Vanderbilt Creek Watershed
Recovery and Management Plan

Vanderbilt Creek Watershed in Juneau, Alaska

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The **Juneau Watershed Partnership** is a nonprofit organization whose mission is to promote watershed integrity in the City and Borough of Juneau through education, research, and communication while encouraging sustainable use and development.

The vision of the Juneau Watershed Partnership is that the Juneau community will consider the streams and other water features as important assets of the natural landscape that benefit the whole community. The community will work to maintain and enhance these features because they are seen as valuable areas for recreation, education, responsible development, aesthetics, and wildlife habitat.

Statement of Purpose and Need

Vanderbilt Creek and its watershed are valued as productive salmon and wildlife habitat. Beginning in 1950 the watershed and surrounding area have been rapidly developed into a commercial and industrial center. Recently, there has been an increased awareness of industrial impacts on the Vanderbilt Watershed, but only a few reports detail the impact of development on habitat and water quality in Vanderbilt Creek.

When the Alaska Department of Environmental Conservation collected baseline water quality data for Vanderbilt and Lemon Creeks in 1993, it was found that Vanderbilt was an impaired system. A Total Maximum Daily Load (TMDL) for sediment and debris was approved for Vanderbilt in 1995. The TMDL is a management tool that identifies actions and pollution controls necessary to bring Vanderbilt Creek into compliance with water quality standards.

Most of the mitigation actions outlined in the TMDL, including water quality monitoring, have not been executed to the extent described in the document. Several other stewardship efforts, such as debris removal and volunteer-level monitoring, attended to some of the listed actions, but have not been sufficient in fully recovering habitat values.

The limited information and data collected since the 1995 TMDL, suggests that Vanderbilt Creek is still impaired. However, baseline data is nearly non-existent for this watershed and water quality and biological data remain deficient for quantifying the extent that urban development has affected the watershed's habitat value.

Little information exists on how natural processes, such as isostatic rebound, could be affecting the watershed. With the recent increased understanding of how isostatic rebound is affecting other watersheds within the Juneau area, it is imperative that this process is considered in planning the recovery of Vanderbilt Creek and other potentially affected watersheds like it.

It is likely that the demand for development within the Vanderbilt Creek Watershed will continue. A comprehensive monitoring plan should be implemented in order to obtain necessary baseline data to ensure the health of the watershed, and potential impacts of anthropogenic and natural processes should be determined. This document identifies and evaluates data and information collected since 1995 to provide an updated management and recovery plan for the Vanderbilt Creek Watershed.

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Cover: Vanderbilt Creek at the intersection of Vanderbilt Hill Road and Egan Highway. Photography by Eric J. Chandler.

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1.0 Introduction

1.1 Watershed Description

Vanderbilt Creek is a small creek located on the eastern side of Lemon Creek Valley, about 5 miles northwest of downtown Juneau, Alaska. The watershed consists of approximately 93 hectacres of land (Rinella et al. 2005) and is bound by Blackerby Ridge to the east; residential and commercial areas to the north; with commercial areas continuing to the west; Channel Landfill to the southwest; and the intersection of Vanderbilt Hill Road and Egan Drive to the south (Figure 3). Vanderbilt Creek is approximately one mile (2 km) long, with major tributaries flowing from Blackerby Ridge.

Figure 1. Vanderbilt Creek at the entrance to the Lemon Creek Trail off of Glacier Highway. Photo by: Eric J. Chandler

The headwaters of Vanderbilt Creek flow through steep, forested uplands before entering a nearly level course passing through urban areas, wetlands and braided channels. Vanderbilt Creek enters Gastineau Channel at the intersection of Egan Drive and Vanderbilt Hill Road.

Elevation ranges from sea level to approximately 2000 feet on Blackerby Ridge. The width of the main stem varies between 4 and 8 feet with depths varying from 6 inches to 6 feet (Adamus et al,1987). Mean annual discharge data for the creek is unavailable.

Figure 2. A tributary flowing from Blackerby Ridge, located along the Lemon Creek Trail. Photos by: Eric J Chandler

Water supply to the creek comes from a combination of groundwater and surface water runoff. Tidal influence occurs as far as one-half mile (1 km) upstream from the Channel (Adamus et al. 1987 and Bethers et al. 1993). Tidal fluctuations in Juneau are predicted to range 13.74-feet on average, with the Spring tides ranging 16.31-feet. The highest tide of 2007 is expected to be +20.5-feet in October, and the lowest tide of the year to be -4.6-feet in May (NOAA 2007).

Landowners include the City and Borough of Juneau (CBJ), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), and various private industrial and residential owners.

Figure 3. Map of Vanderbilt Creek. Stream layer is from the Alaska Department of Fish and Games' Anadromous Waters Catalog. Cartography by Deb Spicer, Juneau Watershed Partnership, May 2007.

1.2 Climate

The maritime climate of Juneau, Alaska is influenced by the proximity of the ocean and high mountains and consists of mild winters and cool summers. Average summer temperatures range from 44 to 66 degrees Fahrenheit; winter temperatures range from 25 to 35 degrees Fahrenheit. Juneau receives an annual average of 92 inches of precipitation annually in the downtown area and 54 inches annually near the airport. Snowfall averages 101 inches.

1.3 Geology and Soils

Vanderbilt Creek is located on the eastern side of Lemon Creek Valley. The surficial geology of the watershed consists primarily of marine and glaciomarine deposits. This includes a significant area of emergent intertidal deposits (Miller 1975). These deposits overlay bedrock of metamorphosed siltstones and mudstones, which are exposed on Blackerby Ridge (Conner and O'Haire 1988).

The marine and glaciomarine deposits are linked with isostatic rebound, or the resultant uplift of land following the last Pleistocene glaciation. Following the Pleistocene epoch, temperatures increased, causing a major glacial retreat that began some 17,000 years ago. During the glacial retreat, many low-lying areas were flooded with marine waters that deposited fine glaciomarine sediments over flooded surfaces. Since that time, isostatic rebound and tectonics have raised these deposits above sea-level, forming glaciomarine terraces that grade into the mountainsides (Nowacki et al. 2001).

The rate of uplift for the Juneau area has been discussed by several researchers (Hicks and Shofnos 1965; Hudson et al 1982) and is estimated to be approximately 1.31 cm per year. Uplift rates in the Juneau area were 0.05 ft/yr for the period 1936 to 1962 (Hicks and Shofnos 1965). Similar rates were found during the period 1959 to 1979, resulting in a total uplift of 0.92 feet for this period (Hudson et al. 1982). Uplift in the Juneau area may not be solely due to isostatic effects of glacial recession. It has been noted by Hudson et al (1982), that tectonic processes resulting from tension along the Queen Charlotte-Fairweather transform fault system may also be a factor.

Other, less extensive surficial deposits include colluvial, alluvial fan and deltaic deposits. Colluvial deposits occur along the mountain side, and older raised beach deposits occur in the Vanderbilt Hill area (Miller, 1975). Alluvial fan deposits also exist along the mountainside, and can be seen along the Lemon Creek Trail (Brian Frenette, personal communication, May 13, 2007). Just north of the Vanderbilt Creek Watershed are deltaic deposits, which are typically found 250 feet above modern sea level and are a source of quality gravel (Miller 1972).

Soils in the watershed range from poorly- to well-drained. Poorly drained soils in the watershed exist in the low-lying areas or at foot-slopes. These soils consist of peat of varying depths overlying till or bedrock. Well-drained soils typically exist on slopes greater than 12 percent and, therefore, occur in the upland areas (Schoephorster and Furbish, 1974). A table describing soil types in the Vanderbilt Creek Watershed is provided in Appendix A.

1.4 Flora and Fauna

Located in the temperate rainforest of Southeast Alaska, the Vanderbilt Creek Watershed consists of a variety of habitats typical of this biome. The lower watershed consists of a variety of wetland habitats such as emergent wetlands, uplift meadows, high marsh, sedge marsh, and succulent marsh. The estuarine wetlands adjacent to Vanderbilt Creek are connected to the larger Mendenhall Wetlands system (Armstrong et al. 2004) and are part of the Lemon Creek Valley Wetlands complex (ADF&G Div. Habitat and Restoration 1999).

Estuarine wetland vegetation includes an array of sedges, rushes, and grasses (Schoephorster and Furbish, 1974). A variety of birds use these estuarine wetlands including the Bufflehead, Goldeneye, Surf Scoter, and Bald Eagle. Least sandpipers may nest in the lower Vanderbilt Creek meadows (Adamus et al.1987; ADFG (1999) and Armstrong et al (2004) include lists of plant and bird species identified within the Lemon Creek Valley Wetlands complex/MWSGR.

Upland habitats in the watershed include second-growth hemlock-spruce forest and freshwater wetlands. Lincoln sparrow, Orange-crowned Warbler, Townsend's Warbler, and Ruby-crowned Kinglet use the freshwater wetlands located in the upper watershed during breeding season (Adamus et al. 1987). These freshwater wetlands also have high salmonid habitat values (CBJ, 1986).

A table summarizing management and important habitat designations of wetlands in the Vanderbilt Creek Watershed is provided in Appendix C.

Several mammal species are found in the Vanderbilt Creek Watershed. Sitka black-tailed deer and Black bear can be found along Vanderbilt Creek (Adamus et al. 1987), and other animals in the area may include marten, river otter, beaver, muskrat, red squirrel, porcupine, and long-tailed vole.

