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LASQUETI ISLAND WATERSHED ASSESSMENT – DETERMINATION OF THE APPLICABILITY OF THE RIPARIAN AREA REGULATION

STONEHOUSE CREEK, COCKTAIL COVE AND HADLEY LAKE WATERSHEDS ADDENDUM

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Lasqueti Island – Watershed Assessment to determine applicability of the RAR – Stonehouse Creek, Cocktail Cove and Hadley Lake Watersheds

1.0 INTRODUCTION

The Riparian Areas Regulation (RAR) forms the basis of streamside protection in British Columbia (BC). The RAR was implemented in 2006 and enacted under Section 12 of the Fish Protection Act (FPA). The RAR process is a joint initiative with the Department of Fisheries and Oceans (DFO), the Ministry of Forests Lands and Natural Resource Operations (MFLNRO) and local governments. The RAR uses a science-based approach to ensure land development activities do not result in "serious harm" to fish through destruction of habitat.

Throughout BC, the definition of fish habitat includes all aquatic and terrestrial areas that play a role in the various life processes of fish. Therefore, the area immediately adjacent to a stream (*i.e.* the riparian area), which provides food, nutrients and other functions vital to the survival of fish is considered fish habitat.

In July of 2014, Madrone Environmental Services Ltd. (Madrone) was retained by Islands Trust (IT) to assess three watersheds (Stonehouse Creek, Cocktail Cove and Hadley Lake) on Lasqueti Island. In the case of Stonehouse Creek and Cocktail Cove, assessments had previously been conducted to determine RAR applicability. Based on recommendations made by Madrone during the March 2013 site visit, IT requested these two watersheds be reassessed during the summer months to confirm main-stem flow regime and potential to support resident fish populations.

Previously, the MFLNRO had classified the Hadley Lake Watershed as being applicable to the RAR process. Local knowledge of the Hadley Lake Watershed suggested that this watershed was inaccurately determined as RAR applicable by MFLNRO due to the fact an impassable barrier currently exists at tidewater. IT

recommended that Madrone conduct an assessment to determine whether this designation was incorrect. As such, the Stonehouse Creek, Cocktail Cove and Hadley Lake Watersheds were field assessed in August, 2014.

This report is meant as an addendum to the document submitted to IT in March of 2014, which details the methodology, results and recommendations for the previously assessed watersheds (Mine Bay and Sam Creek). The methodology for the assessments conducted in the Stonehouse Creek, Cocktail Cove and Hadley Lake Watersheds is the same as described in the report: *Lasqueti Island Watershed Assessment for Presence of Fish Habitat: Mine Bay and Sam Creek Watersheds, by Justin Lange, B.Sc. R.P.Bio., March 27th, 2014.*

2.0 METHODOLOGY

2.1 Background Research

Background research was carried out using the Fisheries Information Summary System (FISS) (http://www.env.gov.bc.ca/fish/fiss/index.html) and Habitat Wizard (http://webmaps.gov.bc.ca/imf5/imf.jsp?site=moe_habwizdatabases) to determine whether any documented stream information existed for the Stonehouse Creek, Cocktail Cove and Hadley Lake Watersheds. In addition, base maps that were previously provided by IT were also reviewed prior to initiating the field assessment.

Local stream names were adopted from the *Lasqueti Island Water Allocation Plan* (Bryden and Barnett, 1992) and assigned to the assessed streams. If a stream was not listed in the 1992 report, stream names were developed based on local knowledge, or other identifiers such as the bay into which the stream drains. It should also be noted that the *Lasqueti Island Water Allocation Plan* was reviewed as a fisheries information resource, as known fish bearing watersheds are listed in the report. The Allocation Plan was also used as a resource in determining stream magnitude and flow regime in the target watersheds.

2.2 Assessment Area

Stonehouse Creek, Cocktail Cove and Hadley Lake Watersheds defined the study area (Figure 1). For the purposes of this assessment, the main focus was applied to the outlet of the main-stem drainage within each watershed. The presence of permanent, insurmountable barriers at tidewater and potential for resident fish presence above barriers were factors that were considered when determining the applicability of RAR. For example, portions of Stonehouse Creek and Cocktail Cove

that are not affected by tidal influence (*i.e.* middle and upper reaches) were assessed to determine whether these streams contain a perennial source of water to support resident fish populations.

