



Bella Coola Watershed Conservation Society

Bella Coola Watershed-based

Fish Sustainability Plan

Stage III

Final Report

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Bella Coola Valley



Prepared for: International Forest Products & the Midcoast TSA Group
of Licensees (FIA Project # MC6603009-07)

On Behalf of: Bella Coola Watershed Conservation Society

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Executive Summary

The Bella Coola River Watershed is a large coastal drainage encompassing more than approximately 5,000 km², with more than 500 km of mainstem tributary channels. The watershed extends from the Bella Coola River mouth to upper headwaters in the Interior Plateau. The study area is vast, with more than 16 individual subbasins ranging from ~10 km² to >700 km², making watershed planning difficult and diverse.

This report is Stage III of the Watershed-based Fish Sustainability Planning process (WFSP), which began in 2001 in Bella Coola Valley by the Bella Coola Watershed Conservation Society. The Stage I and II Reports (BCWCS, 2003 and 2007) provided a large-scale watershed profile, a description of the past and current land and water uses within the Bella Coola Valley and watershed specific fisheries data on fish species present within the watershed. Stage II subsequently identified five (5) '*priority issues*' requiring further assessment and/or other actions to promote watershed-based fish sustainability in the Bella Coola Watershed.

This Stage III report presents a general plan for practically addressing the five '*priority issues*' identified in Stage II planning, based on local resource availability, scope of watershed size and existing knowledge. This plan is not a comprehensive prescription for habitat restoration, fisheries management or detailed sustainability planning, rather it is intended to guide proponents and stakeholders in choosing projects related to '*priority issues*' as identified by the BCWCS during watershed planning. Comprehensive study designs, field assessments or project implementation planning were beyond the scope of this project.

Section 1.0 of the Stage III report provides a summary of Stage II findings and recommendations and subdivides the study area into individual subbasins. Section 2.0 describes methodology for subbasin assessment, and section 3.0 summarizes subbasin findings. Section 4.0 provides recommendations for plan implementation and prioritizes management plan components.

Please contact the Bella Coola Resource Centre at (250) 982-0007 or at info@bellacoolawatershed.com if you have additional information that would be relevant to the Bella Coola WFSP.

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1.0 WFSP Stage III Introduction

Stage III of this Watershed-based fish Sustainability Plan (WFSP) has been completed at the request of the Bella Coola Watershed Conservation Society (BCWCS) to further the process of watershed planning and stewardship that began in 2001 with initial Stage I WFSP activities. Funding for this project was provided by the Forest Investment Account, Project MC6603009-07. Since 2001 Stages I and II have been completed, with the Stage II final report being released in January 2007. Kynoch Resources of Bella Coola Valley has compiled, assessed and presented data and information in this Stage III report on behalf of the BCWCS, with review and input from BCWCS directors and technical committee where available.

1.1 Watershed-based Fish Sustainability Planning Process Summary

As stated in the Stage II report (BCWCS, 2007), Watershed-based Fish Sustainability Planning (WFSP) is a process that was jointly introduced by the Federal and Provincial governments to help manage fish populations and fish habitat to a sustainable level. "Its overall goal is to ensure effective long-term conservation of fish and fish habitat" (Fraser 2001).

The planning phase is based on a four stage planning sequence.

Stage I Establishing Regional Priorities: This stage was led by government agencies and identifies watersheds, potential stakeholders, their interests and the resources available for fish and fish habitat conservation. BCWCS Completed Stage I in 2003.

Stage II Establishing Watershed Priorities: During this stage, local Planning and Technical Committees developed a detailed watershed profile describing fish populations, their habitats, and the factors affecting their health and productivity. Potential management options and a strategic overview of the watershed were prepared. BCWCS completed Stage II in 2007

Stage III Developing a Watershed Plan: In this stage, local Planning and Technical Committees identify how to achieve the objectives, targets and strategies developed in Stage II. This report addresses Stage III topics, as applicable.

Stage IV Implementing and Improving the Plan: In this stage, government and Planning Committees will carry out the actions identified in Stage II and III.

1.2 Rationale for adopting WFSP in Bella Coola Watershed

As indicated in the Stage II report (BCWCS, 2007) and as is the case throughout British Columbia, management of fisheries resources is administered through various federal and provincial agencies. This often results in inadequate watershed management. Making the management of the Bella Coola watershed more complicated, the agencies involved in resource management are situated in different parts of the province, and in the case of the Ministry of Forests and Range (MOF) the Bella Coola watershed is split between two regions. Local stakeholders realized that to properly manage the resources of the watershed it is essential to look at the entire watershed and not regional sections. WFSP allows the entire watershed to be managed as a single unit, which is one of the reasons why the process was chosen by the BCWCS.

By compiling information from other planning processes and filling in the gaps, the WFSP will create a "living plan" for the Bella Coola watershed. This multi-stage plan will be available to the public through the Bella Coola Watershed Conservation Society (BCWCS). This process and plan will assist local landowners, businesses, developers and industry to streamline research on projects, while at the same time ensuring that fish and fish habitat are protected.

1.3 Stage II Report Summary

The Stage II WFSP Report (BCWCS, 2007) provided considerable information on existing watershed resources, fish stocks, and historical activities of the region. The report also identified five primary areas of concern or 'Issues' relating to fish based watershed sustainability within the Bella Coola watershed, including:

1. Priority Fish Stock Issues;
2. Priority Fisheries Management Issues;
3. Priority Land Use Management Issues;
4. Priority Fish Habitat Issues; and,
5. Priority Data Gap Issues (which have been further subdivided).

These five priority issues were determined to be the principle items to be integrated into the Stage III watershed planning and subsequent implementation.

1.4 Stage III Objectives & Plan Strategy

Objectives of Stage III are broadly defined as '*Developing a Watershed Plan*', which has been further broken down into three primary components:

- A. *identifying physical locations of interest within the watershed that may benefit from further assessment or restoration;*
- B. *identifying and incorporating existing fisheries or resource management plans or opportunities within the watershed; and,*
- C. *identifying general strategies for plan implementation.*

Owing to the large size of the Bella Coola River watershed (>5,000 km²) and the limited resources available for planning and plan implementation, the majority of this Stage III report focused on the first of the three plan components (*Point A*: identifying physical locations of interest and opportunity within the watershed). Resource planning and fisheries management strategies (*Point B*) have been incorporated into this Stage III report where feasible; however, it was beyond the scope of this project to incorporate all fisheries management strategies into the Stage III report. Also owing to watershed size, it was not feasible to develop site-specific assessment or restoration prescriptions (*Point C*) for areas identified during *Point A* assessment.

To further aid in identifying suitable locations for Stage III and IV planning and implementation, the Bella Coola River watershed has been subdivided into 16 Specific subbasins and associated tributaries. Each subbasin was subsequently assessed and evaluated based on the five priority issues to determine applicability of each priority to that subbasin's fish-based watershed sustainability and resources.

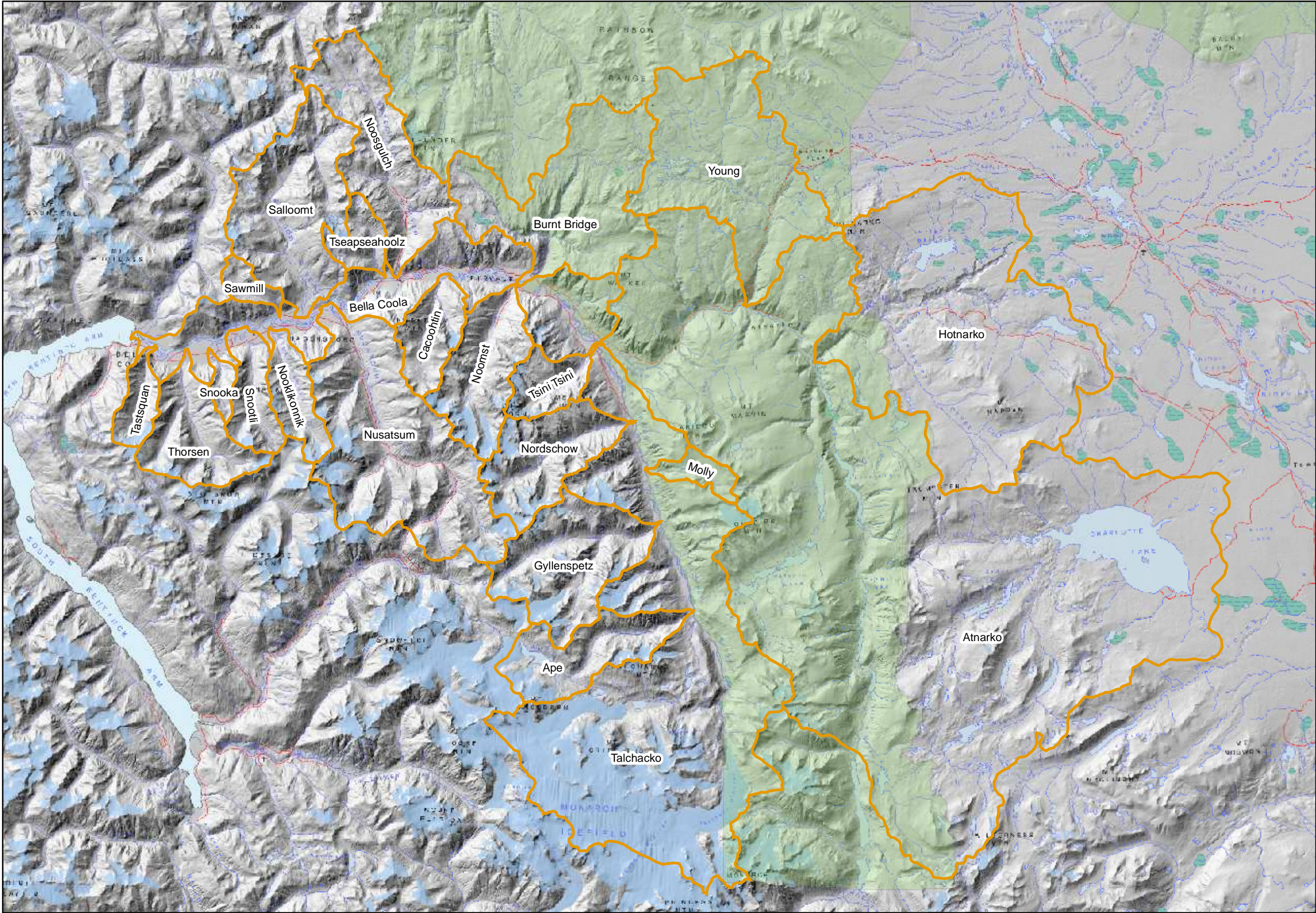
Locations and subbasins of interest selected during *Point A* assessment were chosen based on applicability of meeting criteria of one or more of the five priority issues described in the Stage II Report, as presented above in Section 1.3 (BCWCS, 2007).

Table 1 provides a list of the 16 subbasins assessed during this Stage III report and names and watershed codes of major tributaries, where applicable.

Table 1: Subbasins of Bella Coola River Included in Stage III Planning

Subbasin	Tributary or Alias	Watershed Code	Stream Length (km)	Stream Order	Subbasin Size (km ²)
1. Tastsquan Creek	NA	910-290700-02500	10.87 km	3	28.2
2. Thorsen Creek	NA	910-290700-10000	17 km	4	85.5
3. Snooka Creek	NA	910-290700-15300-23800	3.06 km	2	12.1
4. Snootli Creek	NA	910-290700-21500	14.19 km	4	39
5. Nooklikonnik Creek	NA	910-290700-24100	14.16 km	3	97.5
6. Sawmill Creek	NA	910-290700-27700	8.72 km	3	16.6
7. Salloomt River	NA	910-290700-30900	26.98 km	4	168.9
8. Nusatsum River	NA	910-290700-37800	32.32 km	5	274.6
9. Tseapseahoolz Creek	Alias Big Creek	910-290700-50400	8.63 km	4	29.8
10. Noosgulch River	NA	910-290700-46500	27.25 km	4	150.7
11. Cacohtin Creek	NA	910-290700-63200	12.89 km	4	51.6
12. Noomst Creek	NA	910-290700-75900	14.95 km	4	97.5
13. Burnt Bridge Creek	NA	910-290700-76500	21.85 km	4	212
14. Bella Coola River Residual	<i>Listed Below</i>	910-290700	62.98 km	6	5,150
	Fish Creek	910-290700-25935	4.63 km	1	NA
	Molly Walker Creek	910-290700-49200	3.47 km	1	NA
15. Atnarko River Residual	<i>Listed Below</i>	910-290700-99900	69.64 km	6	1,800
	Young Creek	910-290700-99900-21800	28.69 km	5	252
	Hotnarko River	910-290700-99900-32400	30.27 km	5	539
16. Talchako River Residual	<i>Listed Below</i>	910-290700-99800	49.26 km	5	679
	Nordschow Creek	910-290700-99800-19700	16.78 km	3	99.8
	Gyllenspetz Creek	910-290700-99800-43400	19.43 km	3	139.8

Bella Coola River Watershed

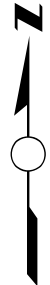


Legend

- Subbasins
- Tweedsmuir Park
- Road

Basin	ha
Ape	9,236
Atnarko	180,324
Bella Coola	24,688
Burnt Bridge	21,200
Cacoohtin	5,191
Gyllenspetz	13,962
Hotnarko	53,981
Molly	2,132
Nookliklonic	4,486
Noomst	9,852
Noosgulch	14,968
Nordschow	9,985
Nusatsum	28,126
Salloompt	17,526
Sawmill	1,662
Snooka	1,169
Snootli	4,796
Talchacko	67,890
Tastsquan	2,842
Thorsen	8,601
Tseapseahoolz	2,954
Tsini Tsini	4,104
Young	25,287
Total	514,962.00

1:400,000



Map created from BC Watershed Atlas, March, 2008

1.5 Summary of Priority Issues: Stage II Findings

A summary of main points of the priority issues identified in the Stage II report (BCWCS, 2007) is provided below.

1.5.1 *Fish Stock Management Issues*

Through Technical Committee review, consultation with resource managers and historic data assessment, four (4) fish stocks in the Bella Coola watershed were identified as priorities, including:

1. Eulachon population decline;
2. Fall chum population decline;
3. Steelhead population decline (and failure to recover after 10 years of river closure as well as modifications to commercial fishery to conserve); and,
4. Sockeye population decline (Atnarko Rivers of major focus).

1.5.2 *Priority Fisheries Management Issues*

Seven (7) Priority Fisheries Management issues in the Bella Coola watershed have been identified, including:

1. Potential threat of over-harvesting of salmonids through direct fisheries or through incidental catch by all user groups (i.e. commercial, First Nations and recreational)
2. Without hatchery production for harvest, commercial fishing opportunity would be reduced and more uncertain from year to year
3. Mixed stock fisheries have, and can, adversely impact smaller populations of non-target fish through unsustainable incidental catch
4. The Atnarko/Bella Coola steelhead population shows no sign of rebuilding in spite of complete fishing closures
5. The uncertainty in fisheries management caused by the inability to determine or predict changes in ocean survival (predator species, prey species, sea water temperature, etc.)
6. Inability to develop a management plan for eulachon (lack of information)
7. Potential impact of commercial netpen culture on wild fish (reduction of fish stocks through disease transfer and displacement of wild fish)

Based on findings of the Stage II and this Stage III WBFS report, certain aspects of fish stock management and fisheries management in general, related to the Bella Coola River watershed have been recommended to be incorporated into watershed planning at the appropriate levels. It is beyond the scope of this project to describe or incorporate all aspects of fish stock and/or fisheries management into a decisive management plan, as that task would require significantly more resources and time than currently available.