1.5 Land Use History

Development of the Lemon Creek Valley began in the early 1900s. Between 1900 and 1950, the primary land uses of the area included logging, homesteading, and fishing. Evidence of logging in the Vanderbilt Creek Watershed still exists along the Lemon Creek Trail (Figure 4), which was used as a logging road in the 1940s and 50s (Pat Quigley, personal communication, May 13, 2007). Wood core samples taken from a spruce tree and analyzed by Discovery Southeast and Dzantik'I Heeni Middle School students in 2003 suggest that logging may have occurred along Vanderbilt Creek as early as 1902.

Commercial, industrial and residential development increased in the area beginning in the 1950's. Major developments in the watershed include the construction of the Egan Drive Causeway in 1973 and the development of gravel extraction operations beginning in 1978 (R&M Consultants, Inc. 1978).

In 2006, approximately 4,805 residents lived along the Glacier Highway corridor, from Norway Point to Fred Meyers. This includes residents in the Salmon Creek, Twin Lakes, Lemon Creek and Switzer Creek areas (CBJ 2006).

Figure 4. Decaying tree stumps from logging along Lemon Creek Trail.

1.0 Water Quality

1.1 TMDL Process

Section 305 (b) of the Clean Water Act requires states to evaluate all surface waterbodies and establish maximum allowable levels of pollutants, reported as the Total Maximum Daily Load (TMDL). TMDLs are developed to meet applicable state water quality standards and provide a goal or target that will lead to attaining the water quality standards.

Water quality standards for the State of Alaska (18 AAC 70) state that existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected. Designated uses for the state's fresh waters include water supply, water recreation and growth and propagation of fish, shellfish, other aquatic life and wildlife. In developing a TMDL, each water quality parameter for which the waterbody is listed must meet all applicable criteria.

In Alaska, the Departments of Environmental Conservation (ADEC), Fish and Game (ADFG) and Natural Resources (DNR) work collaboratively to characterize waterbodies and establish stewardship actions. Waterbodies nominated for protection and/or restoration are included on the Alaska Clean Water Actions (ACWA) list. The ACWA list includes those waterbodies that are in need of TMDL, which are also called "303 (d)" impaired waterbodies.

1.2 Applicable Water Quality Standards

Adamus's 1987 report noted that spawning and rearing habitat in Vanderbilt Creek may have been impacted by large sediment influx from gravel pits located in the headwaters. In the following year, Vanderbilt Creek was identified by the ADEC as having limited water quality. Since 1990, Vanderbilt Creek has appeared on the state's 303 (d) list for water quality impairment due to sediment, turbidity, debris and habitat modification. Though little data existed to quantify the degree of impairment, the 303 (d) listing subjected the creek to the TMDL process.

The TMDL for Vanderbilt Creek was completed and approved by the ADEC in September 1995. With the completion of the TMDL, Vanderbilt Creek was removed from the Section 303 (d) list in 1996, and is currently listed as a Category 4a Waterbody in Alaska's 2004 Integrated Water Quality Monitoring and Assessment Report for turbidity, debris and sediment due to urban run-off.

Designated protected uses for Vanderbilt Creek as identified in Alaska's Water Quality Standard Regulations (18 ACC 70) include drinking water, industrial and aquaculture purposes; contact and secondary recreation; growth and propagation of aquatic life and wildlife.

Water quality criteria specific for the protection of aquatic life was identified in the TMDL as being the impaired designated use of interest. Turbidity, sediment and residues have been identified as impairments to aquatic habitat Vanderbilt Creek. There is no difference between the water quality standards and the water quality criteria necessary for protecting aquatic life. Although habitat modification has also been identified as a stressor to aquatic life and wildlife, the Alaska Water Quality Standards do not include standards or criteria for habitat modification. Alaska's water quality standards for turbidity, sediments and residues are listed as follows:

Sediment
According to Alaska's Water Quality Standard Regulations (18 AAC 70) sediments ranging from 0.1 mm to 4.0 mm in gravel beds of waters used by anadromous fish for spawning may not be increased more than 5 percent by weight above natural conditions; and in no case shall sediments in this range exceed a maximum of 30 percent by weight.

Turbidity
Turbidity may not exceed 5 nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10 percent increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 15 NTU.

Residues
Residues may not, alone or in combination with other substances or wastes, make the water unfit or unsafe for use, or cause acute or chronic problem levels. Residues may not, alone or in combination with other substances cause a film, sheen or discoloration on the surface of the water or adjoining shorelines, or cause leaching of toxic or deleterious substances or cause a sludge, solid or emulsion to be deposited beneath or upon the surface of the water, within the water column, or the bottom or upon adjoining shorelines.

1.3 Impacts on Designated Uses

Impaired water quality can affect the capacity of Vanderbilt Creek in supporting several of its designated uses including drinking water, aquaculture, recreation, supporting aquatic life and wildlife. The following sections discuss in detail the impacts of each pollutant of concern on all designated uses.

1.3.1 Sediment and Turbidity

Sediments become problematic when they affect the water's clarity, and/or deposit and accumulate on the streambed. Suspended and deposited sediment and high turbidity could affect the capacity of Vanderbilt Creek to support several of its designated uses including drinking water, aquaculture, recreation and supporting aquatic life and wildlife.

High turbidity can reduce the amount of light penetrating through the water, which can affect photosynthesis, water temperature, and the amount of dissolved oxygen within the water column, which could impact the health and food supply of juvenile fish. Suspended sediments in large concentrations could also clog and damage the gills of adult and juvenile fish.

If suspended particles are able to settle, spawning habitat can become unsuitable and salmon redds (nests) can be damaged. Alevin (sac-fry) emergence can be prevented from fine sediment accumulation. Salmon alevins generally experience difficulties when the percentage of fine sediments exceeds 20% of the substrate volume. Sediment can also adversely impact macroinvertebrates in the stream.

Furthermore, suspended particles may provide a place for harmful bacteria and microorganisms to settle and grow. The particles can also transport pesticides, toxic metals and excess nutrients throughout the watershed. This will not only make the stream unsuitable for aquatic life and wildlife, but for human use as well.

1.3.2 Suspended Solids

Sources of suspended solids in Vanderbilt Creek include non-point run-off from urban areas; wetland fills; road use, maintenance and snow removal activities; stream bank disturbances; stormwater conveyance; and construction activities.

Figure 5. A storm drain on Short Street that transports sediment directly into Vanderbilt Creek.

1.3.3. Debris

In addition to sediment loading, other debris such as garbage, reduces the capacity of Vanderbilt Creek to support several of its designated uses including drinking water, recreation and supporting aquatic life and wildlife.

Garbage and other debris can reduce aesthetics, introduce contaminants, impede fish passage and degrade habitat. Sources of debris in Vanderbilt Creek include littering, sediment/debris wedges from naturally occurring landslides, and potentially windblown, loose debris from the nearby landfill or other areas.

Figure 6. A TV in a ditch that drains from Charles Way to Vanderbilt Creek.

1.3.4. Channel and Habitat Modifications

Habitat modification has been identified as a stressor to aquatic life and wildlife, but Alaska Water Quality Standards do not include standards or criteria for habitat modification. Furthermore, little data exists to determine the degree of impact channel alterations within Vanderbilt Creek have had on the quality of habitat.

Significant habitat modifications on Vanderbilt Creek include the redirection and relocation of the creek via roadside ditches and culverts, and the filling of wetland areas for development. Such alterations can impact fish passage, spawning, drainage patterns, channel substrate, and water quality.

Given that available historic data regarding habitat values and water quality do not exist for Vanderbilt Creek prior to the area's development it is difficult to determine how much the initial modifications impacted the creek. However, many of the structures related to this development (e.g. culverts) are known to be currently impacting fish habitat and water quality.

In addition, habitat modification can also occur through isostatic rebound. This process can alter the hydrology of the creek, disconnecting it from groundwater re-charge by lowering water tables. Isostatic rebound can also initiate successional changes in the wetland communities and, thereby, modify their use by wildlife. Changes caused by isostatic rebound can amplify problems cause by anthropogenic modifications. Currently, impacts of isostatic rebound in the area have not been extensively studied, though concerns exist that it has already impacted estuarine habitats.

1.3.5 Other Pollutants of Concern

Other pollutants of concern not listed in the TMDL include hydrocarbons and landfill leachate. Hydrocarbons are introduced to the creek from oil, gasoline, and other chemicals used for vehicle maintenance and operation. Due to heavy road traffic and large parking areas in the vicinity of Vanderbilt Creek, hydrocarbons are likely pollutants. Leaks, spills, or improper disposal of chemicals containing hydrocarbons could lead to their being washed into the creek with stormwater runoff, but there is no current data for hydrocarbons in Vanderbilt Creek to quantify this.

Figure 7. A small drain with a pool of sludge accumulating near Vanderbilt Creek.

One of the tributaries to Vanderbilt Creek runs in close proximity to the CBJ landfill. Channel landfill is placed over water-saturated fine-grain deltaic deposits and run-off is generally slow due to the nearly level, loosely compacted nature of these deposits (Miller, 1972). Although it is uncertain if or how leachate is affecting Vanderbilt Creek, it was identified as a potential pollutant in the Juneau Wetland Functions and Values (Adamus et al. 1987).

1.4 Pollutant Sources and Loading

Due to dated nature of the 1995 TMDL, the loading capacity and source load estimates are no longer useful in creating a recovery strategy for Vanderbilt Creek. Therefore, it is not useful to include the data here. In addition, USGS flow data for Duck Creek was used in estimating the loading capacities for Vanderbilt Creek during the TMDL. In updating these estimates, flow data from Vanderbilt Creek may provide more accurate results.

