genetically diverse salmonid populations is crucial for the continued health of the ecosystems and for Indigenous culture.

The Department of Fisheries and Oceans Canada is responsible for Pacific salmon enumeration and management of natural populations including conflicting priorities for use such as commercial fisheries. Population abundance estimates for the Mainland Inlet Territory begin as early as 1953 for some waterbodies, however, records prior to 1995 are incomplete, often missing methodological information. In 1995, the responsibility for enumeration of pacific salmon species and assessment of ecosystem health was formally transferred to the Department of Fisheries and Oceans sciences. Ten years later, in 2005, *Canada's Policy for the Conservation of Wild Pacific Salmon* was introduced. Within the policy, management areas are divided into conservation units (CUs) meant to recognize genetically distinct salmonid populations that, if lost, would be unlikely to recover. The Wild Salmon Policy resides on three core themes: Assessment, Accountability, and Maintaining & Rebuilding Stocks, with Assessment being the initial and crucial first step that is meant to underpin management decisions and support the remaining two themes.

However, currently, monitoring of all five species within AMN territory is at a historic low. There are 25 unique CUs that overlay the A-Tlegay Member Nation Mainland Inlet Territory and all of those CUs show a significant decrease in escapement monitoring. There have been notable declines in the percentage of waterbodies with reported escapement data since 1995. This represents a decrease in spatial and temporal monitoring coverage across the entire A-Tlegay Member Nation Mainland Inlet Territory. Within the territory, there are several CUs that are no longer reporting any escapement monitoring and therefore their population statuses are unknown. For other CUs, spatial monitoring has reduced to the point that indicator streams are no longer monitored and there are only one or two waterbodies with data. This is particularly concerning in cases such as the Klinaklini River which had consistent, robust escapement data for several pacific salmon species up to the introduction of the Wild Salmon Policy and then monitoring stopped completely.

In addition, there are several Chinook and Coho salmon CUs within the A-Tlegay Member Nation Mainland Inlet Territories with runs that are directly targeted by Mark Selective Fisheries (MSFs) in the Bute, Toba, and Knight inlets. Many of those runs also lack any monitoring records, historically or recently, meaning there is no way to quantify the impacts of those MSFs on the populations. The state of monitoring for the A-Tlegay Member Nation Mainland Inlet Territory is far from sufficient to gain even a baseline understanding of current Pacific salmon abundances, much less, inform critical population management decisions such as the opening of fisheries.

6.2 Cowichan Assessment Area

The A-Tlegay Member Nations Territory consist of marine areas and waterbodies of the northern Strait of Georgia and Johnstone Strait regions. Within this territory, is a section of Vancouver Island roughly located between Nanaimo and Shawnigan Lake termed the Cowichan Assessment Unit. The Cowichan Assessment Unit includes the Cowichan, Koksilah, Chemainus, and associated tributaries which drain from the East Coast of Vancouver Island into the Salish Sea (Strait of Georgia). The region has been impacted by increasing threats from climate and associated hydrological changes, forestry, agriculture, water withdrawals and development. Added to this, there is increased pressure for changes in fisheries management in the area. As a result, streams in the Cowichan Assessment Unit were identified as a priority to understand the current health of the stocks, address potential data gaps, and identify threats and other issues that may affect the multiple salmon species the region.

The Department of Fisheries and Oceans Canada (DFO) is responsible for Pacific salmon enumeration, conservation of natural populations, as well as the management of fisheries. Escapement data collected from surveys are recorded in the DFO New Salmon Escapement Database System (NuSEDS). Population abundance estimates for some salmon species began in the 1950, however, the recording of data and methodology did not become standardized until 1995 when enumeration became part of DFO Science. As a result, historical data are incomplete and often missing methodological information and was used in part to illustrate where complete time series exist. After 1995, the data is more robust, however, still incomplete. The escapement data was combined with harvest, hatchery, habitat, and weather station data to create a gap analysis.

