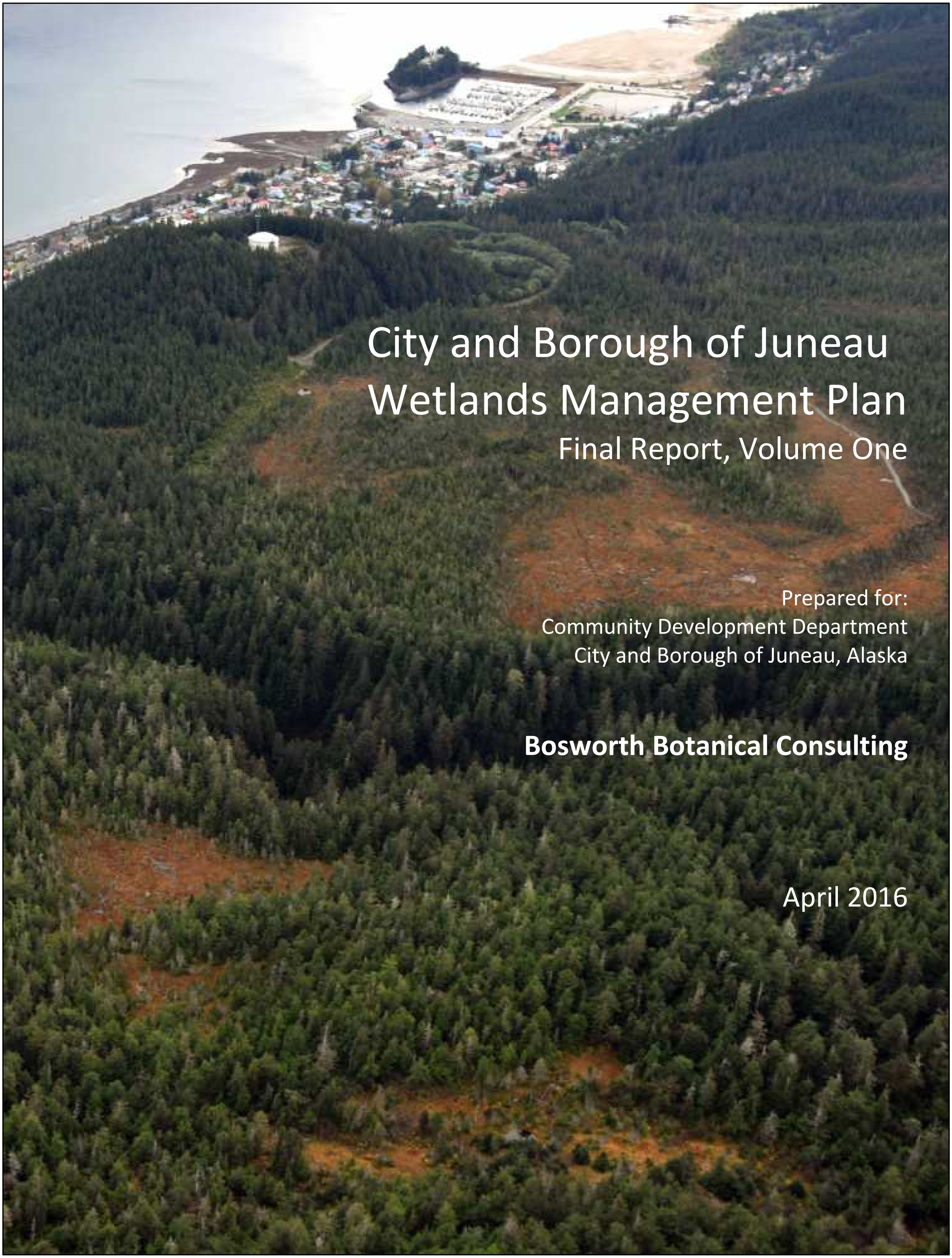

City and Borough of Juneau Wetlands Management Plan

Final Report, Volume One

Prepared for:
Community Development Department
City and Borough of Juneau, Alaska

Bosworth Botanical Consulting

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CONTENTS

List of Tables

List of Photos

Executive Summary

Following a long history of wetland management dating back to the 1980's, the City and Borough of Juneau, Alaska (CBJ) has produced this up-to-date 2016 Juneau Wetland Management Plan (2016 JWMP). Volumes One and Two provide rigorous wetlands mapping for undeveloped parcels covering more than 5,000 acres within CBJ. The study areas, called Priority Areas (PA's), were selected for their potential for future development based on low elevation and proximity to existing infrastructure. The wetland mapping, covering 72 PA's, is sufficiently accurate for site specific wetland resource information, strategic development and watershed planning. It can be used by landowners, agencies, wetland mitigation providers and the public for decision-making necessary for growth and development in CBJ. While the mapping is not an official wetland delineation typically required for proposed development, the accuracy is relatively high for a wetland inventory of a large area. During the 2014 and 2015 field seasons, 94 distinct wetlands were mapped, encompassing 13 tidal and 332 non-tidal wetland assessment areas (AA). AA's are wetland types assessed within the larger mapped wetlands and are therefore more numerous.

The second major component of the 2016 JWMP is wetland functions and values assessments for all of the 345 AA's. Up to 22 wetland functions and 18 wetland values were scored using the Wetland Ecosystem Services Protocol for Alaska—Southeast (WESPAK-SE), a peer-reviewed methodology developed by Dr. Paul Adamus in concert with CBJ and the Southeast Alaska Land Trust (SEALTrust). The scores compare the relative wetland functions (what wetlands do) and the relative wetland values (how they are useful or valued by society) among the entire population of assessed AA's. In concert with the wetlands mapping, the function and value scores allow decision-making at a more refined level, informing which wetlands are higher functioning and should be avoided, which wetlands are lower functioning and could be impacted with appropriate mitigation, and which wetlands are impaired and ideal for restoration. The 2016 JWMP does not provide wetland categories, however this would be a logical next step requiring community input to evaluate which wetland functions and values are most important within CBJ. This plan describes detailed approaches and examples of how to obtain categories from the WESPAK-SE scores.

The 2016 JWMP will be implemented with the site specific resource information it provides for the benefit of strategic planning and public education. It serves as a critical foundation for future data collection, developing wetland categories, and wetland management strategies that CBJ may pursue. As it incorporates a watershed approach, the plan aligns with the 2008 Federal Compensatory Mitigation for Losses of Aquatic Resources Rule (2008 Federal Rule). The plan also benefits wetland mitigation providers, such as mitigation bankers and in-lieu fee providers, by informing where suitable high value mitigation opportunities are located, which is mandated by the 2008 Federal Rule. The plan provides a comprehensive set of policies and implementing actions, including the potential for CBJ to collaborate with the Army Corps to help streamline wetland permitting and improve permit predictability. This would involve CBJ obtaining a Army Corps General Permit for expedited permitting for some or all wetlands within a defined area of the borough.

The 2016 JWMP Volume 1 contains a history of past plans implemented by CBJ, the evolution of WESPAK-SE as a wetland function/value methodology, the methods for wetlands mapping and functional assessment, results and information for interpreting the maps and scoring data, quality assurance testing, specific discussion on the anadromous fish function scoring and why it is important, opportunities and examples for developing wetland categories, discussion of how the plan can be used now and for future potential advancements or refinements, and general policies and implementing actions. Volume 2 contains the maps and function and value scoring data for the mapped wetlands and assessment units.

1.0 INTRODUCTION

This Juneau Wetland Management Plan (2016 JWMP), Volume One, provides results of wetlands mapping and wetland functional assessments within large and currently undeveloped parcels in the Juneau area. The study area included Priority Areas (PA) within CBJ. PAs were selected by the Community Development Department (CDD) for their suitability for potential areas of future development based on low elevation and proximity to existing infrastructure. The majority of the study area consists of CBJ-owned property. A few privately-owned properties are also within the study area. Field work was conducted during the spring and fall of 2014 and the summer of 2015.

Wetlands mapping in the study area was an on-the-ground survey effort, however not a detailed jurisdictional wetlands delineation. In nearly all areas, mapping involved physically walking wetland boundaries with hand-held Global Positioning System (GPS) units affording a high level of wetland mapping accuracy for CBJ planning purposes. Rapid functional assessments were conducted for each wetland Assessment Area (AA), in the field and from the office, utilizing the Wetland Ecosystem Services Protocol for Alaska – Southeast (WESPAK-SE). WESPAK-SE assesses 22 functions and 18 values provided by wetlands.

The purpose, scope, background, methods and results of this wetland mapping and assessment effort are included in Volume One. Additionally, uses of the 2016 JWMP as a site-specific resource, strategic development plan, watershed planning aid and education tool are explained in detail. Opportunities to further advance the plan for wetland categorization, and obtaining a Army Corps General Permit that would allow CBJ to manage some or all wetlands within a defined area are also discussed. Compliance with the 2008 Federal Rule on Compensatory Mitigation and the 2016 JWMP adherence to a watershed-approach are outlined in depth. Also included are policies and implementing action items that the 2016 JWMP aligns with, and that will potentially direct future efforts of the CDD. Rapid assessment scores and maps for each AA are found in the accompanying Volume Two.

1.1 Study Purpose

The wetland mapping and assessment project was developed to provide accurate information about the location and characteristics (functions and values) of wetlands on large and undeveloped parcels in the Juneau area. The information is intended to make land use decisions more objective, science-based, and efficient. Objective decision-making will result from knowing the comparative extent of wetlands and their functions and values. The science-based methods give the project credibility with agencies, stakeholders and the public. Efficiencies are obtained in reducing permit timelines and developing sound wetland mitigation approaches.

1.2 Scope

Primary tasks of this project include:

- Preliminary mapping of wetlands and AAs to plan and guide field efforts;
- Documentation of wetland boundaries using GPS coordinates;
- Post-field processing of GPS data: differential correction, archiving and exporting to shapefile;
- Mapping of wetland boundaries in Geographic Information System (GIS) using GPS results;
- Field and office-based assessment of wetland functions and values;
- Calculation of raw and re-scaled (normalized) wetland assessment scores;

The study area, encompassing about 1% of CBJ, was conducted within PAs shown on maps throughout this document and in Volume 2. The boundaries included areas CDD staff anticipate to be the main focus of development during the next 20 years, thus the majority of selected PA's are lower elevation landscapes with low or moderate slopes and have close proximity to existing or planned infrastructure. The scope also looks forward to future wetland management in the PA's by discussing how the functions and values scoring can be utilized to rank relative importance for avoiding and minimizing impacts to higher functioning wetlands during development, as well as where mitigation is most appropriate.

1.3 History

The CBJ has a long history of local involvement in wetland management. In the 1980's the CBJ established a study area and commissioned an evaluation of wetland functions based on the Adamus Wetlands Evaluation Technique (WET Method). In 1985, the CBJ formed a Wetlands Interagency Advisory Committee, which recommended a study to analyze and prioritize public and private wetlands within the CBJ for development and conservation; the study utilized was Adamus Resource Assessment 1987a, b, c. In 1992, the CDD used the results of this study to formulate the first JWMP. The JWMP was adopted by CBJ's governing board (herein referred to as the Assembly) in November 1992 and reissued with minor revisions in 1997 and 2008. The Assembly also appointed a Wetlands Review Board (WRB) composed of seven members from the public at large and two Planning Commissioners.

Prior to November 1992, wetland management in Juneau was primarily under the jurisdiction of the U.S Army Corps of Engineers (Army Corps). In 1992, in order to establish a stronger local role in wetland management, CBJ adopted the JWMP. Regulatory provisions of the JWMP were adopted into the CBJ Land Use Code by the newly formed WRB. This allowed for wetlands protection, public education and wetlands restoration and creation as the primary mitigating actions for wetland impacts. Following adoption of the JWMP into Land Use Code, regulatory provisions of the JWMP have had the full effect of federal law administered at the local level. The JWMP was recognized by the Army Corps and used at the federal level for decisions regarding local wetland fill permits and other management strategies for public wetland resources.

Under earlier versions of the JWMP, Juneau's wetlands were divided into four main categories: A, B, C, and D. Categories A and B were considered higher quality wetlands; C and D were considered lower quality wetlands. A fifth category, Enhancement Potential (EP) refers to wetlands with potential for enhancement projects. In 1994 the Army Corps signed a cooperative agreement with CBJ allowing the WRB to assume responsibility for all C and D wetlands, providing the WRB with local oversight and authority to grant a General Permit for wetland fill. CBJ continued to regulate Category A and B wetlands through building permits and land use permits. The Army Corps also retained permitting authority for the higher quality A and B wetlands, as well as any wetlands not otherwise classified under the JWMP or identified on existing wetland inventory maps. Any impacts proposed for A or B wetlands required an Individual or Nationwide permit to be issued by the Army Corps, granted within the standard federal regulatory procedure. CBJ also continued to regulate Category A and B wetlands, but only through building permits and land use permits.

The Army Corps continued to reissue local authority for General Permits in C, D, and EP wetlands from 1993 until 2011. In 2011, the Army Corps did not renew the General Permit because the vast majority of C and D wetlands (as identified on existing JWMP wetland maps) had been filled. CBJ pursued development of a mitigation bank from 1997-2008. In 2008, CDD and the Planning Commission concluded the effort was not feasible.

Following a $1.6 million grant award secured through the Federal Coastal Impact Assistance Program in 2012, CBJ scheduled updates to the JWMP to begin in 2013. Aerial imagery and LiDAR was acquired for the PA's in 2013. Draft stream maps were developed from LiDAR in 2015. Other significant grant requirements include methodology site testing, repeatability testing, scientific peer review workshops, a three-day training workshop, and an implementation guide. The assessment methodology was reviewed and approved by an inter-agency technical advisory group comprised of state and federal resource agency representatives: the Habitat Mapping Working Group (HMWG). Field mapping was conducted in 2014 and 2015, and a new 2016 JWMP, this document consisting of Volumes 1 and 2, was completed in 2016.

The 2016 JWMP, along with providing site-specific wetland resource information and strategic planning support and education, addresses new strategies for local wetlands management. This includes developing wetland categories for more rapid characterization and meeting requirements of the Army Corps' 2008 Federal Compensatory Mitigation for Losses of Aquatic Resources Rule, 33CFR Part 332 (2008 Federal Rule) for managing development impacts and mitigation in Juneau's wetland areas.

The 2008 Federal Rule established standards and criteria for the use of all types of compensatory mitigation, including on-site and off-site permittee responsible mitigation, mitigation banks, and in-lieu fee mitigation to offset unavoidable impacts to waters of the U.S. The 2008 Federal Rule outlines a general preference for the methods of mitigation. Another requirement is that a watershed approach must be used to establish compensatory mitigation requirements in Army Corps permits. In general, mitigation should be located in the same watershed as the impact site and where it is most likely to effectively replace lost functions and services while taking into account such watershed scale features as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources, trends in land use, ecological benefits, and compatibility with adjacent land uses. Where watershed boundaries do not exist, such as marine areas, an appropriate spatial scale should be used rather than watershed boundaries.

The issuance of the 2008 Federal Rule and it's requirement for a watershed approach has made the earlier 1992, 1997 and 2008 JWMP's obsolete, as these versions identified and managed wetlands but not in a watershed context. The 2008 JWMP update came out too late to meet the watershed approach standard in the 2008 Federal Rule. In addition, the expiration of the Army Corps' General Permit in 2011 and the need for broader and informed planning by CBJ has also supported the need for the 2016 JWMP.

Results of Volume 1 and 2 will be used by CBJ to target additional areas outside of those areas covered by the original JWMP, updating it to include more rigorous mapping and assessment methods. The study uses the WESPAK-SE assessment method developed under a federal grant to the Southeast Alaska Land Trust (SEAL Trust). In 2009 SEALTrust contracted an independent consulting firm, CH2MHill, to review 17 wetland rapid assessment methods potentially applicable to Southeast Alaska. The study found the Oregon Rapid Wetland Assessment Protocol (ORWAP) to be the most applicable to the region. ORWAP is a regionalized modification of Dr. Adamus' Wetland Ecological Services Protocol U.S. (WESPUS). WESPUS incorporates elements of other widely used rapid assessment methodologies, specifically the Hydrogeomorphic Approach and the Mellennium Ecosystem Assessment. WESPUS is a refinement of the first wetland assessment method used throughout the U.S., Wetland Evaluation Technique (WET), developed by Dr. Adamus in 1983. WET was the methodology used in the original JWMP in 1992. The 2009 study recommended that ORWAP be calibrated to Southeast Alaska conditions. In 2011 SEALTrust began working with Dr. Adamus to modify ORWAP to Southeast Alaska, which included extensive field testing and peer review, which resulted in WESPAK-SE, later refined through a federal grant to CBJ (Adamus 2012, Adamus 2013). The WRB and the HMWG, have formally approved the WESPAK-SE method for the project.

A more in-depth list of policies and implementing actions for the 2016 JWMP are included in Section 4.5 however, general goals of the 2016 JWMP and future efforts of CBJ, which rely on the wetlands mapping and assessments presented in Volumes One and Two, include the following:

- Promote consistency in wetland policies and regulations.
- Rank or categorize wetlands to identify high and low functioning wetlands.
- Maximize use of other sources of wetland mapping and functional assessment.
- Ensure the long-term scientific integrity of the JWMP.
- Promote long-range development strategies with the Army Corps and other partners to avoid, minimize and mitigate wetland impacts.

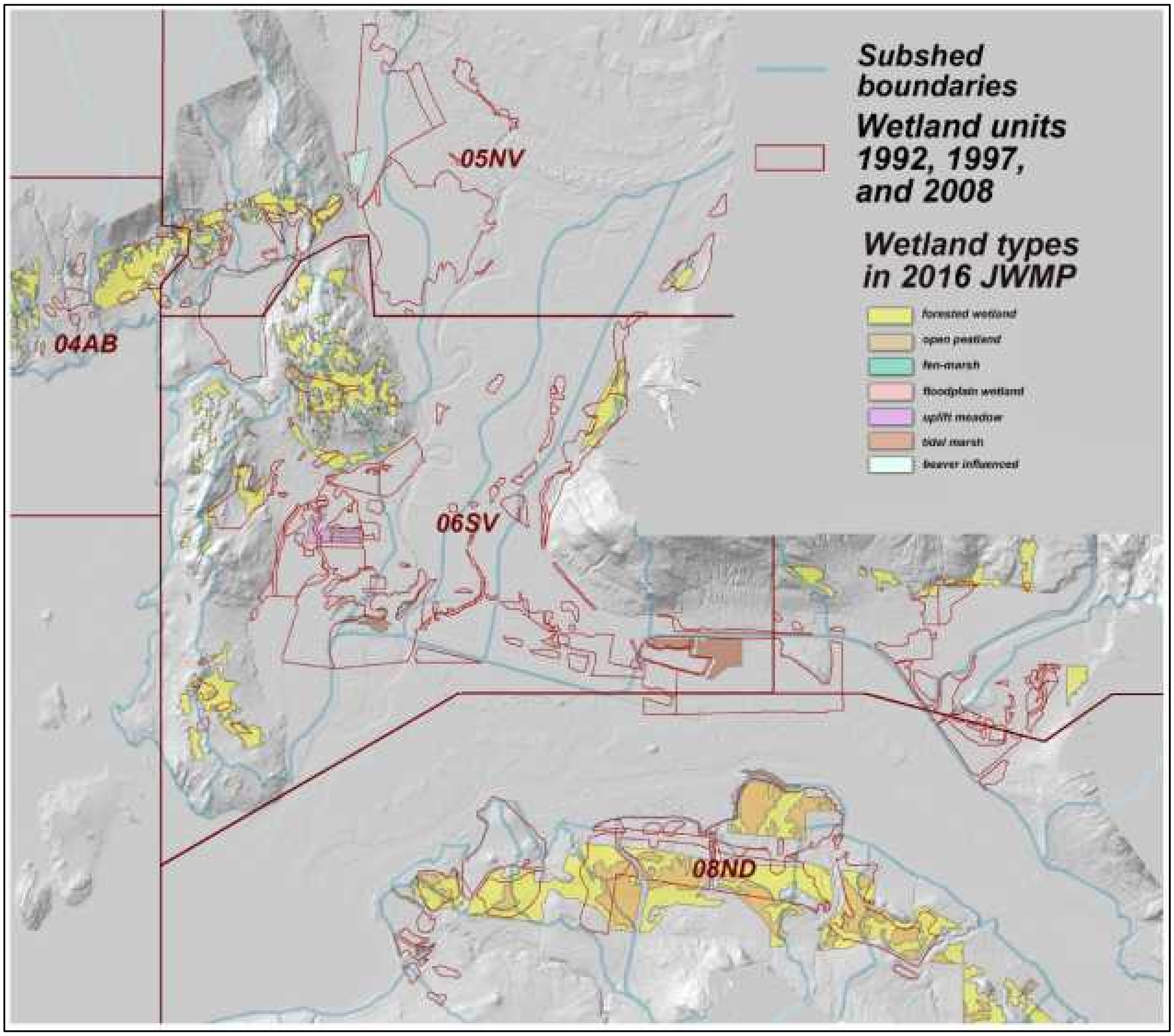
- Promote a variety of mitigation options for development in appropriate areas.
- Promote restoration opportunities in degraded wetland areas.
- Minimize adverse impacts to high functioning wetlands.
- Increase wetland permit predictability and streamline the permitting process.
- Provide informed decisions regarding protection and development of wetlands.
- Incorporate a diversified, watershed-based approach to protect and manage wetlands and minimize cumulative effects.
- Protect wetlands in or near anadromous water bodies, or adjacent to public water sources.
- Promote wetland education.