A generalized list of sources of suspended solids in Vanderbilt Creek include non-point source run-off, wetland fills, stream bank disturbances, road maintenance and snow removal activities, stormwater conveyance, and construction activities. The Kaiser Pit, which has been developed and is now the site of the Home Depot facility, is no longer a source of sediment. If unusually heavy snowfall like that of the winter of 2006 continues, snow removal activities and snow melt are likely to have been greater sources of sediment input than previously estimated in the TMDL.

The target load reductions provided in the TMDL are no longer current due to changes in the sources analyzed, yet it may be a useful guide in generating current target load reductions once the loading capacity and source load estimates have been updated.

1.5 Available Water Quality Data

Water quality data for the Vanderbilt watershed is extremely limited and most information is out of date. Summarized here are the few technical reports that provide information on Vanderbilt Creek's water quality and habitat value.

The *Juneau Wetlands Functions and Values* report (Adamus et al. 1987) includes information on water quality parameters such as nitrogen, phosphorus and iron, as well as habitat values for Vanderbilt Creek. This report is one of the most referenced professional studies of the system to date although, it should be noted that this report is currently twenty years old and may be in need of updating. At this time, Vanderbilt was found to have the highest concentrations of available nitrogen and phosphorus. Nutrients were in highest concentration at the confluence of the three tributaries. Available nitrogen concentrations were the highest just above the wetlands, where gravel mining had heavily altered the surrounding area. This report was the first to document the degradation of Vanderbilt Creek's habitat value due to sedimentation.

Another Juneau-wide study, *Juneau Streams: A Water Quality Study* by R. Williams (1993) included a sampling site on Vanderbilt Creek, which was located 150 feet below the gas station. Parameters measured included dissolved oxygen, temperature, pH, conductivity, turbidity, several heavy metals and organic compounds.

Baseline water quality data was collected by the ADEC in association with the development of the TMDL for Vanderbilt Creek. Water samples were collected in July 1995 and analyzed for total suspended solids and turbidity, and discharge measurements were also gathered. This document, in part, formally recognized Vanderbilt Creek as an impaired waterbody, and it outlined actions necessary for the creek's recovery.

Since 1995, this data had not been greatly expanded upon. Through an ACWA grant, Discovery Southeast was able to collect water quality data on Vanderbilt Creek via an educational stewardship project through partnering with middle school students, ADEC, ADFG, and CBJ. This educational-level monitoring has been the most extensive data collection concerning water quality since the TMDL. Discovery Southeast collected data from the Fall 2002 to the Fall 2004 (provided in Appendix C).

A rapid bio-assessment of Vanderbilt Creek was completed by the University of Alaska Anchorage Environment and Natural Resources Institute (ENRI) in May of 2003 (Rinella et al. 2005). A rapid bio-assessment provides a "snap-shot" of conditions in the creek using macroinvertebrates as bio-indicators. The parameters measured during this study included conductivity, pH, dissolved oxygen, temperature, and discharge; a visual assessment of riparian and streambed habitat; and an assessment of the macroinvertebrate assemblage. Data was collected along a 100-meter stretch of creek where Discovery Alaska's office used to be located. Data from ENRI (see Appendix C) continues to suggest that Vanderbilt Creek is an impaired waterbody.

Figure 8. JWP volunteers conducting a rapid bioassessment on Vanderbilt Creek.

The Juneau Watershed Partnership (JWP) volunteers conducted a rapid bio-assessment of Vanderbilt Creek in May 2007 (Figure 8). Using the volunteer-level methods developed by ENRI, data was collected along a 25-meter portion of the ENRI sampling site on Vanderbilt Creek. The JWP data was collected in association with this project to establish a point in which to begin current discussions of the stream's health. Data from JWP's rapid bioassessment suggest that Vanderbilt Creek's water quality continues to be impaired (see Appendix C).

2.0 Fish and Fish Habitat

2.1 Vanderbilt Creek Fish Species

Vanderbilt Creek has been cataloged by ADFG as an anadromous fish stream (#111-40-10125) important for the spawning and rearing of coho, chum and pink salmon and Dolly Varden char. Pink and chum salmon are known to spawn in the tidally influenced lower reaches, while coho and Dolly Varden use the upper reaches for rearing habitat.

2.2 Fisheries Research

Fish habitat values of the Vanderbilt Creek Watershed are discussed in Adamus (1987). This document recognized the significance of habitat, especially for its productive capacity and its importance for overwintering juvenile salmon. The report acknowledged that while other streams exhibited larger total escapements, their habitat productive capacity (per unit area) is not as great as Vanderbilt. In addition, Vanderbilt Creek contained some of the highest densities of overwintering salmon ever recorded in Southeast Alaska at that time.

ADFG did some fisheries research in association with their classifying Vanderbilt Creek as an anadromous fish stream. Another ADFG survey was conducted in 1997 (Data provided in Appendix E). These surveys demonstrate that the creek was being used by anadromous fish.

The *Juneau Fish Habitat Assessment* (Bethers et al. 1993) describes fish habitat and population surveys. This assessment noted observations of spawning pink, chum and coho salmon.

The ADFG document *Survey of Vegetation, Birds, and Fish* (1999) nicely compiles information on Vanderbilt Creek fisheries since the Adamus et al (1987) report. The document also includes fish survey data collected by ADFG along the lower portion of Vanderbilt Creek. Their data is included in Appendix E. Fish populations have not been monitored in Vanderbilt Creek since 1999 and the current status of fish use in this system is unknown.

2.3 Fish Habitat Impairment

Adamus et al. (1987) provides a historical perspective on the degradation of fish habitat within Vanderbilt Creek. At that time, Vanderbilt Creek had an abundance of high quality fish habitat such as undercut banks, overhanging vegetation, and instream woody debris that made excellent juvenile salmon rearing habitat; and a half-mile of tidally-influenced stream channel that provided excellent spawning habitat. It also served as one of Juneau’s major salmon wintering streams; wintering habitat often being a limiting factor to sustaining healthy fish populations.

However, this information is extremely out dated and it cannot be certain whether this holds true in the present. The Adamus (1987) report acknowledged problems regarding sedimentation occurring from gravel mining and channel modifications as potential impairments to fish habitat values, and these same concerns were noted in the 1995 TMDL. According to ADFG (1999), the water quality concerns documented in the TMDL may be increasing as residential and commercial development has continued since its publication. In fact, the ADF&G Sport Fish Division, which has used Vanderbilt Creek in the past as an index stream to represent the strength of coho salmon runs in the Juneau area, has dropped the creek as an index due to concerns over changes to the habitat and difficulty in monitoring spawning adults (Bethers et al. 1993).

ADFG (1999) also noted that while the habitat values may have degraded due to these activities, significant numbers of fish continue to thrive in Vanderbilt Creek at this time. Indeed, the limited water quality data available for Vanderbilt Creek continue to show that water quality is still impaired in this watershed. Without current fisheries data it is unknown whether the creek is still being used by fish for spawning and rearing. Even if Vanderbilt Creek is maintaining some of its fish productivity, human activities throughout the watershed will continue to degrade the watershed habitat values unless impacts are minimized.

2.3.1 Sediment, Stormwater, and Related Pollution

Sediment inputs typically occur in the upper half of the watershed from both natural inputs; those derived from the slopes of Blackerby Ridge as well as runoff from industrial and residential activities. Water flow in the upper-watershed is generally fast enough to keep sediment suspended in the water column to be transported downstream.

Suspended sediment in large quantities can be problematic in the upper reaches where juvenile salmon rearing habitat occurs. The health of rearing juveniles can be directly impacted by suspended sediment as it passes through their gills, damaging the soft tissue or indirectly as the increased turbidity can change the temperature, dissolved oxygen and food supply.

Further downstream where flow tends to decrease, sediments will begin to settle and the more sediment input in the upper watershed, the more sediment that will deposit downstream. This has the potential to devastate spawning habitat, which should have no more than 20 percent of the streambed materials be fine sediments. Not only will the habitat become unsuitable for spawning, but salmon redds (nests) can be damaged and the survival of the alevins can be greatly reduced.

Measures have been taken to reduce sedimentation from stormwater runoff in the past. When the headwaters of Vanderbilt Creek were being impacted by runoff from the Kaiser/CBJ gravel pits, runoff was diverted through a ditch along Jenkins Street, allowing it to by-pass the most productive section of the stream (Adamus et al. 1987). Later, when the area changed to commercial and industrial use, the runoff was re-routed into Lemon Creek (ADEC 1995).

In addition to transporting sediments, runoff and stormwater from urbanized areas can contribute other pollutants such as hydrocarbons, other chemicals, and debris. For example, Juneau Watershed Partnership volunteers noted oil sheen in Vanderbilt Creek as recently as may 2007; milky colorations, foul odors and litter have also been noted along Vanderbilt Creek (ADF&G 1999).

During a 2007 Vanderbilt Creek Stakeholders meeting, concerns were expressed regarding stormwater, sedimentation, and related pollution included runoff from an exposed hillside behind the Home Depot facility; several stormwater drains along Glacier Highway that have sludge accumulating at their outlets; a creosote bridge; and a pair of culverts located on Glacier Highway. Section 5.4 addresses these concerns.

2.3.2 Fish Passage and Habitat Utilization

Culverts, drainage ditches and sewers used to move stormwater and/or to re-route water flow can potentially impede fish passage and disconnect fish habitat throughout a watershed. Likewise, impervious surface-areas and materials can constrict water flow and affect the creek's hydrology and fish habitat. In urban areas, impervious surfaces also affect stream hydrology by reducing infiltration necessary to recharge groundwater, increase storm-related flooding events.