This baseline and data gap analysis is presented in a report card format which allows for a rapid comparison among the different streams within the assessment unit and highlights areas with little background data. This report contains analysis of four of the five key Pacific salmon species Chinook (*Oncorhynchus tshawytscha*), Coho (*O. kisutch*), Chum (*O. keta*), and Pink (*O. gorbuscha*) salmon and includes escapement, harvest, hatchery releases, juvenile production, habitat, river hydrology, and weather information. Priority salmon-bearing watercourses within the assessment unit are identified throughout as well as limiting factors, and restoration opportunities.

Escapement monitoring: Improved monitoring of smaller systems coupled with consistent and robust escapement methodology. Early-run monitoring including potential molecular methods to help identify runs. Increased monitoring and research to help inform the cause of increased jack returns, and continued efforts into the counting of Pink Salmon.

Hatchery programs: Hatchery programs in the area should have clear objectives for each program. It is advisable to maintain one stock per stream in order to reduce straying, maintain higher PNI values and reduce stocking as required.

Habitat work: Ongoing collaborative management and decision making is required to protect and enhance the health of the watershed.

Environmental monitoring: An overall, general expansion of monitoring should occur to including discharge, water temperature, weather, snowpack, and contaminant monitoring. This is especially important to consider in areas with expected increased land use and potential for run-off.

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APPENDIX A

Appendix A Example Salmon Rebuilding Plans

Sarita Chinook

Abridged Summary: "Since 2017, Huu-ay-aht First Nations have been actively working to renew the Sarita (and Pachena) watersheds and rebuild salmon populations in those watersheds, and eventually other watersheds within the Hahuułi, recognizing that this process may take many generations. The Sarita and Pachena watersheds and surrounding areas are considered to have a high cultural value to HFN because of historical use which includes gathering sites, hunting, and fishing areas, camps, meeting sites, and archaeological, and sacred sites. The watersheds have high value fish and wildlife habitat. For HFN, the renewal of the Sarita and Pachena watersheds and their salmon populations is essential to maintain valuable ecosystem services such as sustainable forestry, a healthy salmon fishery, hunting and gathering, and cultural identity. To that end, a renewal framework (2017) was created. The Renewal Framework is guided by current and future iterations of the resource management goals and objectives of the HFN Land Use Plan (HFNR 2013) and the HFN Strategic Plan (2016).

In 2024, the Renewal Plan process recently developed a ten-year strategy for the continuation of the Watershed Renewal Program (WRP) from 1 April 2025 to 31 March 2035. A key objective of the WRP going forward should be is the continuation of research and rebuilding initiatives for Sarita River Chinook Salmon, which is grounded in the mutual desire of Canada and Huu-ay-aht to rebuild this vital salmon population as part of an overarching rebuilding initiative for Westcoast Vancouver Island (WCVI) Chinook Salmon and to utilize Sarita Chinook Salmon as an ecological indicator for WCVI Chinook Salmon. Ongoing wildlife research will also support sound resource management in the Hahuułi and ensure wildlife (e.g., Elk) important to Huu-ay-aht are sustained. Balancing continued habitat restoration work in the Sarita, Pachena and other watersheds for aquatic, riparian, and upslope habitats with natural recovery will be a key consideration before implementing further restoration activities in these watersheds."
Link: Watershed Renewal Program – Huu-ay-aht (huuayaht.org);
Watershed-Renewal-Sarita-and-Pachena-Framework_2017.pdf (huuayaht.org);

WCVI Chinook

Abridged Summary: "The status of WCVI Chinook has led to the requirement of a rebuilding plan under the fisheries act by 2021. Beyond the requirements of Bill C-68, WCVI First Nations and communities have broader interests that they would like included in a rebuilding plan that integrates habitat, hatcheries and harvest. Timely development of the rebuilding plan will require coordination of information gathering, information analysis, plan drafting, engagement and communication across the geographic area of Port Renfrew to Quatsino. The plan is being jointly developed by WCVI First Nations, DFO, the Salmon Roundtables, and others who deeply care about local wild salmon stocks.
In February 2024, an extension to complete the rebuilding plan was granted under 70(3) of the Fisheries (General) regulations. The rebuilding plan development timeline for West Coast Vancouver Island (WCVI) Chinook was extended by twelve (12) months past its original completion date of April 4, 2024. This was granted to allow additional time to finalize and confirm required science advice for the plan, including a peer-reviewed science process to provide advice on a limit reference point for the WCVI Chinook stock management unit and consult and engage on the plan with First Nations and stakeholders."
Link: https://www.roundtables.westcoastaquatic.ca/blog;
https://www.dfo-mpo.gc.ca/fisheries-peches/decisions/provisions-dispositions/2024/001-eng.html