1.5.3 *Priority Land Use & Management Issues*

Ten (10) priority Land Use Management issues in the Bella Coola watershed have been identified, including:

1. Managing impacts of past forestry operations (hillside destabilization, alteration to natural hydrology patterns, decommissioning and maintenance of roads and riparian zone integrity)
2. Potential impact of future forest operations (forestry management and practices to insure same problems do not occur again, pine beetle management and potential for large fires and resulting deforestation on

- the Chilcotin plateau, private land logging where regulations are not the same)
3. Potential impacts to fish and fish habitat associated with development within the watershed and estuary (i.e. power projects, industrial and agricultural development, resource extraction, recreational facilities, etc.)
 4. Adequacy of regulations and process to protect fish and fish habitat within the CCRD bylaws and OCP (habitat sensitive zones, riparian management, enforcement)
 5. Lack of process for local citizens to have input into and influence the outcome of land use management plans (such as Forest Stewardship Plans)
 6. Road network and corridor impacts (bridges and culvert placement and maintenance, ditching, disruption of natural hydrology, habitat alienation, pollution from road maintenance and use)
 7. Flood management impacts (dike location and proximity to water course, management/maintenance of current dikes and necessity for bedload removal done on an emergency basis with no strategic plan for the future, ongoing need for bedload removal, water passage restriction)
 8. Human settlement impacts (building on the active floodplain, land clearing, riparian management on both large and small streams, water use management, solid waste management, septic and other waste management)
 9. Potential impacts of recreational fisheries and associated activities such as camping (increased angling pressure/number of anglers and use, river access, littering, pollution)
 10. Potential impacts of water based activities (power boat operations, river access, fishing, drift boats/rafting/kayaking, snorkeling)

1.5.4 Fish Habitat Issues

Six (6) Priority Fish Habitat issues in the Bella Coola watershed have been identified, including:

1. Reduced riparian function (cover, bank integrity, flows, water temperature, sedimentation, erosion, habitat complexity (LWD), shift in natural native fish species composition and distribution in the watershed, introduction of beavers and resultant habitat impacts from dam placement)
2. Impacts of climate change (hydrology changes and subsequent reduction in available habitat for aquatic species, changes in water temperatures [higher temperatures in the Atnarko River], high and low water events more severe resulting in mortalities of eggs and juveniles due to freezing and stranding)
3. Sedimentation impacts (caused by human activity such as Snooka Creek, ongoing sediment introduction through natural clay bank erosion in Noosgulch River, Salloomt River and north side of Bella Coola near the airport, Talchako River glacial silt.)
4. Bedload aggradation, removal and loss of natural stream function in the lower portions of Thorsen, Snootli and Nooklikonnik creeks.
5. Loss and reduction of off-channel and side channel habitat in lower valley (Nusatsum River down) resulting in reduced flow and lack of access for salmonids in Hagensborg Creek, Hagensborg Slough and McLellan Creek.
6. Impacts of human settlement (removal of riparian vegetation on small streams, land clearing, road building, drainage ditch and culvert placement and maintenance, bank and streambed degradation from cattle, pollution from fertilizer, pesticides and manure).

1.5.5 Priority Data Gap Issues

In addition to existing fisheries, resource and habitat concerns, data gaps were identified as a major concern in each of the primary management/physical aspects of watershed planning (i.e., Fish Stocks, Fisheries Management, Land Use Management and Fish Habitat).

Four (4) primary data gap issues were identified, including:

1. Fish Stock Issues
 - Identification and understanding of limiting factors causing stock decline for priority fish stocks (eulachon, sockeye, fall chum and steelhead populations)
 - Up-to-date and accurate maps with species distribution for all life stages
 - Stock abundance indicators for various life stages (a large spawning population does not always result in large smolt migration due to over-winter flooding or other impacts)
 - Specific run timings for Noosgulch, Salloomt and Nusatsum chinook and river spawning sockeye
 - Genetic information on fish species within the watershed (as an example it is not known if there is a genetic difference between lake and river type sockeye)
 - Composition of Atnarko sockeye between lake and river type life histories
2. Fisheries Management Issues
 - Species specific information on potential limiting factors (i.e. marine vs. freshwater survival rates)
 - Reliable escapement/abundance estimates for stocks such as steelhead, fall chum, Atnarko River sockeye, Nusatsum River chinook and coho, any species in the Talchako River
 - Hatchery production plan for watershed (for managed and unmanaged species)
3. Land Use Management Issues
 - Up-to-date and accurate base maps with overlays showing property lines, road network, transportation routes, sensitive habitat, etc.
 - TEK knowledge and significant areas identified and incorporated on maps and in data
4. Fish Habitat Issues
 - Species and system specific data on productive capacity
 - Up-to-date and accurate base maps (currently only have 20 year old photos available to produce maps) for entire watershed with habitat classification overlay and species distribution for all age classes
 - Ongoing river/stream health monitoring (water temp., dissolved oxygen, clarity, pH, conductivity, flow, invertebrate production, and other significant factors)
 - Post-project monitoring of restoration activities
 - Inventory and mapping of habitat that has been isolated through natural or anthropogenic causes
 - No consistent watershed "logbook" that recounts significant environmental events and observations related to watershed health

2.0 Assessment Methods

As described in the Introduction (above) 16 subbasins were identified to receive Stage III assessment and preliminary planning. Assessment methods and planning procedures used in this Stage III document were based on review of several existing data sets, historical reports, aerial photographs, maps and interviews with regional stakeholders, resource managers and First Nations. Field assessment was not completed as part of this project.

2.1 Application of Priority Issues

Owing to a large number of Stage II priority issues being based on fisheries and fish stock management, certain criteria were established to ensure applicability to subbasin inclusion during Stage III planning. For example it was practical to assess fish habitat concerns in a subbasin context (i.e., a certain section or reach of a subbasin required riparian enhancement), making Stage III planning of that issue feasible. However, for management issues relating to more complex topics such as fisheries management, off shore ocean conditions, commercial fishing, or aquaculture, direct linkages to subbasin management could not easily be drawn. For these reasons certain fisheries and fish stock management issues were considered beyond the scope of Stage III planning as it relates to physical watershed attributes and subbasins, as was providing recommendations for fisheries management to address these issues at this time.

Where priority issues were identified as tangible restoration, planning or on-the-ground management issues associated with an identified subbasin of the Bella Coola watershed, those items were more fully developed as Stage III planning initiatives for those individual subbasins (i.e., options for: riparian planting, flood mitigation, habitat restoration, fish stock enumeration/enhancement planning, etc.).

A summary of criteria that could be feasibly applied to Stage III planning for the topics of *Land Use Management Issues* and *Fish Habitat Priority Issues* is provided below.

2.1.1 Land Use Management Issues

Of the ten (10) Land Use Management Priority Issues identified in Stage II (summarized in Section 1.5 above), eight of the ten priorities have been merged into the following assessment criteria for subbasin analysis, including:

- effects of forest harvest, including potential watershed impacts of past, present and future harvesting;
- effects of land development, including potential or proposed development of infrastructure, housing, agriculture or other land use in the watershed;
- effects of road and transportation networks (bridges, culverts, etc.) potentially impacting watersheds;
- effects of, or opportunities for, flood management including dikes, bedload removal, maintenance, etc; and,
- potential impacts to subbasins from increased recreational land or water use (e.g., increased camping, angling, or water based recreation).

Two Priority Issues relating to Land Use Management that were not directly applicable to subbasin analysis included:

- adequacy of regulations and processes to protect fish and fish habitat within the CCRD bylaws; and,
- lack of process for local citizens to have input into and influence the outcome of land use management plans.

2.1.2 Fish Habitat Priority Issues

Each of the six (6) Priority Fish Habitat issues identified in the Bella Coola watershed Stage II WBFS plan were selected for subbasin analysis, where applicable, including:

- reduced riparian function (cover, bank integrity, flows, water temperature, sedimentation, erosion, habitat complexity (LWD), shift in natural native fish species composition and distribution in the watershed, introduction of beavers and resultant habitat impacts from dam placement);
- impacts of climate change (changes in hydrology and subsequent reduction in available habitat for aquatic species, changes in water temperatures, more severe high and low water events);
- sedimentation, debris jams, and channel impacts;
- bedload aggradation, removal and loss of natural stream function in the lower portions of Thorsen, Snootli and Nooklikonnik creeks (and others);
- loss and reduction of off-channel and side channel habitat; and,
- impacts of human settlement (removal of riparian vegetation on small streams, land clearing, road building, drainage ditch and culvert placement and maintenance, bank and streambed degradation from cattle, pollution from fertilizer, pesticides and manure).

2.1.3 Fish Stock & Management Priority Issues

An assessment of existing data for each of the four (4) Priority Fish Stocks identified in the Bella Coola watershed Stage II WBFS plan was completed to determine if fish stock assessment was sufficient for management purposes or whether additional assessment would be beneficial. Stock assessment techniques for the following stocks were investigated:

- Eulachon population assessment;
- Fall chum population assessment;
- Steelhead population assessment; and,
- Sockeye population assessment (Atnarko River of primary focus).

In addition to above mentioned fish stock management, requirements for further assessment work in subbasins to determine base-line stock data was considered, where feasible, including:

- requirements to compile an inventory of all species by sub-basin and timing of returns; and,
- opportunities to identify potential limiting factors to production for species in each subbasin.

2.1.4 Data Gap Priority Issues

Data Gap analysis for each subbasin was completed as an ongoing process during assessment of other priority issues and were further compiled for each subbasin based on known data gaps and findings of this project.

2.2 Subbasin Assessment

Existing documents and watershed statistics were used to establish watershed and subbasin boundaries, subbasin area and general drainage, land use and fisheries resources. In particular, the 1996 Coastal Watershed Assessment Procedure (CWAP) Report for the Bella Coola River (Summit, 1996). Each subbasin listed above received CWAP assessment of basic watershed characteristics, which are summarized in the subbasin sections.

Assessment of recent (2006) aerial photographs combined with library resource assessment of material available from the BCWCS, interviews with regional First Nation and government resource managers, and online data and mapping tools (e.g., DFO FISS, Habitat Wizard) was conducted on each watershed subbasin to assess subbasin condition as applicable to the above criteria. These assessments were intended to further identify potential areas of restoration and/or other assessment commensurate with Stage III Planning.

Figure 1 depicts the Bella Coola River Watershed and shows boundaries of major subbasins assessed in this Stage III report.

3.0 Subbasin Assessment Results

Each of the 16 subbasin and relevant tributary streams of the Bella Coola River watershed (Figure 1) were assessed using criteria described in Section 2.0. Assessment was limited to those watershed features and criteria most directly related to BCWCS Stage II priorities as described in Sections 1.5 and 2.0. Assessment methodology and reporting focused on general planning processes and recommendations. Assessment findings do not represent site-specific prescriptions or detailed field level analysis, as field truthing of assessment findings was beyond the scope of this project.

3.1 Tastsquan Creek

3.1.1 Watershed Characteristics

Tastsquan Creek drainage area is 28.2 km² and is located on the south side of the Bella Coola Valley, draining into the Bella Coola River approximately 2 km upstream for the Bella Coola Estuary. In the past Tastsquan Creek provided waterworks and domestic water supply to the Central Coast Regional District and the Nuxalk First Nation (Summit, 1996). Water intakes were upstream of the highway 20 bridge (south of highway 20). Downstream of the highway 20 crossing the stream channel has been armored on the left bank and flows adjacent to residential housing. There has been little or no logging or other land clearing in the Tastsquan subbasin and there is less than one kilometer of road within the watershed.

Aerial photo interpretation (2006 photo series) indicated upper reaches of Tastsquan Creek (south of Highway 20) are predominantly steep mountainous-forested stream banks with coniferous forest cover.

3.1.2 Past Assessment Summary

Continuous discharge monitoring of Tastsquan Creek (Station #08FB003) took place between April 1946 and August 1950 (Summit, 1996). Average monthly peak flows were recorded in June (4.48 m³/s) and low flows typically occurred in March (0.565 m³/s). Maximum daily discharges occurred in October and November each year, with largest peak flows measured as 36.5 m³/s was in October 24, 1947 and a discharge of 25.9 m³/s on November 27, 1949 (Summit, 1996).

During 1996 Coastal Watershed Assessment Procedures (CWAP), Summit Environmental identified several (9) naturally occurring landslides in the Tastsquan subbasin with direct stream contact, however; these were not attributed to past logging or land development. Recent (2006) aerial photographs confirmed that there was little or no upper watershed land development.

3.1.3 Fish Distribution & Habitat

Fish distribution within Tastsquan Creek include anadromous salmon in lower stream reaches, with coho, pink, and chum salmon using stream sections for spawning. Steelhead and Dolly Varden are also reported as present in Tastsquan Creek (BC Fishwizard, 2008). Eulachon have been reported to have historically used lower most reach sections of Tastsquan Creek during their seasonal spawning return to the lower Bella Coola River (Pers. Com. Jason Moody).

Upper distribution of fish in Tastsquan Creek was not available from map or database sources. Anecdotal information suggested a majority of anadromous salmon utilize spawning habitat downstream of the Highway 20 bridge; however, this does not preclude their presence upstream of this area. There where no barriers to fish migration noted on stream reports for Tastsquan Creek (BC Fishwizard; DFO FISS).

It was also noted that Pacific tailed frogs (*Ascaphus truei*) were reported in Tastsquan Creek (V. Michelfelder, Pers. Com.).

3.1.4 Habitat Restoration Opportunities

Based on Tastsquan Creek having been armored and diked in the past, there may be opportunities for riparian re-planting and continued flood mitigation planning. These opportunities were identified based primarily on location of the lower stream adjacent to residential development, requiring a stable stream channel. Off-channel habitat enhancement may also be feasible in lower stream channel sections; however, should be considerate of flood management objectives.

3.1.5 Land Management Opportunities

Lands adjacent to Tastsquan Creek include Nuxalk Nation Reserve lands. Land management opportunities include continued flood management, maintaining access to flood control areas and enhanced fish habitat through integrated flood management and habitat restoration opportunities. Upper watershed land management should maintain bank stability and riparian integrity to reduce risk of increased channel instability in lower stream sections.

There is one bridge crossing of Tastsquan Creek at Highway 20. It is unlikely that increased recreation in upper watershed areas would affect fish habitat, owing to steep terrain and limited recreation options.

3.1.6 Stock Assessment Opportunities

Stock assessment data for Tastsquan Creek were limited to periodic assessment of chum, pink and coho runs. Increased stock assessment and inventories may be beneficial in establishing upstream distribution of anadromous salmon. Tastsquan Creek could also be further assessed to determine if fall chum runs or steelhead runs are currently present, and/or to what extent.

Further inventory on other fish could include potential use by other trout and non-salmonid fish (e.g., sculpin), for which there is little or no data.

3.1.7 Identified Data Gaps

Identified data gaps for Tastsquan Creek included lack of information on fish distribution or physical stream barriers; fish stock presence and abundance; and, use of stream habitat by more diverse fish populations (e.g., eulachon, non-salmonids, etc.).

3.1.8 Subbasin Summary Table

Table 2: Tastsquan Creek		Area: 28.2 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CO, CM, PK, ST, DV 	
Past Assessment Summary	<ul style="list-style-type: none"> • Water Discharge monitoring • Flood Assessment/Control • Past municipal water supply 	
Restoration Opportunities	<ul style="list-style-type: none"> • Integrated habitat complexing in flood management • Riparian planting • Off-channel habitat opportunities in low flood-risk areas 	
Land Management Opportunities	<ul style="list-style-type: none"> • Flood management • Enhanced riparian areas in flood plain 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Increased information on distribution • Species diversity • Fall Chum and Eulachon presence or habitat use 	
Identified Data Gaps	<ul style="list-style-type: none"> • Fish distribution • Species diversity 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • Riparian planting and flood mitigation are likely a priority and appear feasible owing to proximity to settlement area and relatively good access. 	

3.2 Thorsen Creek

3.2.1 Watershed Characteristics

Thorsen Creek flows north into the Bella Coola River approximately 4 km upstream of the Bella Coola River Mouth. Thorsen Creek has a drainage area of approximately 85.5 km², which includes both upper tributary channels (East and West Upper Thorsen; Summit, 1996). CWAP investigations (1996) indicated approximately 6 km of roads within 100 m of the stream channel in lower sections of Thorsen Creek. Roads include dike access roads on the east and west sides of Thorsen creek immediately upstream and to a lesser extent downstream of the Highway 20 crossing. The CCRD landfill and private gravel extraction operations are located on the east stream side of lower Thorsen Creek, and a residential subdivision is located on the west side of Thorsen Creek. These developments are within approximately 2 km of the mouth of Thorsen Creek and do not extend into upper subbasin areas. Areas of the upper subbasin are proposed for conservancy area designation (designated 'Special Conservancy'; MOE, Habitat Wizard, 2008).