2.3 Definition of a "Stream" under the RAR

In order to identify the applicability of RAR to the focus watersheds, the definition of a "stream" as listed under the provincial RAR, was used as a standard. As per Section 1.4.2 of the RAR Assessment Methodology; (http://www.env.gov.bc.ca/habitat/fish_protection_act/riparian/documents/assessment_methods.pdf), a "stream" is defined as follows:

> "…any watercourse – natural or human made – that provides fish habitat that contains water on a perennial or seasonal basis, is scoured by water or contains observable deposits of mineral alluvium, or has a continuous channel bed including a watercourse that is obscured by overhanging or bridging vegetation or soil mats. A watercourse may not itself be inhabited by fish, but may provide water, food and nutrients to streams that do support fish."

The RAR further identifies a stream as:

"…any of the following that provides fish habitat:

(a) a watercourse, whether it usually contains water or not;

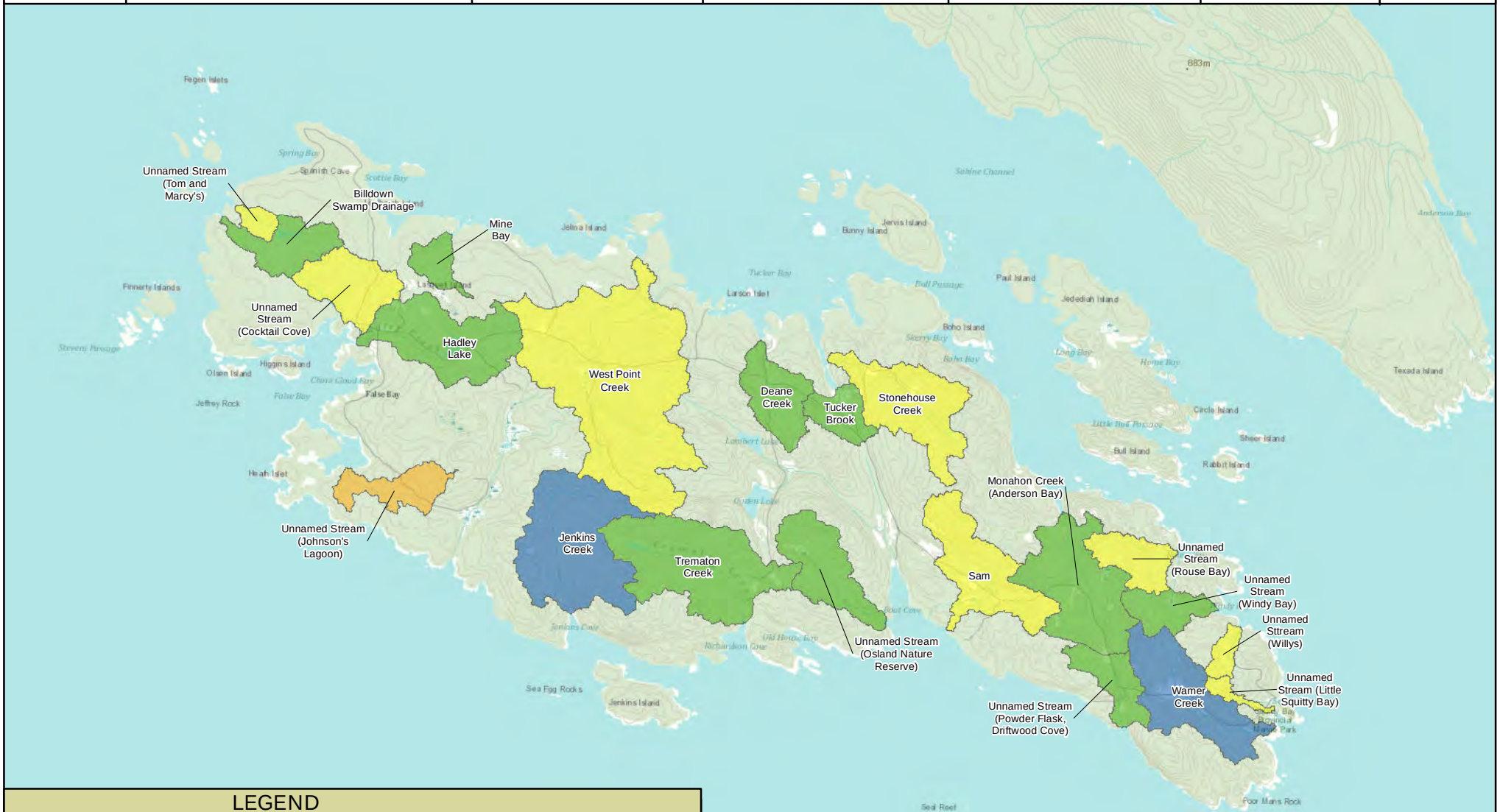
(b) a pond, lake, river, creek, brook;