The requirement to provide fish passage at road crossings is implied in Section 33, Code of Federal Regulations 323.3(B), Clean Water Act; the Southeast Alaska Areas Guide; and the Tongass Land Management Plan (USFS 2002).

Several culverts on Vanderbilt Creek have been identified as potential fish passage barriers, and many of these same culverts are fragmenting habitat in the upper watershed. The two culverts located under Glacier Highway on Vanderbilt Creek have been identified as potential barriers to fish at high water.

Several other culverts located on tributary crossings along the Lemon Creek trail not only impede fish passage but, in conjunction with the Lemon Creek Trail/ road, they disconnect habitat as well. The Lemon Creek Trail is acting like a dike and has impacted the hydrology of the Vanderbilt Creek tributaries (Brian Frenette, personal communication, May 13, 2007). Suggestions on how to improve these fish crossings is included in Section 5.4.

2.3.3 Channel and Habitat Alterations

Channelization and relocation of the stream channel and the filling of adjacent wetlands directly impacts fish habitat. Since the 1950s, Vanderbilt Creek and some of its tributaries have been redirected, relocated or filled in to allow for development. Vanderbilt Creek's main channel once flowed through the area where Channel Landfill and Western Auto are now located (Adamus et al. 1987). Vanderbilt Creek also once connected with the marsh adjacent to the Pioneers Home, but was redirected to its current channel during the construction of Egan Highway in 1973 (Armstrong et al. 2004), A section downstream of Glacier Highway was re-established in the 1970s after being impacted by commercial development (Adamus et al.1987).

However, since available historic data regarding habitat values and water quality do not exist for Vanderbilt Creek during this time period, it is difficult to determine how much such habitat modifications impacted the creek initially.

2.3.4 Isostatic Rebound and Other Natural Processes

Natural processes such as landslides and isostatic rebound can contribute to sediment loads, fish passage problems, and habitat alterations within the Vanderbilt Creek Watershed.

The Vanderbilt Creek Watershed, historically and presently, has been subject to landslides along Blackerby Ridge (Pat Quigley, personal communication, May 13, 2007). Landslides can load the creek with sediments and cause debris blockages that can potentially impede fish passage and cause flooding. In most cases, this is a relatively temporary condition as road crews remove the debris from the road and clear the culverts.

Isostatic rebound is a natural process of particular concern because it is known to be impacting watersheds in the Juneau area, and has potential to affect salmon habitat in the Vanderbilt Creek Watershed in the long term. Isostatic rebound could affect the quality of salmon habitat by altering the hydrology of the creek and initiating succession in low-lying wetland communities.

Currently, little to no data exists to determine the extent to which isostatic rebound is impacting habitat and water quality in this watershed, but based on knowledge of impacts to other local watersheds, it is likely that the process may already be impacting Vanderbilt Creek.

GIS and mapping data show that rebound, along with anthropogenic modifications, is changing the composition of wetland habitats (Carstenson 2004). Areas of low marsh have declined while uplift meadows and high marsh have increased. Low marsh is important in the marine food chain, since sedge traps the algae that sustain the invertebrate population that then feed rearing fish in the marsh. This is especially important in the case of coho salmon, which spend their first summer in the marsh before heading upstream to overwinter (Armstrong et al. 2004).

3.0 Wildlife and Wildlife Habitat

The wetlands in lower Vanderbilt Creek are associated with the greater Mendenhall Wetlands State Game Refuge (MWSGR), and the Lemon Creek Valley wetland complex. According to the ADFG (1999), the Lemon Creek Valley wetlands and the MWSGR are two of the most important areas for waterfowl in Southeast Alaska.

When the MWSGR is open for hunting season, the wetlands located in the Lemon Creek Valley complex (including those associated with Vanderbilt Creek) provide a refuge for game birds since many of these wetlands are located within one-quarter mile of roads (Armstrong et al. 2004).

These areas are also known to support rare species as well as overwintering passerine birds (ADFG 1999). An extensive list of birds that use wetland habitats throughout the Lemon Creek Valley is provided in *Survey of Vegetation, Birds, and Fish in the Lemon Creek Valley Access Corridor* (ADFG 1999).

Human alterations as well as glacial rebound will affect marsh composition and topography throughout the area. Wetland vegetational zones require specific durations of tidal submergence and exposure, and changes in topography due to filling of wetland areas for development and/or isostatic rebound is affecting these cycles and causing a response in the wetland vegetation.

Due to the steep, mountainous terrain of Southeast Alaska there is little land available for development. As a result, wetlands are often filled as they are the flattest areas to build on. Filling of wetland areas for development has already caused a loss of important feeding and nesting areas for migrating birds and waterfowl (Armstrong et al. 2004). Of the 1,188 acres of wetlands present in the Lemon Creek area in 1948, approximately 26% of them were filled by 1984. At that time, about 35% of development activities were occurring in wetlands. The wetlands along Vanderbilt Creek were heavily impacted (Adamus et al. 1984).

Natural forces such as uplift and subsequent successional changes have altered the habitat as well. In 1948, the sedge flats that extend through the Lemon, Switzer and Vanderbilt Creek estuaries were an integral component of the Channel's fish and wildlife habitat. However, the land has risen almost 3 feet since this time (Armstrong et al. 2004), and areas of low marsh have declined while uplift meadows and high marsh have increased in acreage (Carstensen 2004). These changes will modify the use of habitat by birds and other animals; however, not all of these changes are negative. Though the sedge is an important habitat type for grazing birds and mammals (Armstrong et al. 2004), uplift meadows will become increasingly more important for deer, bear and porcupine (Carstensen 2004).

Of the wetland areas that have been lost or damaged, a disproportionate amount is habitat in the important transition zone between tideland and uplands (ADFG 1999). Due to uplift and accreting land, development of private lands could potentially expand into the MWSGR (Armstrong et al. 2004)

4.0 Recovery and Stewardship

4.1 Discussion

The 1995 Vanderbilt Creek TMDL was developed as a management tool to improve water quality and fish habitat in the creek. Many of the control actions in the TMDL have not been executed and many are still relevant for preventing and reducing sedimentation problems and improving fish habitat. This document incorporates and expands upon the 1995 TMDL actions in order to ensure Vanderbilt Creek meets the target reductions and water quality standards.

Feasible control actions to achieve target load reductions and prevent further habitat degradation on Vanderbilt Creek include utilizing best management practices to reduce sediment inputs from road maintenance and stormwater conveyances, replacing culverts, removing debris, and enforcing regulations.

It is important to recognize that the Vanderbilt Creek Watershed will continue to be an area of increasing development; but this provides an opportunity to work with developers, agencies and concerned citizens to ensure that development occurs in such a way as to limit the impact on the watershed. This can be best accomplished by establishing a watershed oversight committee, which should consist of representatives from each stakeholder group including government agencies such as ADEC, CBJ, ADFG, and the Department of Transportation (ADOT) in addition to community groups, private operators, and landowners. The oversight committee will have the capacity to address management concerns and implement control actions within the watershed.

In addition, implementing a monitoring plan is extremely important for improving water quality and habitat for the long-term. Data on the Vanderbilt Creek Watershed has been inconsistent and inadequate. A formal monitoring plan will assist in re-assessing TMDL source load determinations and allocations, the loading capacity for Vanderbilt Creek, and habitat indicators while continually gauging progress toward meeting standards. This is essential in guiding any efforts to protect the watershed.

4.2 Other Stewardship Efforts

Several non-profit organizations have completed stewardship efforts within the Vanderbilt Watershed since the 1995 TMDL. Many of these efforts address sedimentation and habitat problems. These efforts include the following projects:

- Southeast Alaska Guidance Association (SAGA) developed and completed a Vanderbilt Creek Debris Removal Project with funding through the National Oceanic and Atmospheric Administration (NOAA) Community-based Restoration Program Debris Removal Projects in 2003-2004. This project restored approximately five acres of riparian, streambank and in-stream habitats by removing debris and garbage. For this project, SAGA developed a debris removal plan and clean-up protocol, and then recruited and trained community volunteers to complete the on-the-ground work.

- Discovery Southeast received support for their watershed education and stewardship programs from Alaska Discovery in 1999, which allows middle and high school students to study first-hand the integrated ecology of area watersheds, then plan and execute projects to restore riparian habitat. In conjunction with these programs, Discovery Southeast received funding from Alaska Conservation Council in 2000 and ADEC in 2001 and 2002, for conservation education specifically on Vanderbilt Creek. Discovery Southeast's "Vanderbilt Creek Stewards Project" allowed Dzantik'i Heeni (DZ) Middle School students to work alongside professionals to monitor water quality and restore stream habitat in a section of Vanderbilt Creek. The DZ students succeeded in bringing salmon back to this section.

4.3 Recent and Future Development

This section describes a summary of recent and future development activities that seem to be of particular concern to stakeholders within the Vanderbilt Creek Watershed.

4.3.1 Home Depot

When Home Depot (HD) bought portions of the Kaiser and CBJ Pits for the construction of a new facility, concerns were raised about the site's impact on Vanderbilt Creek. Steve Gilbertson, then CBJ Lands and Resources Manager, argued that the construction would stabilize the area and believed that this would reduce sediment input into the creek. HD took measures to reduce potential impacts to Vanderbilt Creek, by donating 7 acres of important wetlands in the headwaters and re-routed runoff to supply Vanderbilt Creek with additional flow (Sica 2006).