Thorsen Creek has been commercially logged in various stages since the early to mid 20th century. Resulting alterations to floodplain activity (e.g., forest harvesting, road building, bridge crossings and dike alignment) have resulted in, or have contributed to areas of aggradation of gravel, cobble and boulder in lower Thorsen Creek mainstem sections. The 1996 CWAP report identified high rates of bedload deposition at the highway bridge and flooding of private land as problems on Lower Thorsen Creek (Summit, 1996). Currently dikes extend approximately 1.3 km upstream from Highway 20 on both east and west stream banks. In 2008 the CCRD excavated an area of Thorsen Creek mainstem to serve as a sediment and debris catchments and completed remedial dike repairs on the right stream bank.

Lower watershed stream channel of Thorsen Creek is predominantly cascade-boulder habitat with areas of riffle-bar habitat extending approximately 3-5 km upstream from the stream mouth. Upstream of this lower section there has been little reported logging activity or road development in the East or West Thorsen subbasins (CWAP data,

Summit, 1996). Most known subbasin data and opportunities for restoration or assessment appear to occur in the Lower Thorsen Creek subbasin area.

3.2.2 Past Assessment Summary

Numerous assessments have been completed regarding fish habitat, stream morphology, stream channel stability and wildlife values of the Thorsen Creek subbasin. It was beyond the scope of this project to review all available date reports. Appendix 2 provides a Table of report titles and the author(s) which are of potential relevance to each subbasin assessed as part of this document.

3.2.3 Fish Distribution & Habitat

DFO FISS lists the following fish as present in Thorsen Creek: chinook, chum, coho and pink and sockeye salmon, cutthroat trout (resident and anadromous), Dolly Varden, rainbow trout, and steelhead. Non salmonids fish include sculpin and the stream provides known habitat for Pacific tailed frogs (Kynoch Resources, 2008). Lower Thorsen Creek is reported to provide high quality salmon spawning habitat in areas predominantly downstream of Highway 20 (DFO FISS). Most salmonids rear in areas removed from Thorsen Creek mainstem owing to lack of cover, cool water temperatures and predators (DFO FISS).

Lower Thorsen Creek is a highly unstable stream channel with aggrading gravel bars in the lowermost reaches described as lower Thorsen Creek (i.e., extending approximately 8 km upstream from the confluence with the Bella Coola River. Two waterfalls are reported as obstructions and are noted as being approximately 5 km upstream from the stream mouth (Fishwizard).

3.2.4 Habitat Restoration Opportunities

Fish habitat restoration opportunities within Thorsen Creek are likely limited to lower stream sections and would likely be contingent on ongoing flood management. In stream fish habitat restoration would not likely be feasible within Thorsen Creek owing to the active nature of the stream channel and flood plain. Opportunities for off-channel habitat restoration would likely also be limited owing to the nature of shoreline diking on both stream banks; however, areas upstream of the dikes could be explored for off-channel habitat creation, targeting anadromous salmonids to potentially provide over-winter or summer refugia and rearing habitat. Areas of flooded backwaters to the east are fed by lateral dike seepage (Radstack, 1998) and may provide ephemeral downstream stream connectivity within the Thorsen Creek subbasin. Areas to the east (i.e., Dump Creek) were assessed in 1998 and found to provide anadromous and resident salmonids habitat (Radstack, 1998). Some restoration work has been completed in this off-channel area; however, overall effectiveness of habitat and access restoration remains unknown. These off-channel areas could provide further options for subbasin habitat enhancement and/or enhanced or restored fish access.

Riparian restoration in conjunction with flood management appears to be feasible options for fish habitat restoration in Thorsen Creek at this time; however, longer term flood management plans may require access to stream channels and/or require continued riparian clearing for stream access. This would require integrated land use planning, flood mitigation and fish habitat assessment to develop riparian restoration prescriptions.

Snootli Creek Hatchery enhances runs of chum salmon on regular basis in Snootli Creek, with opportunistic enhancement of coho salmon when practical.

3.2.5 Land Management Opportunities

Land Management adjacent to Thorsen Creek should be considerate of flood potential. Of potential concern to fish habitat, water quality and general subbasin ecology is the current location of the CCRD landfill, which is approximately 200 m east of Thorsen Creek mainstem, approximately 2 km from the stream mouth. Land use planning for the

Thorsen Creek subbasin should be considerate of potential negative effects of this landfill on aquatic habitat. Other areas of land planning consideration may include expansion or continued development within the Four Mile subdivision area of the Nuxalk Nation lands to the west of Thorsen Creek. Retaining appropriate riparian buffers and effects on off-channel fish habitat of Thorsen Creek should be considered during potential residential or other expansion.

Stream channel aggradation monitoring in lower reaches and effectiveness of flood and debris control projects in reducing stream channel aggradation are also candidates for ongoing land use planning.

The Thorsen Creek subbasin has also been proposed for inclusion in a conservancy area, which may affect land use planning. Where recreation was to increase in the upper Thorsen subbasin it is unlikely to affect fish habitat, as recreation would most likely be regulated by the conservancy.

3.2.6 Stock Assessment Opportunities

Fish stock assessment could be further assessed in Thorsen Creek to include specific enumeration and distribution of fall chum salmon and extent of coho salmon spawning within mainstem areas. Further assessment of in-stream resident salmonid population (e.g., rainbow, cutthroat and Dolly Varden) habitat use and distribution would also be beneficial for Thorsen Creek flood management, particularly as it may pertain to in-stream works. Recent (2008) fish collection (Kynoch Resources, 2008) during in-stream works identified numerous Dolly Varden using interstitial boulder habitats, for which there appeared to be little prior data existing.

3.2.7 Identified Data Gaps

Uncertainty of the CCRD's landfill influences on Thorsen Creek water quality may be an issue to be further assessed and or monitored at a regional management level. Further investigation of resident fish use of mainstem stream sections would also be beneficial in preparing for in-stream works. Effectiveness and/or need for maintenance of habitat restoration structures could be assessed to determine if these structures met their intended goal (i.e., fish ladders and/or off channel habitat structures in Dump Creek).

3.2.8 Subbasin Summary Table

Table 3:Thorsen Creek		Area: 85.5 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CO, CH, CM, PK, SK, ST, DV, CT, RB, COT 	
Past Assessment Summary	<ul style="list-style-type: none"> • Off-channel habitat assessment and restoration • Fish access restoration • Flood Assessment/Control 	
Restoration Opportunities	<ul style="list-style-type: none"> • Integrated habitat complexing in flood management • Riparian planting • Off-channel habitat opportunities in low flood-risk areas • Increased or monitored fish access • Water quality monitoring 	
Land Management Opportunities	<ul style="list-style-type: none"> • Flood management • Enhanced riparian areas in flood plain • Residential planning near stream channels 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Increased information on distribution • Resident fish use of mainstem and off-channel habitat • Fall Chum and Eulachon presence or habitat use 	
Identified Data Gaps	<ul style="list-style-type: none"> • Fish distribution • Water quality data • Undetermined obstruction status of waterfalls, unknown as fish barriers 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • Flood mitigation is a current CCRD priority • Off-channel habitat restoration or enhancement may be feasible in low-risk flood areas • Uncertainty of water quality may be a confounding issue 	

3.3 Snooka Creek

3.3.1 Subbasin Characteristics

Snooka Creek is approximately 12.1 km² in area and is located on the south side of the Bella Coola Valley draining a series of ice and snow fields and three small alpine lakes. The Snooka Creek Subbasin has high relief and steep stream sections, with upper sections at elevations over 2000 m. Logging of the Snooka Creek subbasin has occurred in limited areas adjacent to the Bella Coola Valley floor. A Forest Service Road (FSR) extends approximately 1.2 km in lower subbasin sections. A recreational trail with foot bridges is also present in the subbasin. The CWAP report (Summit, 1996) identified approximately 90% of the logged riparian areas has having recovered hydrologically and noted high fisheries values in the stream channels.

The Snooka Creek channel is unstable and tends to wander with steep debris torrents and alluvial fanning near the Bella Coola Valley. Snooka Creek flows into the Bella Coola River through a series of side channels with connectivity to the Bella Coola mainstem and Lower Thorsen Creek, however; beaver dams and slough-like channels may inhibit fish access at some flows (Summit, 1997).

3.3.2 Past Assessment Summary

Past assessment of Snooka Creek has included a sediment source survey and fish habitat assessment (Summit 1997) and CWAP (Summit, 1996). These assessments indicated the stream channel was susceptible to torrents and has high sediment transport

potential. It was beyond the scope of this project to review all available data reports. Appendix 2 provides a Table of report titles and the author(s) which are of potential relevance to each subbasin assessed as part of this document. DFO FISS database indicated stream survey and mapping was completed on Snooka Creek in 2000; however, this report was not available for review during Stage III planning (FISS Ref.DFO312).

3.3.3 Fish Distribution & Habitat

DFO FISS lists the following fish as present in Snooka Creek: chinook, chum, coho and pink salmon, cutthroat trout, Dolly Varden, and steelhead. Snooka Creek is known to be an area of over wintering for coho and other salmonids, which use lower reach slough and pond habitat. DFO (FISS) reported tagged spawning coho salmon from Thorsen Creek within Snooka Creek channel.

3.3.4 Habitat Restoration Opportunities

Stream channel stabilization would likely be required prior to any in-stream fish habitat restoration of Snooka Creek south of Highway 20. However, stream channel stabilization is unlikely in this area owing to high stream energy and sediment sources (Summit, 1997). Aerial photo interpretation (2006 photo series) confirmed relatively dense riparian cover over most of Snooka Creek south of highway 20, indicating limited requirements for riparian habitat restoration or rehabilitation in this area. In areas north of highway 20, where the stream channel enters ponds and sloughs, opportunities to assess fish passage at beaver dams or debris jams should be considered. Enhanced riparian cover in areas adjacent to agricultural lands should also be assessed in lower stream sections.

3.3.5 Land Management Opportunities

Snooka Creek flows through several areas of private property as well as forested land. Land management could focus on promoting channel stability through bank stabilization, retaining riparian cover and managing for flood-risk. Lower stream sections may benefit from increased riparian cover; however these areas may also be prone to back-channel flooding and creation of large wetted areas during high flow periods (e.g., area of Snooka Creek at Grant Road North crossing). Snooka Creek has two road crossings; one on Highway 20 and the other at Grant Road North. A recreational trail crosses the stream in upper forested reaches. It is unlikely that increased recreation in upper watershed areas would affect fish habitat as trails are managed to Ministry of Tourism and Arts standards.

3.3.6 Stock Assessment Opportunities

Further identifying fish species presence and distribution would benefit prioritizing restoration options and subsequent land use planning. Log jams have been identified as barriers to fish migration in upper stream sections (Fishwizard, 2008) as have beaver dams in lower reaches (Summit, 1997). Collecting concise distribution and access data may provide a better idea of the extent of fish habitat in Snooka Creek.

3.3.7 Identified Data Gaps

Data gaps pertaining to location and extent of barriers and fish presence and distribution have been identified for Snooka subbasin. Water quality in beaver ponds or sloughs could be assessed to ensure existing habitat is functioning.

3.3.8 Subbasin Summary Table

Table 4: Snooka Creek		Area: 12.1 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CO, CH, CM, PK, ST, DV, CT, 	
Past Assessment Summary	<ul style="list-style-type: none"> • Sediment source, fish habitat assessment • CWAP 	
Restoration Opportunities	<ul style="list-style-type: none"> • Limited in-stream restoration owing to high energy system, possibility of stream complexing in low gradient areas undetermined • Potential fish access enhancement where beaver dams present barriers 	
Land Management Opportunities	<ul style="list-style-type: none"> • Flood management 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Increased information on fish presence and distribution • Inventory other salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whiffish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> • Fish distribution • Water quality data in pond areas • Undetermined obstruction status of beaver dams and log jams, unknown as fish barriers 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • In stream habitat enhancement/complexing may be feasible in low gradient stream channel sections. 	

3.4 Snootli Creek

3.4.1 Watershed Characteristics

Snootli Creek flows north into the Bella Coola River. With a channel length of approximately 14 km Snootli Creek flows into the Bella Coola River through a series of abandoned side channels approximately 11 km from the Bella Coola estuary. The Snootli Creek subbasin is approximately 39 km² and it has received limited development, with logging having been done near lower Bella Coola Valley regions. There is approximately 4 km of road in lower sections of the subbasin. The Hagensborg Water District has a water intake on Snootli Creek for domestic water use and Snootli Creek Federal Fish Hatchery is located on the west stream bank adjacent to Highway 20.

There are dikes on both stream banks of Snootli Creek on both upstream and downstream sides of Highway 20. The chanellized stream section offers limited fish habit quality in this area (Summit, 1997). Downstream towards the confluence with Bella Coola River Snootli Creek stream channel has become unstable in recent years and the channel aggrades and braids frequently through the mixed conifer and deciduous forest. Upstream of highway 20 Snootli Creek is relatively confined within the steep walls of the subbasin valley.

3.4.2 Past Assessment Summary

Numerous past assessments have been completed on Snootli Creek, including water quality, fish habitat, wildlife and stream restoration assessments. Owing to Snootli Creek being a community watershed and water source for a local water district, public access and development is limited in the upper portions of the subbasin.

Fish habitat restoration projects have been completed on lower sections of Snootli Creek, including LWD and boulder placement to complex mainstem section of low gradient

areas. In 2001 a fish habitat assessment of Charter Creek (a tributary to Snootli Creek) was completed by Midcoast Aquatics.

3.4.3 Fish Distribution & Habitat

Fish species present in Snootli Creek during various life cycles include chum, chinook, coho and pink salmon, Dolly Varden, steelhead, cutthroat trout (resident and anadromous), Dolly Varden and mountain whitefish, (MOE-Fishwizard). DFO FISS data reports also indicate past sockeye salmon escapements in Snootli Creek. Sculpin are also likely present. A waterfall approximately 3.5 m high was identified as a barrier to fish, but species blocked were not further identified (MOE-Fishwizard). An unnamed tributary (Alias Charter Creek, Midcoast Aquatics, 2001; WSC 910-290700-21500-20600) flows west into Snootli Creek in lower Bella Coola Valley stream reaches, providing an additional 3.6 km of off-channel and stream habitat within the Snootli Creek subbasin. Fish distribution in that tributary was not assessed as part of habitat assessments; however, is likely similar to Snootli Creek.

3.4.4 Habitat Restoration Opportunities

Habitat restoration within Snootli subbasin has been completed in lower stream reaches where channel conditions are more stable (WRP, 2000). Fish habitat restoration of in-stream sections of Snootli Creek are not recommended in areas of high stream energy and channel instability. Opportunities for channel stabilization in areas immediately downstream of the bridge may be possible with ongoing flood protection and mitigation being completed by the CCRD (2008); however, this would require more thorough investigation.

Limited riparian disruption was noted from aerial photographs (2006 series), however, localized areas of riparian planting or canopy diversification may exist, particularly in the ponded areas adjacent to the Snootli mainstem in the Walker Island Regional Park. Off-channel habitat access to Charter Creek could be enhanced or maintained to ensure full value of available off-channel habitat is realized for Snootli Creek.

DFO FISS databases have identified medium value constraints on fisheries potentials of Snootli Creek owing to periodic flooding and limited restoration opportunity owing to high energy stream characteristics (FISS database, 2008).

Snootli Creek Hatchery enhances runs of chum salmon on regular basis in Snootli Creek, with opportunistic enhancement of coho salmon when practical.

3.4.5 Land Management Opportunities

The CCRD, Ministry of Transportation, and Federal Fisheries have, in the past, and as recently as 2008 (CCRD) removed debris from areas upstream and/or downstream of the Highway 20 bridge for flood protection and mitigation. Flood mitigation planning will likely remain a high priority land use planning topic in Snootli Creek subbasin.

Aerial photograph review (2006 photo series) indicated little or no residential development adjacent to Snootli Creek as the stream flows through a Regional Park between Highway 20 and the Bella Coola River. Two bridges cross Snootli Creek, one on Highway 20 and one on Walker Island Road. It is unlikely that recreation would occur in upper watershed areas it is reserved as a community watershed for water withdrawal.