(c) a ditch, spring or wetland that is connected by surface flow to something referred to in paragraph (a) or (b).

If a definitive barrier to the migration of fish is identified at tidewater, a watercourse is classified as a stream above the barrier if there is potential fish habitat (*i.e.* a perennial source of water for resident fish populations). Also, any part of a watercourse above a barrier that is not inhabited by fish, but connects by surface flow to fish habitat below the barrier, is considered a stream under the RAR process. A watercourse would not be classified as a "stream" if it contained a definitive barrier at tidewater and also lacked potential perennial habitat for resident fish above the barrier. In this case, there would be no potential fish habitat (even on a seasonal basis for anadromous fish).

Watercourses that may not be applicable to the RAR based on lack of potential fish habitat still provide benefits to a range of species. Riparian areas and associated watercourses represent important habitat for amphibians (especially if fish are not present), travel corridors for wildlife and provide a niche for unique vegetation assemblages. Isolated wetlands that do not provide habitat for fish, or connect by surface flow to fish habitat offer similar benefits, and can also provide important functions in terms of stormwater retention and maintenance of water quality.

MADRONE environmental services ltd	PROJECT: Watershed Assessment for Riparian Area Designation		LOCATION: Lasqueti Island, B.C.	CLIENT: Islands Trust	DOSSIER NO: 14.0153
	ASSESSED BY: Justin Lange B.Sc., R.P.Bio.	FIELD VISIT: March 15, 2014	MAP SCALE: 1:80,000	MAPPING DATE: September 11, 2014	DRAWN BY: Anna Jeffries



LEGEND

Watershed Designation

- Watersheds with Perennial Fish Habitat
- Watersheds with Potential Seasonal Habitat for Anadromous Fish Below Barriers
- Watersheds Requiring Further Investigation
- Watersheds with no Fish Habitat

0 500 1,000 2,000 3,000 m.

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

2.4 Landowner Contact

Each of the main-stem drainage outlets of the watersheds intersect with private properties. Prior to initiating the field based portion of the assessment, the landowners were contacted by telephone. Due to the fact Doug Hopwood, R.P.F. (local resident) was involved as a field assistant, he assumed the lead role of contacting the property owners. Each landowner was advised of the objectives of the project and asked for access permission.

During the landowner contact phase, the individual who owns property adjacent to the lowermost portion of Hadley Creek expressed concerns related to the assessment. As a result, permission was not granted to access this portion of the stream. It should be noted that the assessment was still completed, as the outlet at tidewater was accessed via public beach. The uppermost section of Hadley Creek was accessed off Main Road. Permission to access the required areas within Stonehouse Creek and Cocktail Cove was granted by all of the property owners.

2.5 Field Assessment

Assessment of the three watersheds was completed on August 7th 2014, by Justin Lange, B.Sc., R.P.Bio., (Madrone) with assistance from Doug Hopwood. During the field assessment, focus was given to the outlet of each watershed (*i.e.,* area where the stream flows into the marine environment). It should be noted that upper portions (*i.e.* areas not influenced by tidal fluctuations) of each stream were also assessed. Information was collected with respect to stream gradient, flow regime, channel morphology (*i.e.,* riffle-pool/cascade-pool or step-pool) and potential for fish to enter and inhabit the stream. As flow regime is an important aspect of the assessment (*i.e.* determining potential for resident fish populations), timing of the site visit (mid-summer) was such that allowed the proper determination of available perennial habitat.

