

Application for Paragraph 35(2)(b) *Fisheries Act* Authorization
for Workforce Accommodation Centre
Revision 1, November 2015



LNG CANADA
Opportunity for British Columbia. Energy for the world

Joint venture companies



8. FISH HABITAT OFFSETTING PLAN

8.1. LNG Canada's Approach

The goal of LNG Canada's offsetting strategy is to offset project-related impacts to the freshwater and estuarine habitats in the Kitimat River watershed and estuary, and to contribute to the sustainability and ongoing productivity of CRA fisheries by increasing the productive capacity of freshwater and estuarine habitats in the Kitimat River watershed and estuary. DFO's guiding principles and policies for offsetting (i.e., Fisheries Protection Policy Statement and Fisheries Productive Investment Policy: A Proponents Guide to Offsetting,) serve as the basis for the proposed offsetting measures described in this fish habitat offsetting plan (DFO 2013a and 2013b).

In considering potential offsetting options for each phase of the Project, LNG Canada has taken into account the following hierarchy of priorities:

1. In-kind habitat in the immediate vicinity of affected habitats, benefiting the affected fish species and life stages
2. Out-of-kind habitat in the immediate vicinity of affected habitats, benefiting the affected fish species and life stages
3. In-kind habitat in the same region as affected habitats (i.e., Kitimat River system, Kitimat Arm), benefiting the affected species and life stages

To identify fisheries management objectives and local restoration priorities, LNG Canada has met with Haisla Nation and other key stakeholders (including DFO and MFLNRO) to discuss offsetting opportunities, reviewed the habitat restoration priorities identified by Haisla Nation and other stakeholders in the lower Kitimat River and estuary through the Lower Kitimat Watershed Planning initiative, and reviewed fisheries management objectives identified in DFO's Integrated Fisheries Management Plans (DFO 2013c). This offsetting plan will have beneficial effects expected to outlive project effects. This plan also takes into consideration any time lags or uncertainty associated with the effectiveness of the offsets. Habitat effectiveness monitoring will allow LNG Canada to monitor the success of offsetting measures and to determine whether they are functioning as intended or if contingency measures should be implemented.

The offsetting measures presented in this plan are the result of a detailed evaluation of freshwater and estuarine offsetting options in the project area. Throughout 2014 and 2015, biologists and other scientists have conducted numerous site visits, desktop and field studies to identify and assess the preliminary feasibility of the various offsetting options. Through this