In addition, a hydrological study of the area was completed, and there is an on-going process to determine where groundwater will flow after disturbing the hillside. As a condition of their permit, HD will be responsible for using check dams to divert water. It was thought that, if water was diverted before reaching the HD site, it would be able to discharge into Vanderbilt Creek in a clean state. ADFG, the Alaska Department of Natural Resources (DNR), and the US Fish and Wildlife Service (USFWS) have met several times to discuss issues regarding Vanderbilt Creek's habitat, water quality and hydrology.

As the HD construction is nearing completion, there are still concerns that could be addressed during the final stages of construction. Observations of the site show that runoff diverted from the exposed hillside behind the HD facility is releasing sediment into a section of the creek. In addition, there is a proposal to convert the Lemon Creek Trail into a haul road that will be used for transporting gravel from the HD facility to Glacier Highway. The proposed road will call for widening the existing trail from 15 feet to 80 feet, and the corridor will run adjacent to wetlands located at the headwaters.

These concerns present opportunities to work with HD to minimize sediment loads from their site and to improve habitat along Vanderbilt Creek. Feasible projects include stabilizing the exposed hillside produced by the road bench and, if the proposed access road is constructed along the existing Lemon Creek Trail to Glacier Highway, potentially replacing the tributary culverts with appropriate fish crossings.

4.3.2 North Douglas Crossing

In 2007, the CBJ Assembly identified a second crossing from the Juneau mainland to Douglas Island, as their top development priority. The North Douglas Crossing project provides an opportunity for Vanderbilt Creek stakeholders to work with the CBJ and ADOT, since the city is considering the Vanderbilt Hill Road Corridor as the community preferred alternative. According to the Juneau Second Channel Crossing Project Development Summary Report prepared by HDR, Inc. (2005), the Vanderbilt Hill Road Area Corridor provides the greatest potential for meeting the comprehensive purpose and need objectives, is the least costly crossing potential, and best avoids the highest value environmental areas within the MWSGR. Presently, the DOT/PF's environmental analysis of the project has not gone beyond initial scoping process Public meetings regarding the Vanderbilt Hill crossing are currently being held by the CBJ, and Vanderbilt Creek stakeholders should be involved in the process.

4.4 Goals and Control Actions

Goal 1: Vanderbilt Creek meets state water quality standards for sediment, turbidity and debris.

Objective 1.1: Initiate source-specific controls to reduce and prevent erosion.

Action 1.1.1: Work with Home Depot to stabilize slope located behind HD facility.

Current HD construction of a road bench behind the facility has exposed an adjacent hillside, making it susceptible to erosional forces, and HD is responsible for stabilizing the area (Sica 2006). This provides an opportunity for local non-profits and concerned citizens to work with Home Depot to effectively stabilize the area to prevent further impairment to Vanderbilt Creek.

JWP has a history of coordinating volunteers to successfully implement BMPs such as live willow stakes to stabilize roadside slopes and stream banks. A partnership between an organization like JWP and HD could result in a volunteer stabilization project that could benefit all parties involved.

Action 1.1.2: Work closely with new developments in the area in the beginning phase of development.

Obtain any construction and/or conditional-use permits and facilitate communication between all stakeholders when appropriate.

Action 1.1.3: Continue to enforce regulatory process to reduce and prevent erosion.

Objective 1.2: Reduce sediments and other pollutants derived from road maintenance practices within Vanderbilt Creek Watershed.

Road cleaning and snow-maintenance practices were identified as a contributor to sediment input on Vanderbilt Creek in the 1995 TMDL. These practices are still known contributors of sediment within the watershed.

Action 1.2.1: Work with CBJ, ADOT, and other landowners to reduce sediments and pollutants derived from road cleaning and snow management practices.

Plowed snow often contains de-icing chemicals, hydrocarbons, sediment and debris. Streams are often used as places to dump snow since they usually do not impede traffic. Road maintenance crews should be encouraged to sweep to the center of the road as they pass the stream.

JWP has documented locations where snow has been directly plowed into streams in various watersheds in Juneau, and has made efforts to educate landowners about the impacts of this practice on fish habitat. However, it is important to note that the winter of 2006 exhibited unusually high snowfall, creating difficult conditions for snow removal and causing both the city and private landowners to plow directly into streams.

Given that climate patterns may change, snow removal practices need to take into account more frequent, heavy snow conditions in order to better prepare for such winters. Though heavy snowfall and melting will cause more input from natural sources, plowing directly into streams will only magnify the problem. A city wide plan should include recommendations on snow storage areas, use of chemicals and sand for de-icing and traction, and use of BMPs such as snow or silt fences to prevent pollutants from entering streams when the snow melts. Outreach activities to educate landowners should continue.

Objective 1.3: Reduce sediments and other pollutants derived from stormwater conveyances discharging into Vanderbilt Creek.

Action 1.3.1: Work with ADOT and landowners to improve stormwater conveyances through installation and/or retro-fitting control structures such as oil/water separators and sediment filters on existing conveyances.

As mentioned in Section 1.3.1, stormwater has the potential to transport sediment as well as other pollutants. Stormwater conveyances include storm sewers, culverts and roadside ditches. Using control structures such as retention basins, sediment traps, constructed wetlands, oil-water separators, etc. could reduce the impact of stormwater pollution in Vanderbilt Creek. Site- specific considerations will determine the most feasible and effective control device.

Figure 9. The temporary water diversion conduit that transports stormwater from the hill behind Home Depot into Vanderbilt Creek. June 2007

There are several conveyances of concern: a drainage pipe conveying stormwater from the located along Glacier Highway accumulating sludge, a grate located on Short Street, and the conveyance diverting runoff from the HD site. Improvements on some of these conveyances are listed as separate actions.

Action 1.3.2: Work with Home Depot to improve quality of stormwater diverted into Vanderbilt Creek.

Home Depot is diverting water from the road bench behind the facility into Vanderbilt Creek. The intention was to supply addition water to the creek, which has been historically cut off from its headwaters. Though the additional water flow would benefit the creek, sediment from the exposed hillside can impact the water and surrounding wetlands. In addition to stabilizing the hillside, which will greatly reduce the sediment load, implementing other BMPs to ensure the added stormwater does not impact the creek may be necessary.

Action 1.3.3: Monitor oil/water separators for effectiveness and correlate to rainfall amounts to understand how often the separators require maintenance for proper function.

Action 1.3.4: Require maintenance of treatment measures for all new conveyances.

Action 1.3.5: Provide education and outreach on stormdrain maintenance.

Action 1.3.6: Stencil or sticker stormdrains to deter people from dumping waste into them.

Action 1.3.7: Assess and improve residential storm water quality.

Action 1.3.8: Remove sediment from the creek by dredging it and prevent additional sediment accumulation through Actions 1.1.1- 1.3.7.

Action 1.3.9: Educate the public regarding negative impacts of using chemical fertilizers and pesticides, dumping pollutants into storm drains, and improperly storing fuels, chemical and garbage on water quality.

Residential runoff often contains chemicals, sediment and debris associated with a variety of homeowner activities. Residential runoff can be improved by educating the public about how they can reduce potential impacts to surface water quality through proper disposal of chemicals, alternative pest controls, etc. Storm drain stenciling projects can remind residents of the fate of their stormwater. Continuing community household hazardous waste collection will provide opportunities to properly dispose of household chemicals and hazardous materials.

Objective 1.4: Enforce and improve riparian and stream disturbance regulations

Action 1.4.1: Enforce regulations that address riparian and stream disturbance when practical.

There are federal, state and local regulations that govern riparian and stream disturbance, which include setback ordinances, state regulations protecting anadromous fish habitat and federal laws that govern wetlands and waterways. Requiring habitat restoration in disturbed areas should be included as part of the enforcement measures, but this will only prove effective with oversight and subsequent monitoring. Where working with landowners to rehabilitate areas fails, issuing citations, when practical, for violations may be necessary to prevent future violations. It is helpful to have interested community groups who are knowledgeable about the various regulations and are willing to report violations, since agency staffing is often limited. In addition, limiting or eliminating variances to the setback will help protect water quality and habitat in the long-term.

Action 1.4.2: Enforce the regulatory process to maintain a 50-foot vegetated buffer along both sides of Vanderbilt Creek.

Vegetated, streamside buffers have multiple benefits within a watershed. Buffers provide near-stream erosion control and can reduce sediment loads from surface runoff. They also provide habitat for various birds and animals. Provisions for 50-ft vegetated buffers currently exist in CBJ land use ordinance. The Juneau Wetlands Management Plan calls for managing of any wetlands located in the 50-foot buffer as Category A wetlands. Again, limiting or eliminating variances will ensure protection of water quality and habitat in the long-term.

Action 1.4.3: Incorporate water quality and habitat based criteria into CBJ variance criteria.

In all provisions listed above, variances from the 50-ft setback requirement are allowed under certain circumstances. However, these criteria do not address water quality and habitat impacts. Incorporating criteria for such impacts will ensure that considerations of variance requests include water quality and habitat based stipulations.

Action 1.4.4: Develop criteria for buffer areas including types of vegetative cover, stability, and permissible uses.

Such criteria for streamside buffers could provide a useful guide in planning and implementing restoration efforts in riparian areas. Several publications exist that already contain some useful criteria for streamside buffer areas in the Pacific Northwest; however, a single document specific to the Southeast Alaska region could not be found. Compiling this information into a single source could produce a valuable resource for watershed management. Palone and Todd, (1998) provide an excellent example of such a document.