2.6 Assessing for Potential Fish Presence

While background research using databases is useful in determining the general distribution of fish, it cannot be relied upon as a complete inventory. For example, a lack of data for any given stream or watershed cannot be interpreted as indicating that no fish are present. Proving non fish presence generally requires rigorous sampling procedures at various times throughout the year. Given the fact this project was focused on determining RAR applicable watersheds and identifying potential resident fish bearing watersheds, fish sampling was beyond the scope of the assessment.

Identifying **permanent** barriers or high gradient reaches at tidewater that could prevent the upstream movement of anadromous fish was a focus of the assessment. Watersheds with outlet streams with barriers at tidewater, which also lacked perennial habitat for resident fish, were not considered "streams" under the scope of this assessment and therefore are not applicable to the RAR process. Flow regime and the identification of potential fish "sources" (*i.e.* lakes or permanently wetted open water wetlands) were factors that were considered when assessing the potential for resident fish to occur.

3.0 RESULTS

3.1 Documented Fish Distribution Data

Fish Distribution data for Lasqueti Island is limited. Of the three assessed watersheds, only Hadley Lake (Watershed Code 905-119500-40900) has documented fish observations. Hadley Lake, which represents the primary water supply for residents of the island, was noted as containing two endemic populations (limnetic and benthic) of threespine stickleback (*Gasterosteus aculeatus*). By 1999, the two populations were considered to be eradicated as a result of brown bullhead "catfish" (*Ameiurus nebulous*) being introduced to the lake. The two species of stickleback were listed as being extinct in May 2000 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC, 2014). It should be noted that there are no records of salmonid (*i.e.* rainbow trout – *Oncorhynchus mykiss* or coastal cutthroat trout - *Oncorhynchus clarkii clarkii* - in Hadley Lake, including both wild and hatchery origin fish.

As per Bryden and Barnett (1992), anadromous and "sport fish" (salmonids) were listed as occurring on Lasqueti Island, in the Ogden Lake and Lambert Lake watersheds, as a result of fisheries enhancement in the Boat Cove area. Bryden and Barnett (1992) also stated that fish migrated up the creeks from Boat Cove. Bryden and Burnett (1992) further stated that the creeks on Lasqueti Island do not flow in the summer months and do not support fish naturally during the summer. This does not necessarily indicate that there is no seasonal habitat for fish, or that pockets of perennial habitat are not present elsewhere (*i.e.* in other lakes with no documented fish habitat).

3.2 Stonehouse Creek Watershed

Stonehouse Creek is located in the north-central portion of Lasquesti Island and drains into Long Bay. At tidewater, the stream flows over a bedrock ledge, which has

a gradient of approximately 45-55%. At the base of the ledge, there is no plunge pool and water flows over bedrock outcrops. It should be noted that during the highest tides of the year, the sea level extends up to the base of the ledge. At the time of the assessment, the bedrock ledge was concealed by dense Himalayan blackberry (*Rubus discolor*) growth.

Upstream of the estuarine environment, the stream channel is well defined and remains relatively undisturbed. The morphology of the stream is most consistent with that of a riffle-pool system. The average bankfull width of the channel is between 1.50 m and 2.50 m. Throughout the assessed area, the gradient of the stream channel is 2-3% and substrate composed mainly of bedrock; however, pockets of alluvium (*i.e.* cobbles and gravel) were also observed. Portions of the bank on both sides of the stream contain extensive undercutting and erosion, an indication that high volumes of water flow through the channel on a seasonal basis.

At the time of the assessment, the stream bed was dry, and only one small pool of standing water was observed. Based on the field observations, Stonehouse Creek possesses a seasonal flow regime and contains water through the winter and early spring. According to the Water Allocation Plan (Bryden & Barnett, 1992), Oasis Swamp represents the headwaters of Stonehouse Creek. During the summer months anecdotal evidence suggests that water levels recede and the swamp does not contribute water to the stream. This was verified during the field assessment, as the stream was not flowing.