Areas adjacent to off-channel and wetland habitat associated with Charter Creek and beaver ponds of the CCRD Snootli Regional Park should be managed to retain riparian cover and stream channel or pond stability. Water quality of these ponds should be assessed and where required land management could enhance water quality (e.g., beaver dam removal to increase flow or flushing, livestock management if applicable, etc.).

3.4.6 Stock Assessment Opportunities

Fish stock presence, abundance and distribution of salmonid and non-salmonid fish species within Snootli Creek mainstem and off-channel habitat should be re-assessed. Information regarding fall chum and potential steelhead and sockeye salmon would be beneficial, along with an inventory of other resident fish common to the Bella Coola watershed, and their use of Snootli Creek habitat. Information on resident salmonid use and life-cycle timing within mainstem channel sections of Snootli Creek may be beneficial in flood mitigation planning.

3.4.7 Identified Data Gaps

Data gaps for Snootli Creek include use of spawning areas by fall chum salmon and sockeye salmon, as well as fish habitat and/or fish presence upstream of the waterfall barrier at 3.5 kkm.

3.4.8 Subbasin Summary Table

Table 5: Snootli Creek		Area: 39 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CO, CH, ST, CM, PK, ST, DV, CT, MWF 	
Past Assessment Summary	<ul style="list-style-type: none"> • Sediment source, fish habitat assessment • CWAP • Water quality for DFO hatchery • Hagensborg Water District Water License 	
Restoration Opportunities	<ul style="list-style-type: none"> • Limited in-stream restoration owing to high energy system, possibility of stream complexing in low gradient areas undetermined • Potential fish access enhancement where beaver dams present barriers in off-channel areas of subbasin 	
Land Management Opportunities	<ul style="list-style-type: none"> • Flood management • Opportunity to enhance public awareness of fisheries resources at Regional Park 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Increased information on fish presence and distribution • Inventory other salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whiffish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> • Fish distribution • Sockeye and fall chum salmon use 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • In stream habitat enhancement/complexing may be feasible in low gradient stream channel sections. 	

3.5 Nooklikonnik Creek

3.5.1 Watershed Characteristics

Nooklikonnik Creek is approximately 14.2 km long, flowing north into the Bella Coola valley approximately 16 km upstream of the Bella Coola River estuary. The Nooklikonnik Creek subbasin encompasses approximately 97.5 km² of which approximately 27% of the sub-basin area below 300 m elevation has been logged. In total, however, all of the logging within the watershed accounts for only approximately 1.2% of the sub-basin area, indicating most logging has occurred near the subbasin juncture with the Bella Coola Valley, with approximately 3.3 km of forest service and other roads in the subbasin (Summit, 1996).

Nooklikonnik Creek exhibits similar lower reach alluvial and debris fans as noted in Thorsen and Snootli Creeks and has similar dikes extending from approximately Highway 20, upstream between 2 km to 3 km on each stream bank. CWAP findings (Summit 1996) indicated approximately 40% of the subbasin was considered to be unstable lands, with 17% classified as erodible soils, indicating a relatively unstable stream system.

Nooklikonnik Creek flows predominantly through forested lands in upper subbasin sections, with lower reaches having dikes and associated access roads adjacent to the stream channel. North (downstream) of Highway 20 the stream flows adjacent to private properties, entering the Bella Coola River through a large perennial side channel of the Bella Coola River at an area to the east of the Bella Coola airport. This side channel is also offers connectivity to Fish Creek, which flows into the channel near the confluence with Nooklikonnik Creek.

3.5.2 Past Assessment Summary

Various fisheries assessment have been completed in Nooklikonnik Creek, including escapement surveys, biological reconnaissance, CWAP and Sediment Source Inventories and Fish Habitat Assessments. Fish habitat assessments (Summit, 1997) indicated limited stream channel complexity in the high energy stream system. High quality spawning habitat exists downstream of the Highway 20 bridge crossing and is used each year by numerous pink and chum salmon.

Nooklikonnik Creek has also been assessed for flood management and flood control, with dikes established on both stream banks and DFO FISS indicated there is a water license on the stream for local irrigation.

3.5.3 Fish Distribution & Habitat

DFO FISS data indicated past presence of spawning pink, chum and chinook salmon, with presence in various life stages of coho salmon, cutthroat trout, Dolly Varden and steelhead. Sculpin are also likely present. Further fish use is undetermined. DFO FISS indicated fish habitat upstream of the Highway 20 bridge is degraded owing to high water velocities associated with stream bank dikes. Large sediment loads were also noted as a habitat constraint in summer months.

3.5.4 Habitat Restoration Opportunities

Owing to the high energy nature of Nooklikonnik Creek there appears to be little opportunity for fish habitat enhancement or restoration in mainstem stream sections; however, opportunities to incorporate fish habitat complexing in future flood mitigation planning and implementation could be explored. Development and maintenance of access to potential off-channel habitat of Nooklikonnik Creek or adjacent tributaries or side channels to the Bella Coola River should also be investigated.

Snootli Creek Hatchery enhances runs of chum salmon on regular basis in Snootli Creek, with opportunistic enhancement of coho salmon when practical.

3.5.5 Land Management Opportunities

Land management of Nooklikonnik Creek subbasin will likely remain focused on flood mitigation and planning. Ministry of Environment and the CCRD have recently completed various assessments to monitor and control stream channel aggradation near and upstream of the Highway 20 bridge.

A rock quarry on the right (east) stream bank is used for rip rap production and any potential expansion should be managed in consideration of its relatively close location to a fish bearing stream (i.e., the quarry is within ~750 m of Nooklikonnik Creek). One bridge crosses Nooklikonnik Creek at Highway 20. Future land development in upper subbasin areas should be managed to mitigate stream channel degradation and erosion.

It is unlikely that increased recreation in upper watershed areas would affect fish habitat, owing to steep terrain and limited recreation options.

3.5.6 Stock Assessment Opportunities

Opportunity to more thoroughly assess spawning distribution, timing and numbers of coho and fall chum should be investigated. Similar to Thorsen and Snootli Creeks, it is recommended more thorough information of resident fish distribution and use be collected to mitigate impacts of potential instream works associated with flood management in the Nooklikonnik subbasin.

3.5.7 Identified Data Gaps

Data gaps regarding use of Nooklikonnik Creek by spawning coho salmon and potential existence or use of off-channel habitat by coho juveniles were identified. Timing and distribution of coho and fall chum salmon runs and continued presence or use by chinook salmon were also identified.

3.5.8 Subbasin Summary Table

Table 6: Nooklikonnik Creek		Area: 97.5 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CO, CH, ST, CM, PK, DV, CT 	
Past Assessment Summary	<ul style="list-style-type: none"> • Sediment source, fish habitat assessment • CWAP • Irrigation Water License • MOE/CCRD Flood planning 	
Restoration Opportunities	<ul style="list-style-type: none"> • Limited in-stream restoration owing to high energy system, possibility of stream complexing in low gradient areas undetermined 	
Land Management Opportunities	<ul style="list-style-type: none"> • Flood management • Consider limits on upper watershed development owing to potential for land instability and/or erosion and consequences on downstream reaches 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Increased information on fish presence and distribution, particularly coho and fall chum • Inventory other salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whitfish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> • Fish distribution • coho and fall chum salmon use • off-channel rearing capacity 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • In stream habitat enhancement/complexing is likely not feasible as low gradient, stable channel sections are limited. 	

3.6 Sawmill Creek

3.6.1 Watershed Characteristics

Sawmill Creek flows south into the Bella Coola River approximately 17 km upstream of the Bella Coola River estuary. Stream channel length is approximately 8.7 km draining a subbasin approximately 16.6 km². Approximately 400 m of lower stream channel are accessible to anadromous fish, at which point a waterfall barrier prevents upstream migration (DFO FISS, Radstack, 1996). During 1996 fish habitat assessments (Radstack)

it was noted the stream channel provided little or no high quality spawning habitat; however, was suited to juvenile salmonid rearing.

3.6.2 Past Assessment Summary

Sawmill Creek was assessed as part of the 1996 CWAP (Summit), which indicated logging of the subbasin was limited to lower reach sections associated with the Bella Coola Valley floor. Radstack (1996) assessed fish habitat of Sawmill creek and confirmed presence of a barrier to fish and sampled juvenile fish within the stream channel.

3.6.3 Fish Distribution & Habitat

DFO FISS identified coho, cutthroat, Dolly Varden and stickleback in Sawmill Creek. Radstack (1996) indicated other sources had identified steelhead as also present.

3.6.4 Habitat Restoration Opportunities

Opportunities for stream bank stabilization to reduce scour in the lower 400 m may exist based on fish habitat assessment observations (Radstack, 1996). Other restoration opportunities including LWD placement remain uncertain.

3.6.5 Land Management Opportunities

Land adjacent to lower reaches of Sawmill Creek is predominantly private property and should be managed to retain riparian cover. Upper stream sections have not been developed (i.e., above the waterfall). Where upper watershed development is considered, downstream fish habitat should be protected through mitigating excessive debris or increased peak flow events. It is unlikely that increased recreation in upper watershed areas would affect fish habitat, owing to steep terrain and limited recreation options.

3.6.6 Stock Assessment Opportunities

Assessment of spawning habitat and/or coho adult presence should be confirmed during fall spawning periods. An inventory of possible resident fish upstream of the waterfall could be completed to further manage land resources upstream of the migration barrier.

3.6.7 Identified Data Gaps

Use of the stream channel for coho spawning is the primary data gap.

3.6.8 Subbasin Summary Table

Table 7: Sawmill Creek		Area: 16.6 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CO, ST, DV, CT 	
Past Assessment Summary	<ul style="list-style-type: none"> • CWAP • Fish Habitat Assessment 	
Restoration Opportunities	<ul style="list-style-type: none"> • Riparian management for stream bank stabilization 	
Land Management Opportunities	<ul style="list-style-type: none"> • Riparian management for stream bank stabilization • Upper watershed management to protect fish habitat in lower reaches 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Assess coho spawning use 	
Identified Data Gaps	<ul style="list-style-type: none"> • Coho spawning 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • Low priority to manage riparian habitat on private property 	

3.7 Salloomt River

3.7.1 Watershed Characteristics

Salloomt river is a large and diverse subbasin watershed of the Bella Coola River, encompassing approximately 170 km² on the north side of the Bella Coola Valley. Salloomt subbasin flows south to meet the Bella Coola River approximately 18 km upstream of the Bella Coola River estuary. Since 1965 Water Survey Canada has been monitoring levels and discharge of water in the Salloomt River (Environment Canada, 2008). The Salloomt River (Station #08FB004) has been monitored continuously since 1965. Average monthly discharge ranges from 3.7 m³/s in February and March to 18.1 m³/s in June. A maximum daily discharge of 141 m³/s and a maximum instantaneous discharge of 241 m³/s were recorded on December 16, 1980. These levels were nearly matched on October 28, 2006 when a maximum daily discharge of 138 m³/s and a maximum instantaneous discharge of 203 m³/s were recorded (Environment Canada, 2008).

Logging has occurred in the Salloomt subbasin for over 50 years, with extensive road networks extending into the subbasin, with most logging having occurred in lower areas of the subbasin (Summit, 1996). DFO FISS reported as early as 1962 that logging had possibly negatively impacted fish habitat and fish stock numbers through poor forest harvesting practices (DFO FISS reference 8-3).

Recently (2006-2008), flooding, aggrading and unstable channel sections in lower Salloomt River reaches (e.g., lower 4 km) have affected land use and fish habitat of the lower Salloomt subbasin. Croft Creek (WSC 910-290700-30900-10300) is the only major tributary below the fish barrier/canyon and presents limited habitat for anadromous fish.

3.7.2 Past Assessment Summary

DFO FISS presents 15 specific references and data sets relating to Salloomt River fisheries resources, and undoubtedly, many more exist. It was beyond the scope of this report to review all documentation for this subbasin. Watershed Restoration Program (WRP) has completed habitat restoration on Croft Creek in 2000 (Braden, 2000), and between 1998 and 2000 D. Burt and Associates prepared two reports for Bella Coola River that identified Salloomt River as a large contributor for Bella Coola River watershed steelhead rearing sites (8%).

3.7.3 Fish Distribution & Habitat

A cascade presents a barrier to fish migration approximately 6 km upstream from the confluence with the Bella Coola River, described as Reach 3 (DFO FISS, 2008). Stream channel of the Salloomt River below this barrier is typically riffle-pool and DFO FISS data indicate chinook, coho, sockeye, chum and pink salmon, cutthroat trout, rainbow trout, Dolly Varden and steelhead are present in the subbasin. It is possible that sculpin, stickleback and rocky mountain whitefish may also be present, along with various other non-salmonid fish.

In 1989 blasting was undertaken at the gradient barrier of Reach 3 to enhance fish access to upper stream sections (DFO FISS, Ref. WL-122). It was undetermined whether this activity enables fish access to upper reaches of Salloomt River. Local residents report having seen adult salmon above the barrier; however, regional fisheries resource personnel had not confirmed adult presence in numerous river swims for inventory purposes (Willis, 2008, Pers. Com.). Natural presence of fish above the stream barrier in Reach 3 includes Dolly Varden char. In the 1980s steelhead fry were released to stream sections above the fish barrier in Reach 3 (DFO FISS Ref. 1511 & 120). Rainbow trout resident populations may have become established from steelhead fry releases above the barrier (Willis, 2008, Pers Com.).

3.7.4 Habitat Restoration Opportunities

Lower stream reaches of Salloomt River are relatively unstable and prone to channel avulsions and debris jams, limiting in-stream habitat restoration or enhancement activities. Creation of off-channel habitat may exist, however; much of the lower Salloomt subbasin is surrounded by private property. Upper subbasin bank and channel stabilization may be an opportunity in Salloomt River to increase downstream channel stability, however; it is beyond the scope of this project to prescribe assessments. Riparian planting for bank stabilization may be an option in some areas of the lower and/or upper Salloomt River. Tributary off-channel access to restoration sites at Croft Creek should be further examined to determine if resident or anadromous fish of Salloomt River have access to restored (pond) habitat.

Snootli Creek Hatchery enhances runs of chum and chinook salmon on regular basis in Salloomt River, with opportunistic enhancement of coho salmon. Stream channel alterations from recent and prolonged flooding and channel instability in the Lower Salloomt River have led to loss of adult salmon spawning habitat (Willis, 2008. Pers. Com.)

3.7.5 Land Management Opportunities

Land management within the lower Salloomt subbasin has recently focused on bank and channel stabilization, and flood control or mitigation. There is much private property in lower reaches of the Salloomt River and land development should be considerate of flood risk and channel stability. In 2007-2008 MOT undertook programs to prevent road-loss due to flooding and the CCRD undertook flood planning projects. Upper sections of Salloomt subbasin should be managed to mitigate impacts on channel stability, peak flow events and sediment transport to downstream river reaches. Land Management in the Salloomt River subbasin is very complex and will likely present challenges. It is beyond the scope of this report to present anything more substantive than general recommendations.

Upper watershed areas should be managed to insure stream channel, stream bank and riparian stability to further help stabilize lower stream sections. Recreation opportunities exist throughout the Salloomt River subbasin and should be managed at a scale and level or type of activity that does not adversely affect the watershed ecology or habitat integrity.

3.7.6 Stock Assessment Opportunities

Further stock assessment to determine an accurate number of Salloomt river chinook, coho, sockeye and steelhead would be beneficial in fisheries management. Also knowing run distribution of fall chum salmon would be beneficial in that specific stock's management. Presence of non-salmonid and/or resident fish presence throughout the watershed is recommended for consideration to assist in regional planning, including flood management and potential future upper subbasin development.

Fish access to upper stream sections should be further documented to definitively determine success or failure of 1989 access enhancement. Fish access from Salloomt River to restoration sites on Croft Creek should also be assessed.

3.7.7 Identified Data Gaps

Data gaps relating to actual success of 1989 attempts to enhance fish access to upper stream sections were identified. DFO FISS data did not definitively describe success or failure of the 1989 project and uncertainty may exist regarding reliable fish access to the upper subbasin.

Extent of historic and/or recent habitat loss owing to channel instability in lower stream reaches was also undetermined, as were results of habitat loss on fish stocks (e.g., chinook, sockeye, steelhead).