Action 1.4.5: Incorporate buffer provisions into CBJ conditional use permits and state certification of Section 404 permits.

Objective 1.5: Promote the use of best management practices (BMPs) to reduce sediment from development activities.

Action 1.5.1: Use BMPs for construction and other sediment producing activities in the Vanderbilt Creek Watershed.

Action 1.5.2: Implement BMPs through the CBJ development and building permits, and DEC Section 401 federal permit certification authority.

Objective 1.6: Keep Vanderbilt Creek and its tributaries free of anthropogenic debris

Action 1.6.1: Enforce local ordinances that address garbage storage, littering, and illegal camping.

Ordinances exist for littering, polluting water and illegal camping. Trash and illegal structures from squatters camping along the Lemon Creek Trail and Vanderbilt Creek were observed by JWP staff in May 2007. Enforcing these ordinances will deter littering and illegal camping in the area and help protect habitat quality. In addition, if the area remains a trail for public use, it may be necessary to assess whether bear proof garbage receptacles would be beneficial at the trailhead.

Action 1.6.2: Organize clean-ups to remove litter and debris that could diminish habitat value or threaten aquatic life and wildlife.

Litter and debris can be seen in many areas of the Vanderbilt Creek Watershed, especially along Glacier Highway. When debris is carried by stormwater through conveyances, it can accumulate at culverts and prevent fish passage, and such debris should be removed periodically from the creek. Currently, the JWP organizes stream clean-up events bi-annually, and has an 'Adopt-a-Stream' public stream monitoring program in affect on Vanderbilt Creek.

Goal 2: Improve Vanderbilt Creek anadromous and resident fish habitat

Objective 2.1: Establish and monitor indices of habitat condition

Action 2.1.1: Establish a monitoring plan to assess water quality on Vanderbilt Creek.

The limited information and data compiled for Vanderbilt Creek suggests that water quality is impaired (refer to Section 1.5). A monitoring plan was developed during the TMDL process but was never executed. Furthermore, the plan outlined in the TMDL emphasized monitoring total suspended solids, turbidity, discharge, and percent fines in the gravel bed. Though the source of impairment is primarily sediment, potentially Vanderbilt Creek is being impacted through other means. Many water quality parameters are inter-related through various physical, chemical and biological processes, and monitoring basic parameters will give a more complete picture of how the system is responding.

A monitoring plan that seeks to improve habitat should account for other basic water quality parameters such as pH, conductivity, and dissolved oxygen and should consider other parameters such as discharge, hydrocarbons, creosote, storm drain runoff, and biological monitoring. Such a plan would also provide complete and consistent baseline data from which future assessments can be compared. This will enable interested parties to better determine the creek's response to restoration efforts and/or further impairment and, therefore, make management decisions based on these determinations.

Action 2.1.2: Establish data on discharge and groundwater for Vanderbilt Creek Watershed.

Regularly monitoring stream flow and providing base-line data will be important to any monitoring strategy and future management of Vanderbilt Creek. Discharge data supplements other monitoring parameters, and the eventual development of long-term data can be used to correlate changes in discharge with climate change, isostatic rebound, and other factors over time.

Action 2.1.3: Identify spawning and rearing habitat, and monitor physical characteristics of the streambed and channel.

Identifying key fish habitat areas and monitoring stream characteristics can provide important information for managing the watershed. Monitoring these areas will provide more information on fish productivity and determine if water quality is impacting the quality of spawning and rearing habitat. This information will help in determining sources of habitat impairment and establishing priorities for restoration or protection.

Action 2.1.5: Conduct fish and fish habitat inventory of Vanderbilt Creek

Data on Vanderbilt Creek fish populations, spawning, and rearing is limited. Existing data shows that Vanderbilt Creek is being used by anadromous fish for spawning and rearing, but is not consistent enough to be used in further analysis. Data should be collected over time and during important life stages for each species, as this will allow for statistical analysis of population trends which will help determine the condition of the creek's fisheries.

Action 2.1.6: Monitor and assess invertebrate populations.

Macroinvertebrate assemblages have proven to be an excellent index from which to assess water quality and habitat. Certain macroinvertebrate species are intolerant or sensitive to changes in stream water quality and channel substrate. Using the procedures developed by ENRI to conduct rapid bioassessments of Vanderbilt Creek can provide useful information to supplement other monitoring efforts. These procedures can be modified to fit the needs and skills of any agency or organization wanting to obtain a quick snapshot of the watershed's health.

Action 2.1.7: Delineate and map all wetlands in the Vanderbilt Creek Watershed

Objective 2.2: Maintain and improve riparian, in-stream and other essential fish habitat.

Action 2.2.1: Enforce the regulatory process governing anadromous waters, associated wetlands and intertidal habitat.

Though federal, state and CBJ regulations governing anadromous waters, wetland habitats and intertidal/estuarine habitats are often listed as separate considerations, enforcing these regulations is essential to prevent future impacts and protect the watershed function and values as a whole.

Enforcing these regulations will involve working with developers, landowners, and agencies to obtain the necessary permits, especially where work includes working in-stream. Enforcement will also require accessing sites for permit or code violations and issuing citations to violators.

Action 2.2.2: Identify riparian and other essential habitat in the Vanderbilt Creek Watershed and work with landowners to ensure additional stewardship or protection of key areas.

Identifying and mapping important riparian and other habitat essential to the function and habitat value of Vanderbilt Creek Watershed can provide a useful management tool. A map of particularly important or sensitive habitat will make it easier to monitor these areas for potential impacts from current and future development including proper permitting, execution of BMPs, potential permit or code violations, degradation of water quality, etc. In addition, these areas can be identified for possible mitigation or restoration efforts for future projects, or for protection from further development.

Action 2.2.3: Stabilize and re-vegetate disturbed streambanks and riparian areas.

Though prevention is more effective and, oftentimes, less expensive in the long-term, it requires government agencies and local community groups to be proactive in enforcing existing pollution controls. Working with landowners to stabilize areas where disturbance has occurred, including areas within the setback, can repair negative impacts to the stream.

Action 2.2.4: Re-establish riparian corridors where possible.

Objective 2.3: Ensure adequate passage and access to habitat for resident and anadromous fish during all life stages

Action 2.3.1: Replace culverts located on Glacier Highway, near the north entrance of Western Auto/Grant Plaza

Figure 10. The inlet (left) and outlet (right) of the Glacier Highway culverts. As shown, one of the culverts has failed due to sediment build up.

The pair of culverts that direct the mainstem of Vanderbilt Creek under Glacier Highway have several problems that make them a priority for replacement. Both culverts are closed-bottom which could affect the presence of natural substrate and hydrologic conditions, and there is visible rotting of the culvert material in one of the culverts.

In addition, the culverts are not placed in a manner that creates an appropriate fish crossing. One of the culverts has failed, and does not seem to be directing stream flow (Brian Frenette, personal communication, May 13, 2007). This particular culvert appears to be blocked by a sediment bank that formed at the inlet of the culvert. According to Brian Frenette, at high flow this culvert may provide a velocity barrier to fish, and he recommends that these culverts should be replaced with a bridge.

Before a decision is made to replace the culverts with a bridge, the crossing can be assessed using the USFS "FishXing" software, and the crossing conditions can be assessed to determine what type of structure would be the best replacement.

Action 2.3.2: Replace culverts on several Vanderbilt Creek tributaries along the Lemon Creek trail with bridges and reconnect the habitat.

The Vanderbilt Creek tributaries along the Lemon Creek Trail bisect active alluvial fans, which appear to provide excellent coho habitat (Brian Frenette, personal communication, May 13, 2007). However, many of the culverts directing tributaries under the Lemon Creek Trail are too small in diameter and have perched outlets. In addition, the Lemon Creek Trail, which is actually a 15-ft wide drivable gravel route, is acting like a dike and constricting water flow. Both the culverts and the road are subsequently disconnecting much of the habitat at the toe of the alluvial fan.

Figure 11. One of several undersized, perched culverts on Vanderbilt Creek along the Lemon Creek Trail

Though fish have not been seen using many of these tributaries (Pat Quigley, personal communication, May 13, 2007), Frenette suspects that coho have historically used the waters and will do so again once the habitat is reconnected. Replacing these culverts with bridges would allow each tributary to flow naturally across the landscape, reconnecting the habitat. Frenette says proper stream crossings would also prevent road washout along the Lemon Creek Trail. Again, these culverts can be assessed using the US Forest Service' (USFS) "FishXing" software and alternatives for replacement structures can be considered.

Currently, the jurisdiction of the Lemon Creek Trail is in dispute, but if it is found that the USFS is responsible for road maintenance, they should be approached as partners in order to replace these culverts. However, there is a proposal to convert the Lemon Creek Trail into a haul road that will be used for transporting gravel from the Home Depot facility to Glacier Highway. The proposed road will call for widening the existing road to 80-feet. If construction of this proposed road is approved, it will be even more important to address the issues outlined here. It will provide an opportunity to work with Home Depot, ADOT, and other authorities to complete this action.

Goal 3: Vanderbilt Creek water quality and habitat is not impacted by point and nonpoint source pollution.

Objective 3.1: Assess known and potential contaminant sources, and reduce and prevent future pollution.

Action 3.1.1: Identify and map point and non-point sources of pollution within the Vanderbilt Creek Watershed.