1.3.1 Comparison of 1992, 1997, and 2008 JWMP to 2016 JWMP

Table 1 provides a summary of major differences between the 1992, 1997, & 2008 JWMP and the 2016 JWMP, represented by Volumes 1 and 2.

Table 1: Comparison: 1992, 1997, and 2008 JWMP vs. 2016 JWMP

CATEGORIES	1992, 1997, & 2008 JWMP	2016 JWMP
Areas Covered	15-square mile area in the Juneau area; 141 wetlands mapped and assessed. No estuarine or tidal wetlands assessed.	Approximately 20-square miles of study area, including 94 distinct wetlands within 72 assessed PAs. Areas mapped and assessed are included in 10 map pages. Includes 15 estuarine or tidal wetlands.
Wetland Categories	Four categories from higher value (A or B) to lower value (C or D) and a fifth category for wetlands with EP.	No categories developed in Volumes 1 & 2, however framework provided to form categories based on function and value scores of wetlands
Wetland Mapping Methods	Based on 1986 Army Corps' mapping by aerial photo, with updates on case-by-case delineations or permit actions from 1986 to 1997.	On-the-ground GPS mapping of wetland boundaries on accessible properties, aerial photo mapping of wetlands on inaccessible properties, during the spring, summer and fall of 2014-2015.
Functional Assessment Methodology	Adamus WET technique with 14 separate functions for freshwater wetlands.	WESPAK-SE assessing 22 function and 18 values provided by seven wetland types.
Watershed Approach	Not specifically as all wetlands were mapped and assessed independent of the watersheds in which they were located.	Yes-certain functions, for example, relationship of any AA wetland to other wetlands, contains important elements of a watershed approach.

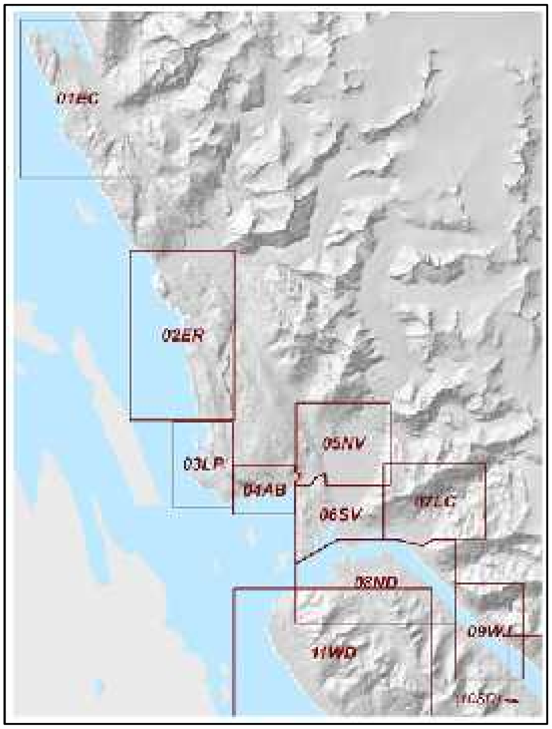


1.4 Project Area

The project area consists of 72 PAs; each assigned one of four levels of priority for mapping and assessment. The majority of the PAs are lower elevation landscapes with low or moderate slope; however some steep and/or higher elevation sites are also included. The tracts span from Cowee Creek at the northern end of Glacier Highway to southern Douglas Island. Vast and varied lowland wetlands on both sides of the Douglas highway are included, as well as large tracts along Fish Creek, at Eagle Crest, and on west Douglas Island.

For the purposes of this report, the areas mapped and assessed within 10 map pages. North to south, these pages are:

1. Echo Cove	(01EC)	6. South Valley	(06SV)
2. Eagle River	(02ER)	7. Lemon Creek	(07LC)
3. Lena Point	(03LP)	8. North Douglas	(08ND)
4. Auke Bay	(04AB)	9. West Juneau	(09WJ)
5. North Valley	(05NV)	10. West Douglas	(11WD)



Areas within CBJ's map page 10, South Douglas Island, were assigned lower priority for field efforts so were not included in the field surveys. Instead, they were mapped and assessed using a different, off-site method, described below in Section 2.3.4, Off-Site Assessments.

1.5 Wetland Functions and Values

The Federal Clean Water Act (CWA), under Section 404, requires regulatory agencies to consider a wetland's function and value when reaching decisions about permit approval and mitigation needs. Functions are what wetlands do naturally, such as store water, purify polluted runoff, and provide habitat. Dozens of functions could be described for any given wetland, but some are of unknown or limited importance to society and/or ecological resources, and others are difficult to assess. Therefore, most wetland assessments focus on a limited set of generally recognized functions and other attributes that are most relevant in a given region. Those considered having the greatest potential relevance to Southeast Alaska, and which therefore were assessed in this study and could be used to prioritize Juneau wetlands, are defined in Table 2 below. As contrasted with Functions, wetland Values describe the context of a wetland in a broader physical, biological, and social landscape, as well as addressing the extent to which one wetland function may contribute to others. Assessments of functions and values together help regulators evaluate whether altering a wetland may have a negative effect on people and/or ecosystems.

Table 2: The definition and values of the wetland functions assessed in this study

Function or Other Attribute	Definition	Values
Water Storage & Delay	Storing runoff or delaying the downslope movement of surface water for long or short periods.	Flood control, maintain ecological systems.
Stream Flow Support	Contributing water to streams, especially during the driest part of a growing season.	Support fish and other aquatic life.
Water Cooling	Maintaining or reducing temperature of downslope waters.	Support coldwater fish and other aquatic life.
Water Warming	Increasing the temperature of downslope waters and extending length of the aquatic growing season.	Maintain late-season ice-free conditions.
Sediment Retention & Stabilization	Intercepting and filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilizing underlying sediments or soil.	Maintain quality of receiving waters. Protect shoreline structures from erosion.
Phosphorus Retention	Retaining phosphorus for long periods (>1 growing season)	Maintain quality of receiving waters.
Nitrate Removal & Retention	Retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas while generating little or no nitrous oxide (a potent greenhouse gas).	Maintain quality of receiving waters.
Carbon Sequestration	Retaining both incoming particulate and dissolved carbon, and converting carbon dioxide gas to organic matter (particulate or dissolved), and then retaining that organic matter on a net annual basis for long periods while emitting little or no methane (a potent greenhouse gas).	Reduce risk of global climate warming.
Organic Nutrient Export	Producing and subsequently exporting organic nutrients (mainly carbon), either particulate or dissolved.	Support food chains in receiving waters. Facilitate

Function or Other Attribute	Definition	Values
		transfer of iron to marine waters.
Anadromous Fish Habitat	Supporting rearing or spawning habitat of fish species that migrate from marine waters into freshwater streams to spawn, e.g., coho and sockeye salmon.	Support commercial, subsistence, sport, and ecological values. Infuse uplands with marine nutrients.
Resident Fish Habitat	Supporting an abundance and diversity of native fish (both resident and visiting species) that are not anadromous, e.g., Dolly Varden and cutthroat trout.	Support commercial, subsistence, sport, and ecological values.
Invertebrate Habitat	Supporting or contributing to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	Support salmon and other aquatic life. Maintain regional biodiversity.
Amphibian Habitat	Supporting or contributing to an abundance or diversity of native frogs, toads, and salamanders.	Maintain regional biodiversity.
Waterbird Feeding Habitat	Supporting or contributing to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	Support subsistence, sport, and ecological values. Maintain regional biodiversity.
Waterbird Nesting Habitat	Supporting or contributing to an abundance or diversity of waterbirds that nest in the region.	Maintain regional biodiversity.
Songbird, Raptor, & Mammal Habitat	Supporting or contributing to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water.	Maintain regional biodiversity.
Pollinator Habitat	Supporting pollinating insects, such as bees, wasps, flies, butterflies, moths, and beetles.	Maintain forest productivity and food chains.
Native Plant Habitat	Supporting or contributing to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups.	Maintain regional biodiversity and food chains.
Public Use & Recognition	Prior designation of the wetland, by a natural resource or environmental protection agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, education, or research.	Commercial and social benefits of recreation. Protection of prior public investments.
Wetland Ecological Condition*	The integrity or health of a wetland, as defined operationally by its vegetation composition and richness of native species. More broadly, the similarity of a wetland's structure, composition, and function with that of reference wetlands of the same type and landscape setting, operating within the bounds of natural or historical disturbance regimes.	
Wetland Sensitivity*	A wetland's lack of intrinsic resistance and resilience to human and natural stressors (higher score = more sensitive).	
Stress Potential*	The degree to which a wetland has recently been altered by or is exposed to risk from factors capable of reducing one or more of its functions and which are primarily human-related.	

* These are other attributes of wetlands and are not considered to be either functions or values

2.0 METHODS

2.1 Mapping Wetland Boundaries

When an applicant applies for a permit to fill a wetland, by law, a determination must be made regarding the exact location of the boundary between what is wetland and what is non-wetland. For this study, wetlands were mapped only with an on-the-ground survey effort, NOT delineated as typically required for applicants. To be Army Corps-verified a wetland boundary delineation needs significantly more detail, including on-the-ground staking or flagging, wetland and upland determination plots and detailed data sheets, and a report prepared describing the effort. That level of detail was not within the scope of this effort. That said, the mapping followed the method required for wetland determinations for what is, and what is not, wetland, titled the Routine Determination Method according to the *Army Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987): Alaska Region (Version 2.0) (Army Corps 2010). For regulatory purposes under the CWA, Section 404, the Environmental Protection Agency (EPA) defines wetlands as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (EPA 2014). These three criteria were applied to map wetlands in the PAs described in this docudment.

Before wetlands were assessed, ArcGIS software, digital orthophotography, Light Detection and Ranging (LiDAR), and high resolution aerial imagery were used to predict potential wetland locations. Geo-referenced PAs and predicted wetland boundaries were uploaded to GPS units for real-time navigation on-the-ground. Predicted wetland locations provided a starting point for field analysis and were at times very close to reality on the ground. In most situations wetlands were found to be larger in the field than predicted using imagery. Wetlands were also found in locations that were not predicted by imagery or existing maps. Tidal extreme and mean high water lines were used for identifying wetland boundaries per the Army Corps' CWA lateral jurisdiction: 33 CFR 328.3e. Wetland data collected in the field was downloaded, archived, and post-processed daily. Post-processed GPS files were exported to Environmental Systems Research Institute (ESRI) ArcGIS shapefiles in the NAD 2011 State Plane projection and used to draw averaged wetland units presented in this report.

2.2 Mapping Wetland Assessment Areas

The CDD requested entire wetlands be divided into multiple wetland AAs if they were larger than one acre in size and met other specific criteria described below. This was requested for logistical reasons as some Juneau wetlands extend for many miles, which can potentially reduce the accuracy and utility of scores that might be assigned to the entire wetland.

Dividing an entire wetland into separate AAs is a subjective process, as boundary locations can dramatically influence the resulting scores. The CDD specified that guidelines in the WESPAK-SE manual be used as the basis for splitting AAs, and that no individual AA smaller than one acre be mapped or separated from its contiguous wetland (Adamus 2012). The project, in an effort to honor those guidelines and provide additional detail essential to enhance consistency, stated that AAs would be distinguished as follows:

a. Different wetland type using definitions in Form F of WESPAK-SE.

b. Different wetland system, class, or subclass as mapped by the National Wetlands Inventory using the Cowardin classification.
c. Road crossing or other persistently non-vegetated area.
d. Pre-existing data that shows clear differences in one or more functions within a possible wetland (e.g., anadromous fish in one intersecting stream but not another).
e. Convex topography or watershed boundary (e.g., portion of the precipitation hitting the wetland would flow in one direction and the rest would flow in the opposite direction due to a topographic mound within the wetland).

It was never intended that all the above rules be applied in all cases; rather, used as a guide. If *all* of the above criteria had been applied to the wetlands in the study area, the number of resulting AAs would likely have exceeded 1,000 and visiting and assessing a number that large would be cost prohibitive to the project. As a more realistic target, the CDD had suggested that 400 AAs within the study area be visited and assessed. Based only on interpretation of aerial imagery (LiDAR and orthophotos provided by the CDD) in the early phases of the project it was estimated the number of AAs in the study area would come closest to matching the target number if they were delimited only by criteria (a) and (e). Those criteria also best reflect the WESPAK-SE manual's statement that *"boundaries of the AA should be based mainly on hydrologic connectivity."*

As relates to criterion (a), the following seven wetland types were used to delimit separate AAs:

a. Tidal Wetland (*td*)
b. Forested Peatland (*fw*)
c. Open Peatland (*op*)
d. Fen/Marsh (*fm*)
e. Uplift Meadow (*um*)
f. Floodplain Wetland (*fl*)
g. Beaver-influenced Wetland (*bi*)

Definitions are found in Table 10 (Appendix) and illustrated in the WESPAK-SE *Short Guide* and manual, with one exception: Beaver-influenced wetland. While similar to Fen/Marsh and Floodplain Wetland, it differs in several important ways functionally, and meets the objective of representing a dramatically different hydrologic regime.

Subshed mapping Watersheds can be delimited at many spatial scales. For this study, models of stream networks were adjusted to an appropriate level of detail and used to delimit the watersheds, which were termed "subsheds." That is, wherever a wetland of a particular type was intersected by a significant watershed divide, the portions of the wetland draining to each stream were delimited as separate AAs despite being contiguous with each other and of the same wetland type. However, where application of this watershed criterion would have resulted in an AA smaller than one acre, no splitting was done.

Subshed mapping was done as-needed over the course of the 2014 field season. Near the end of the season, a similar, but borough-wide, streams model, received from CBJ, allowed fine-tuning of subshed boundaries. Some wetland units were merged (subsumed) and others split along basin divides. For more information on this process and criteria, see report entitled *subshedmapping.pdf* (Bosworth, Carstensen & Pohl, 2014b).

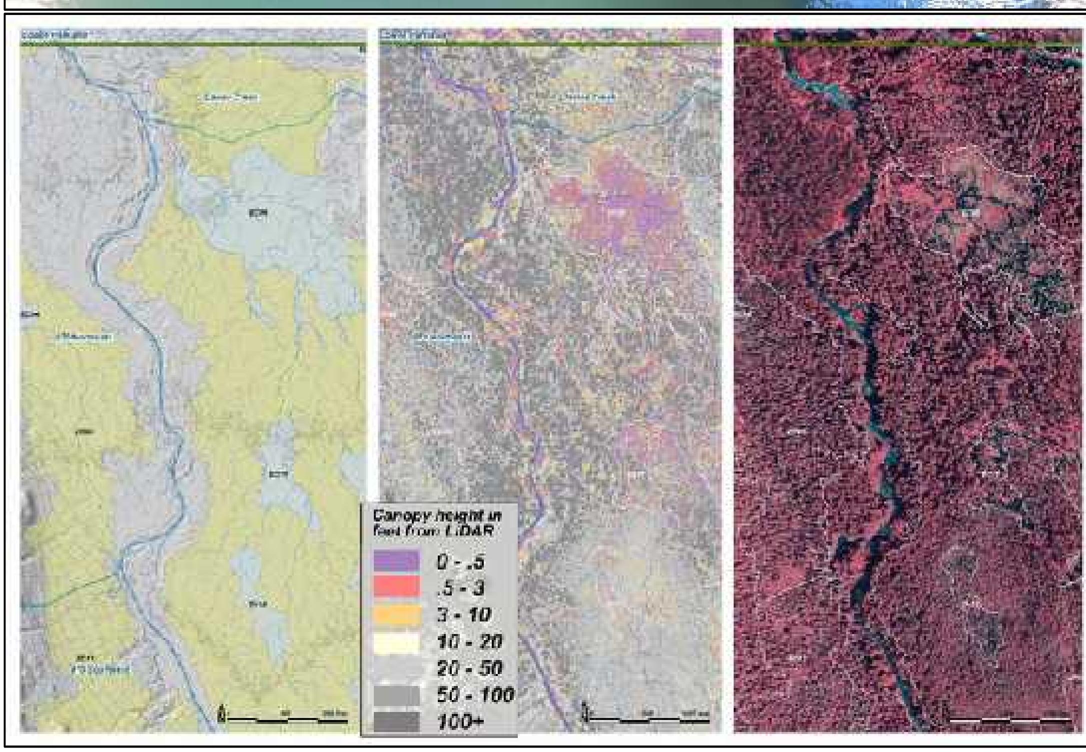
2.3 Assessing Wetland Functions and Values

WESPAK-SE is a standardized tool for assessing a wetland's functions and values as well as other attributes. It consists of data forms and a spreadsheet that computes a score for each function, value, or other attribute on a scale of 0 (lowest) to 10 (highest). Although many standardized tools are available for assessing wetland functions, the CDD selected WESPAK-SE because it is specifically customized for Southeast Alaska wetlands and has previously been tested and reviewed in Juneau and throughout the region. Additionally, consultants and agency personnel have been trained in its use.

WESPAK-SE does not measure wetland functions and values directly. Rather, it uses rapidly observable indicators to build a case for the relative level of a given function that may exist in a specific wetland AA (relative meaning relative to other wetlands in the study area). Indicators are used in lieu of direct measurement which would be extremely expensive and require years of data.

WESPAK-SE has both a field component and an office component. Completing both is essential in order for the tool to generate scores for each function and value. The implementation of these components is described below. Other features of WESPAK-SE, including its strengths and limitations, detailed accounts of its models, and descriptions of how it computes scores, are presented in the WESPAK-SE manual (Adamus 2012).

Photo 1: Cowee Creek



Cowee Creek valley depicted using: (left) hillshade with modeled streams and 10-foot contours generated from a LiDAR-based digital elevation model; (center) normalized vegetation imagery colored by total vegetation height class; and (right) color infrared using 6-inch pixel orthophotography. Wetland unit outlines depicted in all three maps are the final surveyed boundaries.

2.3.1 Field Component

The orthophotos and derivatives of LiDAR products provided by CDD helped field crews navigate to the AAs, locate features within each AA to assess, find inflow and outflow channels, and estimate gradients. Field data was collected by up to five team members, often in two teams. The field portion of the WESPAK-SE assessment typically required less than two hours to complete during a single visit, while mapping wetland-upland boundaries with GPS required from one to several days depending on size, remoteness, and character of the wetland area. Typically, one team member conducted a set of assessments and took photos, while the other crew member(s) located and documented the wetland boundary using GPS. Team membership and roles varied throughout the field season, which ran from May 8, 2014 to mid-October 2014. A few remaining assessments were completed in June 2015.

The orthophotos and LiDAR provided by CDD were helpful in ensuring accurate estimation of several indicators of wetland functions. These images and data layers were reviewed before completing each AA's WESPAK-SE data forms. In particular, they measured wetland and stream gradient; located small streams, beaver dams, and topographic indicators of groundwater discharge, and measured tree heights and percentages of conifer vs. deciduous vegetation and tree vs. shrub cover.

2.3.2 Office Component

The WESPAK-SE office forms require a WESPAK-SE user to access and obtain many types of data from an internet portal assembled specifically for WESPAK-SE by Southeast Alaska GIS Library (http://seakgis.alaska.edu/flex/wetlands/). However, when large numbers of wetlands need to be assessed, efficiencies can be gained by using desktop GIS software to query the same or similar spatial data layers— as was done for this study. A set of improved and additional GIS layers tailored to the needs of this project were developed, along with a guide to its use (Bosworth, Carstensen & Pohl, 2014c).