Fish presence beyond Pacific salmon, trout and char species was not available for the Salloomt River (e.g., mountain whitefish, non-salmonid species).

3.7.8 Subbasin Summary Table

Table 8: Salloomt River		Area: 168.9 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CO, CM, PK, CN, SK, ST, DV, CT 	
Past Assessment Summary	<ul style="list-style-type: none"> • CWAP • Numerous Fish Habitat Assessments and stock assessments • DFO FISS references 15 reports • Inclusion in numerous Bella Coola River studies • Continual water level & discharge monitoring from 1964 • Watershed assessment and restoration projects 	
Restoration Opportunities	<ul style="list-style-type: none"> • Upper subbasin channel stabilization undetermined • Flood mitigation and control in lower stream reaches • Riparian management for stream bank stabilization in all reaches • Off channel development to mitigate in-stream habitat loss/alteration 	
Land Management Opportunities	<ul style="list-style-type: none"> • Flood protection • Habitat loss mitigation • Riparian management for stream bank stabilization • Upper watershed management to protect property and fish habitat in lower reaches 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Assess chinook, coho and sockeye stocks • Determine use and extent of fall chum runs • Inventory other salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whitefish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> • Upper subbasin fish access • Distribution of fish stocks • Future upper watershed management plans 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • Flood management is likely priority • Access to lower stream sections is good through private lands and flood mitigation/prevention is recommended to include fish habitat mitigation or enhancement where feasible. 	

3.8 Nusatsum river

3.8.1 Watershed Characteristics

Nusatsum River is a large tributary subbasin to the Bella Coola River Watershed, comprising approximately 275 km² on the south side of the Bella Coola Valley. Similar to Salloomt River, Nusatsum River subbasin has had a long history of logging and has a well established road network, which at one time (established 1984) extended as far south as the Noeick River in South Bentinck Arm. In lower stream sections there are forest service roads on both sides of the subbasin (East and West Nusatsum FSR). Currently (2008) West Nusatsum FSR is maintained as four wheel drive access as far as the Purgatory Lookout Recreation Site.

Nusatsum River flows northwest approximately 32 km to the Bella Coola Valley, entering the Bella Coola River approximately 18 km upstream of the river's estuary. The stream

channel is varied between riffle-pool and boulder-cascade stream type (Summit, 1997). Lower mainstem reaches are highly braided with mainstem spawning habitat and side channel rearing habitat. As summarized by Summit in 1997, the Nusatsum River is a large, high energy stream with extensive past forest harvesting throughout the subbasin. Stream channel and fish habitat impacts were largely related to past riparian disturbances, channelization and sedimentation.

3.8.2 Past Assessment Summary

As a large subbasin to the Bella Coola Valley, Nusatsum River has undergone a variety of assessments, developments and fisheries initiatives. DFO FISS lists 18 references for fisheries related assessments and projects on the Nusatsum River, including government and consultant reports, stock assessment records and stream surveys. DFO Snootli Creek hatchery conducts regular chinook salmon egg takes on the Nusatsum River and a WRP restoration project was established at approximately 8 km on the West Nusatsum FSR to provide off-channel rearing for coho salmon and cutthroat trout.

3.8.3 Fish Distribution & Habitat

DFO FISS lists the following fish species as present in the Nusatsum River subbasin: chinook, coho, chum and pink salmon, steelhead, cutthroat, Dolly Varden and three-spine stickleback. Distribution of anadromous salmon is documented in the lower 18 km of the Nusatsum River (DFO FISS Ref. 8-50 and M-023). Distribution beyond this point remains undocumented and may be influenced by habitat and/or gradient.

In 1983 Snootli Creek hatchery released steelhead fry into the Nusatsum River (Habitatwizard, 2008).

3.8.4 Habitat Restoration Opportunities

Fish habitat restoration opportunities within Nusatsum River subbasin are most likely associated with riparian restoration and/or past sediment sources and channel instability. Lower stream sections (i.e., downstream of the Highway 20 bridge) are heavily braided with extensive exposed, non-vegetated river bar (as confirmed on 2006 series aerial photographs). This portion of stream has several side channels and apparently unstable aggraded bars, likely not suitable to in-stream habitat restoration. A Level 1 FHAP report (Summit, 1997) indicated that owing to high energy stream characteristics of Nusatsum River, fish habitat restoration would be most feasible through riparian and sediment source rehabilitation associated with upslope and road disturbances.

3.8.5 Land Management Opportunities

Nusatsum River has limited residential development in lower stream sections, with off-set dikes on portions of the south bank floodplain approximately 2 km upstream from the confluence of the Bella Coola River. One highway bridge crosses the stream channel in a canyon approximately 3.5 km upstream from the stream mouth. Owing to topography, this canyon also marks the approximate upstream boundary of residential or other occupied land development of the Nusatsum subbasin, and is the point of commencement for the West and East Nusatsum FSRs. Extensive logging has occurred on both FSRs, adjacent to the south and north stream banks, respectively. There is one Highway 20 bridge and three FSR bridges over the Nusatsum River mainstem.

Land management opportunities are recommended to be considerate of fish habitat through increased or maintained private land riparian management on properties adjacent to the lower Nusatsum River as well as long term planning for riparian maintenance and/or enhancement in upper watershed sections.

The Bella Coola Local Resource Use Plan (LRUP, 1996) also describes maintaining recreation features of the Nusatsum West FSR (e.g., Ape Lake trail, Odegarrd Falls, etc.). Maintenance of these sites may also be beneficial in larger-scale environmental

and watershed stewardship through expanded educational or learning opportunities for the public and visitors (e.g. interpretive trails, etc.).

Recreation opportunities exist throughout the Nusatsum River subbasin and should be managed at a scale and level or type of activity that does not adversely affect the watershed ecology or habitat integrity.

3.8.6 Stock Assessment Opportunities

Further stock assessment may be warranted on Nusatsum River chinook and coho salmon and steelhead to determine timing and extent of runs. Presence of non-salmonid and/or resident fish presence throughout the watershed is recommended for consideration to assist in regional planning, including flood management and potential future upper subbasin development.

3.8.7 Identified Data Gaps

There is considerable information regarding the Nusatsum River subbasin; however, data gaps pertaining to fish stock runs, distribution and habitat use in upper stream sections appears limited. Identification of additional potential off-channel fish habitat restoration or enhancement sites may be a beneficial way of restoring fish habitat in the subbasin. Timing of salmon runs in this river also remains largely unknown and additional escapement data relating to general run timing would be beneficial. Presence or absence of sockeye salmon has not been definitively determined in the Nusatsum River subbasin.

3.8.8 Subbasin Summary Table

Table 9: Nusatsum River		Area: 274.6 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CO, CM, PK, CN, ST, DV, CT 	
Past Assessment Summary	<ul style="list-style-type: none"> • CWAP • Various fish habitat and stock assessments • DFO FISS references 18 reports • Inclusion in numerous Bella Coola River studies • Watershed assessment and restoration projects 	
Restoration Opportunities	<ul style="list-style-type: none"> • Riparian management for stream bank stabilization in all reaches • Off channel development to mitigate in-stream habitat loss/alteration 	
Land Management Opportunities	<ul style="list-style-type: none"> • Flood protection • Riparian management for stream bank stabilization • Upper watershed management to protect stream stability and fish habitat in lower reaches 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Assess chinook, coho and steelhead run timing and abundance • Inventory other salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whitefish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> • Upper subbasin fish access and distribution of fish stocks • Future upper watershed management plans • Presence or occurrences of sockeye salmon 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • In-stream works are low priority owing to high energy stream channel • Riparian restoration is feasible in areas of maintained access • Off-channel restoration opportunities may exist in lower watershed sections 	

3.9 Tseapseahoolz Creek

3.9.1 Watershed Characteristics

Tseapseahoolz Creek (alias Big Creek) flows approximately 8.6 km south into the Bella Coola Valley, draining a subbasin of approximately 30 km². The confluence with the Bella Coola River is approximately 29.8 km² upstream of the Bella Coola estuary. Tseapseahoolz Creek is described in the 1996 CWAP (Summit) as having low levels of historic logging; however, approximately 6 km of roads come within 100 m of stream banks within the subbasin, resulting in moderate levels of past riparian disturbances.

Lower stream sections were reported as braided (Summit, 1997), potentially offering limited fish habitat in mainstem and side channel braids of lower stream sections. Approximately 1 km upstream of the confluence with the Bella Coola River, Tseapseahoolz Creek becomes a predominantly boulder cascade stream channel, offering limited fish habitat. Stream morphology (braiding and cascade features) were confirmed through 2006 aerial photo interpretation, and site visits by the author during 2007 and 2008 field work in the region.

3.9.2 Past Assessment Summary

Limited previous assessment data were available for Tseapseahoolz Creek. In 1996 and 1997 CWAP, Sediment source and fish habitat assessments were completed in the Tseapseahoolz subbasin (Summit). Aside from these references, DFO FISS referenced only one other report for the Tseapseahoolz subbasin.

3.9.3 Fish Distribution & Habitat

MOE Fiswizard describes pink salmon cutthroat and steelhead as present in Tseapseahoolz Creek. DFO FISS data does not show other fish species use of this subbasin. Owing to connectivity to the Bella Coola River, other fish species presence is likely in this subbasin.

3.9.4 Habitat Restoration Opportunities

Habitat restoration of Tseapseahoolz Creek is likely limited to riparian planning and upper watershed management to stabilize stream sections and control sediment and aggradation of lower stream reaches, most accessible to fish from the Bella Coola River. Where stable, low gradient areas are present adjacent to the lower stream channel, off-channel habitat creation may benefit juvenile fish resulting from spawning in mainstem stream sections (i.e., coho or steelhead where present).

3.9.5 Land Management Opportunities

Upper watershed management and riparian preservation to increase channel stability should be considered in Tseapseahoolz Creek subbasin. In 2008 it appeared access was limited to roads of the subbasin by a gate on private property, possibly further increasing road stability through limited use. Land management may review access issues to upper watershed reaches for restoration or assessment as required.

3.9.6 Stock Assessment Opportunities

Opportunities for more comprehensive assessment of anadromous or resident fish, including non-salmonid fish, and their distribution throughout Tseapseahoolz Creek were identified. Specifically, information on chum salmon and coho salmon spawning and distribution would be useful, owing to mainstem connectivity to the Bella Coola River.

3.9.7 Identified Data Gaps

Fish presence, distribution and stock composition in lower reaches and fish access to upper stream sections remain undetermined.

3.9.8 Subbasin Summary Table

Table 10: Tseapseahoolz Creek		Area: 29.8 km ²
Known Fish Presence	<ul style="list-style-type: none"> • PK, ST, CT 	
Past Assessment Summary	<ul style="list-style-type: none"> • CWAP and Sediment Source/Fish Habitat • DFO FISS references 1 other (steelhead assessment) reports 	
Restoration Opportunities	<ul style="list-style-type: none"> • Riparian management for stream bank stabilization in all reaches • Off channel development to mitigate in-stream habitat loss/alteration 	
Land Management Opportunities	<ul style="list-style-type: none"> • Riparian management for stream bank stabilization • Upper watershed management to protect stream stability and fish habitat in lower reaches 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Inventory salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whitefish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> • Upper subbasin fish access and distribution of fish stocks 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • In-stream works are low priority owing to high energy stream channel • Riparian restoration is feasible in areas of maintained access • Off-channel restoration opportunities may exist in lower watershed sections 	

3.10 Noosgulch river

3.10.1 Watershed Characteristics

Noosgulch River is another large subbasin of the Bella Coola River at approximately 150 km² area. The mainstem Noosgulch channel length is approximately 25 km long, flowing south into the Bella Coola River approximately 28 km upstream of the Bella Coola River estuary. Lower stream sections are relatively high energy riffle-pool and cascade boulder morphology with spawning habitat, but limited pools (Summit, 1997). An obstruction to anadromous fish was identified approximately 1.3 km upstream of the river mouth (MOE Fishwizard). Fish had previously been out planted above this barrier (Summit, 1997). DFO Snootli Hatchery collects chinook salmon broodstock from lower sections of the Noosgulch River.

The Noosgulch subbasin had approximately 31 km of roads, with ~15 km within 100 m of stream channels (Summit, 1996). DFO FISS summary reference reports indicated the stream is prone to flooding and sedimentation (DFO FISS Ref. BC-063 & 8-33), which was confirmed in CWAP reporting (Summit, 1996).

More recently Central Coast power Ltd. has been developing plans for creation of an independent power project (IPP) for hydroelectric production in the Noosgulch subbasin. As of 2008 development of the IPP appeared to have been land subdivision and road-infrastructure alterations/maintenance.

3.10.2 Past Assessment Summary

DFO FISS reports 11 references relevant to the Noosgulch River. Currently There have been numerous assessments completed in Noosguch River, including stock assessment, bloodstock collection, habitat assessment and restoration, fish releases and land management assessments relating to forestry and most recently independent power projects (IPPs). Currently Central Coast Power Corporation holds a water use license for use of 360.06 CS (10.20 m³/Second) for hydroelectric production.

3.10.3 Fish Distribution & Habitat

DFO FISS documents presence of chum, chinook, pink, and sockeye salmon, cutthroat, steelhead and rainbow trout. Independent consulting reports also have confirmed presence of coho salmon in off-channel areas (Kynoch Resources, 2007.). Other salmonids and non salmonid fish may also utilize lower portions of the Noosgulch River owing to direct mainstem connectivity with the Bella Coola River.

Fish distribution upstream of the waterfall/cascade barrier in the lower river is likely limited to resident trout or char; however, distribution data were not available.

3.10.4 Habitat Restoration Opportunities

Past habitat restoration within the Noosgulch subbasin has included creation of off-channel fish ponds for juvenile rearing. In-stream habitat restoration in lower stream sections is likely not feasible owing to channel instability and high energy/flood events. Upstream areas of the subbasin (e.g., above the fish barrier) may be suitable to enhanced riparian rehabilitation and/or maintenance to increase bank stability. Habitat restoration associated with possible effects of the proposed IPP have not been assessed as part of this summary.

3.10.5 Land Management Opportunities

Land management within the Noosgulch subbasin will be largely contingent on development of the Noosgulch IPP; however, should focus on increased slope and stream channel stability to stabilize downstream river sections and associated fish habitat. Recreation opportunities within the Noosgulch River are undetermined based on proposed IPP development; however, should be managed with similar watershed land use objectives of land slope stability and riparian protection.

3.10.6 Stock Assessment Opportunities

Opportunities for more comprehensive assessment of anadromous or resident fish, including non-salmonid fish, and their distribution throughout lower and upper Noosgulch River were identified. Specifically, information on coho salmon spawning and distribution would be useful, owing to mainstem connectivity to the Bella Coola River. Assessment of sockeye stocks would be beneficial.

3.10.7 Identified Data Gaps

Fish distribution upstream of the waterfall barrier remained uncertain, as did fish habitat quality and suitability for various species. Data uncertainties in FISS records pertaining to coho presence were also identified as was uncertainty in sockeye presence and distribution.

3.10.8 Subbasin Summary Table

Table 11: Noosgulch River		Area: 150 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CM, CN, CO, SK, PK, ST, CT, RB 	
Past Assessment Summary	<ul style="list-style-type: none"> • CWAP and Sediment Source/Fish Habitat • DFO FISS references 10 other references 	
Restoration Opportunities	<ul style="list-style-type: none"> • Riparian management for stream bank stabilization in all reaches • Work with IPP to mitigate fish impacts 	
Land Management Opportunities	<ul style="list-style-type: none"> • Riparian management for stream bank stabilization • Upper watershed management to protect stream stability and fish habitat in lower reaches • Work with IPP to mitigate fish impacts 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Inventory salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whitefish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> • Upper subbasin fish access and distribution of fish stocks • Presence and extent of coho spawners 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • In-stream works are low priority owing to high energy stream channel • Riparian restoration is feasible in areas of maintained access • Additional off-channel restoration opportunities may exist in lower watershed sections 	

3.11 Cachootin Creek

3.11.1 Watershed Characteristics

Cachootin Creek is approximately 13 km long, draining a subbasin approximately 51 km². The stream channel flows north in the Bella Coola River approximately 33 km upstream of the Bella Coola River mouth. The 1996 CWAP indicated approximately 33% of the fish bearing stream section and ~27% of the non fish bearing stream section had been logged. A road network extends to higher elevations and logging had occurred beyond the 1996 reporting period. Stream channel characteristics of lower Cachootin Creek were described as providing high value fish habitat owing to presence of spawning and rearing habitat (Summit, 1997); however, water and fish habitat quality were potentially negatively impacted by cattle and livestock presence in the subbasin (DFO FISS Ref. HQ2293). Approximately 2 km upstream from the mouth stream gradient increases and Cachootin Creek is reported as presenting non-fish bearing habitat based on gradient (Summit 1997).