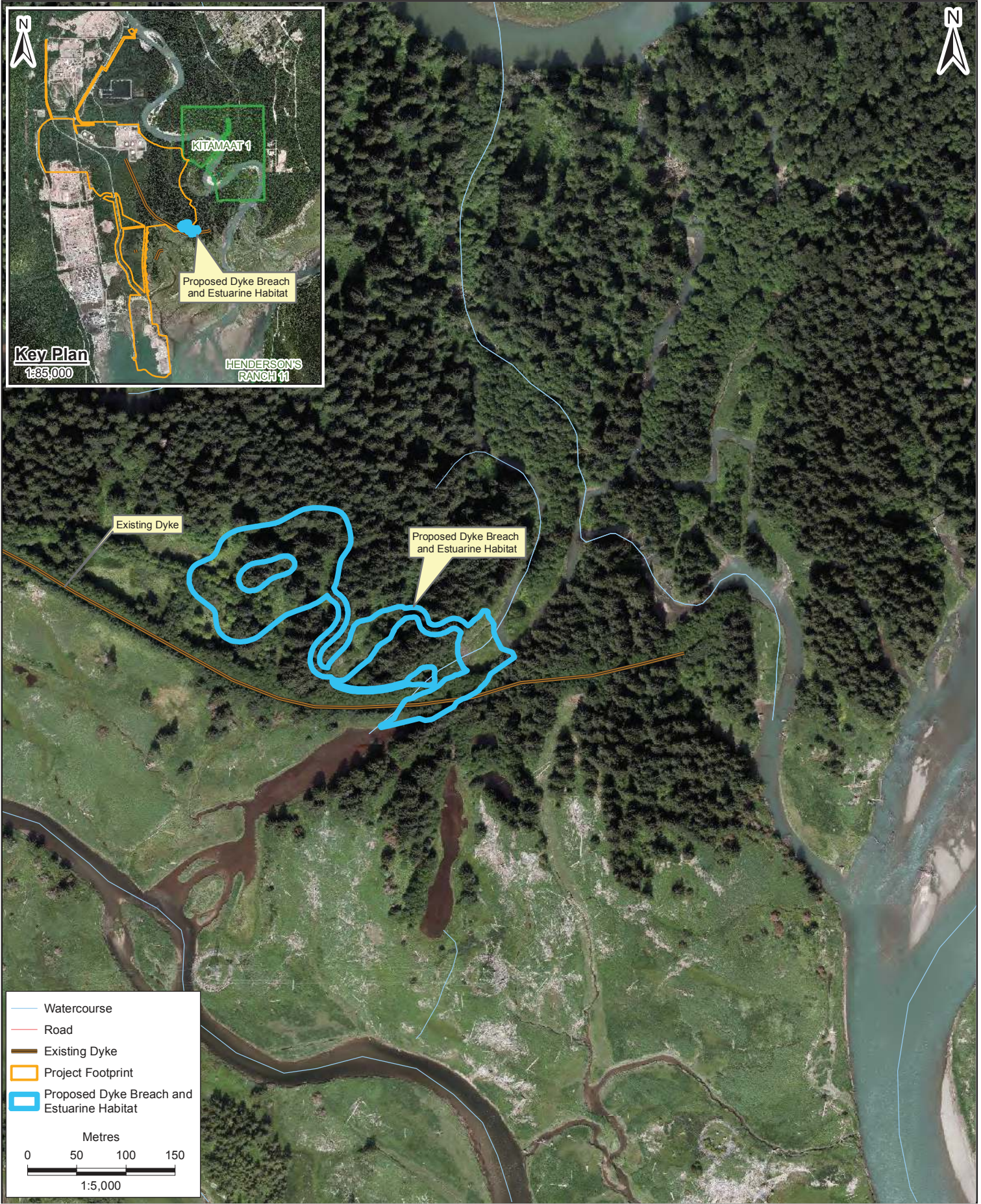
process, a number of offsetting options were determined to be not feasible and were removed from the plan for a range of reasons, including: land ownership constraints; various biophysical factors (e.g., existing fish habitat, questionable enhancement suitability for target fish species and life stages, limited access and significant engineering constraints); and lack of alignment with Provincial and federal environmental regulations and policy. As a result, the proposed offsetting measures described in this plan represent the best available options for offsetting project-related residual *serious harm to fish* expected to have a localized fish population effect, and are considered technically feasible and to complement the existing terrain. The offsetting proposed also supports the sustainability and ongoing productivity of affected CRA fisheries in the Kitimat region and provides the key ecosystem functions of the existing habitat being affected.

8.2. Offsetting Strategy

LNG Canada is proposing to offset residual *serious harm to fish* from the Project that is expected to have a localized effect to fish populations (Table 7-2) through breaching a dyke to the west of the Kitimat River and construction of overwintering and rearing habitats.

A dyke constructed by RTA is located on a channel running through the west bank delta of the Kitimat River (see Figure 8-1). Several offset options referenced in minutes from the Lower Kitimat Watershed Planning Meeting (LKWPM; January 10, 2013) involved breaching the dyke. Two of the three potential dyke breach sites described in the LKWPM minutes are not feasible due to their location within the project footprint. However, the easternmost breach site discussed in the LKWPM minutes is feasible and could improve habitat conditions within a 1 km long section of tidal channel(s) (see Figure 8-2). As designed, this offset would create approximately 20,630 m² of new estuarine habitat by removing the dyke footprint (3,404 m²) and excavating two ponded areas connected by estuarine tidal channels (17,226 m²) north of the dyke breach (Appendix 6).

The following sections describe the proposed fish habitat creation and enhancement measures to offset project effects in Area A causing *serious harm to fish* as a result of site preparation for the workforce accommodation centre.