2.3.3 Normalizing the Scores

Although each of the models WESPAK-SE uses to assign scores has a theoretical minimum score of 0 and a maximum score of 10, in practice when WESPAK-SE is applied to a large number of wetlands the actual range for any given function, value, or other attribute is usually narrower. Depending on the function or value, the resulting range of raw scores found among all sites may be broad (e.g. 1 to 9) or narrow (e.g. 3 to 8). After all field data had been collected and raw scores calculated, they were converted mathematically to a common zero to 10 scale for ease of interpretation and rough comparison. This is termed normalizing. The normalizing of scores for a given wetland AA was done by comparing its raw scores with the range of scores determined for all of the assessed AAs. A formula was then applied using the range of raw scores for each wetland function and each wetland value among the 332 non-tidal AAs and then separately for the 13 tidal AAs. Again, note that raw scores were normalized to those from the population of local wetlands visited by this study, not to a range of raw scores from all Juneau wetlands or to wetlands throughout Southeast Alaska.

After scores were computed and normalized, a descriptor (Lower, Moderate, Higher) was placed next to each function and value score. For a given function or value, natural breaks in the statistical distribution of scores among all assessed sites in the PA were used to determine whether to characterize a score as Lower, Moderate, or Higher. Natural breaks were identified using a popular statistical procedure called Jenks Optimization (Jenks 1967). Using iterative calculations with gradual adjustments in group membership, the method minimizes variance within groups while maximizing the variance between groups.

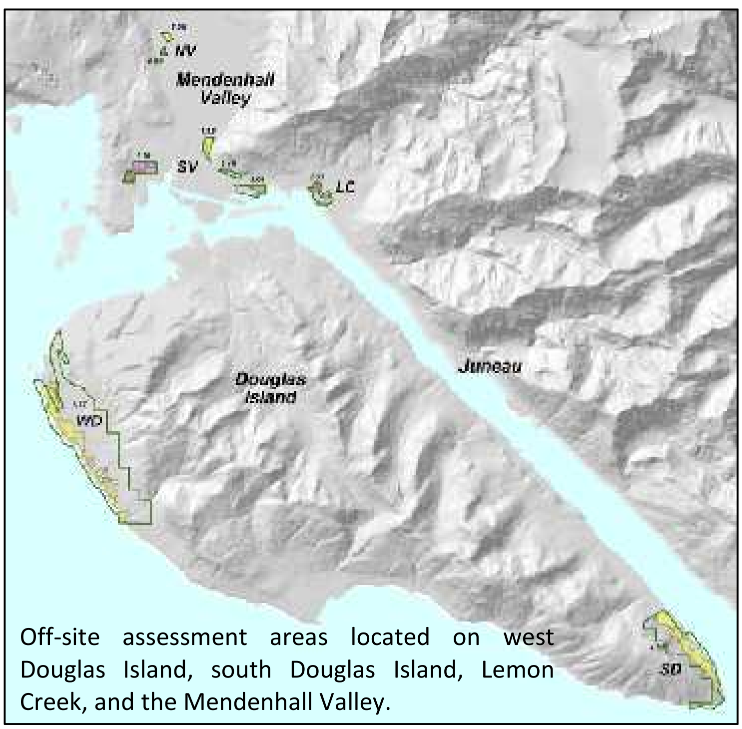
2.3.4 Off-site Assessments Methodology

A number of the parcels chosen by the CDD for potential mapping and assessment in this project could not be assessed on-site because CDD did not receive written landowner permission to visit the property. The CDD asked the study team to map and assess 12 of these private parcels, which would have to be assessed off-site, meaning no on-the-ground mapping was done. Additionally, one other CBJ parcel located on South Douglas Island, with difficult access, was also done as an off-site assessment. The off-site assessments are useful to landowners and CDD planning to get a better sense of the overall extent and configuration of wetlands, for example within the same watershed, beyond the borders of the PA's where wetland systems may extend over broader areas. For example, a future road alignment plan may need to take in consideration off-site wetlands that are located outside the PA's, but would have to be avoided due to large size or high function and value.

As with the pre-field mapping of onsite areas, the CBJ's 2013 high-resolution aerial imagery and LiDAR- derived digital elevation models and it's associated products were used in estimating the wetland boundaries for off-site areas. For open peatlands, fen/marshes, uplift meadows and tidal wetlands this method worked well, but because of their closed tree and shrub canopies, mapping forested wetlands was more challenging.

Off-site wetlands were further divided, when necessary, into assessment areas (AA's) using the same two basic criteria as the on-site wetlands - wetland type and sub-shed. Completing the office form component of the assessment was no different than for the on-site assessments but, there were some questions on the field form that were more difficult off-site. However, by referring to the combination of: "normalized vegetation," high-resolution stream maps, hillshade, contours and color infrared orthophotography, most of the field form questions could be answered, albeit with less confidence than when sites were visited in the field.

The raw scores of wetlands assessed off site were normalized, not by comparison with all assessed Juneau wetlands, but rather by comparison with the other wetlands assessed off site. The numbering convention for off-site AA's uses the same map page conventions as on-site AA's but "of" is appended—e.g. SD01of'.



Off-site assessment areas located on west Douglas Island, south Douglas Island, Lemon Creek, and the Mendenhall Valley.

Table 3: Off-site units and acreages by wetland type

Wetland Type	Total AAs	% AAs	Total Acres	% Acres
td	7	15%	112	13%
fw	23	48%	657	74%
op	10	21%	28	3%
fm	1	2%	5	1%
um	5	10%	74	8%
fl	0	0%	0	0%
bi	2	4%	11	1%
Totals	**48**	**100%**	**887**	**100%**

2.3.5 Quality Assurance

Several procedures were undertaken throughout the duration of the project to ensure the quality (consistency and accuracy) of the collected WESPAK-SE data. These include but are not limited to ones described below.

Data Entry

As WESPAK-SE field assessments were completed, data was double-entered into the standard spreadsheet. An Excel script automatically flagged entries that were in conflict. The hard-copy data form was then referred to in order to resolve any discord. Data entry proved highly accurate so double entry was discontinued mid-season.

Repeatability of Results

The repeatability of WESPAK-SE scores among independent users visiting the same wetlands had been tested previously in 2013 with generally good results (mean error of + or - 0.86 on a scale of 0 to 10). Repeatability testing was conducted again at the start of the 2014 field season and the results demonstrated a higher overall level of consistency.

All office-based portions of the wetland assessments were completed using ESRI ArcMap desktop GIS software along with locally tailored and enhanced data layers specific to the project area. To check accuracy of the office form portion of the wetland assessment protocol, office assessments were completed independently by another person for four separate AAs using similar data layers via the University Alaska Southeast online WESPAK-SE wetlands portal and Google Earth. No inconsistencies were found.

Clarifications and Interpretations Provided for WESPAK-SE: Field Questions

To help maintain consistency among assessments, field form interpretations and clarifications prepared by the WESPAK-SE author were used and are noted below.

<u>**Non-tidal Wetlands**</u>

Definitions of wetland types that comprise the choices for the first question of the non-tidal field form were clarified and refined as follows:

- Forested Peatland was clarified to include *muck* (either mineral or organic muck) as well as peat soil.
- Uplift Meadow was refined as *usually less than 30% tree canopy cover.*
- Open Peatland was clarified as having *less than 5% cover of trees* (in addition to already specifying less than 30% cover of woody plants over 3 feet tall).
- Definition of Fen/marsh was clarified similarly.
- Fen/marsh was described with additional examples of regionally common emergent plant species (*marsh marigold*) and settings (*often beaver-created or adjoining larger water bodies*).

Several clarifications were also made to other WESPAK-SE non-tidal field form questions to ensure consistent and intended interpretation:

- For question F9, loose muck was included as part of water depth. In question F12, the flat shoreline extent is expressed as percent of shoreline length.
- In question F21, the color of water is more specifically described as tea-stained.
- Inflow, in question F25, was clarified to mean surface water that at least once annually, flows from a stream or ditch longer than 300 feet (before it reaches the AA) or in a pipe or hardened conduit, directly or as overbank floodwater.
- The flow complexity choice in question F28 is to be selected for most of the flowing water or the choice producing the greatest friction, rather than the first applicable description.
- For question 31, part b concerning flow into a soil pit was disregarded.

● Question F43, Moss Extent, refers to the percent of the vegetated ground cover comprised of peat- forming moss (excluding moss on trees or rocks).
● Upland inclusions, F46, can be mounds of any type of upland soil. Invasive species (F54) can be woody or herbaceous.
● Shorebird feeding habitat, question F48, is further defined as non-acidic water shallower than 4 inches.
● In question F54, the slope from disturbed lands is to be considered uphill of the unit, or adjoining it if there are none.
● For F55 (Weed Source), the upland edge can be in any direction, not just uphill.
● For question 63, non-consumptive uses, walking refers to walking access for an average person. Interpretive centers, trails with signs or brochures, or regular guided tours apply only if within .25 mile of the AA and if they interpret the natural features of the AA or associated lands.
● All hunting is to be included (question F68) with waterfowl hunting; known berry picking areas are to be included with harvesting of native plants.

Tidal Wetlands

The definition of Tidal Wetland includes tidal freshwater as well as saline areas. "Dominated by emergent herbaceous or woody plants" was interpreted simply as "*dominated by vascular plant cover (excluding submerged aquatics).*" The criterion "level of surface water fluctuates every ~6 hours" was interpreted to mean *only when surface water is present,* which may be as little as once annually. *"Driftwood"* (Tidal Form question 12) refers to largely horizontal logs on the ground near the high water line. "*Large woody debris*" refers to wood such as root masses, large trunks and branches carried into the unit by currents or fallen from adjacent uplands.

Photo 2: Tidal wetland on north Douglas Island.

2.3.6 Limitations

Known limitations of the WESPAK-SE tool used to score this study's wetlands are described in the WESPAK-SE manual and will not be repeated here. In addition, the following is a partial list of other significant limitations:

- In nearly all instances, and as a result of time and budget constraints, wetland AAs were visited only once during the two-year field component of this project. This has the potential to affect the location of some mapped wetland boundaries but especially, the scores resulting from use of WESPAK-SE. To address this, the study teams used observable indicators and previously-acquired knowledge of the project area's climate and geology to interpret conditions that were not directly observable on the day of the visit.

- Although federal wetland delineation criteria served as a guide for mapping wetland boundaries in the field, test plot data routinely required for formal wetland delineation were not collected or recorded. Doing so over such a large area was not possible within the time frame and funding constraints of the grant that supported this project. For this reason, wetland boundaries and locations presented in this report are to be considered approximate; they provide an inventory of wetland resources rather than a delineation of wetland boundaries. Data presented in this report normally cannot be considered "final" for use in applications for wetland alteration permits. Primarily, it is intended to be used for land use planning

- Considerable variation in vegetation, water regime, and ultimately function may occur *within* a wetland. For example, a Forested Peatland could be split by form (shrub or tree) and/or foliage (deciduous or conifer), and Tidal Wetland could be split into low marsh (inundated daily) versus high marsh. In this example, splitting Forested Peatland into finer components could provide more-refined information useful for assessing biodiversity at broader scales. It could also indicate which areas within a wetland AA contribute more or less to its function score. However, using a wetland classification any finer than the current seven-class one, even if such existed, was beyond the time and budget constraints of this project. It is likely that much of the variation within the project wetlands that is important for predicting their functions was captured by the 126 questions in the WESPAK- SE tool.

- The office form component of the WESPAK-SE score calculator requires the use of spatial data obtained from resource agencies. The resource agencies typically make no claims as to the completeness, accuracy, precision, or recentness of the spatial data they provide. Nonetheless, excluding the data entirely from these wetland assessments would result in much poorer estimates of wetland function. The data obtained from other agencies have varying levels of influence on the scores and ratings of the wetlands described in this report. The degree of influence depends on which function is being assessed.

- Although it is not possible to state with certainty the length of time the scores of any wetland AA will remain valid, a best estimate suggests approximately 10-30 years. A more exact estimate would depend on forecasting the likelihood of short and long-term changes in climate, uplift from glacial rebound, new debris flows or roads, beaver activity, natural succession of vegetation, development-related land cover changes in nearby areas, and a host of other factors. A particular wetland's capacity to resist functional change in response to these factors cannot be predicted, nor can the functions which would be most sensitive to these factors be identified beforehand. Major changes in any of these factors that are apparent in a wetland or within a few miles of that wetland, especially along connected streams, could suggest a need to reassess the wetland using the same version of WESPAK-SE used in this study.

- The indicators and models featured in WESPAK-SE are intended to represent wetland science as it currently exists. As with all science, continued research in this region and elsewhere could yield new discoveries that might suggest a need to change some of the indicator variables and assumptions currently embedded in WESPAK-SE. It is recommended that new spatial data sets and new information about wetland science be reviewed at least once every 10 years and their impact on WESPAK-SE models, scores, and ratings be evaluated. However, any future changes made to the indicator variables WESPAK-SE uses, the wording of its questions, or the weights and combination rules of its models, will require that all the wetland AAs covered by this study be reassessed and re-categorized. That would be true regardless of which methodology had been used in this study.

- WESPAK-SE was used to assess 94 wetland units for the 2016 JWMP. Function and value scores are limited to the attributes of wetlands within the priority area boundaries defined by the 2016 JWMP. Therefore, function and value scores will change when wetlands outside the priority area are added to the study, or if wetland units are found to be located within the priority area boundaries but inadvertently overlooked during 2014 fieldwork for the 2016 JWMP.

3.0 INVENTORY OVERVIEW

3.1 Acreages, Wetland Distributions

During the 2014 and 2015 field seasons, 94 distinct wetland units were mapped within 72 PAs, dividing these into 345 units and covering 5,204 acres. Within these, the functions of 13 tidal and 332 non-tidal wetland AAs were assessed. The PAs surveyed were as follows: 13 of 21 in Priority I Area; 23 of 27 in Priority II Area, and 24 of 27 in Priority III Area. Two AAs surveyed on request from private owners were located outside of any PA.

PAs not covered in the wetland surveys included 15 priority I, II, & III private parcels (eight priority I; four priority II; three priority III); the private-land portions of three priority I areas, including a large area on the west side of Douglas Island; and the three priority IV areas.

Wetlands mapped totaled 5,584 acres, or 44% of the 12,717 acres of PAs surveyed. The most extensive wetlands occurred on level, poorly drained marine terraces, notably the raised benches of North Douglas (87%), West Juneau (67%) and West Douglas. To give a more realistic percentage for West Douglas, the estimated acres from off-site assessments on private lands seaward of CBJ property were added. Because this side of the island was more wave exposed at time of deposition (~9000 to 12,000 years ago), sediments are coarser, and wetlands fewer, with much less open peatland.

Underlying these patterns in wetland distribution are the geographic constraints governing PAs the CBJ wanted investigated. Steep slopes pose challenges to construction and are also avoided due to liabilities such as post-logging erosion and impacts to streams downslope. This drives PA selection toward low-lying landforms whose drainage characteristics depend on sediment size, which in turn stems from glaciomarine history. Most of the flat but well-drained alluvial, deltaic or coarse-till surfaces in the CBJ were developed by the 1970s. Remaining flat or gently rolling terrain is generally blanketed by marine fines, raised above sea level millennia ago. These sediments are referred to locally as "blue clay," and while they typically contain more silt than clay-sized particles, they generally support open or forested wetlands.

Least wetland cover (28%) was found on PAs within the Lemon Creek (LC) Map Page. Considerable portions of these units occupy fairly well-drained toeslope (colluvial) positions. Forested Peatlands comprise the large majority (76% by acreage) of wetlands within the study PAs. Many of the forested wetlands had small, well-dispersed hemlocks with large gaps between tree crowns, resulting in brushy understories over an herbaceous layer dominated by skunk cabbage. Wetlands with skunk cabbage were also present, however, in larger closed-canopy hemlock forest, often on moderate slopes, and in large-tree riparian spruce forest.

Second most common (15%) are open peatlands (*op*), typically with very deep, saturated sphagnum or sedge/sphagnum peat. These ranged from recently uplifted tidelands (*e.g.* Amalga) to ancient peatlands. They varied from nearly flat sphagnum-dominated bogs to sloping spike rush-dominated, pond-studded fens with orchids.

The remaining five wetland types are relatively rare, collectively constituting only 8% of the total by acreage, and 24% by number of mapped units. Such low percentages do not mean these wetland types are ecologically insignificant. Beaver wetlands (*bi*) support rich fish and wildlife traffic. Uplift meadows (*um*) are Juneau's most globally unique habitats on the most heavily developed landform. Tidal wetlands (*td*) are uncommon within the surveys because few assigned PAs overlapped tidelands.

If the AA boundaries based upon differing wetland type or subshed (*i.e.* hydrologic divide) were dissolved, the total number of discrete wetlands assessed drops from 345 to 94.

The models utilized to generate the WESPAK-SE scores are explained in detail in the WESPAK-SE Manual.

3.2 Wetland Categories for Plan Implementation

Establishing wetland categories is potentially useful in implementing the JWMP. However, at this time, CBJ will not establish specific wetland categories that indicate high value (A and B) or low value (C and D). This option may be considered at a later date before or after the JWMP is finalized. The reason CBJ has chosen not to establish categories at this stage is categorization requires a public discussion, among agencies, stakeholders and the public, of the relative value of different wetland functions (for example, whether salmon habitat or flood control/water storage has more value to society). The wetland mapping and WESPAK-SE assessments presented in the previous chapters provide a body of science-based information on the functions wetlands provide in the CBJ; a key tool necessary for the categorization process to be successful. The process of reaching wetland categories is a collaborative process with CBJ staff, policy makers, and stakeholders to agree upon a prioritization of wetland functional values.


Photo 3: Fen-marsh near Amalga Harbor

3.2.1 Options for Summarizing a Wetland's Relative Importance

In order for the CBJ to make consistent decisions regarding wetlands, a procedure is needed that specifies how to use WESPAK-SE scores to evaluate and compare wetlands. A single score or rating derived from the 40 functions and values assessed by WESPAK-SE for an individual AA affords decision makers a consistent tool to manage wetlands within the CBJ. The challenge is how best to combine into a single score or rating the 40 scores that WESPAK-SE generates for an individual wetland. WESPAK-SE provides science and statistics for wetland analysis; these must be paired with policies or preferences of agencies and elected officials to provide meaningful rules.

To date, CBJ has not adopted a detailed procedure for summarizing a wetland's relative importance from the assessment scores provided by WESPAK-SE. Creating a wetland rating system will involve using the 22 functions and 18 values that WESPAK-SE produces for each wetland and combining those numbers into an overall wetland score in a manner that does not distort the information. Input from resource agencies, stakeholders, and the public will be required for this task.

To begin a discussion for combining scores for multiple functions and values into one overall score per wetland, three questions must be addressed:

1) Should the overall wetland score reflect functions, values, or both functions and values? What weight should be given to values as opposed to functions?

2) How should scores for different functions and their values be combined to yield an overall wetland score?

3) For converting a wetland's overall score to a rating, should that score first be placed into one of three groups (e.g., Lower, Moderate, Higher) or four (e.g., A, B, C, D), or an alternative grouping?

Question #1

Consider the function and value scores, and function ratings, for "Anadromous Fish Habitat" calculated from eight wetlands in the JWMP:

Table 4: Function, Value, and Rating Scores for “Anadromous Fish Habitat” for eight of the AAs

Site ID	Function score (normalized)	Function rating	Value score (normalized)	Value rating
ER08	8.44	Higher	8.17	Higher
ER71	10.00	Higher	6.67	Moderate
WD15	9.09	Higher	1.75	Lower
ER07	7.26	Moderate	8.67	**Higher**
ER02	4.28	Moderate	6.67	Moderate
EC49	6.19	Moderate	0.50	Lower
ER66	1.55	Lower	6.67	**Moderate**
AB01	0.00	Lower	0.00	Lower

Function, in this instance, refers to the likely capacity of each wetland to support anadromous fish based on access and the presence of surface water. If anadromous fish cannot access a wetland or if the wetland never has surface water then the function score is 0. That does not mean they are unimportant to anadromous fish. At least some of those AAs help support fish habitat downstream by maintaining water temperature and the flow of nutrients and invertebrate foods to downstream fish habitat that is accessible. Those functions are scored and rated separately at this stage of the calculations and so are not shown in this table. Function scores for wetlands accessible to anadromous fish depend mainly on the estimated duration of their stream connection, their hydrologic regime, habitat structure, productivity, absence of man-made features likely to harm fish, and the condition of adjoining riparian habitat. The specific indicators (e.g., large wood in channel) that define these broader attributes (such as habitat structure), and the manner in which they were estimated visually and combined, are described in the WESPAK-SE manual and spreadsheet calculator.