3.11.2 Past Assessment Summary

Assessment of Cachootin Creek fisheries resources appears to be limited to CWAP, sediment source and fish habitat assessment completed in 1996 and 1997 (Summit). DFO FISS data report one other reference for fisheries related data about Cachootin Creek.

3.11.3 Fish Distribution & Habitat

Lower mainstream sections of Cachootin Creek are known to have chum, chinook, coho and pink salmon, with unidentified trout juveniles present (DFO FISS). Known fish distribution is limited to approximately the lower 2 km of stream channel, owing to high

gradient above this point (Summit, 1997). A canyon is reported in Reach 3 (2 km). Side channel sections of Cachootin Creek near the stream mouth were identified as offering rearing and spawning habitat for salmon, with moderate amounts of LWD. However, a debris jam and eroding banks indicated potential stream bank instability (CWAP, Summit, 1996).

3.11.4 Habitat Restoration Opportunities

Habitat restoration in Cachootin subbasin could include riparian restoration, including livestock management to avoid riparian vegetation damage. Livestock could also be managed to reduce impacts on stream channel stability and potentially water quality of Cachootin Creek.

Off-channel habitat restoration may be feasible in lower gradient downstream areas associated with the Bella Coola River floodplain and Cachootin side channels. In stream channel habitat restoration is likely not feasible owing to high energy stream characteristics.

3.11.5 Land Management Opportunities

Opportunities for livestock management to protect stream and riparian habitat could be considered. Upper watershed logging and road maintenance should also be considerate of downstream fish habitat. Recreation opportunities exist in the form of enhanced wilderness trails, alpine access and viewpoints. Land use planning for recreation should follow environmental best practices during any recreational development to protect fish and fish habitat.

3.11.6 Stock Assessment Opportunities

Assessment of fish presence in high gradient stream sections above reach 3 (~2 km) should be assessed or reviewed to confirm fish presence or absence. Lower stream sections could be further assessed to determine a more complete inventory of fish, including identifying juvenile salmonid and any non-salmonid fish use.

3.11.7 Identified Data Gaps

Data gaps relating to fish presence in high gradient stream sections as well as fish species composition in lower and upper subbasin sections were identified.

3.11.8 Subbasin Summary Table

Table 12: Cachatoin Creek		Area: 51.6 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CM, CO, PK, unidentified trout 	
Past Assessment Summary	<ul style="list-style-type: none"> • CWAP and Sediment Source/Fish Habitat • DFO FISS references 1 other reference 	
Restoration Opportunities	<ul style="list-style-type: none"> • Livestock management for stream bank riparian protection in lower reaches • Potential off-channel habitat creation in lower stream sections 	
Land Management Opportunities	<ul style="list-style-type: none"> • Livestock management for stream bank stabilization • Upper watershed management to protect stream stability and fish habitat in lower reaches 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Inventory salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whitefish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> • Upper subbasin fish access and distribution of fish in high gradient stream sections • Identification of trout species • Potential impacts to water quality of a small stream associated with adjacent agriculture/livestock use 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • In-stream works are low priority owing to high energy stream channel • Riparian restoration is feasible in areas of maintained access • Additional off-channel restoration opportunities may exist in lower watershed sections; however, it is recommended livestock management also be considered. 	

3.12 Noomst Creek

3.12.1 Watershed Characteristics

Noomst Creek is approximately 15 km long, draining a subbasin area of approximately 97.5 km², and flowing north into the Bella Coola River approximately 40 km upstream of the Bella Coola River mouth. The stream channel is a relatively high energy 4th order, glacially influenced stream with approximately 88% of the subbasin situated above 800 m elevation, resulting in approximately 33% of the subbasin being covered in glacial ice and rock (Summit, 1997). During 1997 fish habitat assessments (Summit, 1997), lower stream sections were reported as being moderate fish habitat; however, it was noted that little or no spawning habitat was present and pools were noted to be limited in frequency and distribution.

An extensive road network had previously been established in the Noomst subbasin and is now partially deactivated. Most stream information appears to have been collected on stream sections within approximately 1 km of the confluence with the Bella Coola River.

3.12.2 Past Assessment Summary

Very little fish habitat assessment or fisheries information were available for Noomst Creek. In 1996 and 1997 Summit Environmental Consultants completed CWAP, sediment source and fish habitat assessments on Noomst Creek, and DFO FISS reported that in 1983 DFO released steelhead fry into the stream channel.

Subbasin development planning for logging may have resulted in collection of other relevant fisheries data, however, these were not listed on DFO FISS, Fishwizard or Habitatwizard databases and not other reports were available from the BCWCS library.

3.12.3 Fish Distribution & Habitat

DFO FISS reported Dolly Varden and steelhead as present in the Noomst stream channel. No data on distribution or lifecycle was available and further species diversity or presence remained undocumented.

3.12.4 Habitat Restoration Opportunities

Owing to limited fish stock information and high stream energy, it appeared fish habitat restoration identified in the 1997 fish habitat assessment (Summit, 1997) was limited to upslope and riparian management and rehabilitation. These activities were further recommended to occur in lower stream section where fish habitat was possibly higher value. Riparian planting adjacent to stream channels was recommended in the lower several hundred meters of Noomst Creek.

Opportunities for off-channel habitat restoration remain relatively unknown for Noomst Creek. Off-channel habitat restoration would likely be required to be associated with the Bella Coola River floodplain for higher fisheries values, including connectivity and species diversity. Similar projects have been completed in areas of the Bella Coola floodplain upstream at McCall Flats, where off-channel ponds have been created for juvenile rearing.

3.12.5 Land Management Opportunities

Land management within the Noomst subbasin should focus on land slope and sediment source stabilization to promote stream channel stability throughout the subbasin. Recreation opportunities are unknown in this subbasin.

3.12.6 Stock Assessment Opportunities

It is recommended Noomst Creek receive a more thorough assessment of year round fish species presence, stock diversity and life cycle use.

3.12.7 Identified Data Gaps

Fish stock and species presence, distribution, habitat and abundance was identified as a data gap for Noomst Creek. Similar subbasins in the Bella Coola valley appeared to have more diverse data on fish use and habitat distribution than did Noomst Creek.

3.12.8 Subbasin Summary Table

Table 13: Noomst Creek		Area: 97.5 km ²
Known Fish Presence	<ul style="list-style-type: none"> DV,ST 	
Past Assessment Summary	<ul style="list-style-type: none"> CWAP and Sediment Source/Fish Habitat DFO FISS references 1 other reference 	
Restoration Opportunities	<ul style="list-style-type: none"> Stream bank riparian protection in lower reaches Potential off-channel habitat creation in lower stream sections 	
Land Management Opportunities	<ul style="list-style-type: none"> Upper watershed management to protect stream stability and fish habitat in lower reaches 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> Inventory salmonid and non-salmonid fish common to Bella Coola River(e.g., dace, whitefish, sculpin, stickleback). 	
Identified Data Gaps	<ul style="list-style-type: none"> Fish presence and distribution throughout the subbasin Potential impacts to water quality of a small stream associated with adjacent agriculture/livestock use 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> Riparian restoration is feasible in areas of maintained access Additional off-channel restoration opportunities may exist in lower watershed sections with connectivity to Bella Coola River and/or stable water sources 	

3.13 Burnt Bridge Creek

3.13.1 Watershed Characteristics

Burnt Bridge Creek is a 4th order watershed situated on, and in upper tributary subbasins, forming the western boundary of Tweedsmuir Provincial Park. The stream channel is approximately 22 km in length, flowing south east into the Bella Coola River approximately 40 km upstream of the Bella Coola river mouth. Area of the watershed was approximately 212 km². Little or no stream channel data were available from FISS or other data sources (Habitatwizard, Fishwizard). There do not appear to have been past WRP projects in the stream subbasin as the area is within a Provincial Park.

Burnt Bridge Creek’s headwaters are on the western edge of the Chilcotin Plateau, an area recently affected by pine beetle infestations. Burnt Bridge Creek and other eastern subbasins of the Bella Coola River watershed may provide unique habitat and management issues owing to the as of yet largely undetermined effects of pine beetle forest loss on stream hydrology, riparian cover and other watershed characteristics.

3.13.2 Past Assessment Summary

Assessments of Burnt Bridge subbasin have included escapement inventories, fish transplant-releases (DFO FISS), and steelhead fry assessments (D. Burt and Associates, 1999). The 1996 CWAP dealt with a small area (53.3 km²) outside of the provincial park and there appear to be few or no available fish habitat assessments of the stream or upper subbasin. The CWAP report identified a small amount of past forest harvest in Burnt Bridge subbasin and also identified one stock watering water license on the stream (Summit, 1996). Steelhead sample sites were established in the mainstem during 1989 assessments (D. Burt, 1999), however, little other information is available.

3.13.3 Fish Distribution & Habitat

Little is recorded or available regarding fish habitat or fish species composition or distribution in the Burnt Bridge subbasin. DFO FISS identified Dolly Varden and

steelhead as present in Burnt Bridge mainstem. D. Burt and Associated 1999 and 2002 indicated that in addition to those inventoried species, juvenile chinook, coho, and cutthroat were collected at two different electrofishing sites. Adult spawning habitat or locations were not assessed.

Fish distribution in upper watershed sections and small lakes also appear to be unknown. Some of these areas are used as recreation areas (e.g., Mackenzie Pass trail network), yet little or no information on fish or fisheries values are available.

3.13.4 Habitat Restoration Opportunities

Habitat restoration, rehabilitation or enhancement opportunities within Burnt Bridge subbasin remain largely undetermined.

3.13.5 Land Management Opportunities

Limited development has occurred within Burnt Bridge subbasin; however, a bridge crosses Burnt Bridge Creek at Highway 20 and BC Parks maintains a day use area on the east side of Burnt Bridge. A recreational foot bridge crosses Burnt Bridge on a loop trail and historic connections to First Nations and European peoples exists on the established Mackenzie-Grease Trail, potentially offering opportunities for further public awareness of watershed and fish conservation requirements.

Upper Burnt Bridge subbasin areas are used for backcountry winter and summer recreation and should also be managed in a way that preserved watershed conditions for downstream stream sections. Upper areas of the subbasin should also be managed with pine beetle forest loss considerations to downstream watershed sections.

3.13.6 Stock Assessment Opportunities

Opportunities to assess and document adult and juvenile presence and distribution of anadromous and resident salmonid and various non salmonid fish species exist throughout the Burnt Bridge subbasin.

3.13.7 Identified Data Gaps

Data gaps were identified in a number of areas for Burnt Bridge subbasin, including limited information on fish species or habitat presence or distribution, including upper subbasin lakes; fish passage barriers or resident fish presence; and, habitat restoration or management options.

3.13.8 Subbasin Summary Table

Table 14: Burnt Bridge Creek		Area:212 km ²
Known Fish Presence	<ul style="list-style-type: none"> DV,ST 	
Past Assessment Summary	<ul style="list-style-type: none"> CWAP on lower DFO FISS references 1 other reference 	
Restoration Opportunities	<ul style="list-style-type: none"> Undetermined 	
Land Management Opportunities	<ul style="list-style-type: none"> Pine beetle forest management Recreation features Education opportunities 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> Opportunity for a variety of fish inventories, distribution mapping and lake surveys 	
Identified Data Gaps	<ul style="list-style-type: none"> Limited fish presence or distribution data and little or no fish habitat data for subbasin, including lakes Potential impacts to water quality of a small stream associated with adjacent agriculture/livestock use 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> Feasibility of assessments and/or potential habitat restoration is undetermined owing to BC Parks stats and limited subbasin access. 	

3.14 Bella Coola River Residual

Residual waters of the Bella Coola River watershed by definition include all mainstem sections of the Bella Coola River and other tributaries, side channels, sloughs and back waters. Owing to the vast size of the Bella Coola River watershed (5,150 km²) some key tributary channels have been selected for assessment (i.e., Subbasins 1-16, Table 1); however, it was not feasible to complete Stage III assessment on all tributaries and mainstem sections of the Bella Coola River.

Of the named (Gazetted) streams within Bella Coola Valley, only three were not assessed as individual subbasins in this Stage III report, including:

- Assananay Creek;
- Horsetail Creek; and,
- Stennar Creek.

These streams are briefly described in 3.14.8 (below). Several other unnamed tributaries, are also described in Section 3.14.9, including those locally referred to as:

- Fish Creek;
- Hagensborg Slough;
- Molly Walker Creek; and,
- Charter Creek.

In addition to specific stream channels a table of past watershed restoration is presented (Table 15, below) and further options for habitat and land management are provided based on lower, mid and upper locations in the Bella Coola watershed.

3.14.1 Watershed Characteristics (Bella Coola Mainstem)

The Bella Coola River is a 6th order stream flowing approximately 63 west from its origin at the confluences of the Talchako River (from the SE) and the Atnarko River (from the NE). The Bella Coola River watershed drains approximately 5,130 Km² (including those subbasins listed above).

CWAP findings (Summit, 1996) indicated approximately 42% of the area considered Bella Coola River residual lies below 300 m elevation, including most of the Bella Coola Valley floor and floodplain. The CWAP report also indicated that due to high public interest and high fisheries values within the Bella Coola River valley, there was a high priority for assessment work identified. It was recommended that field assessments be conducted for all areas within the sub-basin, including those on private land, that may have stream impacts (CWAP: Summit, 1996).

Bella Coola River Estuary

The Bella Coola River estuary covers approximately 150 ha at the mouth of the Bella Coola River and is recognized as a significant habitat feature of the Bella Coola River and coastal BC (Leaney and Morris 1981). As part of the Official Community Plan development process for the CCRD the Ministry of Lands, and Housing completed the "North Bentinck Arm Foreshore Study", which made recommendations for foreshore use as early as 1985. A majority of the foreshore within the Plan boundaries was slated for conservation use (UMA Engineering Ltd. 1985). In 2005 a steering committee was formed as part of the Waterfront/Estuary Plan in Bella Coola Valley, and is in the process of collecting information on the current state of knowledge regarding the estuary (CCRD 2005; BCWCS, 2007).

3.14.2 Past Assessment Summary

Numerous past assessments have been completed on mainstem, tributary and side channel sections of the Bella Coola River, encompassing fish and fish habitat, water resources, water quality, wildlife, flood protection, sediment movement and other ecological, environmental, social and cultural features. It was beyond the scope of this project to compile, list or review all documents.

A water level monitoring station is located on the Bella Coola River above Burnt Bridge Creek.

3.14.3 Fish Distribution & Habitat

Chinook, chum, coho, pink and sockeye salmon, coast range sculpin, anadromous and resident cutthroat trout, steelhead, rainbow trout, Dolly Varden, lamprey (general), longnose dace, stickleback (general), and eulachon are all known to use habitat of the Bella Coola River, and/or associated subbasins.

Fish distribution is generally through all areas of the Bella Coola watershed as no mainstem barriers are present or recorded on the river mainstem.

3.14.4 Habitat Restoration Opportunities

Fish Habitat restoration within the mainstem of the Bella Coola River is likely not feasible owing to large river size and high energy potential. Shoreline rehabilitation of riparian habitat and upslope stream banks and sediment sources is likely the most realistic approach to mainstem habitat remediation or rehabilitation in the Bella Coola River channel. Off-channel and small tributary channel habitat restoration, rehabilitation or creation is likely the most effective method of restoring or creating additional fish habitat in the Bella Coola River watershed.

Flood control, land management and transportation infrastructure planning (e.g., bridge placement or repairs) are recommended to be considerate of fish habitat and mitigate impacts to fish habitat as required.