Key Plan
1:35,000

HENDERSON'S
RANCH 11

Existing Dyke

Proposed Dyke Breach
and Estuarine Habitat

— Watercourse
 — Road
 — Existing Dyke
 — Project Footprint
 — Proposed Dyke Breach and Estuarine Habitat

Metres

0 50 100 150

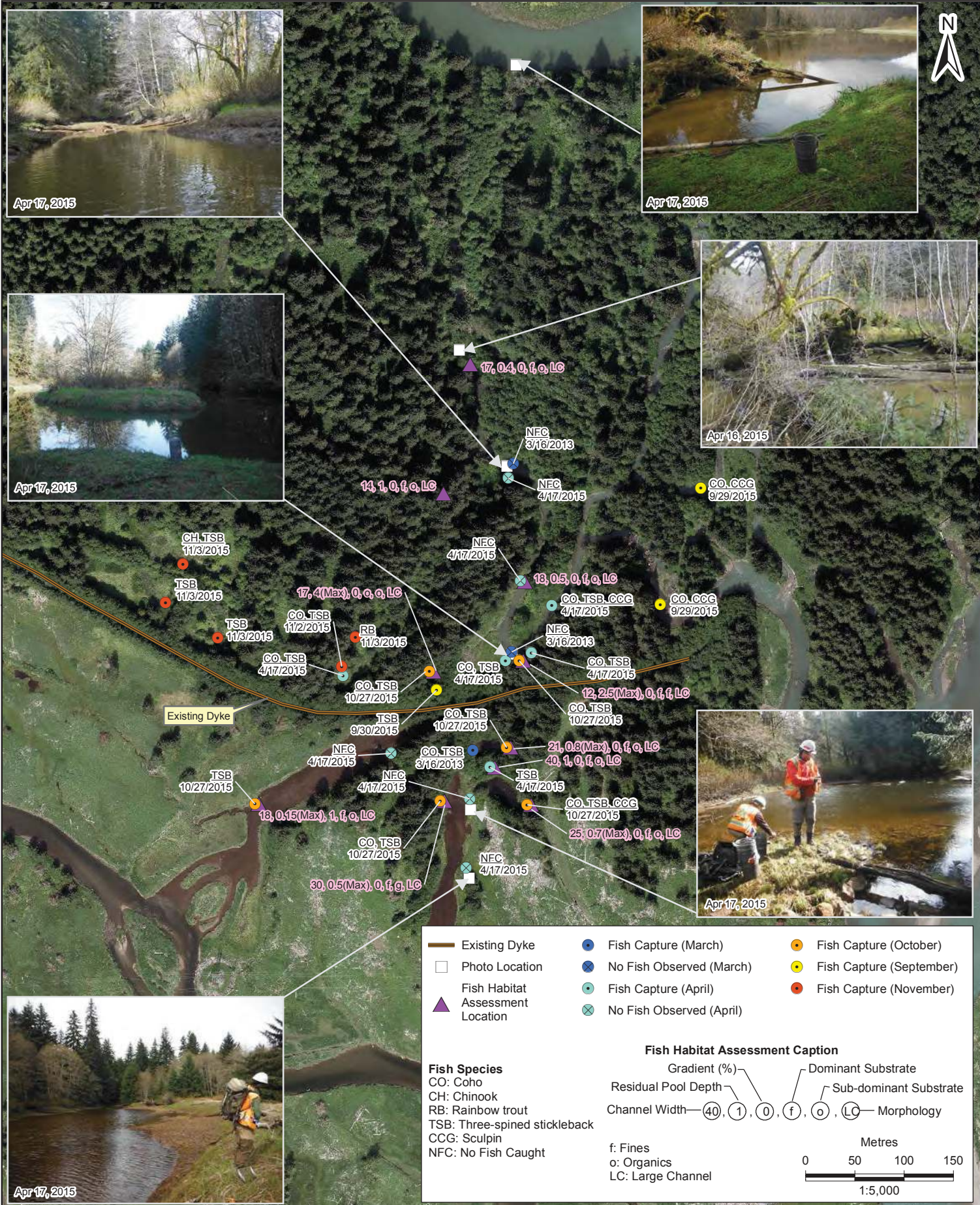
1:5,000

APPLICATION FOR A FISHERIES ACT AUTHORIZATION FOR SERIOUS HARM TO FISH ASSOCIATED WITH THE WORKFORCE ACCOMMODATION CENTRE