Value of Anadromous Fish Habitat in any wetland is automatically assigned a 0 if the Function score is 0 due to no fish access. For all other wetlands, the Value of the wetland's Anadromous Fish Habitat is considered more important if the wetland:

- is predicted to provide good habitat for two other functions (the AA's scores for Waterbird Feeding Habitat and Songbird-Raptor-Mammal Habitat are averaged), or,
- is visited more frequently or there is evidence of fishing, or,
- is located within one of the higher-scoring watersheds for anadromous fish habitat in all of Southeast Alaska as denoted in the "Conservation Assessment and Resource Synthesis for Southeast Alaska," sponsored by Audubon Alaska and The Nature Conservancy (Schoen and Dovechin 2007).

The maximum of these three is what determines the Value score. Thus, a wetland with fish access can still receive a high Value score if it lacks of one of them. However, if the AA cannot be accessed by anadromous species, its Value score is set at 0 (because its Function score will be 0), regardless of whether it is located in one of the higher-scoring watersheds.

In Table 3, note the two AAs (ER07 and ER66), whose Value score is higher than their Function score. A wetland would be considered to be of higher value if it provides only mediocre habitat is because Function and Value use different criteria, and partly because there is no consensus as to how much a Value score should be increased if a Function score is relatively large. Similarly, in the opposite situation (site WD15, whose Value score is lower despite the site scoring high for Function), there is no consensus as to how much (if at all) the Function score should be lowered because its Value score is low.

One option for wetland rating would be to always use the Function score and/or rating to represent a site's Anadromous Fish Habitat unless the site's Value score or rating for Anadromous Fish Habitat is greater. In those rare cases (3 percent of the study wetlands) the average of the two scores could be used to represent Anadromous Fish Habitat. Alternatively, the function score could be increased by some uniformly-applied percentage any time the value score is greater than the function score.

A second option is to ignore the value score entirely and use only the function score to represent a site's Anadromous Fish Habitat. In those cases, there is a risk that fish-accessible wetlands whose watersheds provide some of the best overall habitat for anadromous fish in Southeast Alaska could potentially score lower than fish-accessible wetlands in watersheds that are unremarkable overall for anadromous fish habitat. For this reason, the second option is not recommended. Indicators and criteria used to determine the value score of the other wetland functions considered by WESPAK-SE are described in the WESPAK-SE manual.

Table 5: AAs Having Different Combinations of Function and Value Ratings for “Anadromous Fish Habitat”

Function Rating	Value Rating	# of AA's having that combination	%
Higher	Higher	6	2%
Higher	Moderate	25	8%
Higher	Lower	2	1%
Moderate	Higher	8	2%
Moderate	Moderate	26	8%
Moderate	Lower	6	2%
Lower	Higher	0	0%
Lower	Moderate	2	1%
Lower	Lower	256	77%

Photo 4: Fish Creek on west Doulas Island

Question #2
With regard to this question, several options for calculations are shown at the bottom of Table 5.

Table 6: Normalized function scores and ratings for four study area wetlands, with results of six options for calculating an overall score for each wetland

	Site:	ER71		ER02		ER09		ER08	
Group	Function	Score	Rating	Score	Rating	Score	Rating	Score	Rating
1	Anadromous Fish Habitat	**10.00**	H	4.28	M	0.00	L	**8.44**	H
	Resident Fish Habitat	8.60	H	7.09	M	6.61	M	7.48	H
2	Carbon Sequestration	2.65	L	6.87	H	**7.09**	H	2.83	L
	Nitrate Removal	4.84	H	2.12	M	1.84	L	3.11	M
	Phosphorus Retention	3.78	M	3.83	M	4.20	H	3.55	M
	Sediment Retention & Stabilization	3.81	M	2.59	M	6.22	H	4.88	H
3	Invertebrate Habitat	6.22	H	2.75	L	1.88	L	2.23	L
	Organic Nutrient Export	7.32	M	5.35	L	4.51	L	6.57	M
	Stream Flow Support	2.57	L	0.42	L	0.50	L	4.29	M
	Water Cooling	4.85	M	4.28	M	4.60	M	7.51	H
	Water Warming	4.12	M	2.94	M	0.00	L	1.26	L
4	Water Storage	3.98	M	5.96	H	2.56	L	5.90	H
5	Amphibian Habitat	1.55	L	4.04	M	4.36	M	2.90	M
	Waterbird Feeding Habitat	8.07	H	6.33	H	6.71	H	0.00	L
	Waterbird Nesting Habitat	5.61	M	3.86	M	0.00	L	3.98	M
6	Songbird, Raptor, & Mammal Habitat	4.76	M	**7.30**	H	5.19	M	7.53	H
	Native Plant Habitat	4.85	M	4.55	M	3.23	M	5.86	H
	Pollinator Habitat	2.31	L	4.97	M	1.77	L	3.09	L
	Option 2a. Average of All	4.99		4.42		3.40		4.52	
	Option 2b. Maximum of All	10.00		7.30		7.09		8.44	
	Option 2c. (Average + Max)/2 of All	7.50		5.86		5.25		6.48	
	Option 2d. Group Averages, then Average Groups	5.19		4.83		3.35		4.94	
	Option 2e. Group Averages, then Max of Groups	9.30		5.96		4.84		7.96	
	Option 2f. Group Max's, then Average Groups	6.51		6.48		5.46		6.37	

- In the table's Options 2d-f, the functions are placed into thematic groups before doing the final calculations. If the CDD wishes to form such groups that are intermediate in the calculations of each site's overall score, the membership of the groups may be changed or stay the same as shown here. The grouping in this table, while recommended, is mainly for illustration.
- The CDD may choose to use weighted averages rather than plain averages, with weights for the more important wetland functions decided by the CDD after public input.
- In any of the summarizing calculations, the CDD may choose to include the scores of either or both of two other attributes calculated by WESPAK-SE but which are not truly wetland functions and thus were not shown in the table. Those are: Public Use & Recognition, and Wetland Sensitivity.
- Once a particular option is chosen, the overall scores of all assessed sites must be normalized (adjusted mathematically to ensure they fully span a 0-to-10 scale) and then converted to ratings by using the

recommended statistical procedure (described in section 2.3.3) to identify natural breaks in the distribution of overall scores among those sites.

- The CDD may choose to weight an AA's overall score by the size (area) of either the AA or of the AA plus its adjoining AAs, if any. The CDD may also choose to weight an AA's overall score by the AA's proximity to public roads, with the assumption that AAs closest to roads are most attractive for development, all other factors being equal. In calculations associated with either option, the CDD must decide whether to weight an AA's overall score based on WESPAK-SE equally with either or both of these factors.
- Any score combination procedure which involves use of averages, maximums, or percentiles will introduce some statistical distortion because the score distributions of different functions differ. Some functions skew high overall, others low; this is due both to differences among functions in the overall capacity of local wetlands to perform those functions and to the structures of the function models. While efforts have been made to reduce this distortion, some is inevitable.

For the sites in Table 7 the calculation option (2a-2f) had no measurable effect on the ranking of the sites. The ranking results unintentionally parallel the ranking of the sites based on just their Anadromous Fish Habitat function score. It is unknown whether the results are generally applicable to this study's data.

The same normalized score sometimes results in different ratings for different functions. For example, for site ER08 a score of 2.90 for Amphibian Habitat results in a rating of Moderate, yet a score of 3.09 for Pollinator Habitat gets a rating of Low. Although that may seem counterintuitive, it occurs because each function's scores have a statistical distribution that differs from those of the other functions. This is explained further in section 2.3.3. Tables 6 and 7 show the break-points used in this study to convert the normalized scores to ratings for each function.

Photo 5: Beaver-influenced wetland on west Douglas Island.

Table 7: Thresholds of normalized scores used to determine rating of each function or value in each **non-tidal** AA

	Thresholds for Function Rating		Thresholds for Value Rating	
Function:	Low IF:	High IF:	Low IF:	High IF:
Anadromous Fish Habitat	≤ 2.76	≥ 7.37	≤ 2.00	≥ 7.33
Resident Fish Habitat	= 0	≥ 7.23	≤ 2.31	≥ 5.66
Carbon Sequestration	≤ 3.88	≥ 6.02	N.A.	N.A.
Nitrate Removal	≤ 1.86	≥ 3.17	≤ 3.03	≥ 5.35
Phosphorus Retention	≤ 2.56	≥ 3.85	≤ 2.15	≥ 5.67
Sediment Retention & Stabilization	≤ 2.28	≥ 4.1	≤ 1.93	≥ 6.27
Invertebrate Habitat	≤ 3.17	≥ 5.22	≤ 2.85	≥ 6.36
Organic Nutrient Export	≤ 5.93	≥ 7.67	N.A.	N.A.
Stream Flow Support	≤ 3.2	≥ 5.8	= 0	≥ 4.58
Water Cooling	≤ 2.04	≥ 5.3	≤ 2.04	≥ 3.95
Water Warming	≤ 1.43	≥ 4.75	≤ 2.63	≥ 5.61
Water Storage	≤ 2.75	≥ 5.03	≤ 3.06	≥ 7.08
Amphibian Habitat	≤ 2.72	≥ 5.16	≤ 3.75	≥ 6.31
Waterbird Feeding Habitat	= 0	≥ 5.94	= 0	≥ 5.33
Waterbird Nesting Habitat	= 0	≥ 5.66	= 0	≥ 9.70
Songbird, Raptor, & Mammal Habitat	≤ 2.62	≥ 6.93	≤ 2.50	≥ 6.73
Native Plant Habitat	≤ 3.10	≥ 5.25	≤ 1.88	≥ 5.29
Pollinator Habitat	≤ 4.11	≥ 6.72	= 0	≥ 4.47
Public Use & Recognition	N.A.	N.A.	≤ 2.38	≥ 4.41
Wetland Sensitivity	N.A.	N.A.	≤ 4.44	≥ 6.77
Wetland Risk	N.A.	N.A.	≤ 3.88	≥ 6.40
Wetland Stressors	N.A.	N.A.	≤ 4.84	≥ 7.63
Wetland Ecological Condition	N.A.	N.A.	≤ 3.23	≥ 5.70

Table 8: Thresholds of normalized scores used to determine rating of each Function or Value in each **tidal** AA

	Thresholds for Function Rating		Thresholds for Value Rating	
Function:	Low IF:	High IF:	Low IF:	High IF:
Anadromous Fish Habitat	= 0	≥ 4.34	= 0	≥ 7.62
Carbon Sequestration	≤ 1.30	≥ 3.49	N.A.	N.A.
Organic Nutrient Export	≤ 2.49	≥ 5.71	N.A.	N.A.
Sediment Retention	≤ 1.49	≥ 4.26	≤ 1.80	≥ 4.79
Waterbird Feeding Habitat	≤ 2.08	≥ 6.40	≤ 3.33	≥ 6.67
Songbird, Raptor, & Mammal Habitat	≤ 2.43	≥ 5.89	= 0	= 10
Native Plant Habitat	≤ 1.39	≥ 3.60	= 0	= 10
Public Use & Recognition	N.A.	N.A.	= 0	≥ 7.61

Question #3

The CBJ's 1992, 1997, and 2008 JWMP assigned wetlands to four categories. Going forward with four or more categories would provide more flexibility in wetland planning decisions and complies with past practices in Juneau, although the criteria used to define the boundaries of the categories using the current data would differ from those used previously. Alternatively, the use of three categories may be more statistically defensible (e.g., broader confidence intervals), given the potential for some human error in applying WESPAK-SE.

3.2.2 The Watershed Context for Wetland Function Scores

This study assigned scores to individual AAs. However, the relationship of any one AA to others, as well as to anadromous streams, was partially factored into each AA's score. Thus, this study contained key elements of a watershed approach. The connectivity or contiguity (even ephemeral) of any AA to an anadromous stream is indicated by its Anadromous Fish Habitat function score--all those with a score of 0 cannot be accessed by anadromous fish. If a wetland unit has a channel outlet but no fish access, and the waters flowing through that outlet connect to tidewater or anadromous fish habitat further downslope, this was noted during the field work. The WESPAK-SE models are constructed such that it potentially increases the scores of that wetland unit for several functions: Stream Flow Support, Water Cooling, Organic Nutrient Export, Aquatic Invertebrates, and Native Plant Habitat. It does so because, despite the absence of anadromous fish in the AA itself, the AA potentially buffers environmental extremes and thus supports the temperature, hydrologic, and water quality regimes of anadromous fish habitat below blockages. Such blockages prohibit fish upstream movement into the AA but generally do not halt the seaward flow of surface water out of the AA.

Analysis of function ratings generated by the WESPAK-SE models support the importance of non-anadromous wetlands for a host of other functions. Of the sites rated Lower for Anadromous Fish Habitat, more than half were rated Moderate or Higher for the following functions by the WESPAK-SE models:

- Songbird, Raptor, & Mammal Habitat
- Water Cooling
- Carbon Sequestration
- Organic Nutrient Export
- Water Warming
- Pollinator Habitat
- Water Storage
- Native Plant Habitat
- Phosphorus Retention

Another aspect of connectivity concerns the contiguity of any single wetland AA to others. The identification numbers of all such contiguous AAs can be identified from the maps in JWMP Volume Two, which also shows the watershed ("subshed") boundaries in the project area. The WESPAK-SE models used to rate the wetlands are structured such that AAs which are adjoined by growing numbers of other AAs are more likely to have higher scores for all the habitat functions, provided they meet other requirements of most species associated with that function: Aquatic Invertebrate Habitat, Amphibian Habitat, Waterbird Feeding Habitat, Waterbird Nesting Habitat, Songbird-Raptor-Mammal Habitat, Native Plant Habitat, Pollinator Habitat.

Although beyond the scope of resources available in this current contract, an analysis could be undertaken in the future that would identify, from the current data set, which wetland functions are rarest in each subshed (watershed) or in the study area overall. Then, the value scores of any wetlands that do perform those rare functions in that subshed could be increased in proportion to the rarity of those functions in that subshed or study area or by some predetermined percentage. However, it must be recognized that watershed boundaries are not relevant to several wetland functions (e.g. Pollinator Habitat, Waterbird Habitat) and values (Public Use & Recognition) because the use of a wetland by pollinators, waterbirds, and people is virtually unaffected by a watershed boundary.

Another analysis that could strengthen a watershed approach would apply to AAs that are not accessible to anadromous fish but would involve using each AA's flow-path distance to anadromous fish habitat (stream, floodplain, or estuarine) as a weighting factor for Anadromous Fish Habitat function or value score. Preferably, the flow-path distance would be measured only after the study area's hydrologic connections are determined and mapped more thoroughly, and surveys are completed that document fish presence (especially coho) in smaller channels and floodplains of the study area.

Additionally, another examination that could strengthen a watershed approach, but was also beyond the scope of resources available, would involve using as a weighting factor the historical losses of wetlands or specific wetland types in the study area or its watersheds. However, comprehensive data on such losses do not exist. Looking forward, careful record-keeping of the extent of wetland alterations permitted, by watershed and function scores/ratings, could help address concerns about cumulative impacts of function losses associated with the permit programs.

3.3 Anadromous Fish Habitat and WESPAK-SE

WESPAK-SE examines twenty potential functions and values that southeast Alaska wetlands provide to humans and the natural environment, and anadromous fish habitat is one of these. When interpreting WESPAK-SE, it is important to remember that function scores and value scores convey different sets of information about a wetland's ability to provide anadromous fish habitat. A wetland functions as anadromous fish habitat if it supports rearing or spawning of fish species that migrate from marine waters into freshwater streams. By supporting anadromous fish habitat a wetland provides human or societal value through contributions to successful commercial, subsistence, or recreational fisheries, cultural traditions, and other forms of regional identity and livelihood.

<u>Function Scores and Ratings for Anadromous Fish Habitat in Non-tidal Wetlands</u>

Wetlands are scored 0 if not accessible to anadromous fish or if no surface water is ever present. In all other wetlands, Anadromous Fish Habitat can only be rated Moderate or High -- never Low. The score and associated rating increases with increasing certainty of fish access to the wetland and persistence of the wetland's outflow. The scores for these two factors are averaged and then multiplied by the average of wetland Productivity, Structure, Hydrologic Regime, Landscape Condition, and a lack of human-related Stressors. However, these last 3 factors are moot if access is lacking and are less important if outflow persistence is less. In these calculations:

- Productivity is assumed to be greater where the wetland contains or is adjoined by alder, is at low elevation, near marine waters, is a floodplain wetland or fen/marsh, and there is evidence of significant groundwater input. These indicators are considered equally predictive and so are averaged.
- Structure beneficial to anadromous fish is represented by the average of beaver presence (considered a positive indicator) and a group average for increased shade and cover of aquatic plants, large woody debris, presence of both ponded and flowing water, and more favorable wetland type (Floodplain wetland > Fen/marsh > Uplift meadow > Forested peatland > Open peatland).
- Hydrologic Regime is considered optimal when all or nearly all of the wetland has surface water at least seasonally and water depths are moderate. The remaining one-third of the score for this factor is based on the average of interspersion of patches of vegetation and open water, wetland adjacency to a lake, wetland intersected by channels that meander and intersect flooded trees, and a moderate proportion of habitat remains persistently or seasonally inundated.
- Landscape condition is assumed to be better when land cover in the contributing area and area closest to the wetland is mostly natural.
- Stressors are represented by absence of known or suspected contaminants, absence of turbid glacial meltwater input, lack of other sediment inputs in excessive concentrations, and lack of altered flows. These indicators are considered equally predictive and so are averaged.

When determining anadromous fish access and presence, BBC relied on field observations as well as documentation from Alaska Department of Fish and Game (ADFG) and Alaska Department of Natural Resources (ADNR). During fieldwork in 2014, many wetland units with fish access also had recent fish carcasses or remnants of carcasses from previous seasons near a stream channel. In wetland units where anadromous fish use was probable but there was no direct evidence in the form of carcasses or fish nests, BBC relied on existing documentation in the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes (Catalog) and the Atlas to the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes (Atlas). Alaska Statute 41.14.870(a) requires the ADNR specify the various rivers, lakes, and streams, or parts of them, that are important for spawning, rearing, or migration of anadromous fishes. According to Alaska Administrative Code (AAC) 195.010, the Catalog and Atlas are used to make this specification. The Catalog is a numerically-ordered list of the water bodies with documented use by anadromous fish for these purposes. The Atlas shows cartographically the location, name and number of these specified water bodies, the anadromous fish species using these water bodies, and the fish life history phases for which the water bodies are used (to the extent known) (ADFG 2007).

Photo 6: Cowee Creek side channel.

Value Scores and Ratings for Anadromous Fish Habitat in Non-tidal Wetlands

If no BBC observations or ADFG maps indicated the existence of anadromous fish in a wetland (including channels exiting a wetland) then the value score -- as is the case with the function score -- is set to 0 and the rating for this function is never greater than Low. However, for other wetland functions that indirectly support anadromous fish rearing or spawning, such as water cooling and stream flow support, the inaccessible wetland can nonetheless receive a function rating of High, Moderate, or Low depending on its characteristics.

If BBC observations or ADFG maps did indicate the existance of anadromous fish in a wetland, then the value score and rating (as contrasted with the function score and rating) depend on whether it is in a conservation priority watershed for anadromous fish (from Schoen & Dovichin 2007), or has a high function score for Feeding Waterbirds or Songbirds & Mammals, or the group average of the following was high: observed evidence of fishing, frequent human visitation, near a population center, near a road. The Value score for Anadromous Fish Habitat can therefore never be affected more than 25% by any of these last four indicators. In many cases the last four indicators were rendered entirely moot and ignored in the score calculations because the average of the scores for the other two habitat functions was higher, or the wetland was in a conservation priority watershed, and either of these became the positive driver of the Anadromous Fish Habitat value score.

Function Scores and Ratings for Anadromous Fish Habitat in Tidal Wetlands

If there is even minimal fish Access to the tidal wetland, as there almost always is, the model considers the likely extent and duration of that access, potentially predictive Landscape-scale factors, and secondarily the wetland's potential Productivity and general Habitat Structure. The latter two together are given the same weight as each of the former.

In the above calculations:

- Access is assumed to be greater in wetlands having extensive areas that fish can reach even at monthly low tide, and those with extensive internal channel networks and natural outlets. These indicators are considered equally predictive and so are averaged. However, if there is no fish access, this factor is set to zero.
- Productivity is assumed to be greater in tidal wetlands with wide vegetation zones, groundwater seeps, large adjoining trees (especially deciduous), having or being near tributaries, and with no existing data that indicate presence of toxic pollution levels in or near the wetland. These indicators are considered equally predictive and so are averaged.
- Structure is assumed to be greater in tidal wetlands that have a variety of complementary marine shoreline types within 1 mile, and either are wooded or have much large woody debris or other fish cover. These indicators are considered equally predictive and so are averaged.
- Landscape factors that favor anadromous fish include whether the wetland is located in a priority watershed for anadromous fish within its biogeographic province (subregion) in Southeast Alaska (from Schoen & Dovichin 2007). This accounts for half the Landscape score. Considered equally influential, and thus accounting for the other half, is the average of 5 indicators: geographic position (outer coast, inner coast, mainland), location along a major river or in a bay/lagoon, proximity to eelgrass, the average of the distance to the nearest other tidal wetland and extent of tidal wetlands generally in the associated watershed, and the average of the proximity to connected freshwater ponds/wetlands (positive), and percent of the upland buffer that is natural land cover (positive).