Point and non-point sources within the watershed should be identified and assessed on a regular basis to guide future monitoring of source impacts to water quality and for general good watershed management. Specific sources of pollution that should be considered for this watershed include creosote wood structures, acid rain, increased development, and Stormwater drainage. A catalog of pollution sources can help determine sampling sites for a monitoring strategy that aims to assess source outfalls. Monitoring above and below source outfalls will 1) allow for updating source loads; 2) determine load reductions necessary to obtain water quality standards; 3) determine if implemented source controls are reducing source loads. In addition, identifying flow pathways and stormwater inputs may prove useful in future management.

Action 3.1.2: Update the original TMDL assessment for Vanderbilt Creek based on the most current data.

In order to make informed management decisions, much of the information (e.g. loading capacity of the creek) needs to be regularly updated in the original TMDL assessment once monitoring data has been collected and improvements have been made.

Action 3.1.3: Remove the creosote bridges and abutments located on Glacier Highway.

Two creosote bridges cross Vanderbilt Creek on Glacier Highway, providing access to Grant's Plaza/Western Auto and Jerry's Meats. There is also an additional creosote abutment that is currently not being used as a bridge.

Figure 12. One of the creosote bridges crossing Vanderbilt Creek. Photo by: Eric J. Chandler

Action 3.1.4: Differentiate between the upper and lower reaches of the steam above and below Glacier Highway and remove the silt that has accumulated in the stream.

Action 3.1.5: Work with CBJ to require stormwater protection plans for all new gravel pits.

Action 3.1.6: Work with CBJ and local businesses operating trucks to provide a wheel wash facility to reduce the amount of dust and sediment being spread along roads in this area by muddy vehicles.

Action 3.1.7: If the haul road that is proposed in the current Lemon Flats Access project is constructed along the Lemon Creek Trail, CBJ should consider paving it to reduce the introduction of more airborne contaminants and sediment.

Objective 3.2: Improve agency and public awareness of Vanderbilt Creek values and efforts to protect them.

Action 3.2.1: Seek and develop opportunities to raise agency awareness through memoranda of agreement (MOAs), distribution of this document, fact sheets and other means.

Action 3.2.2: Seek and develop opportunities to raise public awareness through signage, informational materials, fact sheets, engaging the public in agency decision-making, and other means.

Objective 3.3: Establish an Oversight and Implementation Committee for Vanderbilt Creek

Action 3.3.1: Identify and encourage stakeholders to weigh-in on current and future management decisions within the Vanderbilt Creek Watershed.

Whether or not an oversight and implementation committee is formed, stakeholders need to be informed of opportunities to weigh-in on management decisions occurring within the watershed. Public processes are incorporated into CBJ planning. Current management topics within the

Vanderbilt Creek Watershed include commercial development and stormwater management near the headwaters, the North Douglas Crossing Project, and the Lemon Flats Access Study.

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APPENDICES

APPENDIX A: SOIL TYPES IN THE VANDERBILT CREEK WATERSHED

Series	Series Description	Mapping Unit	Soil Depth (ft)	Depth to Ground-water (ft)	Mapping Unit Description	Vegetation Type
Tidal Flat	Nearly level areas of medium textured sediments bordering the coast that are frequently inundated by tides that are higher than normal	Tf	> 5	0	N/A	Sedges, rushes, grasses and other plants common to coastal meadows; few areas are bare
Tolstoi – McGilvery Complex	Shallow, well-drained soils overlying bedrock on hilly to steep ridges and mountainsides. Consists of forest litter resting on gray or brown soils or directly on bedrock. Stones and large boulders common.	ToE	0.5-2	--	20 – 35% slopes	Sitka spruce-Western hemlock forest
Kupreanof	Well-drained soils on moraines that formed in very gravelly loamy till. Coarse fragments make up 40 – 60% of the volume. Large stones or boulders are common.	KuC	>5	>5	Gravelly silt loam on 7 – 12% slopes; may include small spots of Wadleigh, Maybeso, and Karta soils.	Sitka spruce-Western hemlock forest
		KuD	>5	>5	Gravelly silt loam on 12 – 20% slopes; may include small spots of Wadleigh, Maybeso, and Karta soils.	
		KuE	>5	>5	Gravelly silt loam on 20 – 35% slopes; may include small spots of Tolstoi and Karta soils.	
Maybeso	Very poorly drained soils of seepage areas, drainageways, and benches. Soils consist of mucky peat overlaying glacial till. Coarse fragments make up 40 – 60% of the till and large stones and boulders are common.	MaC	>5	<2	Mucky peat overlying till on 7 – 12% slopes; may include small patches of Wadleigh soils and a few spots of Kina and Kaikli soils.	Western hemlock with scattered Sitka spruce
Co	Poorly drained soils consisting of deep gray waterlaid, silty sediments on nearly level alluvial plains. Commonly contains thin strata of sandy materials and peat.	CoA	>5	<2	Silt loam on 0 – 3% slopes; includes areas of very poorly drained shallow peat and pockets of Am and Le	Dominate vegetation is sedge and grasses, but will support stands of Sitka spruce and Western Hemlock

					soils.	
Wadleigh	Somewhat poorly drained soils on lower slopes of hills and mountainsides. Consists of forest litter overlying gravelly loamy soil. A substratum of firm glacial till impedes internal drainage.	WaD	>5	<1	Gravelly silt loam on 12 – 20% slopes	Western hemlock with scattered Sitka spruce
Kina	Poorly drained deep peat soils that occur on benches and footslopes. Peat material derived primarily from sedges. Underlying material may be rock or glacial till.	KiA	>5	<1	Peat on 0 – 3% slopes; may include small patches of Maybeso and Wadleigh soils.	Scattered Lodgepole pine with sedges and moss

APPENDIX B: WETLAND HABITAT DESIGNATIONS AND DESCRIPTIONS

Wetland habitat designations and descriptions for wetlands located near Vanderbilt Creek. Modified from the City and Borough of Juneau. 1986. Juneau Wetlands Management Plan. Juneau, Alaska.

Wetland Unit	Management Range	Management Category	Description
L8	A-B	A	10 acres of emergent vegetation between Vanderbilt Hill Rd. and the Pioneer's Home
L12	B-C	B(S)	18 acres of emergent vegetation adjacent to the east side of old Glacier Highway and bisected by Vanderbilt Creek. Corridors along the creek are Category A. Wetland is Category B by best professional judgment to protect the productivity of Vanderbilt Creek. High salmonid habitat value.
L13	B-C	C	1 acre of forested wetland adjacent to old Glacier Highway and separated from the Vanderbilt drainage of L12 and L14 by an old berm. Low salmonid habitat value.
L14	B-C	B(S)	9 acres of emergent vegetation within a forested area bisected by Vanderbilt Creek. Corridors along the creek are Category A. High salmonid habitat value.

APPENDIX C: AVAILABLE WATER QUALITY DATA

Water quality data collected on Vanderbilt Creek in 1991. Sampling site for this study was located at an unfinished bridge abutment located approximately 150 feet below the gas station. Source: Williams, R. 1993. Juneau Streams, A Water Quality Study.

Parameter	Units	Criteria	Date	Result	Date	Result	Date	Result
Temp	C	20	2/19/91	1.5	5/7/91	8	9/9/91	10
DO	mg/L	>7	2/19/91	12.4	5/7/91	11.8	9/9/91	9.4
pH		6.5-9.0	2/19/91	6.53	5/7/91	7.45	9/9/91	7
Conductivity	uS/cm – 25 C	--	2/19/91	121	5/7/91	70	9/9/91	72
Turbidity	NTUs	Amb. + 25	2/19/91	23	5/7/91	1.1	9/9/91	4.95
Alkalinity	mg/L CaCO3	--	2/19/91	24	5/7/91	26.7	9/9/91	21.5
Arsenic	ug/L	50	2/19/91	<2.1	5/7/91	<2.1	9/9/91	3.7
Barium	ug/L	1000	2/19/91	22	5/7/91	19	9/9/91	20
Cadmium	ug/L	10	2/19/91	<0.2	5/7/91	<0.19	9/9/91	4.4
Chromium	ug/L	50	2/19/91	<1.7	5/7/91	<1.0	9/9/91	7
Lead	ug/L	50	2/19/91	<12B	5/7/91	<1.0	9/9/91	2
Selenium	ug/L	10	2/19/91	<1.3	5/7/91	<1.3	9/9/91	<1.3
Silver	ug/L	0.12	2/19/91	<0.31	5/7/91	<0.31	9/9/91	0.6
Mercury	ug/L	0.012	2/19/91	<0.11	5/7/91	<0.11	9/9/91	<0.11
TDS	mg/L	500	2/19/91	67	5/7/91	51	9/9/91	54
TSS	mg/L	--	2/19/91	<11	5/7/91	<11	9/9/91	<4.1
VOC	ug/L	10 total	2/19/91	<1.0	5/8/91	<1.0	9/9/91	<1.0
MCEO	mg/L	--	2/19/91	<1.0	--	--	9/9/91	--
Nitrates	ug/L	10,000	2/19/91	<50	5/30/91	330	9/9/91	214

Water quality data collected by Discovery Southeast and DZ Middle School students from October 2001 to November 2003.