PROPOSED DYKE BREACH AND ESTUARINE CHANNEL CREATION SITE
LNG CANADA EXPORT TERMINAL
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	RC
DATE	02-NOV-15	FIGURE NO.	8-1





APPLICATION FOR A FISHERIES ACT AUTHORIZATION FOR SERIOUS HARM TO FISH ASSOCIATED WITH THE WORKFORCE ACCOMMODATION CENTRE
EXISTING CONDITIONS – PROPOSED DYKE BREACH AND ESTUARINE CHANNEL CREATION SITE
 LNG CANADA EXPORT TERMINAL
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	RC
DATUM	NAD 83	CHECKED BY	RC
DATE	05-NOV-15	FIGURE NO.	8-2

\\CD1183-F04\workgroup\1231\active\EM\123110458\gis\figures\fisheries_act_authorization\Area A\fig_10458_DFO_area_A_fish_8_2_existing_condition_dyke_breach.mxd 11/5/2015 - 1:19:12 PM

8.2.1. Existing Environmental Conditions

Fish sampling and habitat assessments in the area of the proposed dyke breach were conducted in March 2013, and in April, September, October and November 2015.

In March 2013, no fish were captured in traps set upstream of the dyke. One juvenile coho and one threespine stickleback were captured downstream of the dyke (Figure 8-2; Table 8-1). In April 2015, coho and stickleback were captured upstream of the dyke in the area of the proposed offsetting habitat as well as in the immediate vicinity of the proposed dyke breach. Stickleback were the only fish species captured downstream of the dyke (Table 8-1; Figure 8-2). During fall sampling (September to November 2015), coho, chinook, stickleback and rainbow trout were captured within the proposed offsetting area, coho and stickleback were captured in the immediate vicinity of the dyke breach, and coho, stickleback and slimy sculpin were captured downstream of the dyke (Table 8-1; Figure 8-2).

Table 8-1 Fish Sampling Summary in Area of Dyke Breach

Area	Year	Month	Fish Species (# of fish) ¹
Within proposed offsetting habitat (upstream of the dyke)	2013	March	No fish captured
	2015	April	CO(4) TSB(2)
		September	TSB(98)
		October	CO(7) TSB(408)
		November	CO(1) CH(5) TSB(22) RB(1)
Immediate area of dyke breach	2013	March	No fish captured
	2015	April	CO(7) TSB(8)
		October	CO(3) TSB(3)
Downstream of the dyke	2013	March	CO(1) TSB(1)
	2015	April	TSB (10)
		October	CO(30) TSB(55) CCG(2)

¹ CCG=slimy sculpin; CO=coho; CH=chinook; RB=rainbow trout; TSB=threespine stickleback

Habitat in the vicinity of the dyke breach is characterized by very low gradients (0%) and predominantly fines and organic substrates. Flow through this area is tide dependent and water levels were observed to fluctuate approximately 1.2 m between low and high tides. Surface water connectivity at high tide was good, though at low tides, several stranded pools between 20 and 60 cm deep were observed.

The location of the proposed habitat is comprised of forested and grassy areas that flood during high water events, primarily in spring and autumn. Some areas of standing water and isolated pools persist after water levels recede. However, surface connectivity of these wetted areas is poor and fish access to the Kitimat River and side channels is poor to nonexistent. Fish remaining

in these areas after high water events have moderate to high potential to be stranded and die as water quality declines with receding water levels.