Value Scores and Ratings for Anadromous Fish Habitat in Tidal Wetlands

If the wetland is in a priority watershed for priority watershed for anadromous fish within its biogeographic province (subregion) in Southeast Alaska (from Schoen & Dovichin 2007), or is in a watershed with good bear habitat (Schoen & Dovichin 2007), or is distant from other tidal wetlands, then the tidal wetland's value score for Anadromous Fish Habitat is higher.

Resident (Non-Anadromous) Fish Habitat and WESPAK-SE

Function and value scores are also assigned to wetlands to reflect their support for non-anadromous resident fish. These include Dolly Varden char and cutthroat trout as well as non-sport fish such as sculpin, stickleback, and lamprey. However, despite their importance to many non-anadromous fish species, tidal wetlands are not scored because no suitable rapid indicators of their capacity to predict habitat suitability for non-anadromous species could be found.

There are fewer resources documenting the locations of resident fish in either tidal or non-tidal waters. BBC relied primarily on direct field observations to determine whether or not resident fish were present or potentially present.

Function Scores and Ratings for Resident Fish Habitat

A wetland automatically scores a 0 for Resident Fish Habitat function if there is no fish access and it is not known to contain resident fish, or if it never contains surface water. For all other wetlands, the score increases with increased wetland Productivity, Hydrologic Regime, and habitat Structure, and decreased Stressors and risk of winterkill from Anoxia (lack of oxygen in the water). These 5 factors are considered equally predictive of resident fish habitat suitability and so are averaged.

In the above calculations:

• Productivity is assumed to be greater where the wetland contains both an inlet and outlet, contains or is adjoined by extensive alder, has evidence of significant groundwater input, is not on granitic bedrock, has not been recently deglaciated, and (in order of decreasing productivity) is a Floodplain wetland > Fen/marsh > Uplift meadow > Forested peatland > Open peatland. These indicators are considered equally predictive so their scores are averaged.
• Structure beneficial to resident fish is represented by the average of a score for beaver presence (considered a positive indicator) and a group average that again includes wetland type (see ranking above) as well as increased shade, extensive aquatic plants, and other aquatic cover.
• Hydrologic Regime is assumed most favorable for resident fish when surface water is present at least seasonally, both ponded and flowing water are present, interspersion of patches of vegetation and open water is good, there are complex internal channel networks that intersect woody vegetation, and a variety of water depths is present in fairly equal proportions. These indicators are considered equally predictive and so their scores are averaged.
• Stressors are represented by the average of: lack of known toxicity of contaminants, lack of artificially altered flow timing, and lack of turbid glacier-water inputs. These are considered equally predictive .
• Anoxia Risk is assumed to increase with two factors that are averaged. The first is represented by the average of increasing water depth and outflow persistence. The second is the average of decreasing elevation (relative position in watershed), warmer temperature, proximity to tidal waters, and lakeside (as opposed to small isolated pond) location. These are considered equally predictive of resident fish winterkill and so are averaged.

Value Scores and Ratings for Resident Fish Habitat

This value score and rating for Resident Fish Habitat is greater degree if the wetland's feeding waterbird score is high or if the average of 4 indicators is large: evidence of fishing, minimal distance to a population center, minimal distance to a road, and greater accessibility of the wetland to people.

4.0 Implementation

4.1 Site-specific Resource, Planning and Education Tool--Current Uses of the 2016 JWMP

The 2016 JWMP can be utilized in its current form for the following uses:

Wetland determinations and background information for wetland delineations. Wetland determinations (are there wetlands on a property?) are important for deciding what properties can be developed with or without wetland permitting. The mapped wetlands in Priority Areas (PA's) of the 2016 JWMP can be utilized immediately to inform landowners if they have wetlands and a very good approximation of where they are located. Even the off-site assessments where no on-the-ground mapping was done, have a relatively good approximation of wetland presence and location. If there are wetlands mapped by the 2016 JWMP, a landowner has more certainty about where they are located and how extensively arranged they might be on the parcel or site. While the 2016 JWMP mapped wetlands are not officially delineated wetlands, the maps provide highly useable background information for conducting a subsequent site specific official wetland delineation, one that can be verified by the Army Corps during the permitting process. The availability of the 2016 JWMP wetland mapping saves landowners and land managers the cost of doing their own feasibility studies for wetlands.

Strategic site planning, short term and long range. Landowners and land managers can use the wetland mapping in the 2016 JWMP to identify the best areas of non-wetland for near term site development. These are areas most likely along existing road corridors and other existing human-built areas that will not require extensive infrastructure development. Long range development planning, for example neighborhood developments or mixed used developments, can target interconnected non-wetland and larger non-wetland areas for various phases of their long range development plans. For example, one or more areas of gently sloping non-wetland polygons could be connected together with a planned road extension. Recognizing that some impacts to wetlands would occur from street or utility crossings, wetland impacts are still minimized by concentrating the actual developments within the non-wetland polygons. Use of the 2016 JWMP wetland maps for strategic development planning avoids and minimizes wetland impacts for all types of planned development, including but not limited to industrial, commercial, residential, institutional, transportation and recreational projects. Cost savings for development planners, short term and long term, are significant as feasibility studies for wetlands over large tracts of land are typically expensive.

"Least impact" analyzes of potential development impacts between two or more wetlands. If wetland impacts are unavoidable within an area contemplated for development, the 2016 JWMP wetland function and value assessment scores using WESPAK-SE provide a comparison of wetland function and values between wetlands that can benefit decision-making to achieve the least impactful development option. In most cases, the lower scoring functions and values that are compared between two or more wetlands will indicate which wetland should be impacted to avoid and minimize overall wetland impacts. Where function and value scores are compared but are inconclusive, because different functions and values score higher among compared wetlands, an extra step will be necessary which will involve the professional judgement of wetland regulators and wetland consultants to determine which wetland has the most overall lower function and value. However, simply having the function and value scores to compare among wetlands is a significant resource to those contemplating or planning future development, and a cost savings to those who would otherwise have to prepare their own feasibility studies of wetlands and their function and values.

Watershed planning for mitigation sequencing of wetlands and aquatic resources. Where the 2016 JWMP has mapped wetlands within watersheds, particularly those with anadromous fish habitat resources, the mapping and WESPAK-SE function and value scores can be reviewed for watershed management planning. Mitigation sequencing is the process, in order of preference, for avoiding, minimizing, and mitigating unavoidable impacts. Critical wetlands, for example those providing fish habitat or abutting streams with anadromous and resident fish, can be identified for emphasis on avoidance and protection. If these wetlands are high functioning, but are currently undisturbed, they can be targeted for preservation, possibly in concert with a mitigation bank or in-lieu fee program. Also, wetlands that have impaired functions and values due to past and present impacts can be targeted for mitigation through re-establishment, restoration, rehabilitation and enhancement. There are areas likely within the watershed that would be suited for some types of development, which the mapping and WESPAK-SE scoring of wetlands can inform. Wetland impacts can be minimized if development is focused on lower functioning wetlands in a watershed. Whereas the greatest challenge in watershed planning is in having a comprehensive resource assessment, including mapping and characterization of wetlands and aquatic resources, the 2016 JWMP provides just that necessary resource for the PA's. Here again, the information provided is a cost savings for those undertaking the task of developing watershed management plans.

Wetland education. The 2016 JWMP provides abundant wetland maps, wetland characterization data, and wetland function and values assessments that are a resource for the public to better understand wetland resources within CBJ. An informed public, ranging from landowners, elected officials, agencies, mitigation providers, nature enthusiasts, college students and students of all ages, is best able to comprehend and discuss the issues relating to wetland management when there is equal access to science-based credible data which the JWMP provides. The public discussion of how CBJ grows in a responsible fashion will not have to focus on the questions of "are wetlands involved and how important are they"?, rather it will focus on the questions "what functions do we value highest, and what tradeoffs must we accommodate to allow growth to occur while minimizing impacts?."

Database for future studies and wetland management implementation. The comprehensive maps and data within the 2016 JWMP are a foundation upon which future studies involving wetlands and aquatic resources within CBJ are added as the science evolves. The remainder of this section describes several logical next steps if the wetland mapping and functional scores are further developed into wetland categories, or used to obtain an Army Corps General Permit for wetland management within some areas, or to certain wetlands, within CBJ.

4.2 Implementation Discussion

Proposed wetland policies and implementing actions are outlined in Section 4.5. To achieve these policies and actions, beyond those already achieved by the site-specific resource information and education it provides, this section discusses potential next steps for implementation of the 2016 JWMP. This includes development of wetland categories, converting general policies into enforceable policies, and contemplates the acquisition of an Army Corps General Permit to allow CBJ control of wetland management some or all wetlands in a defined area. Also identified is where these possible steps align with the proposed wetland policies and implementing actions in Section 4.5. This implementation chapter examines the successes and issues with wetland management in the past and discusses the role of the 2016 JWMP as a planning and educational tool. Furthermore, regional examples of wetland management in Alaska are cited and included in the appendix. In the earlier plan iterations, 1992, 1997, and 2008 JWMP, CBJ's management strategy has involved the use of a General Permit from the Army Corps. The General Permit expired in 2011, therefore discussion is provided for obtaining a new General Permit.

Building on the 2016 JWMP role as a site specific resource, useful for strategic planning and as an educational tool, the plan can be advanced and extended with wetland categories and wetland management policies. Since the expiration of CBJ's General Permit in 2011, wetland permitting has been managed by the Army Corps for all wetlands in the borough. CBJ comments on wetland fill permit applications through the Army Corps public process, and has existing authority under building and land use permits, but does not administer any wetland fill permits. Regardless of how the plan is further advanced, the long-term scientific integrity of the JWMP is maintained by the in-depth wetland mapping and data collection of wetland functions and values. As a site specific resource, useful for strategic planning and education, the 2016 JWMP is aligned with many of the proposed wetland policies and implementing actions of Section 4.6.

Photo 7: Auke Bay Marina.

The detailed and extensive wetland mapping and WESPAK-SE assessments offer a science-based product that provides the 2016 JWMP as an educational tool with guiding principles for wetland management. This tool is compliant with the 2008 Federal Rule as it takes into account regional differences in wetland resources and functions and, as much as possible, uses a watershed approach to wetland management. An example of this type of implementation can be found in Matanuska-Susitna (Mat-su) Borough's (MSB) Wetlands Management Plan (MSBWMP, HDR, 2012). A summary of the Mat-su approach is included in the Appendix.

CBJ has many advantages due to the size of the borough and their accessibility and agreement to use WESPAK-SE. The recent mapping produced in this update should not limit CBJ's ability to acquire updated wetland and habitat mapping in the future. This is an implementing action, in that it maximizes use of watershed-based wetland mapping and wetland functional assessment sources available within CBJ. The 2016 JWMP allows for informed decision-making for the development of wetland categories, wetland conservation and mitigation approaches. The Army Corps has expressed its support of the WESPAK-SE tool and CBJ has seen potential for its use in growth management planning.
Additionally, the JWMP is a useful tool to all stakeholders as a science-based document. It plays a valuable role in planning for future development by all entities involved in wetland management. As it is consistent with the 2008 Federal Rule and the Army Corps regulatory oversight of wetlands, the 2016 JWMP is least influenced by political pressures. It serves as a tool for future planning regarding community and borough priorities and values.

General intentions for updating the 2016 JWMP are outlined in the policies and implementing actions section (4.5) at the end of this chapter. Wetland categories (such as A, B, C, D or High, Moderate, Low) are not necessary to complete the 2016 JWMP update, however creating categories would be the logical next step. If so desired, the public process of creating categories from WESPAK-SE can be accomplished through a prioritization of wetland functions and values important to the community. If wetland categories are established , and the Army Corps formerly adopts, or at minimum informally recognizes, the categories within CBJ jurisdiction, there would be a defacto CBJ-influence on Army Corps permits.

The earlier versions of the JWMP have included enforceable policies and, until 2011, the administration of wetland fill permits for lower quality wetlands. The 2016 JWMP is currently a site specific resource, useful for strategic planning and as an educational tool, This maintains CBJ as stakeholder and commenter on proposed wetland fill permits issued by the Army Corps but would not, exceed its wetland authority other than what it possesses through building and land use permits. The only remaining direct wetland authority with CBJ would be in the scenario of CBJ as an applicant or landowner for a proposed project. CBJ could self-impose whatever restrictions or wetland management policies it deemed in the best interest of the borough. Such restrictions would be administrative.

Applicants may have found clarity and consistency from the CBJ's past involvement in wetland permitting. With all authority currently under the Army Corps for permitting impacts to wetlands, many applicants may be incentivized to support more involvement by CBJ as a way to establish local control of wetland management.

For current stakeholders, considering the previous update of the JWMP occurred eight years previous, and the expiration of the general permit was nearly five years ago, the current situation of no CBJ-enforceable wetland policies has likely become familiar as the status quo. However, stakeholders will recognize a benefit of any collaboration between CBJ and the Army Corps by utilizing the foundational information in the 2016 JWMP, forging that collaboration through information sharing, communication, or a more formal Memorandum of Agreement or General Permit. Inconsistency among agencies and regulations is often the greatest frustration of applicants who navigate the wetland permitting process. Therefore, this effort by CBJ to promote consistency in wetland policies and regulations, among its own adopted CBJ documents and plans, and consistency with other agencies policies and regulations, will likely be positively received.

4.3 Developing Wetland Categories

If wetland categories are established for advanced implementation of the 2016 JWMP, the categorization options are outlined in this section. There are five most likely options for wetland categorization:

1) Follow SEALTrust's wetland function averaging formula when final and approved
2) Rank wetlands in a hierarchy of what the community determines is most appropriate

3) Develop a wetland categorization task force including two members of the WRB to formulate an approach

4) Simplify categorization to the primary factors in previous versions of the JWMP, such as anadromous streams (highest value) and proximity to roads (lower value), to promote development adjacent to road corridors

These options are not exclusive of each other as one or more could be combined, or others not listed developed in their place. Wetland categorization meets the proposed wetland protection policy allowing ranking of wetlands to identify high and low functioning wetlands suitable for development and protection. Wetlands categorized as having high function for anadromous and resident fish, or that are highly valued for public water sources, can receive added protection through the ranking. Conversely, lower functioning wetlands near roads and higher-density areas may be so categorized, thereby avoiding pressure on higher functioning wetland systems and watersheds. Categorized wetlands may also be more readily identified for restoration of lost or impaired functions by practitioners of mitigation banks and in-lieu fee providers. Easily identifiable wetland categories, that are understandable for applicants and the public, also provide for more informed decision making, increased permit predictability and permit processing.

Photo 8: Eagle Crest Ski Area

4.4 General Permit

CBJ's intentions for considering a new General Permit are outlined in policy 11.a at the end of this section. This would reauthorize, or establish anew, the expired Army Corps General Permit described as the wetland management process in the 2008 JWMP. In the 2008 JWMP a Plan Implementation section summarizes the approach and is provided in the Appendix. The General Permit would authorize CBJ to manage and permit some or all wetlands within a defined area of the borough.

Wetland categories would need to be established and updated with a selected categorization method. It will require agreement between the Army Corps and CBJ on what constitutes "lower" and "higher" functioning wetlands through an established categorization system.

Renewing or obtaining a new Army Corps General Permit to manage CBJ wetlands provides incentives for certainty and time efficiencies for an applicant. This method inherently directs wetland impacts toward lower functioning wetlands as it processes wetland permitting at the local level for lower functioning, and low category wetlands. Using the General Permit for wetlands management would transfer wetland delineation and determination authority to CBJ in certain cases and will be beneficial to CBJ's own development planning services. Applicants are benefitted by the locally managed regulatory process and can avoid an often extensive alternatives analysis process typically required for Army Corps individual permits. The General Permit can also target wetlands suitable for mitigation, or types of mitigation such as preservation of high functioning wetlands and restoration of wetlands with impaired functions. It can incentivize advanced mitigation in anticipation of future impacts by supporting wetland mitigation as a commodity, tradeable as credits through approved wetland mitigation banks or in-lieu fee programs.

Some challenges of this level of wetland management center around the need to renew the General Permit every five years. The initial acquisition and the renewal process required of the Army Corps' approval which may come with uncertainty and additional expenses. Once the General Permit is approved, CBJ will need to have an established administrative and technical review for wetland impact assessment and mitigation. Additional updating of the CBJ code would also be necessary, essentially converting the goals and policies stated herein and making them enforceable.

4.5 Summary

The 2016 JWMP provides a site specific wetlands resource for landowners, a strategic planning tool for agencies and an educational tool for the public in general. It provides key information for watershed-based planning that would allow decision-makers to target wetlands, such as those providing anadromous fish habitat, to be avoided during development, perhaps through preservation as a mitigation option. The maps and WESPAK-SE function and value scores inform where wetlands are impaired and thus could be restored, or where lower functioning wetlands could be impacted and their loss be mitigated elsewhere. Possible future steps or advancements of the 2016 JWMP are discussed for consideration of CBJ staff and decision-makers. These steps include development of wetland categories, converting general policies and goals into enforceable policies or CBJ code, and possible acquisition of an Army Corps General Permit to allow CBJ-controlled permitting of impacts to some or all wetlands within a defined area of the borough. These possible steps are not exclusive and can be combined with these or other logical outgrowths of the JMWP, including but not limited to, wetland education, promoting restoration, and improving collaboration between agencies, landowners and the public.

4.6 Wetland Policies and Implementing Actions

Big-Picture Planning

1. Promote consistency in wetland policies and regulations within adopted CBJ documents.
    a. Revise the CBJ Comprehensive Plan, Title 49, and other officially adopted documents to ensure consistency among wetland policies and regulations, and to ensure conformance with federal law.

2. Ensure the long-term scientific integrity of the JWMP and the wetland methodology that supports it.
    a. Update the JWMP with Best Available Science and peer review among resource professionals.
    b. Evaluate and include scientific information when determining wetland policies, plans, and regulations that support the plan.

Protection

3. Minimize adverse impacts to high functioning wetlands.
    a. Rank and/or categorize wetlands to identify high and low functioning wetlands suitable for development and protection.
    b. Consider establishment of a wetland categorization task force comprised of WRB representatives, resource agency representatives, CBJ staff, and other qualified members to determine a scientifically-sound ranking method.
    c. Consider development of regulations and/or more detailed wetland policies to support wetland rankings or categorization.

4. Protect wetlands near or adjacent to anadromous lakes or streams, and near or adjacent to public water sources.
   a. Consider development of regulations and/or specific policies that upgrade the value or ranking of wetlands near anadromous lakes or streams and provide stricter development requirements.
   b. Provide special consideration for wetlands near Alaska Department of Environmental Conservation-classified impaired water bodies and/or unique habitat areas.

5. Promote restoration opportunities in degraded wetland areas.
   a. Identify degraded wetland areas, or wetlands that may be suitable for enhancement, as documented through WESPAK-SE wetland assessments.
   b. Identify funding sources and establish a restoration plan.

6. Incorporate a diversified, watershed-based approach to better protect wetlands and to manage cumulative effects.

Development/Permitting Process

7. Provide for informed decisions regarding protection and development of wetlands.

8. Increase wetland permit predictability and streamline wetland permitting processing.

9. Promote development in lower functioning wetlands, particularly along road corridors and within the Urban Service Boundary.
   a. Identify lower functioning wetlands through a ranking process using the WESPAK-SE wetland assessments.
   b. Prioritize lower functioning wetland areas according to proximity to roaded and higher-density areas.

10. Promote a variety of wetland mitigation options to allow for wetland development in appropriate areas.
    a. Identify large areas of CBJ-owned high functioning wetlands or degraded wetlands eligible for preservation or restoration.
    b. Consider development of a mitigation bank or single-user mitigation site(s) based on restoration, enhancement, preservation, or a combination.