Riparian vegetation consists mainly of mature forest, with Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*) and bigleaf maple (*Acer macrophyllum*) dominating. Red alder (*Alnus rubra*) was also documented as being a component of the tree layer, albeit minimal. Dominant shrub and herb species within the riparian zone of the stream include oceanspray (*Holodiscus discolor*), salmonberry (*Rubus spectabilis*), salal (*Gaultheria shallon*) and sword fern (*Polystichum munitum*).

Some streams with a seasonal flow regime can support fish, but the most important factor is that sufficient wetted habitat must remain during the summer months to provide fish with summer refugia habitat. Seasonal streams with pools that have a significant residual pool depth, or consist of segments of perennially-flowing water can support fish year round above a barrier to fish movement.

As Stonehouse Creek contains seasonal flow, and also has a definitive barrier at tidewater preventing seasonal use by anadromous fish, it was important to determine

whether perennially-available habitat was sufficient to support resident fish. During the assessment, the stream bed was dry, and no continuous segments of flowing water were noted. The stream is also not of a sufficient magnitude to allow the retention of wetted pools that would provide suitable summer refugia for fish.

Based on a lack of perennial habitat for resident fish, and lack of access to any parts of the watershed to anadromous fish that could potentially use seasonal streams (e.g. chum – *O.keta* and pink - *O.gorbuscha* – salmon), this watershed has been designated a "Watershed with No Fish Habitat". In addition, this watershed is not subject to the RAR process.

3.3 Cocktail Cove Watershed

The outlet of the Cocktail Cove Watershed enters the ocean at the northwest end of Lasqueti Island, at the head of Cocktail Cove. At tidewater, the stream flows over a vertical bedrock ledge, approximately 2-3 m high and onto a gravel/sand beach. Immediately upstream of the bedrock cascade, the stream is well defined and the bankfull width of the stream is between 2.0 m and 2.5 m. The gradient of the stream bed is 1-2% and the composition of the substrate is dominated by organics (*i.e.* decomposing leaf litter and woody debris); however, pockets of small gravel alluvium were observed. Isolated pockets of standing water, approximately 0.2 m deep, were noted within the channel at the time of the assessment.

Approximately 75 m upstream of tidewater, the stream is fed by a wetland that has been created as a result of beaver activity (*i.e.* dam construction). The wetland is at least 50 m wide and 200 m long. Substrate within the wetland is composed entirely of organic material.

Riparian vegetation adjacent to the stream and wetland consists mainly of mature forest. The tree layer is dominated by arbutus (*Arbutus menziesii*), Douglas-fir and western redcedar. Red alder was also documented as being a minor component of the tree layer. The shrub layer is dominated by oceanspray, salmonberry and salal. Dominant herb species noted adjacent to the stream and wetland include common horsetail (*Equisetum arvense*), common rush (*Juncus effuses*), sedges (*Carex spp.*) and swordfern.

Aquatic plant growth was noted as being abundant within the wetland. Cattails (*Typha latifolia*) and yellow pond lily (*Nuphar polysepalum*) were noted as being the dominant species.

The wetland and portions of the stream contain water on a perennial basis due to the fact that recent beaver activity has altered the hydrology of the wetland and stream. A dam has been constructed at the outlet of the wetland, which supports retention of water in the wetland for longer periods of time and prevents the entire stream bed from drying. Prior to the dam being constructed, evidence suggests the wetland and stream were void of standing water during the summer months annually (as reported in Bryden and Barnett 1992, where streams were shown to be dry during the summer months). Although water currently exists on a perennial basis due to the recent activity of beavers, the magnitude of the stream is not sufficient to have provided suitable perennial habitat for resident salmonids prior to the beaver activity. The bedrock ledge at tidewater represents a definitive barrier, which prevents the potential use of the lower reaches by anadromous fish that do not necessarily rely on permanent freshwater habitat for rearing (*i.e.* chum and pink salmon). As a result this watershed has been designated a "Watershed with No Fish Habitat" and is not subject to the RAR process.