3.14.5 Land Management Opportunities

Land management within the Bella Coola River watershed and floodplain could likely contribute the single largest component associated with fish habitat management and preservation in the Bella Coola Watershed. Land management in these terms is meant to include: industrial; residential; agricultural; and, recreational lands. These categories

broadly include activities such as logging, farming, and housing development and conservancy areas.

Flood control and mitigation is also a key component of watershed management and must be administered in a way that mitigates against negative impacts to fish habitat where feasible, and/or offers compensation as may be required.

Of concern to residents and visitors of Bella Coola Valley is increasing difficulty in achieving access to the Bella Coola River through private property and developed lands. River access has long been an important topic for valley residents and visitors and land management should consider methods of insuring maintained access and enhancing access where feasible.

The Bella Coola River estuary has been identified as an area of unique significance and should be more further investigated for fish habitat values and ecological importance prior to land use management decisions being made.

3.14.6 Stock Assessment Opportunities

Stock assessment of mainstem runs of eulachon, fall chum, sockeye (including Atnarko River), steelhead and coho salmon have been identified and would be beneficial while done in conjunction with tributary stream stock assessment.

3.14.7 Identified Data Gaps

Accurate mapping of the Bella Coola watershed was identified as a major Data Gap in Stage II planning. Recently (2007-2008) a TRIM II project created updated TRIM maps for the Bella Coola Watershed study area, including tributary subbasins. Refer to Specific Tributary sections for additional data gaps.

Water quality the watershed and specific habitat use by various fish species and their distribution in tributary, mainstem and estuary habitat were also identified.

3.14.8 Named Tributaries

Three named tributaries of the Bella Coola River were not assessed as part of subbasin designation. Those included: Stennar Creek; Assananny Creek and Horsetail Creek. Each of these streams are located in areas of relatively steep terrain, with limited stream sections <300 m elevation and limited areas of low gradient stream channels. However, each of these streams likely has habitat in the Bella Coola Valley floor that provides habitat for fish of the Bella Coola watershed. There were no available literature sources on these stream channels and MOE Fishwizard or Habitatwizard databases had little or no stream, habitat or fish distribution data.

It is recommended that lower stream sections of these subbasins receive preliminary ground assessment to determine extent of fish habitat and properly document and report those findings.

3.14.9 Unnamed & Smaller Tributaries

There are numerous unnamed (Gazetted) tributaries of the Bella Coola River. Some of these tributaries have considerable fisheries information available (e.g., Molly Walker Creek, Fish Creek, Charter Creek), while others have little or no information.

Of those unnamed tributaries for which available data were assessed and reviewed, it appeared several had received successful small to large scale restoration activities as part of off-channel or side-channel restoration, rehabilitation or enhancement projects. Table 9 lists a variety of existing fish habitat restoration projects within the Bella Coola (and Talchako) mainstem residual watersheds that have received fish habitat restoration. This table may not be comprehensive as there may be other projects not identified in literature reviewed.

Fish Habitat Assessment & Past Restoration

Fish habitat assessment of many of these small streams and numerous other stream channels, watered-ditches, side-channels and sloughs have been completed over the years throughout Bella Coola Valley; however, there are still undoubtedly additional habitat units that remained not assessed, incorrectly mapped, or with other data gaps. It is recommended that the Bella Coola Valley be further assessed through small scale fish habitat assessments or monitoring to accurately collect outstanding data. This will more fully inventory habitat distribution, fish use of habitat and habitat restoration or monitoring opportunities of these small streams.

Table 15 lists 20 stream and side channel restoration projects completed in the Bella Coola watershed. Many of these projects have been monitored shortly after project completion; however, most do not appear to have had long-term monitoring schedules to insure they are functioning as designed and/or built. Loss or malfunction of restored habitat is another potential negative impact to the Bella Coola watershed, which could be mitigated with a regular monitoring program or interval.

Table 15: Past Restoration Projects in Small or Unnamed Tributary and Stream Channels of Bella Coola River			
	Stream Name/Alias	Type of work Completed	Year
Lower Bella Coola Watershed	Ponds (4-mile)	Pond Restoration	2000
	Nuxalk Creek	Stream Restoration	1999
	Dump Creek	Off-channel Restoration	1999
	Tuck Creek	Stream Restoration	1999
	Snootli Creek	Stream Restoration	1999
	George Hall Creek	Stream Restoration	1999
	Hagensborg Slough	Stream & Pond restoration/access	1997- 1999
	Fish Creek	Pond Restoration	1998
Mid Bella Coola Watershed	Sato Creek	Off-channel Restoration	2000
	Croft Creek	Pond Creation/rehabilitation	2001
	Nusatsum 8 KM	Pond Creation/rehabilitation	1999
	Molly Walker Creek	Stream Restoration	1999
	Noosgulch Ponds	Pond Creation/rehabilitation	2002
	Ann Creek	Stream Restoration	2001
	Anderson Creek	Stream-Off-channel Restoration	2001
Upper Bella Coola Watershed	McCall Flats	Pond Creation/rehabilitation	1998
	Talchako River Km, 72-84	Stream-Off-channel Restoration	1998
	Talchako River Km, 56.5	Pond Creation/rehabilitation	2000
	Talchako River Km, 84.5	Pond Creation/rehabilitation	2000
	Atnarko River	Spawning Channel Restoration	2000

Land Use & Fish Habitat Management

Fish habitat units of small tributary and off-channel habitat of the Bella Coola River residual areas, floodplain and valley floor, are often disproportionately more surrounded by private or developed lands than are fish habitat units in larger subbasins. This can

make impacts of land use more severe in smaller streams than larger watersheds. However, many of these smaller streams offer more opportunities for habitat restoration, rehabilitation or creation, owing to their size, accessibility and because they are typically less subject to large peak flows.

Habitat enhancement in small streams and tributaries, coupled with land management to protect and enhance fish and riparian habitat are two opportunities that could feasibly be implemented on a small scale to achieve habitat protection and remediation throughout the Bella Coola River watershed.

Water Quality

Water quality may be altered by long term effects of even limited amounts of urbanization, agriculture or other development adjacent to a watercourse. Streams adjacent to or downstream of development, including residential, business/industry and agriculture within the Bella Coola River watershed, should be regularly monitored for basic water quality to determine if small scale or unseen changes may be detrimental to fish and aquatic health. Often simple assessments such as benthic invertebrate population structure can reveal water quality characteristics.

Habitat Mapping

An opportunity for enhanced land use and fish habitat management in the Bella Coola watershed has been identified in the form of Sensitive Habitat Inventory & Mapping (SHIM). SHIM provides an opportunity to add digital map information to existing base maps to further enhance existing data or supplement existing data sets with new data. SHIM mapping may be beneficial in areas where relatively high proportions of land surrounding small streams is either developed or privately owned. SHIM mapping would further enable land planners, property owners and the public to access information important to fish habitat, stream bank and riparian protection and other general watershed characteristics.

3.14.10 Subbasin Summary

Owing to diversity and scope of watershed components, a Subbasin Summary Table was not prepared for residual areas of the Bella Coola Watershed. Please refer to specific subbasins as required, or to supplementary data provided below on named and unnamed small tributaries of the Bella Coola River Residual watershed.

3.15 Atnarko River Residual

This overview includes general details of Young Creek and Hotnarko River.

3.15.1 Watershed Characteristics

Atnarko River is a unique subbasin of the Bella Coola Watershed, with its headwaters being predominantly lake derived, as opposed to primarily glacial as in most other Bella Coola River subbasins. The Atnarko River subbasin is partially within Tweedsmuir Provincial Park, draining approximately 1,800 km², flowing west from the Chilcotin (Interior) Plateau, joining the Talchako River to form the Bella Coola River mainstem below this confluence. A majority of lakes of the Bella Coola River watershed are associated with headwaters of the Atnarko River, including: Stillwater and Lonesome Lakes, the Turner Lake chain, Charlotte lake and others.

Land use within the Atnarko subbasin is very diverse, including ranchland, recreational properties and commercial logging in headwater areas, and conservation/protected areas within Tweedsmuir Park.

Channel and river morphology of the Atnarko River is varied as well. Upper subbasin stream channels tend to be lower gradient in higher elevation plateau areas, with steep sections dropping to the Atnarko, Hotnarko, and Bella Coola Valley floors, often with

dramatic waterfalls over steep sections, creating numerous barriers to anadromous Fish. Lower watershed areas of the Atnarko River mainstem have varied gradient and varied stream morphology; however, owing to the lake fed nature of the subbasin, most stream channels are relatively stable, compared to other glacial fed subbasins of the Bella Coola watershed.

Main tributaries of the Atnarko River subbasin include:

- Young Creek; and,
- Hotnarko River.

Young Creek lies entirely within Tweedsmuir Provincial Park, while Hotnarko River and Atnarko River have headwater lakes east of the park boundary (Hotnarko Lake and Charlotte Lake, respectively).

3.15.2 Past Assessment Summary

Numerous assessments have been completed on the Atnarko River mainstem and several tributary lakes and subbasins, including lake inventories, stream assessments, fisheries enhancement projects, annual escapement reports and habitat enhancement.

3.15.3 Fish Distribution & Habitat

All five Pacific salmon of the Bella Coola River are present in the Atnarko River, along with cutthroat trout, rainbow trout, steelhead, mountain whitefish, sculpin, lamprey and stickleback (MOE Fishwizard, DFO FISS). Fish distribution within the subbasin is typically established by gradient or gradient-barriers (e.g., waterfalls). Typically areas of low gradient and regular channel connectivity are accessible to anadromous fish, while areas of continuous high gradient stream channels or above known barriers are inhabit by resident fish species.

Anadromous salmon are known to reach areas upstream of Lonesome Lake on the Atnarko River South channel, (Willis, 2008. Pers Com.); however, relatively little documentation existed describing upstream fish distribution in upper watershed tributaries of the Atnarko River. DFO collects chinook broodstock from the Atnarko River and a salmon enumeration tower is located in lower Atnarko River sections for seasonal enumerations.

3.15.4 Habitat Restoration Opportunities

Anadromous fish habitats within the Atnarko river subbasin are predominantly within BC Parks. Upstream areas of the subbasin, including drainages of Hotnarko and Charlotte Lake are east of the park boundary and include areas of private and crown lands. Habitat restoration opportunities in anadromous fish areas are limited owing to the largely undisturbed nature of the lower Atnarko River subbasin. In 1987 DFO created some off-channel spawning and refugia habitat at the Belarko Spawning Channel, which was subsequently further enhanced in 1999 to provide additional juvenile rearing habitat.

Opportunities for small scale habitat restoration may exist in lower Atnarko subbasin stream sections; however, there is little indication that these areas habitats' have been altered significantly by watershed development or landscape disturbances (e.g., residential, agricultural or logging development, etc.) owing to the area being within a BC Provincial Park.

Field knowledge of the Atnarko River (F. Koroluk, personal observation) has shown stream channel aggradation and debris jams in lower sections of the Atnarko River have created channel avulsions and side channels. Assessment of the nature of these debris and gravel bar developments should be assessed to determine if localized bank or stream stabilization may be beneficial.

3.15.5 Land Management Opportunities

Mitigation of further negative impacts to fish habitat of the Atnarko River are likely the best approach to habitat restoration or rehabilitation in the Atnarko River. Land management in upper watershed areas, east of Tweedsmuir Park should focus on riparian conservation and rehabilitation, considerate of forest loss due to pine beetle effects, and subsequent increased logging in areas.

Land management in these areas should also focus on reducing sediment sources, enhancing stream channel stability and managing livestock for streamside protection and water quality. It is beyond the scope of his project to make specific recommendations on these management practices.

Tweedsmuir Park is managed by BC Parks for recreational values. These values and extent of recreational use should be reviewed from a fisheries and watershed stewardship level to insure parks use is commensurate with watershed sustainability (e.g., numbers of users, activities, extent of development, etc.). Highway 20 runs parallel to the north bank of the Atnarko River, giving opportunity for public access to portions of the river channel. BC Parks maintains official campsites at two locations on the River as well as day use areas. Access by the public is a key recreation feature and should be enhanced with opportunities for increased public knowledge of watershed stewardship where feasible.

3.15.6 Stock Assessment Opportunities

Opportunities to further assess steelhead and sockeye have been identified as Stage II watershed plan objectives for the Atnarko River. Further identifying fish distribution in high gradient stream sections would be beneficial in land use planning and upper watershed management.

3.15.7 Identified Data Gaps

Data gaps exist in obvious areas of fish stock assessment (e.g., sockeye and steelhead), as well less obvious issues of fish distribution within the Atnarko River subbasin tributaries.

3.15.8 Subbasin Summary Table

Table 16: Atnarko River		Area: 1,800 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CM, CH, PK, SK, RB, DV, ST, MTW 	
Past Assessment Summary	<ul style="list-style-type: none"> • Numerous past assessments 	
Restoration Opportunities	<ul style="list-style-type: none"> • Undetermined 	
Land Management Opportunities	<ul style="list-style-type: none"> • Pine beetle forest management • Recreation features • Education opportunities 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Opportunity for a variety of fish inventories, distribution mapping and lake surveys 	
Identified Data Gaps	<ul style="list-style-type: none"> • Fish presence or distribution in high gradient stream sections and upper subbasin headwater streams and lakes. • Extent of watershed development eligible or feasible for restoration 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • Feasibility of assessments and/or potential habitat restoration is undetermined owing to BC Parks status and limited subbasin access. 	

3.16 Talchako River Residual

For the purposes of this report the Talchako River subbasin has not been further subdivided into its own subbasin drainages. The Talchako River is the second largest subbasin of the Bella Coola River system covering approximately 680 km², essentially comprising the headwaters of the Bella Coola River mainstem. Six named (gazetted) tributaries were identified within the Talchako River subbasin, including:

1. Ape Creek,
2. Gyllenspetz Creek;
3. Jacobson Creek;
4. Molly Creek;
5. Nordschow Creek; and,
6. Tsini Tsini Creek.

3.16.1 Watershed Characteristics

The Talchako River is the largest single subbasin of the Bella Coola River watershed, comprising approximately 680 km². The Talchako River originates from the Talchako Glacier and Monarch ice field, and flows northwest to its confluence with the Atnarko River, where the two rivers form the Bella Coola River, approximately 63 km upstream of the Bella Coola River estuary. The Talchako River is glacially influenced, resulting in high summer flows and reduced winter flows. In summer months melting glacial run off colours the waters of the Talchako and Bella Coola rivers, giving those systems their distinguished glacial chalk colour.

3.16.2 Past Assessment Summary

A variety of fisheries, forestry and resource related reports and assessments have been completed throughout the Talchako River subbasin, including Fish habitat assessment and restoration projects, fish inventories and sampling programs and CWAP assessments.

3.16.3 Fish Distribution & Habitat

Fish species identified as present in the Talchako River subbasin include chinook, coho, chum, and pink salmon, rainbow and cutthroat trout, steelhead and Dolly Varden. Other species presence was not documented on DFO FISS databases and remains undetermined. It is likely similar to other mainstem Bella Coola River sections, possibly including Rocky Mountain whitefish and various resident non-salmonid species.

Coho salmon reach upper headwater sections of the Talchako river and off-channel habitat restoration has focused on coho and trout off-channel habitat at areas of 72 km to 84 km along the Talchako FSR (approximately 20 km upstream from the confluence of Talchako and Atnarko Rivers).

3.16.4 Habitat Restoration Opportunities

In-stream habitat restoration is likely not feasible in the Talchako River owing to the large size of the stream channel (5th order stream) and the high energy stream channel. Off-channel habitat restoration has been completed in various sections of the watershed, including side channels, groundwater ponds and wetland/beaver pond areas. Livestock fencing has also been installed in certain areas to reduce cattle access and damage to stream sections.

Opportunity for enhanced riparian planting exists and could be further assessed. The 1996 CWAP report (Summit) identified 63 stream crossings in the Talchako River subbasins and assessment may be required to insure fish passage remains possible at these crossings, considering recent road deactivation and potentially unknown road conditions in the subbasin.

3.16.5 Land Management Opportunities

Roads, hill slopes and riparian areas should be managed to reduce potential sediment input to the stream and promote stream channel stability. Livestock management to reduce cattle's impact on streams and off-channel habitat should also be maintained to protect fish habitat and water quality.

Recreation sites may be an opportunity to develop stewardship through public land use and opportunities for recreational land use should be explored in areas of the Talchako River.