11. Develop long-range development strategies with the Army Corps and other partners to promote development in appropriate areas while preserving high value wetlands.
    a. Investigate options for use of General Permit for expedited wetland permitting utilizing advance wetland mitigation and planned development.
       i. Identify large areas of vacant public-private land within a preferred development corridor for a long-term development plan.
    b. Identify large contiguous or connected high functioning wetlands. Consider options for joint protection among property owners.
    c. Develop a Memorandum of Agreement with the Army Corps to promote collaboration and communication.

d. Cooperate with private and non-profit organization mitigation providers to cooperatively identify wetland mitigation areas to compensate proposed wetland development.

Outreach & Education

12. Maximize use of wetland mapping and wetland functional assessment sources available within CBJ.
    a. Utilize previous versions of the JWMP as a resource inventory.
    b. Develop partnerships with the Southeast Alaska GIS Library, NOAA Shorezone Program, Army Corps, and other entities to maximize information sharing regarding wetland resources.

13. Promote wetland education.
    a. Identify wetland areas near schools.
    b. Identify grant funding for wetland education and interpretative signage.
    C. Educate property owners on the value of delineating and protecting wetlands.

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6.0 CONTRIBUTIONS

For the study described in this document, responsibilities were as follows:

Project Manager and Principal Field Scientist: Koren Bosworth (BBC)

Study conceptual design, training of field crews, data processing, quality assurance: Dr. Paul Adamus (ARA)

Field work -- wetland delineations: Andrew Allison (ELS), Koren Bosworth, Catherine Pohl
Field work -- WESPAK-SE assessments: Koren Bosworth, Andrew Allison, Rachel Allison (ELS), Richard Carstensen (Discovery Southeast), Catherine Pohl, Dr. Paul Adamus

Interpretation of aerial imagery, off-site assessments, office component of WESPAK-SE assessment tool: Koren Bosworth, Richard Carstensen, Catherine Pohl

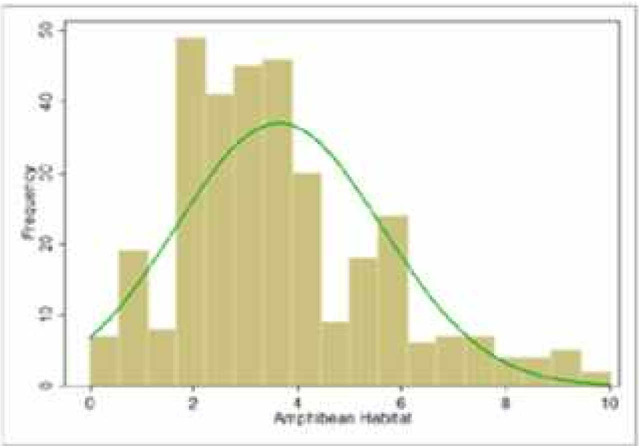
Processing of GPS and LiDAR data (including differential correction and management of sub-meter GPS, creation of modeled streams layers, raster catalogs, project-wide tidelines and hillshades): Catherine Pohl

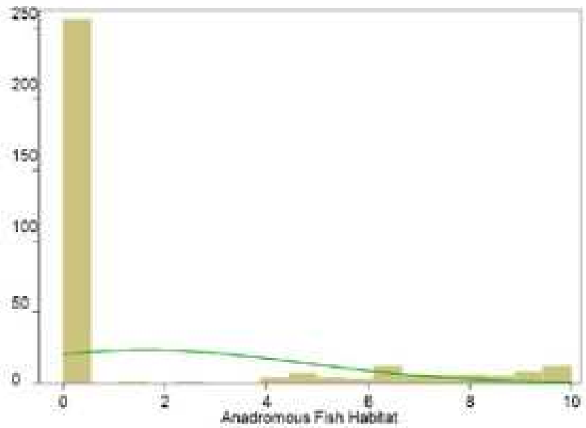
GIS map making (including wetland boundary shapefiles and custom GIS to support it): Richard Carstensen

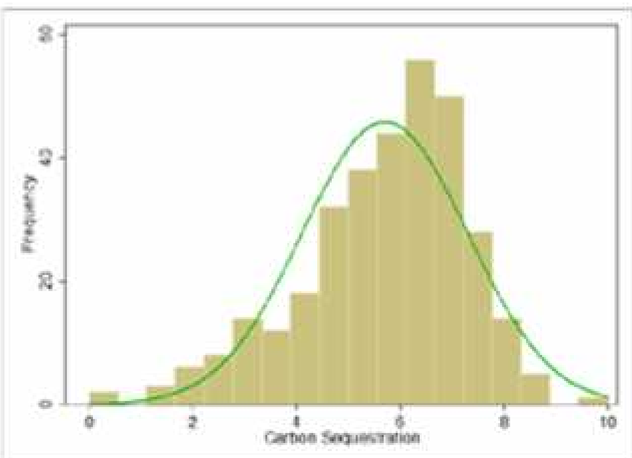
Project Final Report Writing: Dr. Paul Adamus, Rachel Allison, Andrew Allison, Francis Naglich (ELS), Morgan Steele (ELS)

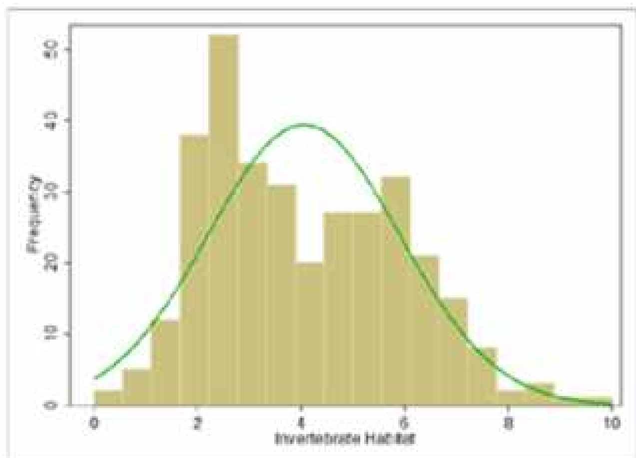
7.0 APPENDIX

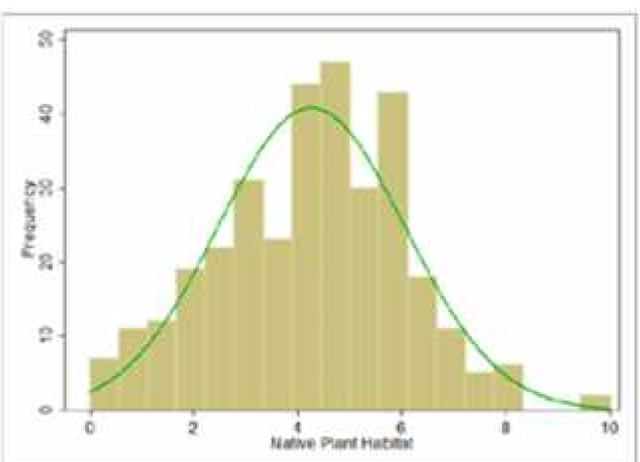
7.1 Score Distributions for FUNCTIONS for 332 Non-tidal Wetlands

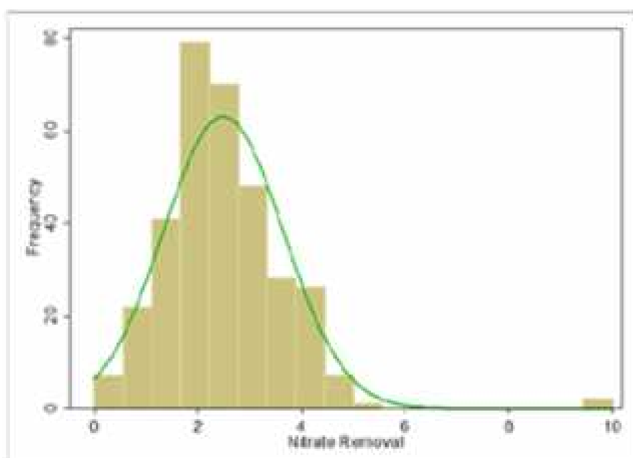


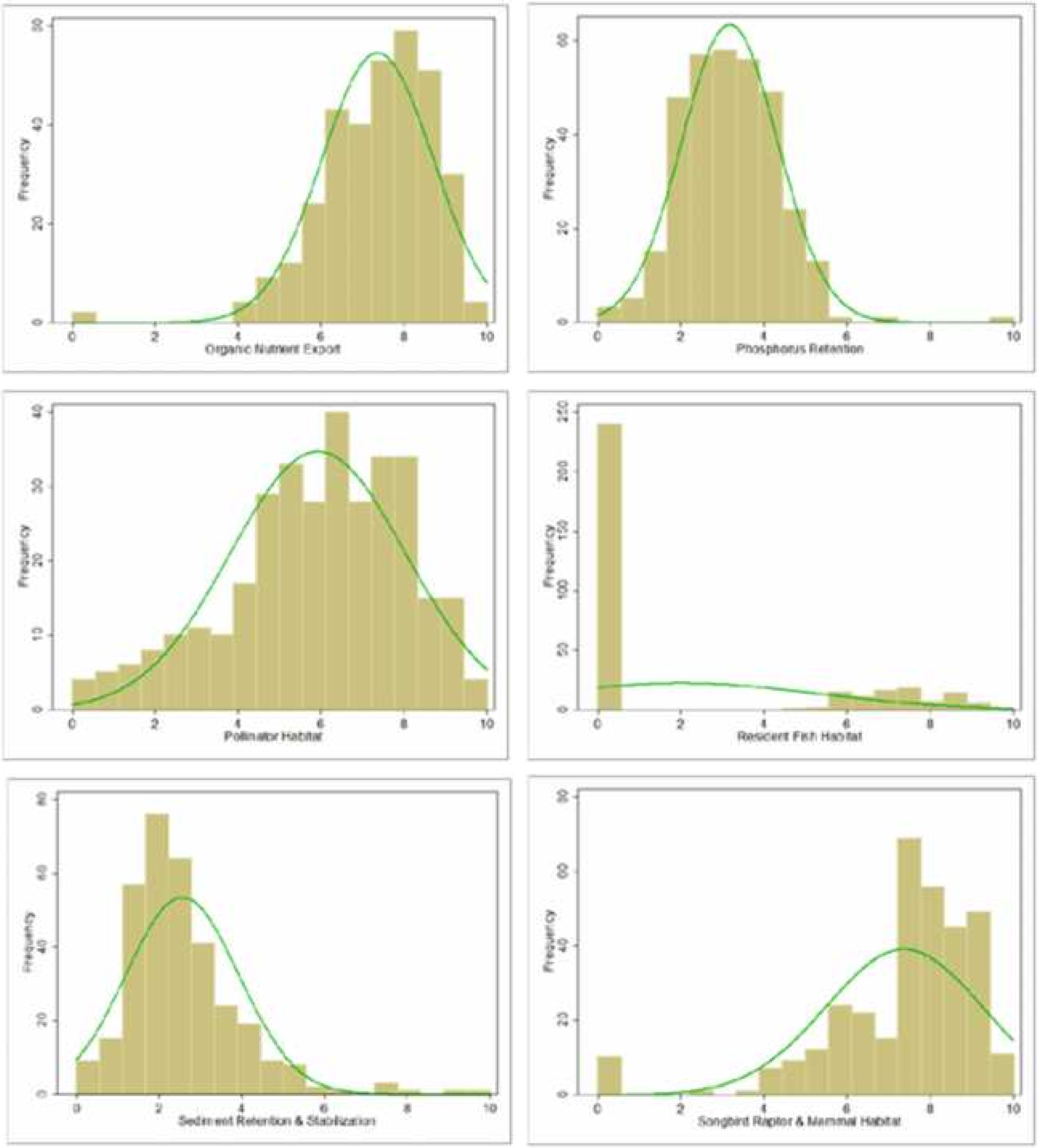


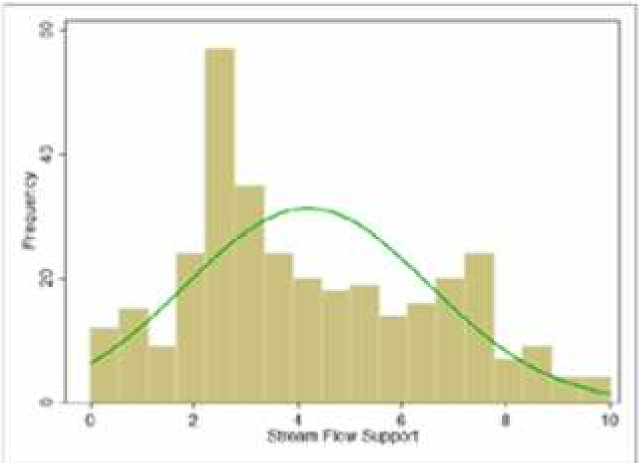









Frequency
Organic Nutrient Export
Phosphorus Retention
Pollinator Habitat
Resident Fish Habitat
Sediment Retention & Stabilization
Songbird Raptor & Mammal Habitat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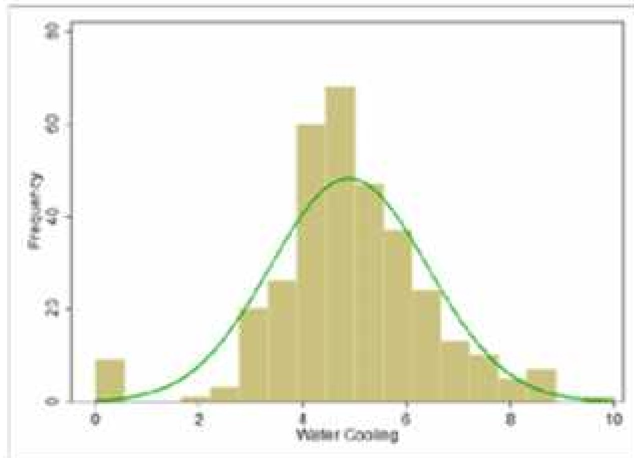
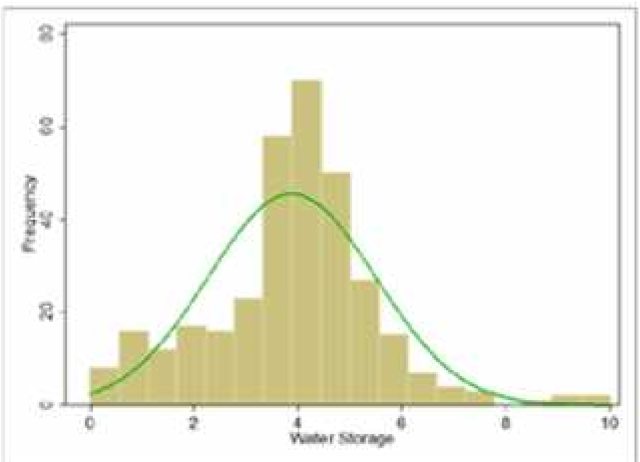

Frequency
Water Cooling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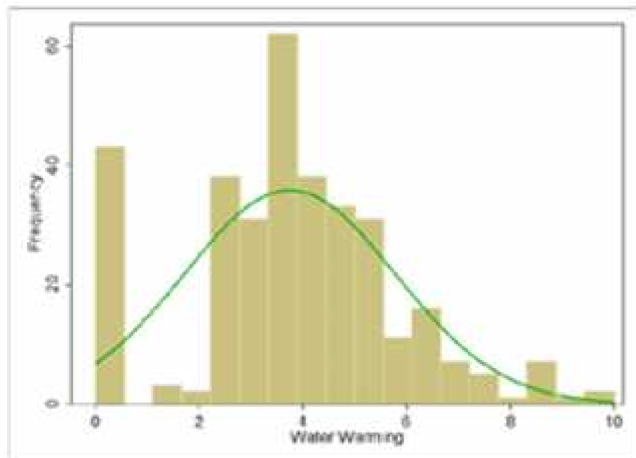
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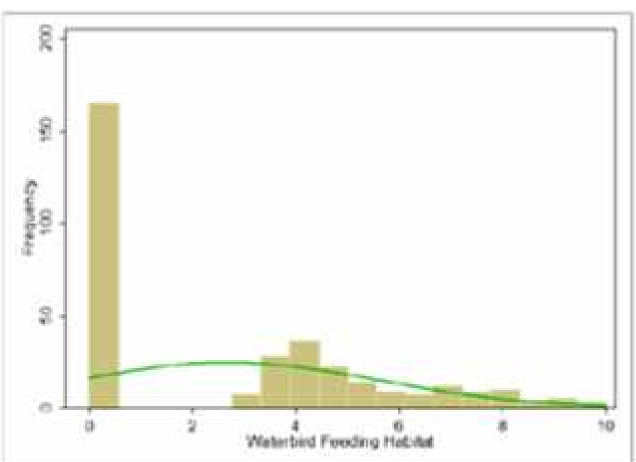
Water Warming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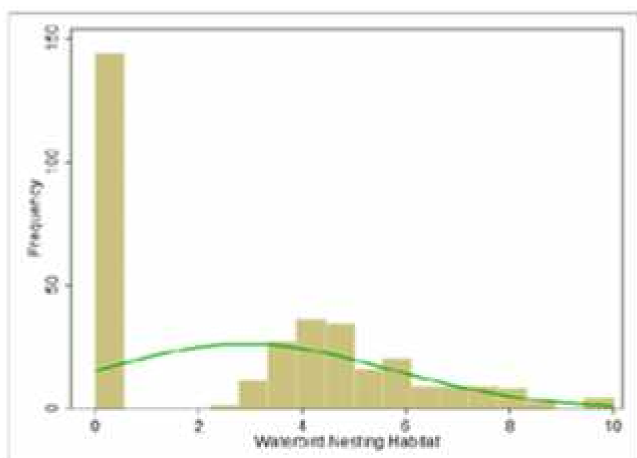
Waterbird Feeding Habitat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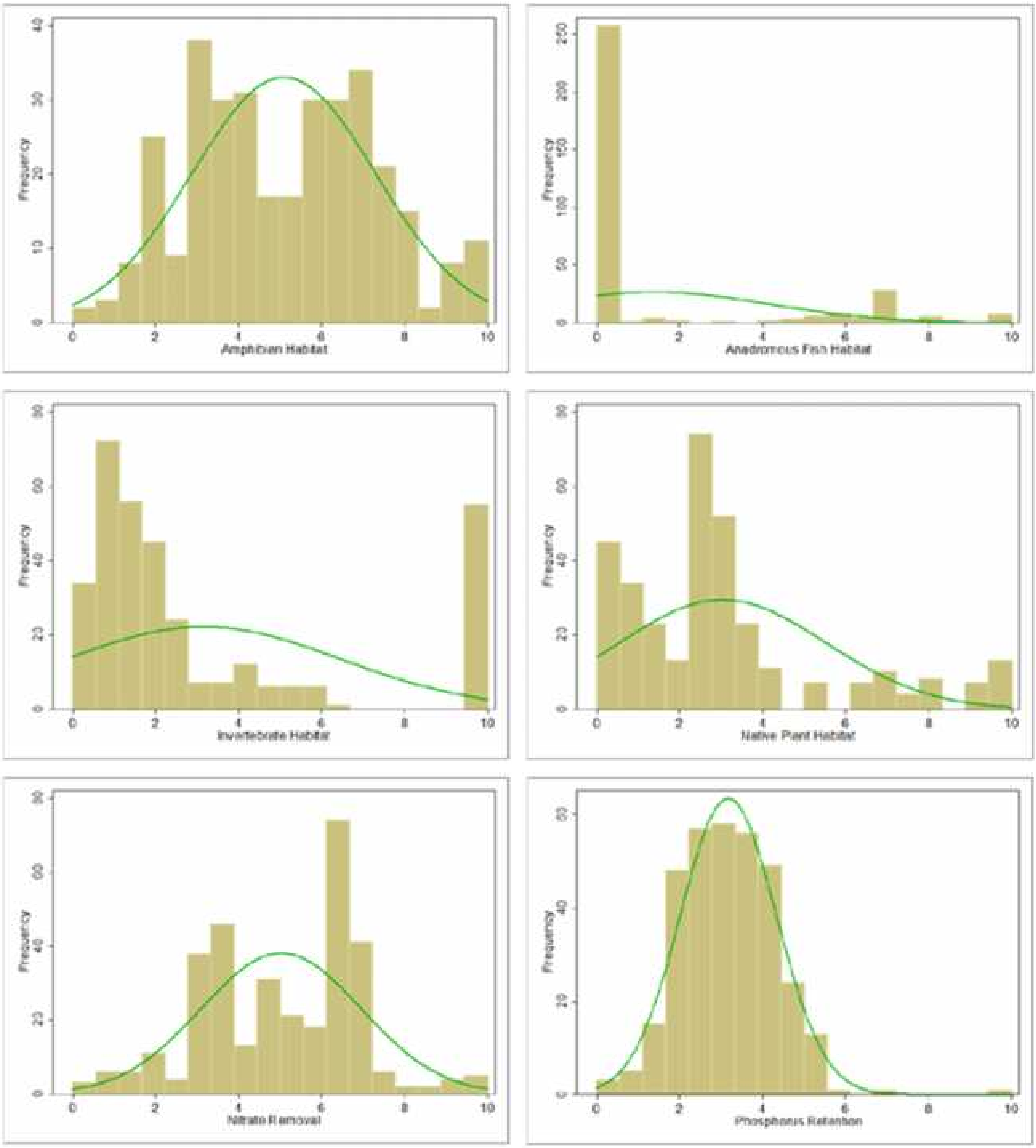
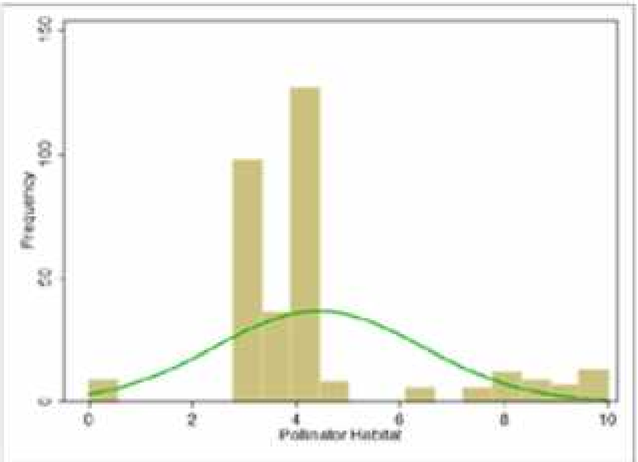
7.2 Score Distributions for VALUES1 for 332 Non-tidal Wetlands