Cowichan Chinook

Abridged Summary: Under Strategy 3 of the WSP, the DFOs RAMS assessment model was used to report on 18 watersheds on the West Coast of Vancouver Island. The information from these workshops supported the development of a summary rebuilding plan for Cowichan chinook. Cowichan Tribes and DFO have partnered in the development of this initiative aimed at watershed health and Chinook in the Cowichan, with the opportunity to implement the Federal Wild Salmon Policy framework and goals and Cowichan Tribes indigenous governance at a local level. The objective is to foster a "made in Cowichan" solution. The report includes recommended actions and implementation for freshwater habitat health, predation management, fisheries management, hatchery supplementation, monitoring and outreach.
Link: http://www.pacfish.ca/Cowichan/

Interior Columbia Basin Salmon and Steelhead

Abridged Summary: "The scope of this analysis includes steelhead originating above Bonneville Dam (i.e., in the interior Columbia River basin), as well as their life-cycle needs associated with freshwater, estuary, and marine habitats. These stocks are critically important to Columbia River basin tribes, as well as to the economy and overall ecological health of the region. Despite their undisputed value, they have been negatively affected by extensive anthropogenic activity—in particular, the dams and reservoirs that form the Columbia River System4. The *Rebuilding Interior Columbia Basin Salmon and Steelhead* report identifies a comprehensive suite of actions that would have the greatest likelihood of making considerable progress toward rebuilding Columbia Basin salmon and steelhead to healthy and harvestable levels. The report was finalized by NOAA Fisheries, with input from the U.S. Fish and Wildlife Service, and with feedback from state and tribal fishery co-managers. The suite of actions span the salmon life cycle and include: Increasing habitat restoration, Reintroducing salmon into blocked areas, Managing predators, Breaching dams, Reforming fish hatcheries and harvest, Improving water quality, especially toxic pollutant levels, Managing marine ecosystems, and Reconnecting floodplain habitat"
Link:https://www.fisheries.noaa.gov/resource/document/rebuilding-interior-columbia-basin-salmon-and-steelhead

Okanagan Chinook

Abridged Summary: "Okanagan Chinook were prescribed as a major fish stock of the *Fisheries Act* in April 2022 and will require a Rebuilding Plan by April 2024. Currently, the status of the SARA- listing consultation on the COSEWIC endangered status is open. If SARA-listed a rebuilding plan would not be required as more stringent measures would be applied.
However, the Okanagan Nation Alliance (ONA) along with partners including the DFO have implemented the Chinook Restoration Program. The program is a long-term effort to restore Okanagan chinook salmon, which include sk'lwist (summer-run salmon) spawning in the mainstem Okanagan River and ntitiyx (spring-run salmon) spawning in its tributaries. ONA has been monitoring live adult chinook and carcasses for over 15 years to gather information on abundance, distribution, and biological population characteristics. Conservation status assessments for Okanagan sk'lwist were completed in 2006 (Threatened) and 2016 (Endangered). ONA's Okanagan Chinook Recovery Action Plan (2016) outlines recovery goals and proposes specific actions to achieve those goals."
Links: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/consultation-documents/chinook-salmon-2023/chinook-management-summary-2023.html;

https://syilx.org/projects/okanagan-chinook-restoration-program/#:~:text=ONA%E2%80%99s%20Okanagan%20Chinook%20Recovery%20Action%20Plan%20%282016%29%20outlines,Releases%20have%20ranged%20from%203%2C400%20%E2%80%93%2022%2C000%20chinook.