3.16.6 Stock Assessment Opportunities

Opportunities for increased information on salmonid and non-salmonid use of the Talchako River subbasin were identified, including whitefish and other species present in mainstem Bella Coola River. Distribution of anadromous salmon throughout the Talchako River mainstem and tributary channels should also be inventoried and assessed for better fish and fish habitat management. Further assessment of sockeye salmon presence or distribution could also be assessed.

3.16.7 Identified Data Gaps

Data gaps relating to fish distribution and fish habitat potential in upper subbasin reaches and tributaries were identified, as were potential uncertainty of road condition at previous stream crossings, possibly presenting barriers to fish migration.

3.16.8 Subbasin Summary Table

Table 17: Talchako River		Area: 679 km ²
Known Fish Presence	<ul style="list-style-type: none"> • CM, CH, PK, RB, CT, DV, ST, 	
Past Assessment Summary	<ul style="list-style-type: none"> • Numerous past assessments 	
Restoration Opportunities	<ul style="list-style-type: none"> • Likely limited to off-channel habitat and small tributary streams near the Talchako River mainstem and valley floor. 	
Land Management Opportunities	<ul style="list-style-type: none"> • Road and hill slope management • Riparian management • Fish passage at road crossings • Recreational development 	
Stock Assessment Opportunities	<ul style="list-style-type: none"> • Opportunity for a variety of fish inventories, distribution mapping and surveys • Presence-distribution of sockeye salmon 	
Identified Data Gaps	<ul style="list-style-type: none"> • Fish presence or distribution in high gradient stream sections and upper subbasin headwater streams 	
Feasibility and/or Priority of Implementation	<ul style="list-style-type: none"> • Feasibility of assessments and/or potential habitat restoration is dependant on subbasin access. 	

4.0 Discussion & Recommendations

Stage III of Watershed-based Fish Sustainability Planning for the Bella Coola Watershed included an office-based assessment of 16 distinct subbasins and tributaries encompassing approximately 5,150 km² and more than 500 km of lineal stream channel. Watershed management, sustainability and/or restoration planning in a study area of this size required subdivision into manageable subbasins. Most of the 16 subbasins assessed in Section 3.0 of this report are of a sufficient enough size that they alone could receive individual Stage III assessment and have detailed WBFS Plans developed for each subbasin. However, the initial scope of the BCWCS and Bella Coola WFSP combined these subbasins for a larger all-inclusive watershed plan. Based on inclusion of more watershed subbasins and area, detail and precision was limited to broad categories of management, sustainability and restoration planning within the watershed as a whole.

Observations and recommendations of this Stage III report are limited to recommending geographic areas that may be suitable for a variety of habitat assessment, planning, management, and/or restoration activities based on subbasin characteristics assessed as described in Sections 2.0 and 3.0. It was beyond the scope of this report to prescribe site or reach-specific assessment, management or restoration plans for the Bella Coola River watershed.

4.1 Bella Coola Valley Floor & Residual Watershed

Areas of the Bella Coola Valley floor, small tributary streams and river and stream side channels appeared to offer the most manageable areas for habitat assessment, fish inventories and habitat enhancement or restoration. It is recommended these areas be given the highest priority for further assessment and sustainability planning.

First and second order streams of the Bella Coola Valley floor (e.g., Fish Creek, Charter Creek, etc.) appear to offer very valuable habitat that is well suited to land and resource management. It was noted during Stage III planning that although there is considerable information regarding certain areas of fish habitat within the Bella Coola Valley floor and associated tributary side-channels, there are also numerous data gaps relating to fish presence and distribution, habitat type and condition, water quality and watercourse location.

Seeing that these small streams and watercourses may offer the largest single manageable and sustainable network of fish habitat components in the Bella Coola Watershed that are suitable to WBFS Planning, it appears important that accurate data be collected regarding habitat use, fish presence and land management potential.

4.1.1 *Habitat Mapping*

Habitat mapping projects in the Bella Coola watershed have been discussed before and some mapping had been completed prior to Stage II WBFS Planning. As an outcome of Stage II planning having identified large data gaps in existing (pre-2007) TRIM maps, the BCWCS in conjunction with Frontier Resource Management, received funding to complete a TRIM 2 map update for the Bella Coola River watershed.

Updated TRIM mapping has been ongoing and will be completed in Spring 2008. These maps will provide a more accurate base-map on which to add fish habitat data. The BCWCS maintains a map-survey quality Trimble GPS, suitable for acquiring field data. Project funding may be available from a variety of resources for a combined fish habitat and land management mapping project to further identify, map and describe fish habitat, watershed characteristics and land management features.

One option for mapping may be Sensitive Habitat Inventory Mapping (SHIM) in conjunction with CCRD and/or other land management data users. Ongoing discussion with the CCRD, BCWCS, Bella Coola Sustainable Agriculture Society (BCSAS) and BC Ministry of Forests and Range (MoFR) have indicated that opportunities for digital data warehousing at the regional (e.g., CCRD) level may exist. The BCWCS may have an opportunity to partner with, or lead in data collection as part of this mapping project.

Opportunities for a fish habitat mapping plan to be developed are recommended to be prioritized on relative human population density in proximity to streams and watercourses. Basic map, air photo or GIS assessment could prioritize mapping areas into discrete polygons based on known or suspected fish habitat and relative human/residential or other adjacent land development. This sequence of priorities would likely follow an approximate mapping process from the lower Bella Coola to upper Bella Coola watershed areas, providing a systematic means of collecting consistent data throughout the study area.

It is beyond the scope of this project to fully describe or develop a mapping plan for the Bella Coola Valley floor; however, it is recommended mapping procedures and features selected are compatible with current versions of SHIM mapping, including, but not limited to:

- Accurate stream channel or watercourse location;
- Fish presence and species diversity (to RISC inventory levels);
- Habitat feature mapping;
- Side-channel connectivity and water flow;
- Water quality;
- Adjacent land use and riparian cover;
- Fish passage; and,
- Other relevant fish habitat and mapping features and standards.

- **Recommendation-** Develop an integrated field based mapping plan to collect consistent data usable by various agencies.
- **Recommendation-** Seek funding for map/survey implementation.
- **Recommendation-** Train local technicians in mapping data collection (e.g., SHIM).

4.1.2 Fish Species Inventory & Distribution

As part of fish habitat mapping, Resource Inventory Standards Committee (RISC) Reconnaissance or 1:20,000 scale fish distribution data should be collected for all stream channels without accurate or reliable existing fish distribution data (e.g., as recognized by DFO and MOE for inventory purposes). Mapping of critical habitat for identified species would also be beneficial for land planning and habitat restoration or recovery.

Fish presence and distribution data combined with accurate seasonal habitat use within tributary streams, including subbasin streams on the Bella Coola Valley floor, should be accurately recorded and inventoried to help with land use planning, such as flood mitigation or other activities potentially requiring in-stream work.

- **Recommendation-** Compile regional fisheries data relating to in-stream habitat use and timing specific to each fish species in each local tributary stream and side channels.

4.1.3 **Water Quality Assessments**

In conjunction with development of a SHIM habitat mapping plan, it is recommended a detailed water quality assessment be completed on small tributary streams, ponds and water courses of the Bella Coola Valley floor to determine if localized water quality may be affecting fish habitat or fish stocks. A systematic process of assessing water quality throughout various areas of the watershed should be implemented to determine if land use or natural conditions may influence fish habitat in certain areas of the watershed. This water quality assessment should be designed in consultation with planning and ecological experts to determine if negative water quality trends or opportunities for water quality improvements could be identified in the Bella Coola River watershed. Depending upon results, opportunities to improve water quality should be explored.

- **Recommendation-** Develop a comprehensive water quality assessment and monitoring plan to evaluate and track water quality relating to fish habitat in the Bella Coola River watershed.

4.1.4 **Past Restoration Evaluation**

As part of routine effectiveness monitoring it is recommended that reconnaissance level (low to moderate effort) monitoring of the approximately 20 watershed restoration projects described in Table 9 (above) be completed to determine if the various types of habitat restoration were effective over prolonged time periods (e.g., 8-10 years). Many projects have post-implementation reports available from periods of 1-3 years after implementation. It would be valuable to reassess these restoration projects and see if there is a discernable net ecological gain resulting from the project, prior to potentially implementing similar habitat restoration for similar goals.

- **Recommendation-** Implement a low intensity Routine Evaluation and Effectiveness (REE) monitoring program for previously restored sites.

4.1.5 **Watershed Activity Log**

Based on limited availability of a concise record of activities in the Bella Coola River watershed over the past several decades, it is recommended that the BCWCS implement a 'Watershed Quarterly' reporting program, where key resource managers, government agencies, land owners, First Nations groups or public provide a quarterly report card on activities or events implemented or observed in the Bella Coola river watershed. These data could be collected in digital format on a standardized form and stored for public record on the BCWCS website. This reporting format could potentially provide up to date and historic records of major watershed events (floods, expanded dikes, restoration activity, etc.). This reporting and recording method would also provide a form of extended watershed monitoring to assess success or failure of various activities.

- **Recommendation-** Create a quarterly reporting format and enter into MOUs with key resource agencies to collect significant watershed data and event timing.

4.1.6 Habitat Restoration Planning

Where fish habitat mapping, water quality assessment and land management procedures were established and implemented, opportunities for further fish habitat restoration may be identified. With current mapping, land use and water quality data for the watershed available, assigning priority and assessing feasibility and net gain of restoration projects would be more practical.

It is recommended restoration planning focus on key outcomes of the habitat mapping and species inventory assessments, combined with land use plans and water quality results. Integrated habitat assessment and planning would likely result in the most cost-effective and ecologically beneficial and sustainable restorative works.

- **Recommendation-** At outcome of mapping and inventory assessments, prioritize restoration opportunities and seek funding for high priority sites.

4.1.7 Land Use Planning

As part of recommended habitat mapping project development (Section 4.1.1) it is recommended the BCWCS and project partners consult with CCRD land planners or community plan developers (e.g., OCP consultant) to include land use management topics in the OCP or other relevant CCRD regulations or bylaws. Items for potential discussion or inclusion could include:

- Riparian protection;
- Streamside or foreshore development guidelines;
- River access; or,
- Other relevant fish and fish habitat items as indicted by the scope of the recommended mapping project.

- **Recommendation-** Consult with CCRD during mapping project development to incorporate land use management and planning at the Regional OCP level.

4.2 Tributary Subbasins

Tributary subbasins of the Bella Coola River typically exhibited high energy stream channels that drained mountainous valleys subject to high peak stream flows and channel instability. These subbasins typically offered less opportunity for habitat restoration activities; however, were often apparently suited to longer term sustainability and recovery planning through up-slope land riparian habitat stabilization. In larger subbasin (e.g., Salloomt, Nusatsum and Talchako Rivers) opportunities for valley floor restoration of off-channel areas may exist.

4.2.1 Subbasin Land Stabilization

A majority of subbasins assessed that exhibited high energy stream channels had been previously logged (with some exceptions). As part of logging operations these subbasins likely received prescriptions for land stabilization to reduce erosion, sediment sources and road failures (e.g., CWAP findings; Summit, 1996). Monitoring or assessment of implementation and/or success of these large scale land slope and stabilization plans should be completed and monitored as required to assess ongoing land stability. It is likely beyond the scope of a single agency or group to complete such an assessment; however, cumulative data could be collected and compiled by various agencies or resource

groups to monitor subbasin stability (e.g., targeted air photo review of known sources with possible over flights by agencies or groups during related or non-related regional assessment). These data could be useful in compiling watershed temporal logs or profiles for prolonged periods. This may be particularly beneficial in areas where commercial logging or other activities is not continuing and access by resource personnel is limited or difficult.

- **Recommendation-** Create an inventory of prescribed land slope, sediment control or channel stabilization prescriptions for each tributary subbasin and assess success or stability through air photo and/or field reconnaissance.

4.2.2 Subbasin Riparian Planning & Stabilization

Similar to land slope stability planning, subbasins that had been previously logged also likely received silviculture and riparian restoration planning. Where known riparian management or restoration was implemented within a subbasin (e.g., restorative planting or prescribed buffers for stream channel stabilization) these areas should be assessed from recent air photos and local or resource agency knowledge to determine mid- to long-term success of riparian stabilization or restoration.

- **Recommendation-** Create an inventory of prescribed riparian activities in each subbasin and assess success or stability through air photo and/or field reconnaissance.

4.2.3 Assessing Fish Passage & Distribution

Limited fish accessibility to existing habitat due to failed structures could result in a net loss of habitat that is often easily restored (e.g., culvert removal or modification).

- **Recommendation-** Fish passage to habitat at previous road crossings in subbasins with extensive road networks should be assessed where feasible.

4.2 Prioritized Summary Plan

Based on recommendations provided above, a summarized priority plan for Stage IV WFSP activities is provided in Table 18.

Table18: Prioritized Watershed Opportunities

Priority	Item ID ¹	Management - Assessment Category	Geographic Area	Recommended Action
HIGH	LU-1	<ul style="list-style-type: none"> • Mapping • Land Use Management • Fish Habitat • Riparian Management 	Bella Coola Valley Floor	Conduct detailed SHIM mapping on aquatic habitat of the Bella Coola Valley floor and integrate study design to include land use elements relevant to CCRD and other regional stakeholders. Explore opportunities for multi-agency mapping and data warehousing. Results would be used to drive projects LU-2, INV-1, and RES-1. Project could display data from projects INV-1 through INV-6.
	LU-2	<ul style="list-style-type: none"> • Water Quality 	Bella Coola Valley Floor	Design and implement a water quality sampling project based on preliminary habitat mapping (LU-1). Project scope should include land use management to determine potential large or small-scale effects of land management or use on water quality.
	LU-3	<ul style="list-style-type: none"> • Watershed Log • Data Gaps 	Entire watershed & Subbasins	Create a quarterly watershed log to record events, management, sustainability, or recovery planning. Make this available to the public. Multi-project connectedness.
	INV-1	<ul style="list-style-type: none"> • Fisheries Management 	Tributary subbasins, mainstems	Assess stocks of fall chum, sockeye and steelhead to determine current status or distribution and move to Recovery Planning for threatened stocks as required. Opportunity to track data in project LU-1 deliverables.
MODERATE	INV-2	<ul style="list-style-type: none"> • Fish Habitat • Fish Inventory • Mapping 	Bella Coola Side channels, Trib. Mainstems	Inventory fish species presence/absence and/or distribution within watershed subbasins and off-channel habitat. Opportunity to track data in project LU-1 deliverables and determine need for RES-1 follow up or application.
	LU-4	<ul style="list-style-type: none"> • Land Use Management • Flood Mitigation 	Tributary Channels	Establish formal links between CCD and other flood mitigation planners and incorporate habitat preservation or enhancement in flood planning where feasible. Opportunities for project LU-1 and RES-1 integration.
	RES-1	<ul style="list-style-type: none"> • Restoration Planning 	Undetermined	As Site-specific restoration opportunities are identified begin developing restoration plans as required. Refer to LU-1 and INV-4 project results during planning.
	INV-3	<ul style="list-style-type: none"> • Land Slope Stability 	Subbasins	Establish a multi agency/stakeholder review of success in past and present management of upper subbasin mainstem and tributary channel stability since last overview report (i.e., 1996-CWAP). Review recent (2006) air photos to tack historic change/recovery. Combine field observations where practical.
LOW	INV-4	<ul style="list-style-type: none"> • Restoration Monitoring 	As required	Assess success of past restoration projects in Bella Coola Watershed. Use adaptive Management to improve as required. Results will influence RES-1.
	INV-5	<ul style="list-style-type: none"> • Riparian Assessment 	Subbasins	Assess riparian function in areas of prescribed or previously recommended enhancement or restoration. Opportunity to assess overall riparian function of subbasins may exist. Opportunity for LU-1 data storage.
	INV-6	<ul style="list-style-type: none"> • Fish Passage Assessment 	Subbasins	Assess fish passage capabilities of road crossings in subbasin tributaries. Confirm deactivation where prescribed and complete field assessments/confirmation as practical. Opportunity for LU-1 data storage.

1 - Item IDs are assigned to better track and describe projects and the connectedness with other projects
 LU=Land Use; INV=Inventory or Investigation; RES=Restoration

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