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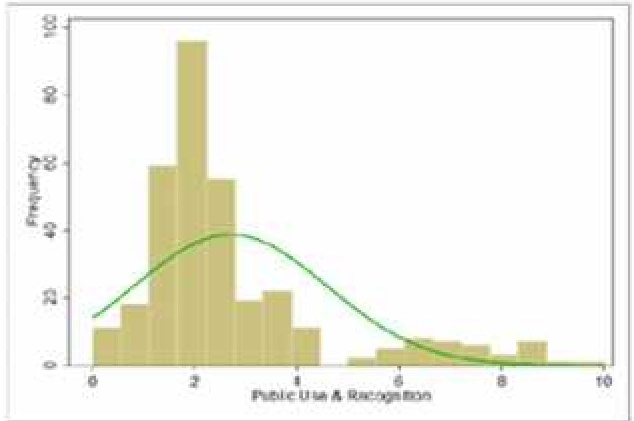
Pollinator Habitat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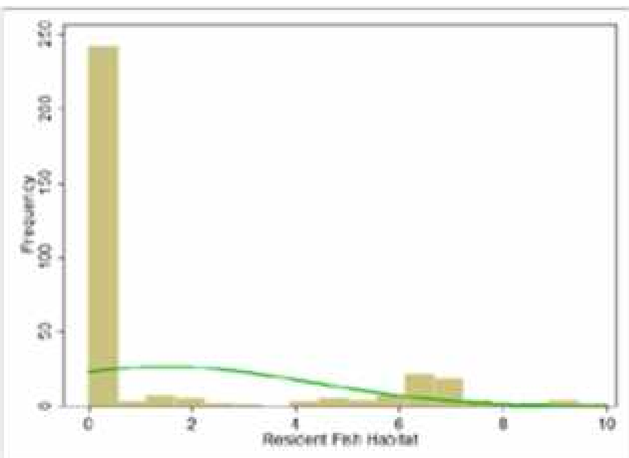
Public Use & Recognition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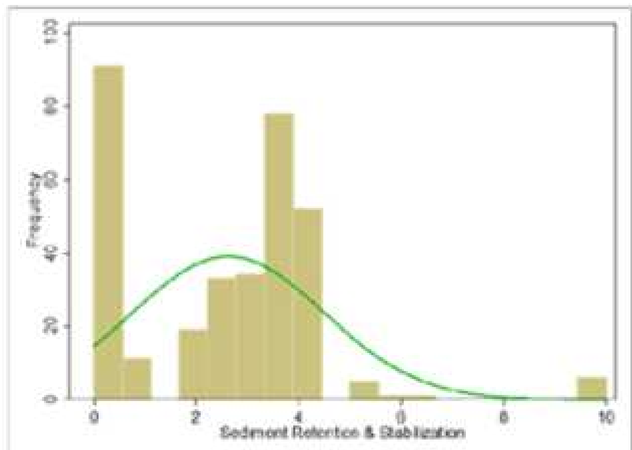
Resident Fish Habitat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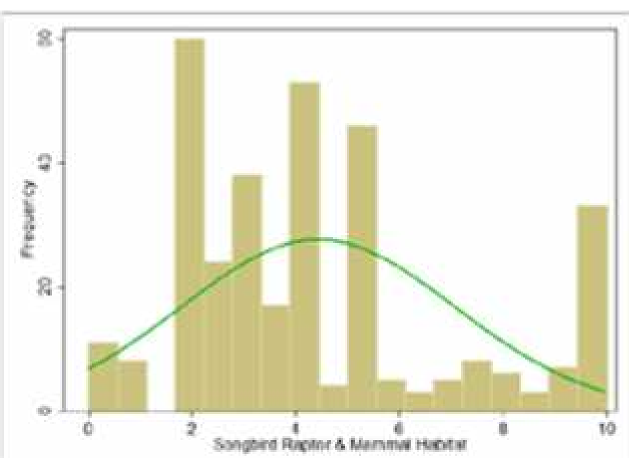
Sediment Retention & Stabilization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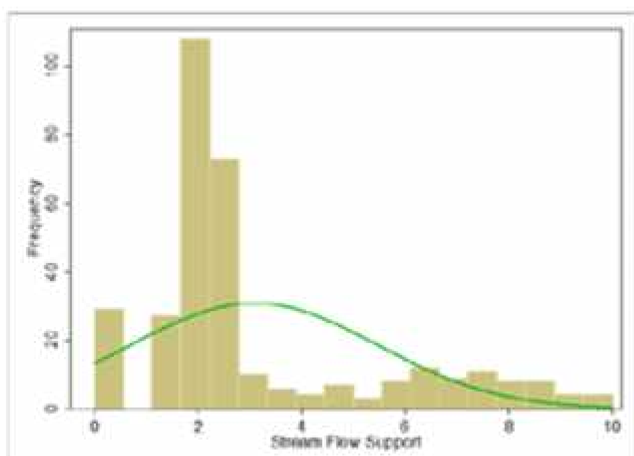
Songbird Raptor & Mammal Habitat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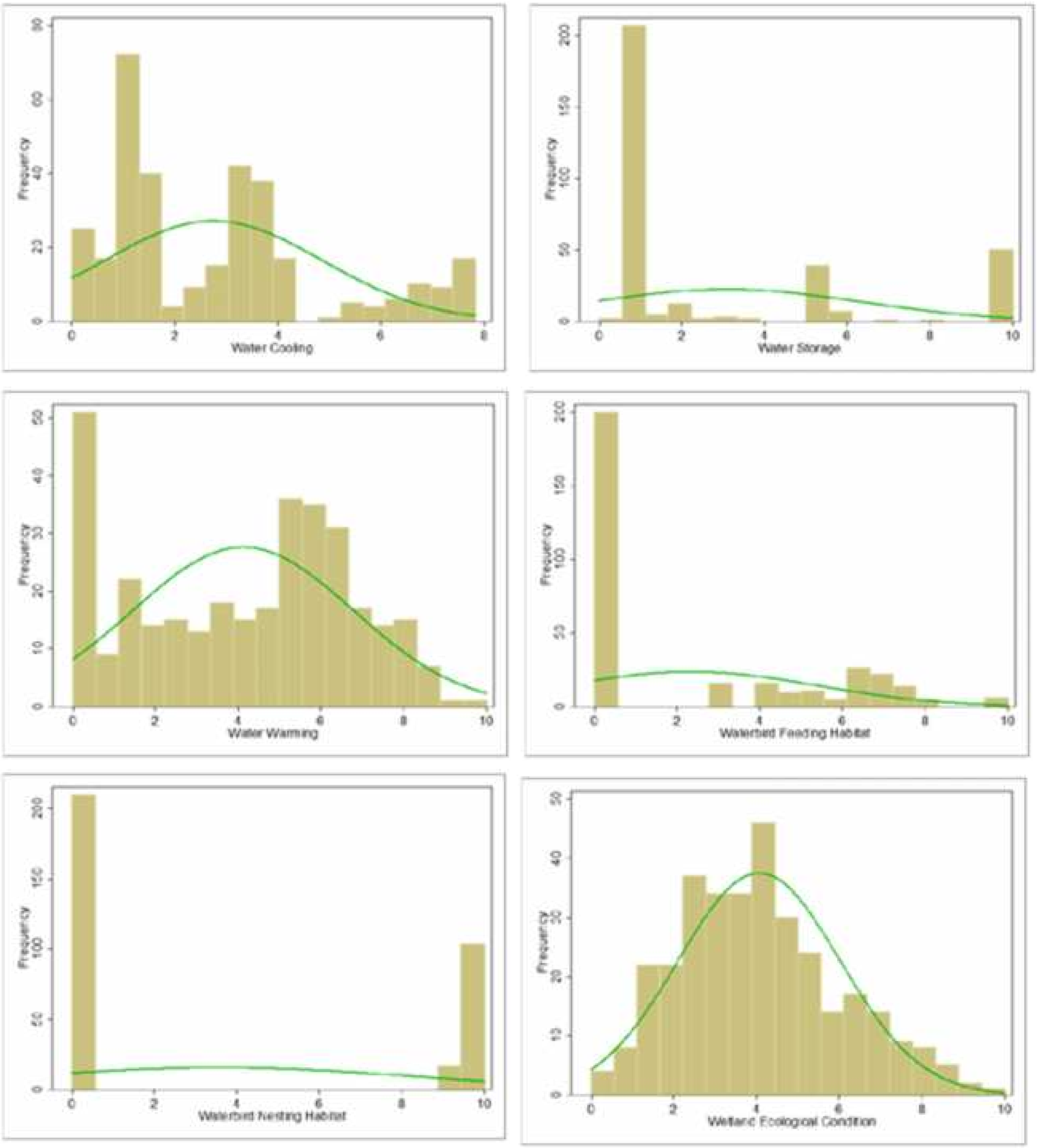
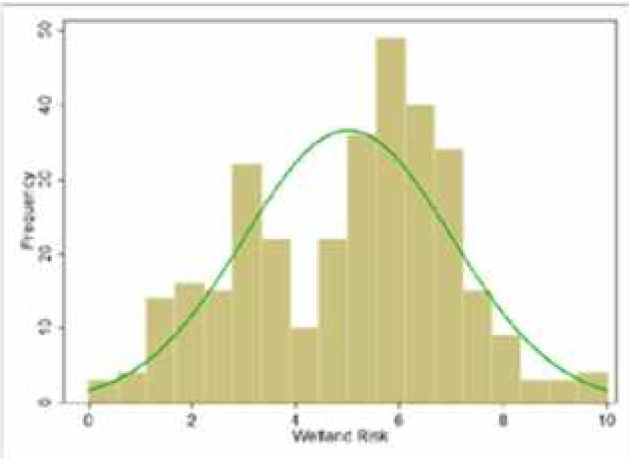

Frequency
Water Cooling
Frequency
Water Storage
Frequency
Water Warming
Frequency
Waterbird Feeding Habitat
Frequency
Waterbird Nesting Habitat
Frequency
Wetland Ecological Condition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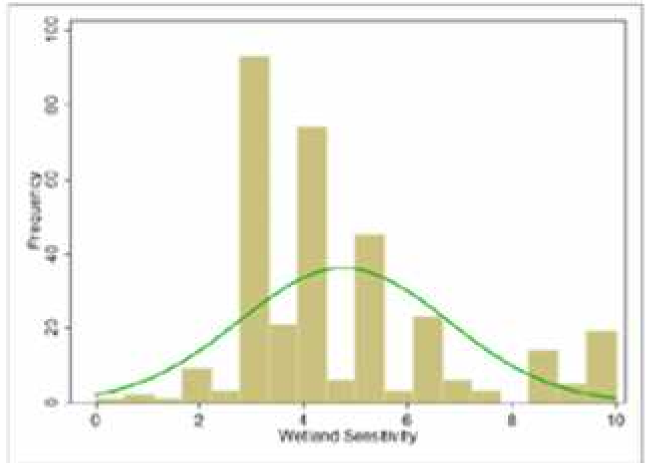
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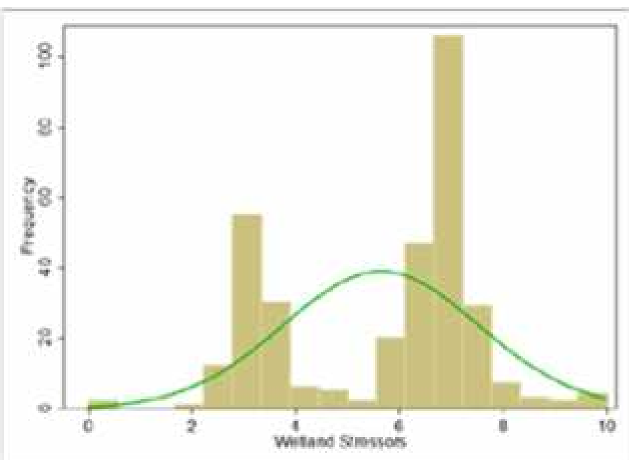
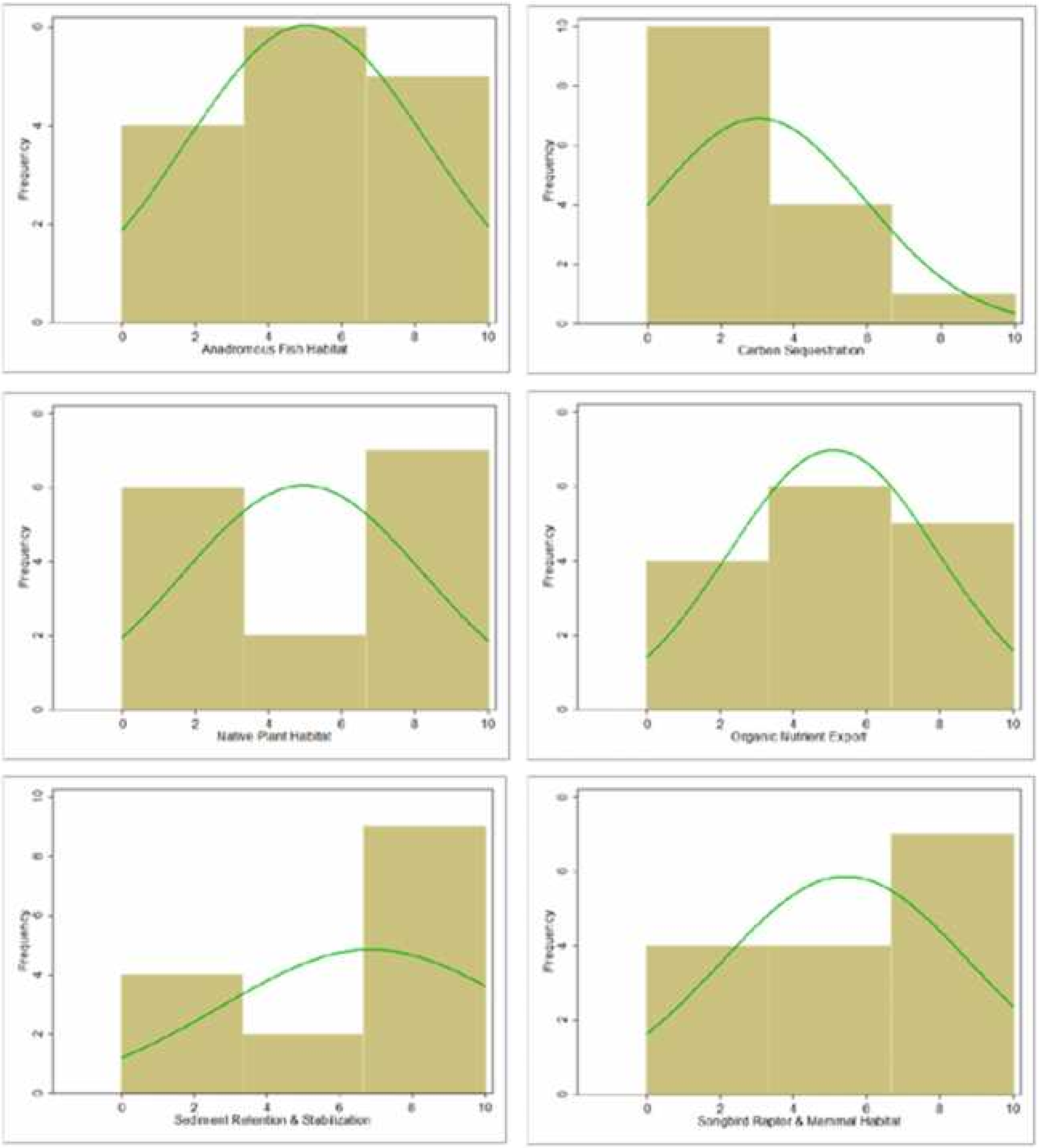
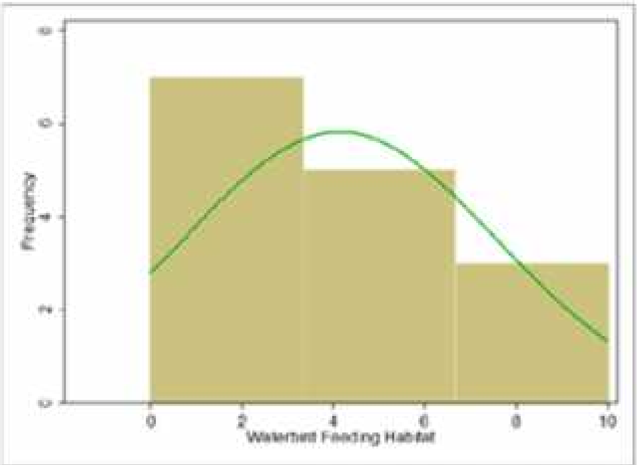
Wetland Sensitivity

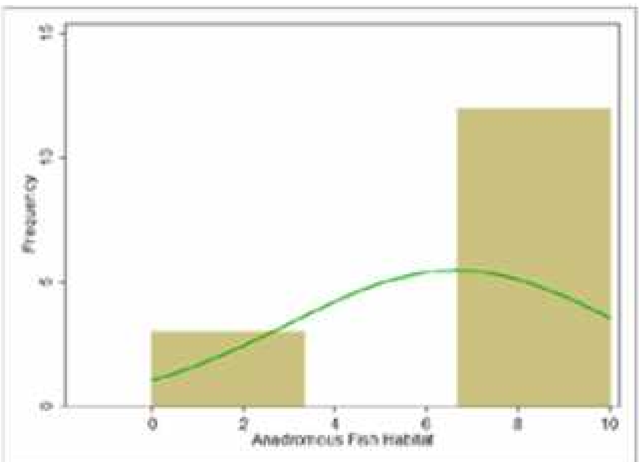

Frequency
Wetland Stressors

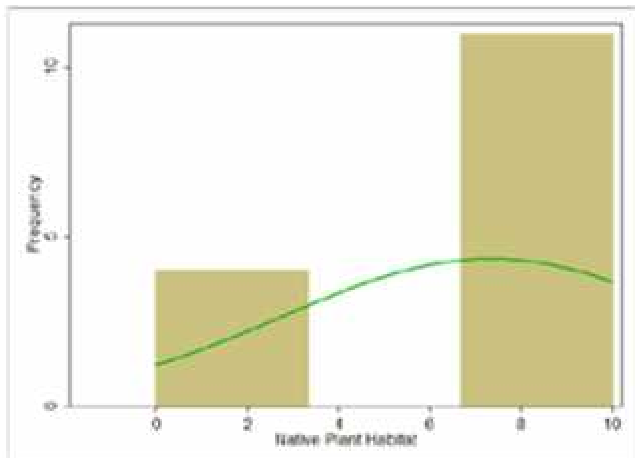
7.3 Tidal Sites Function Score Histograms