8.2.2. Habitat Function and Benefits to Fish

This offsetting measure was selected to maintain the productivity of the CRA fishery species most likely to be affected by the Project, coho salmon. The offset measures will also enhance the productivity of chum salmon which use side channels and estuarine areas of the Kitimat River. These measures focus on creating productive estuarine rearing and migratory habitat for coho and chum salmon in the immediate vicinity of affected habitats, and addressing a local habitat restoration priority identified by Haisla Nation. This aligns with DFO's and LNG Canada's offsetting objectives and priorities by providing direct benefits to affected CRA fish populations through creation of new productive estuarine rearing and migratory habitat for salmonids and other CRA fishery species.

The habitat gains from the footprint of the dyke breach and the creation of new estuarine pool and channel habitat will offset *serious harm to fish* associated with the workforce accommodation centre. The total area of proposed offsetting is greater than that stipulated in the habitat balance in Section 8.3 (Table 8-2) to account for the existence of the marginal, ephemeral habitat provided by the area during high water events. Habitat productivity gains associated with this offsetting measure are expected from the creation of perennial channel and pool estuarine habitat that improves flow, fish access and migration through the estuary. More specifically, the dyke breach restores connectivity between side channel habitats of the Kitimat River with the habitats of Moore, Anderson and Beaver creeks. This will allow juvenile salmonids to move between these areas without entering highly brackish or saline waters at the mouth of the Kitimat River.

Table 8-2 Impact-Offset Balance Sheet

Habitat Type	Serious Harm (m ²)	Required Offsetting		Proposed Offsetting	
		Ratio	m ²	Works	m ²
Off-channel Rearing	15,652	1:1	15,652	Dyke breach and creation of estuarine rearing and migratory habitats	20,630
Off-channel Overwintering	2,364	2:1	4,728		
Totals	18,016		20,380		20,630

8.2.3. Design

Detailed design drawings for the dyke breach and new estuarine habitat are available in Appendix 6. The proposed design involves breaching a 3,404 m² area of the RTA dyke, and creating connectivity between pools and connecting channels excavated to the immediate

northeast of the dyke breach location (see Figure 8-2 and Appendix 6). Following construction, constructed estuarine habitat upstream of the dyke breach will consist of one large pool (11,484 m²) connected to a smaller pool (2,046 m²), which in turn is connected to the dyke breach. Connecting channels will have a width of approximately 7.5 m from top of bank (see Appendix 6). The channels will have grades of approximately 0.01% and side slopes will be sloped at stable gradients of 2H:1V. Fish cover in the estuarine ponds and channels will be provided by placement of large woody debris throughout the site (see Appendix 6).

The estuarine habitat will be constructed through existing vegetated areas, so that optimized functional riparian areas will be provided. The design of the dyke breach has been optimized to include a 5 m adjacent riparian planting zone, sloped at a 5H:1V gradient from either side of the bank-full width of the channel.

Where feasible, cleared vegetation of sufficient size will be incorporated into the offsetting projects as habitat complexing features. Following construction, disturbed or unvegetated upland areas adjacent to the new estuarine channel and dyke breach will be planted at the first suitable opportunity (i.e., fall or spring, whichever comes first, in accordance with DFO's Riparian Areas and Revegetation Pacific Region Operational Statement). Meanwhile, ground cover will be immediately established through seeding with an approved mixture and/or other protective materials to control erosion and sedimentation. Fast-growing native riparian shrubs with mature heights of 2 m or less will be planted in disturbed areas within the flare stack safety zone and mixed tree and shrubs will be planted in disturbed areas outside of the safety zone. In general, vegetation species are strongly associated with elevation. Sedge is dominant at elevations between mean high water mark and high high water mark. Tufted hair grass and shrubs (e.g., *Myrica gale*, Sitka willow, crab apple, and Sitka spruce) are dominant above high water marks. Draft riparian planting plans are included in the design package provided in Appendix 6.

8.2.4. Confidence and Effectiveness

There is high confidence that the estuarine habitat creation measures described above will be effective because the techniques being proposed (e.g., tidal channel reactivation and large organic debris installation) are recognized fish habitat enhancement techniques in British Columbia (Envirowest Environmental Consultants 1990). The proposed sites were selected based on site investigations by qualified fisheries biologists, geomorphologists, and water resources engineers.