3.4 Hadley Lake Watershed

Hadley Creek, which represents the outlet drainage of Hadley Lake, flows in a westerly direction and enters the ocean on the northwest shore of Lasqueti Island. At tidewater, the stream flows through a 30 m long cement culvert that is approximately 400 m in diameter. Water flows from the outlet of the culvert and spreads out over a bedrock outcrop, which contains numerous steps that range between 0.5 m and1.0 m high. When the culvert was installed, it was positioned at a slope of 15-20% and gravel fill was imported and landscaped around the culvert to provide stability.

Upstream of the estuarine environment (lower-most reach), the stream channel could not be accessed as the land owner did not grant permission to traverse the property. However, anecdotal evidence suggests that modifications have been made to the stream channel through the creation of ponds.

The upper reaches of the creek are well defined. The morphology of the stream is consistent with that of a riffle-pool system. The average bankfull width of the channel is approximately 2.0 m. The gradient of the stream channel is 2-3% and substrate composed mainly of cobbles and gravel. At the time of the assessment, the stream bed was dry. Hadley Creek possesses a seasonal flow regime and only contains water through the winter and early spring. There will also be seasonal variation based on weather patterns. At the lake outlet, water flows into the creek via two 1000 mm corrugated metal pipes (CMPs). At the outlet of the culverts, the stream channel is

not defined and water flows over a steep bank that has a slope of greater than 30%. The bank is composed of rip-rap boulders. It should also be noted that once the lake level drops below its two outlet culverts the only source of water input to the creek is through rain fall. The stream channel becomes defined approximately 30 m downstream of the lake outlet.

Riparian vegetation consists mainly of mature forest, with Douglas-fir, western redcedar and bigleaf maple dominating. Red alder was also documented within the riparian zone of Hadley Creek. Dominant shrub and herb species within the riparian zone of the stream include salmonberry, salal and sword fern.

Hadley Creek contains seasonal flow, and currently possess an outflow culvert that currently represents a barrier at tidewater. During the assessment, the stream bed was dry, and no continuous segments of flowing water or standing pools were noted. The magnitude of the stream is such that it does not allow for the retention of wetted pools along its length, and there is no summer refugia habitat for fish in the stream itself. Based on a lack of perennial habitat for resident fish in the stream, and current lack of access to any parts of the watershed to anadromous fish that could potentially use seasonal streams (due to the culvert barrier at tidewater), it is unlikely that this watershed currently provides habitat for fish. Despite there being no documentation of fish presence for Hadley Lake through either Bryden or Barnett (1992) or Habitat Wizard, there is the potential (albeit low) that Hadley Lake could support resident salmonids.

In spite of the fact there is no known fish presence in the Hadley Lake Watershed, Hadley Creek meets the definition of a "stream" under the RAR and is subject to RAR regulations as per the MFLNRO original classification. This is due, in part, to the fact that the tidewater culvert does not represent a permanent barrier, and if removed anadromous fish capable of completing their life cycles in seasonal streams (e.g. chum and pink salmon) could migrate into Hadley Creek. In addition, despite there being no documented salmonid resource in Hadley Lake, there is the potential (albeit very unlikely) that the lake contains resident salmonids.

4.0 DISCUSSION

Upon completion of the field assessment, it was determined that Stonehouse Creek and Cocktail Cove do not contain habitat suitable to support resident species of salmonids. As resident fish populations inhabit a stream year round, it is necessary for adequate perennially-available habitat to be present on a long-term basis, to provide

summer refuge habitat. It has been documented that there is no flow in any of the Lasqueti Island streams during August and September. In addition, during years of extreme low flow, streams have been recorded as having no flow from June to October (Bryden and Barnett, 1992). The field assessments supported the conclusions made in Bryden and Barnett. In the case of Cocktail Cove, the watershed is not documented in Bryden and Barnett (1992). The fact that the watershed was not included provides further evidence to support the low magnitude of the stream and lack of potential fish habitat. Both Cocktail Cove and Stonehouse Creek exhibited natural barriers at tidewater preventing the potential for seasonal use of the streams by anadromous fish (*i.e.* chum and pink salmon).