Date	Site	Flow cfs	H2O Temp °F	Air Temp °F	DO mg/l	Turbidity NTU	Settleable solids ml/L	Iron Ppm	pH
10/29/01	Disco	n/a	42	49	12	3.4	n/a	0.75	6
11/5/01	Disco	0.44	41	40	11	1.8	0.01	0.75	6
11/6/01	Disco	0.44	38	32	12	n/a	n/a	0.75	5.5
11/14/01	Disco	0.46	38	35	17	9.5	n/a	2	6
11/16/01	Disco	0.5	40	42	13	8.7	0.1	0.75	6
11/21/01	Disco	0.38	39	40	12	2.9	n/a	1	5.5
11/21/01	Disco	0.38	40	41	13	2.8	n/a	1	n/a
11/28/01	Disco	Frozen	32	20	Frozen	2.3	n/a	1	n/a
11/30/01	Disco	Frozen	32	19	Frozen	Frozen	n/a	Frozen	Frozen
4/19/02	Disco	0.3	39	40	10	-		0.75	6
4/24/02	Disco	0.3	40	42	11	2.6		0.75	6
4/26/02	Disco	0.3	39	44	7.5	-		0.75	5.5
5/1/02	Disco	0.4	38	47	11	3.8		2	6
5/3/02	Disco	0.3	-	40	11.5	-		0.75	6
5/8/02	Disco	0.3	44	48	-	7.1		1	5.5
5/15/02	Disco	0.4	44	51	-	1.3		1	n/a
5/17/02	Disco	0.4	43	54	12	1.2		1	n/a
5/24/02	Disco	0.4	41	58	11	1.2		Frozen	Frozen
9/27/02			46	56	12			0.75	6
10/4/02			45	43	12			1.0	6
10/10/02			42	27	12			0.25	6
10/24/02			40	41	13			1	5
10/31/02			40	31	11.5			4	5
11/7/02			40	33	12.5			1	5
4/17/03			38	40	13	4.5		0.5	n/a
4/17/03			38	42	13	3.1		0.5	5
4/24/03			40	38	12	3.68		n/a	5
4/24/03			43	60	12	4.41		n/a	5
5/01/03			41	48	14	1.6		1	6
5/01/03			44	51	11	8.7		0.5	5.5
5/15/03			40	40	9	2.23		0.5	7
5/15/03			41	42	10	3.08		1	5.5
5/22/03			45	52	12	2.25		1	5.5
5/22/03			45	52	n/a	7.58		0.5	5
9/30/03	akdisco		47	54	12	2.55		2.5	6
10/1/03	akdisco		43	44	11.6	1.52		0.5	5.75
10/7/03	akdisco		N/A	50	12	3.01		0.6	5.6
10/15/03	akdisco		N/A	29	11	3.75		0.5	5.75
10/22/03	Akdisco		39	41	8	7.34		0.75	6.25
10/22/03	Forest		39	48	10	2.95		0.5	7
10/22/03	Dump		41	40	9	11.65		0.5	6.25
10/22/03	wetlands		39	41	10	9.92		0.5	6
10/29/03	akdisco		38	33	11	12.85		0.5	6
10/29/03	Dump		38	38	9	14.4		0.5	5.5
10/29/03	wetlands		38	38	6	8.36		0.5	5.5

10/29/03	Forest		40	34	8	1.5		0.5	6
11/5/03	akdisco		33	25	11	3.05		0.5	5.5
11/5/03	Forest		34	26	14	1.72		0.75	5.75
11/5/03	wetlands		31	35	12	8.46		0.5	5
11/5/03	dump		31	35	8	9.14		0.5	6

Rapid bioassessment data. ENRI conducted a professional level assessment in May 2003. JWP conducted a volunteer level assessment in May 2007. Due to differences in methodology, there may be variation in data.

Physical characteristics of Vanderbilt Creek, as determined during a rapid bioassessment conducted by ENRI in 2003.

Date	Bedrock %	Boulder %	Cobble %	Gravel %	Sand %	Silt %	Clay %	Discharge (cfs)	Channel Slope %	Rosgen Stream Class	USFS Channel Type	Water Color
05-13-2003	0	0	5	40	35	20	0	29.26	0.5	C4	FP3	Clear
05-13-2007								2.27				Clear/Oil sheen

Physiochemical data collected during a rapid bioassessment conducted by ENRI on Vanderbilt Creek in 2003.

Date	Conductivity (us/cm)	Dissolved Oxygen (% saturation)	Dissolved Oxygen (mg/L)	pH	Water Temperature (C)
05-13-2003	57.7	85.5	11.92	6.8	5.90
05-13-2007	N/A		11.60	6.5	

Visual habitat assessment conducted by ENRI during a rapid bioassessment of Vanderbilt Creek in 2003.

Date	Total Score	Epi-faunal substrate/ available cover	Embed-dedness / pool substrate	Velocity depth regime/ pool variabi-lity	Sediment deposition	Chan-nel flow status	Chan-nel altera-tion	Frequency of riffles or bends/ channel sinuosity	Bank stability (left bank)	Bank stability (right bank)	Veget-ative protect-tion (left bank)	Veget-ative protect-tion (right bank)	Ripar-ian veget-ative zone width (left bank)	Ripar-ian veget-ative zone width (left bank)
05-13-2003	132	11	6	14	10	19	10	18	8	8	8	8	8	4
05-13-2007	54	6.5	4	4	5	7.5	7.5	4.5	2.5	3	3	2.5	2	2

Multimetric Index, individual metric scores

Date	A priori disturbance class	Multimetrix index	Insect taxa	Non-insect % taxa	%EPT	Scraper taxa	Clinger taxa	Intolerant % taxa	Predictive model O/E
05-13-2003	Class 1	43.7	14	22.2	16.9	2	6	38.9	0.67
05-13-2007					29.69				

APPENDIX D: AVAILABLE FISH DATA

Fish trapping data collected by ADF&G from July through September 1997 at the drainage slough known as the Vanderbilt Creek "Dump Tributary."
Source:

Rearing						Spawning				
Date Set	Date Pulled	Soak Time	Coho	Dolly Varden	Notes	Date Counted	Pink	Chum	Coho	Notes
8-Jul	9-Jul	23.25	1	0	Set 3, many scu./stic.					
15-Jul	16-Jul	21.25	5	0	Set 4, many stic.					
22-Jul	23-Jul	27.33	3	1	Set 4, many scu./stic.					
29-Jul	30-Jul	22.50	3	0	Set 2 traps; 1 sc. 40 sb					
10-Sep	11-Sep	23.50	0	0	2 traps, 6 sculp 28 sb					
18-Sep	19-Sep	23.50	1	0	2 traps					
23-Sep	24-Sep	23.50	4	0	2 traps					

Fish trapping data collected by ADF&G from July through September 1997 at Vanderbilt Creek.
Source:

Rearing						Spawning				
Date Set	Date Pulled	Soak Time	Coho	Dolly Varden	Notes	Date Counted	Pink	Chum	Coho	Notes
1-Jul	2-Jul	25.00	16	66	Set 6, many scu./stic.					
8-Jul	9-Jul	23.25	10	108	Set 6, many scul.					
15-Jul	16-Jul	21.25	11	61	Set 6, 2 scu.	22-Jul	0	4 lv., 1de.	0	Count in index area
22-Jul	23-Jul	27.50	28	127	Set 6, 6 scul.	23-Jul	0	15 lv, 0 de.	0	Count in index area
29-Jul	30-Jul	23.00	16	27	Set 6; 4 sculpin	30-Jul	2	59 lv., 0 de.	0	From Egan to culvert
5-Aug	6-Aug	18.33	14	53	11, scul	5-Aug	8	23 lv., 20 de.		Count in index area
10-Sep	11-Sep	23.50	24	9	6 traps, sb	12-Aug	54 lv., 13 d.	12 lv., 75 de.		From Egan to culvert
18-Sep	19-Sep	23.00	11	1	6 traps, 3 sb	27-Aug	215/110	81 lv., 93 de.		
23-Sep	24-Sep	23.50	20	10	6 traps	8-Sep	28 lv., 170 d.	0 lv., 78 de.		

APPENDIX F: A PRELIMINARY LIST AND DESCRIPTION OF IMPORTANT HABITATS IN VANDERBILT CREEK

A preliminary list and description of important habitats in Vanderbilt Creek

Intertidal emergent wetlands and drainage sloughs: the wetlands and drainage sloughs adjacent to lower Vanderbilt Creek and the Western Auto/Grant Plaza, are important habitat that is at risk of further development. There have been several proposals to fill the portions of these wetlands with sand and gravel to provide building and parking pads for future commercial development. The National Marine Fisheries Service (NMFS) has reviewed several such proposals and concluded that the proposed projects may "result in substantial and unacceptable impacts to aquatic resources." These wetlands have been identified as Essential Fish Habitat, pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, and are highly critical to fish utilizing Vanderbilt Creek and the interconnected Mendenhall Wetlands. NMFS states that the "habitat values and hydrological functions (of this area) are important and should be maintained."

Donated acreage by Home Depot: Home Depot is considering plans for an access road that will start at Concrete Way, run through property and connect to Glacier Highway near Western Auto. This potential corridor appears to run through the 7.27 acres of property Home Depot has donated to the city for non-development. In their offer, Home Depot acknowledged that this property contains valuable wetlands at the headwaters of the creek. The value of this property is a sentiment shared by land-owner Pat Quigley, who has property adjacent to these wetlands and is concerned by their potential development (personal communication). This area is also classified as Class B(S) Wetlands in the Juneau Coastal Management Plan (2005) for the protection of Vanderbilt Creek.

If possible, it would be extremely beneficial to maintain this area for non-development. Due to the importance of these wetlands to the watershed, working with Home Depot to either 1) identify a feasible, alternative access location to keep the area completely free of development; or 2) ensure that road construction, should it occur, is completed in a fashion that minimizes impact to the surrounding wetlands and potentially even improves habitat along Vanderbilt Creek.