LNG Canada has carried out a variety of site-specific investigations and modelling to inform the final (i.e., issued for construction) design specifications of the estuarine habitat offsetting

features. This investigative program will continue until offset habitats are constructed. Parameters collected during site-specific investigations include the following:

- Topographic surveys
- Reference reach surveys
- Implementation of a tide level monitoring program upstream and downstream of the proposed dyke breach
- Surface water quality sampling
- Vegetation characterization
- Fish and fish habitat surveys

Using this information to develop the final design of the estuarine habitat creation and enhancement features will increase confidence that they will be constructible, stable and will provide the intended ecological functions.

8.3. Impact-Offset Balance Sheet

The total area of residual *serious harm to fish* from the construction of the workforce accommodation centre in freshwater aquatic environments that requires offsetting is 18,016 m² of freshwater off-channel habitat (15,652 m² of off-channel rearing and feeding habitat and 2,364 m² of potential overwintering habitat) and associated riparian habitat (Table 8-2). An impact-offset balance sheet describing the benefits of the proposed measures in relation to the residual *serious harm to fish* from the Project is provided in Table 8-2. To offset residual *serious harm to fish* associated with the workforce accommodation centre described in Section 7.2 above, LNG Canada is proposing offset-to-impact ratios of 2:1 for overwintering habitat and 1:1 for off-channel rearing habitat based on the ephemeral nature (inundated only during flood seasons) of the majority of the off-channel rearing areas. Loss of freshwater off-channel habitat and associated riparian habitat will be offset by creating 20,630 m² of perennial estuarine rearing and migratory habitat by breaching the RTA dyke and creating estuarine tidal channels and pools upstream of the breach, and by providing fully functioning riparian habitat for the aquatic offset habitat. The offset habitat will benefit the CRA fish species and life stages affected by the Project, and it is expected to increase productivity of CRA fisheries for these species in the lower Kitimat River watershed.

8.4. Implementation and Monitoring

8.4.1. Implementation Schedule and Access

Subject to regulatory approvals, LNG Canada will conduct the site preparation works for the workforce accommodation centre between November 2015 and spring 2017. Construction of

the offsetting ponds and channels will be undertaken in 2016 and riparian planting work will be complete within one year of start of construction of the offsetting works. This timing will result in the offset habitats being available for salmonid overwintering and rearing through winter 2016/2017.

8.4.2. Construction Methods

Construction access to the offset site will be attained via trail access along the dyke itself or by shallow draft barge to the end of the dyke. Breaching of the dyke and excavation of the estuarine tidal habitat will most likely be performed using an excavator. Low ground pressure equipment and swamp mats will be used below the high tide mark to minimize disturbance to existing habitat and prevent stranding of equipment. Work shall be completed at low tide and in isolation of flowing water. Excavated material will be spoiled along the edge of the dyke, and all spoil piles will be graded, dressed with topsoil, and seeded. Debris and waste materials will be removed and disposed of off-site in accordance with all federal, provincial, and municipal regulations.

8.4.3. Avoidance and Mitigation Measures

In-water works will be minimized to the greatest extent possible. Measures to avoid and mitigate effects on fish and fish habitat during implementation of this fish habitat offsetting plan are described in the following sub-sections, and summarized in Appendix 10.

8.4.3.1. Fish Salvage

Prior to instream work, habitats known or suspected to be fish bearing will be isolated from flow and adjacent fish bearing areas. Fish will then be salvaged from the isolated work areas prior to dewatering and construction. Captured individuals will be released into suitable habitat away from construction activities to reduce the number of fish at risk of injury or mortality.

8.4.3.2. Riparian Management

To maintain bank stability and minimize potential sediment-laden runoff into watercourses, disturbed riparian areas will be reclaimed with appropriate vegetation cover, as soon as practicable after construction.

8.4.3.3. Best Management Practices and Environmental Management Plans Application

Relevant BMPs and EMPs listed in Sections 6.2.4 and 6.2.5 will be applied to offset construction work to protect fish and fish habitat.