In the case of Hadley Creek, the MFLNRO had previously designated the watershed as being applicable to the RAR. Observations at the time of the assessment supported the premise that anadromous salmonids cannot currently enter the stream, as the existing culvert currently represents a barrier to upstream migration. However, in this particular case, the culvert does not represent a permanent barrier. If the culvert were removed, anadromous salmonids such as pink salmon or chum salmon would be capable of migrating into the lower reaches of the stream. These two species can use seasonal drainages, as newly hatched juveniles migrate quickly to the ocean and do not rear for an extended period in freshwater.

Based on the fact the stream was void of water at the time of the assessment, Hadley Creek in itself cannot support a resident population of fish. The survival and sustainment of any resident salmonid fish dropping down from the lake into the creek to spawn on a seasonal basis is unlikely, due to the fact that the outlet from the lake represents a significant obstacle for fish (especially juveniles) moving back upstream into the perennial habitat of the lake. The occurrence of resident salmonids in the lake cannot be completely discounted, however, as there may be potential seasonal spawning habitat in lake inlet drainages, that allow for both adult and juvenile fish to re-enter the lake prior to the streams drying up.

As the tidewater culvert does not represent a permanent barrier to fish, and no other natural barriers to the upstream movement of anadromous fish were observed and due the potential for resident fish to occur in Hadley Lake, Hadley Creek represents a "stream" under the RAR. As a result, the Hadley Lake watershed is subject to the RAR process.

If you have any questions or comments about the stream mapping process, please do not hesitate in contacting the undersigned.

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5.0 REFERENCES

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APPENDIX I – PHOTOS

Stonehouse Creek

Photo 1. Looking west at the area where Stonehouse Creek flows into the marine environment.

Photo 2. The outlet of Stonehouse Creek. Note the vertical bedrock ledge and lack of a plunge pool. Also, vegetation growth conceals the area where water flows over the ledge (marked with red arrow).

Photo 3. A photo representing the area where Stonehouse Creek flows over the bedrock ledge.

Photo 4. A portion of Stonehouse Creek, approximately 35 m upstream of the bedrock ledge. It should be noted this pool of water was isolated at the time of the assessment, and there was no water flowing in or out of the pool. This pool does not represent adequate habitat for resident fish.

Photo 5. A photo representing the lack of perennial water flow within Stonehouse Creek. Based on the channel characteristics (*i.e.* bedrock substrate and bank erosion), it appears as though Stonehouse Creek is a flashy drainage.

Cocktail Cove

Photo 6. Looking east towards the head of Cocktail Cove. The red arrow marks the approximate location where the main outlet drainage for the watershed flows into the marine environment.

Photo 7. A photo of the ledge that the Cocktail Cove outflow creek flows over at tidewater. Note the dense shrub growth that conceals the ledge.

Photo 8. The shallow plunge pool located at the base of the bedrock ledge. It should be noted that this pool does not provide sufficient depth for anadromous salmonids to jump the ledge, even during a high tide.

Photo 9. The morphology of the Cocktail Cove outlet drainage approximately 30-40 m upstream of tidewater. It should be noted that sections of the channel contain water due to the recent construction of beaver dams immediately upstream.

Photo 10. The beaver dam, which was constructed approximately 70 m upstream of tidewater. Construction of the dam has altered hydrology throughout the area and created a wetland that currently contains water on a perennial basis.

Photo 11. The wetland as seen from the beaver dam. Note the abundance of aquatic vegetation throughout the wetland.

Hadley Lake

Photo 12. Looking northwest at the estuary of Hadley Creek.

Photo 13. The cement culvert at the outlet of Hadley Creek, near tidewater. It should be noted that this culvert currently represents a barrier (albeit not permanent) to upstream migration by anadromous salmonids.

Photo 14. Looking east from the outlet of Hadley Lake. This lake provides potable water to residents of Lasqueti Island. The lake provides at least potential habitat for resident salmonid fish to occur.

Photo 15. The inlets of the two outlet culverts that drain Hadley Lake. Note the summer-time water level of the lake is approximately 1.0 m below the bottom of the culverts.

Photo 16. Looking downstream (west) from the outlets of the two culverts that drain Hadley Lake. During periods of high flow, water flows over the rip-rap boulders and into the defined channel at the base of the slope (marked with red arrow).