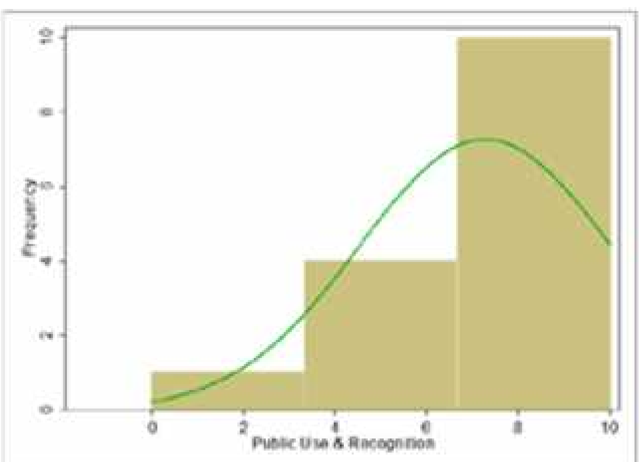


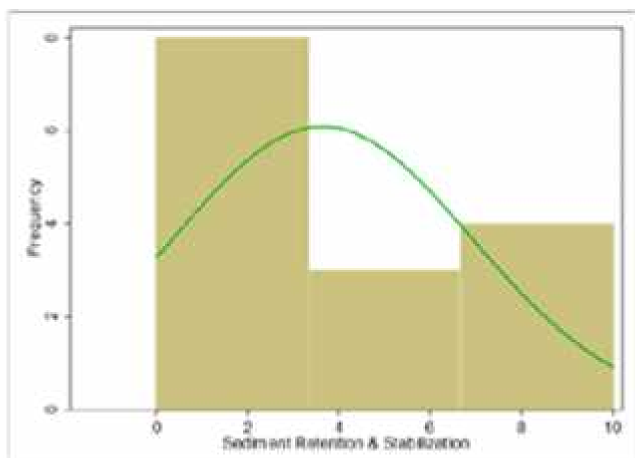


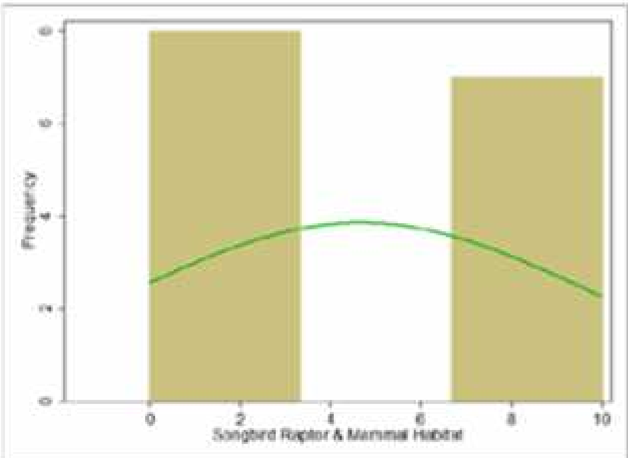
7.4 Tidal Sites Value Score Histograms

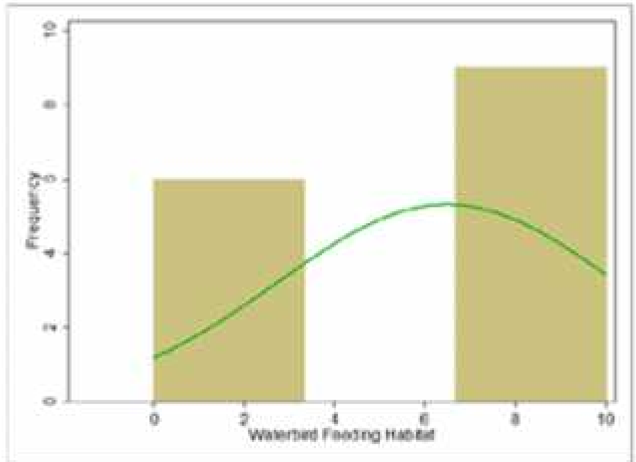


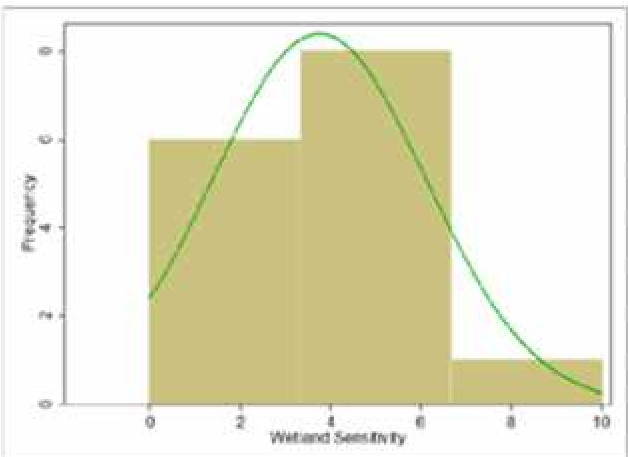


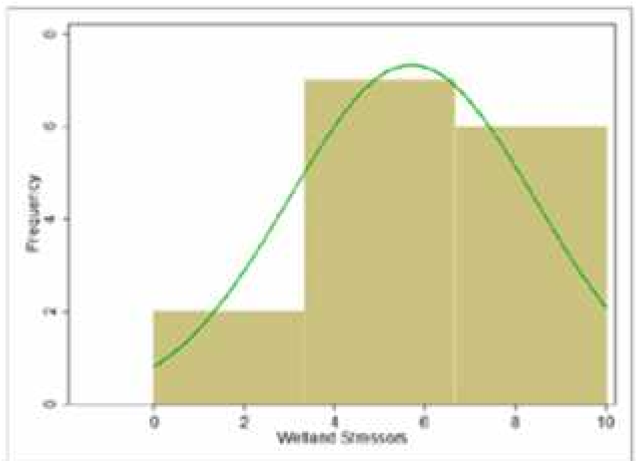












The charts showing the score distributions for each of the 22 functions and 18 values of the assessed non-tidal wetlands, using WESPAK-SE, illustrate visually the distribution of the various possible scores, 0-10, over the entire population of 332 non-tidal wetlands. The brown bars show how many of the 332 wetlands scored a particular function or value score and therefore the distribution or range across the possible spectrum of 0-10. The green line, typically a bell curve or similar shape, shows the average across the population of 332 wetlands for the function or value score. The maximum high point of the curve shows the median score for that particular function or value. When comparing scores, it is important to understand that the distribution of the 0-10 scores will vary between the individual 22 functions and 18 values. For example, a median score of 3 for the value phosphorus retention is contrasted with a median score of 5 for the value amphibian habitat. However the range for the value phosphorus detention is 0-6 whereas the range for the value amphibian habitat is 0-10. Therefore one could see that the number 3 represents a median or moderate score for the value phosphorus retention, and 5 represents the a median or moderate score for the value amphibian habitat. For this reason, number scores do not transfer from one function or value to another function or value with the same result. For example, a score of 3 for the value phosphorus retention is moderate, but a score of 3 for the value amphibian habitat would be low.

Table 9: Assessment Area Units and Wetland Acreage per Map Page

Map page	#units	Acres	PA acres	% of PAs
EC	48	1115	2902	38%
ER	61	485	1587	31%
LP	6	90	236	38%
AB	16	277	375	74%
NV	31	402	1206	33%
SV	43	409	1161	35%
LC	10	74	263	28%
ND	70	1111	1275	87%
WJ	15	184	276	67%
WD	45	1437*	2064	70%
Totals	**345**	**5204**	**11345**	**49%**

This table defines assessment area units by map page, number of units, and total acreage. The highest percentage of wetland was located within the North Douglas (ND) map page. The lowest percentage of wetland was located within the Lemon Creek (LC) map page.

*Total acres for the West Douglas (WD) units includes an estimate for off-site assessments completed for WD. Therefore, 70% wetland coverage in the PA is also an estimated number.

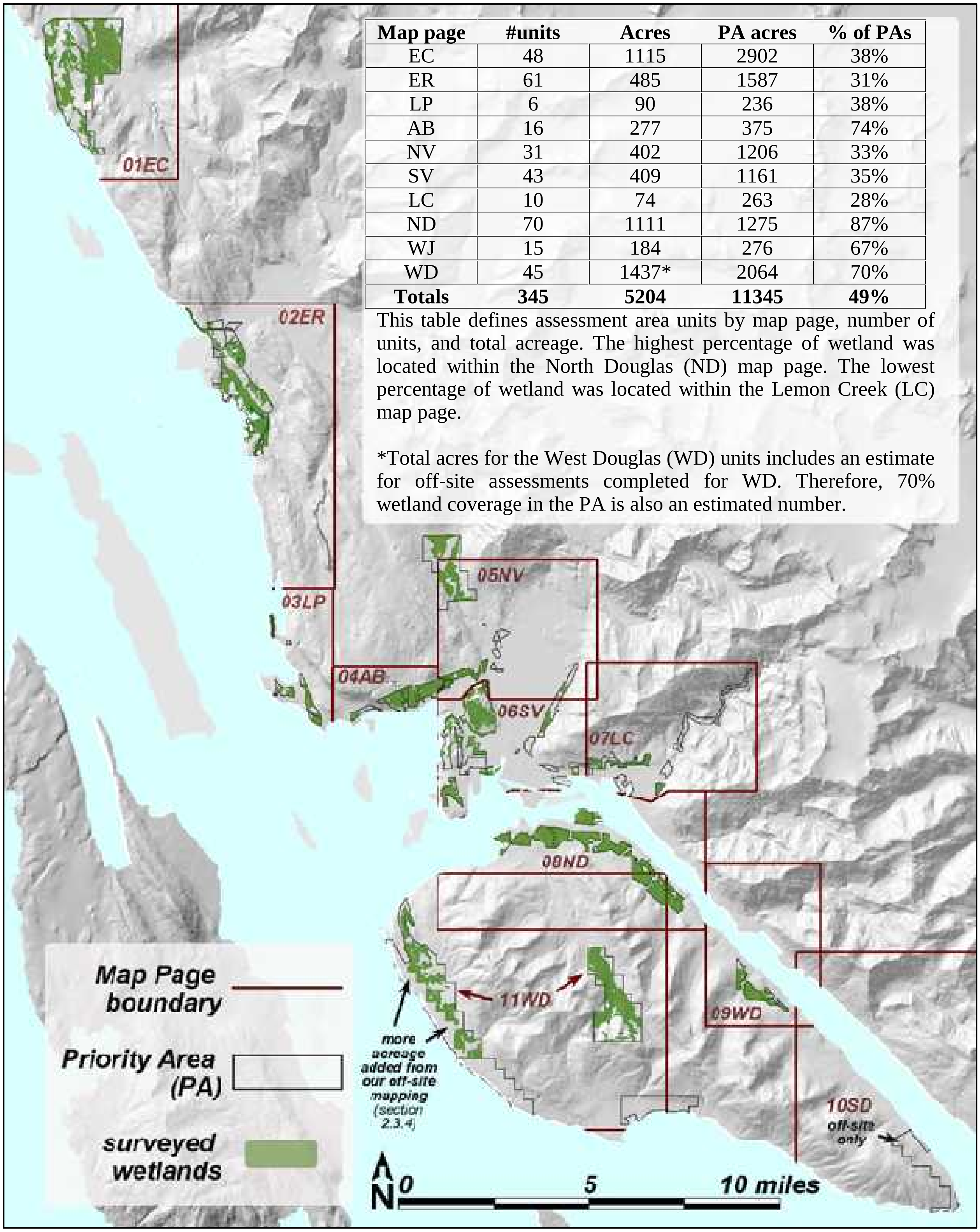


Table 10: Wetland Type Definitions

Wetland Type	WESPAK-SE Definition
Tidal Wetland (*td*)	*td* are inundated by tide at least once annually and dominated by emergent herbaceous or woody plants; surface water levels fluctuate approximately every 6 hours daily in response to tides; *td* does support beachgrass (*Leymus* or *Elymus mollis*, also called ryegrass) unless inundation occurs at the above frequency; *td* does not include areas that are entirely eelgrass or seaweeds.
Forested Peatland (*fw*)	*fw* is nearly entirely moss-covered and/or with peat or muck soils to a depth of at least 4 inches, sometimes greater if not rocky. More tall (>3 ft) woody cover than herbaceous; trees are often hemlock or cedar, often with skunk cabbage (at least in seasonal channels), and blueberries; little or no open water is present; includes shrub fringes of open peatland and fen. *fw* is not in active floodplain.
Open Peatland (*op*)	Nearly all of an *op* is moss-covered; peat depth usually greater than 16 inches except where bedrock is near surface. Tree cover is greater than 5 percent and cover of tall shrubs (more than 3 feet) is greater than 30 percent. Shore pine, Labrador tea, and crowberry often occur; often with small scattered stair-step pools (less than 25 square feet) with acidic, stained water. Some examples are flat bogs, floating bogs, and sloping muskeg.
Fen/Marsh (*fm*)	*fm* is often with extensive surface water, at least seasonally, and usually with more emergent herbaceous vegetation than tall woody plant cover (more than 3 feet in height); herbaceous vegetation often consists of sedges, deer cabbage, marsh marigold, horsetail, burreed, and pond lily; if the ground is moss-covered, the moss often is mostly obscured by sedges or other herbaceous plants. Soils often muck or peat and are seldom coarse unless the *fm* is created by excavation. *fm* is often beaver-created, or at base of steep slopes, or in depressions or adjoining larger water bodies.
Uplift Meadow (*um*)	*um* is within a few miles of tidewater or a glacier, but non-tidal, and mostly within 100 miles of Glacier Bay National Park. u*m* contains little or no persistent surface water except in channels, which may be strongly down-cut. Sweetgale and/or herbaceous vegetation, such as silverweed, iris, and Lyngbye's sedge, compose the dominant vegetation species. Tree cover usually less than 30 percent and peat depth usually less than 16 inches. *um* is the result of uplift following isostatic rebound as a glacier receded within recent centuries.
Floodplain Wetland (*fl*)	At least once annually, surface water in a channel flows through or adjoins an *fl* and causes the width of surface water in the wetland (perpendicular to the channel) to more than double. The increased width is due mainly to channel inflow and not to hillslope seepage or runoff. Soils are silt or coarser; little or no organic soil, or peat, is present. Vegetation can be woody or herbaceous, often consisting of alder, willow, and devil's club.
Beaver-influenced Wetland (*bi*)	*bi* is active or recent beaver activity that has altered the water regime and vegetation. These wetlands are typically episodic, with periods of flood-induced tree mortality alternating with periods of de-watering and vegetation recovery.

7.5 ACRONYMS

AA	Assessment Area
AB	Auke Bay
ACDM	Anchorage Debit-Credit Method
ACMP	Alaska Coastal Management Program
Army Corps	Army Corps of Engineers
AWAM	Anchorage Wetlands Assessment Methodology
AWMP	Anchorage Wetland Management Plan
bi	Beaver-influenced Wetland
BMPs	Best Management Practices
CBJ	City and Borough of Juneau
CDD	Community Development Department
CWA	Federal Clean Water Act
EC	Echo Cove
EP	Enhancement Potential
EPA	Environmental Protection Agency
ER	Eagle River
ERSI	Environmental Systems Research Institute
fm	Fen/Marsh
fl	Floodplain Wetland
fw	Forested Peatland
GIS	Geographic Information System
GP	General Permits
GPS	Global Positioning System
JWMP	Juneau Wetland Management Plan
LC	Lemon Creek
LiDAR	Light Detection and Ranging
LP	Lena Point
MSB	Matanuska-Susitna Borough
MSBWMP	Matanuska-Susitna Borough Wetlands Management Plan
ND	North Douglas
NV	North Valley
op	Open Peatland
PA	Priority Area
SEAL Trust	Southeast Alaska Land Trust
SV	South Valley
td	Tidal Wetland
um	Uplift Meadow
WD	West Douglas
WESPAK-SE	Wetland Ecosystem Services Protocol for Alaska—Southeast
WJ	West Juneau
WRB	Wetlands Review Board

7.6 Summary of the 2008 Federal Rule and Status of Wetland Mitigation in Southeast Alaska

The 2008 Federal Rule

The purpose of the 2008 Federal Compensatory Mitigation for Losses of Aquatic Resources Rule (2008 Federal Rule) is to establish standards and criteria for the use of all types of compensatory mitigation, including on-site and off-site permittee responsible mitigation, mitigation banks, and in-lieu fee mitigation to offset unavoidable impacts to waters of the U.S. authorized through the Corp permits under Section 404 of the CWA and Sections 9 or 10 of the Rivers and Harbors Act. The 2008 Federal Rule directs that standards and criteria shall:

● to the extent practicable, maximize available credits and opportunities for mitigation;
● provide for regional variations in wetland conditions, functions, and values, and;
● apply equivalent standards and criteria to each type of compensatory mitigation.

For all Army Corps permits, the applicant must take all appropriate and practicable steps to avoid and minimize adverse impacts to waters/wetlands of the U.S. prior to proposing and implementing mitigation. This is referred to as sequencing, where the permit process requires in sequence: 1) avoidance, 2) minimization, and 3) mitigation. Permits cannot be obtained by directly proposing mitigation for anticipated impacts. Instead, the Army Corps requires the applicant demonstrate avoidance and minimization measures have been fully considered and documented before moving to the mitigation phase of the permit process. Equal mitigation/impact ratio is required for most permits and the quality/quantity of that is weighed in the permitting process, but only after avoidance and minimization measures are considered.

The 2008 Federal Rule outlines a general preference for the methods of mitigation as 1) restoration, 2) establishment or enhancement, and in certain circumstances 3) preservation. Preservation, which does not create, restore, rehabilitate, enhance, or otherwise lift wetland function, can only be utilized when all the following criteria are met:

● the resources to be preserved provide important physical, chemical, or biological functions for the watershed and
● the resources to be preserved contribute significantly to the ecological sustainability of the watershed

Where preservation is used, the 2008 Federal Rule states that “to the extent appropriate and practicable the preservation shall be done in conjunction with aquatic resource restoration, establishment, and/or enhancement activities. When this requirement is waived by the Army Corps District Engineer, and deemed preservation only, compensation ratios shall be higher.”

Another requirement of the 2008 Federal Rule is a watershed approach must be used to establish compensatory mitigation requirements in Army Corps permits. In general, mitigation should be located in the same watershed as the impact site and where it is most likely to effectively replace lost functions and services taking into account such watershed scale features as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources, trends in land use, ecological benefits, and compatibility with adjacent land uses. Where watershed boundaries do not exist, such as marine areas, an appropriate spatial scale should be used rather than watershed boundaries. The 2008 Federal Rule does not specify at what scale watersheds should be mapped, so without further guidance it is not possible to ensure that mitigation occurs "in the same watershed as the impact site." This CBJ study has mapped watersheds (subsheds) in the study area at a much finer scale than is commonly used to evaluate mitigation requirements. See section 4.3.2 for additional description of how this study has implemented a watershed approach.

Furthermore, the 2008 Federal Rule stated preference for the type and location of compensatory mitigation is listed as follows along with a brief characterization of each type:

1) Mitigation bank credits: a site or suite of sites where resources are restored, established, enhanced, and/or preserved. In general, a mitigation bank sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor.
2) In-lieu fee program means a program involving the restoration, establishment, enhancement and/or preservation of resources through funds paid to a governmental or non-profit natural resource management entity. Similar to a mitigation bank, credits are sold to permittees whose obligation to provide mitigation is then transferred to the in-lieu fee sponsor.
3) Permittee-responsible mitigation under a watershed approach: resource restoration, establishment, enhancement and/or preservation undertaken by the permittee.
4) permittee-responsible mitigation through on-site and in-kind mitigation, performed by the applicant on the project site.
5) Permittee-responsible mitigation through off-site and/or out-of-kind mitigation, performed by the applicant on another site arranged by the applicant.

These above-stated compensatory wetland mitigation preferences, watershed approach and functional replacement requirements of the 2008 Federal Rule are aligned with the wetlands mapping and functional scoring of wetlands in Volume 1 and 2 of the 2016 JWMP. Furthermore, future development of CBJ wetlands management policies should continue this alignment with the Rule. Most importantly, since the Army Corps regulatory program must abide by the 2008 Federal Rule, future CBJ policies that align with the Rule for wetlands management will also be consistent with the Army Corps, thereby avoiding conflicting standards between two regulatory agencies. From an environmental perspective, this benefits wetlands protection and mitigation success. From a policy perspective, this consistency benefits applicants, stakeholders, resource agencies and the public.

Status of Wetland Mitigation in Southeast Alaska

Per the 2008 Federal Rule, wetland mitigation demonstrating restoration and enhancement is preferred over preservation mitigation. The availability of wetland restoration and enhancement opportunities on private land in Southeast Alaska is limited, and furthermore, such opportunities on public land are often encumbered with legal or administrative prohibitions or policies discouraging private investment. As such, preservation mitigation has been the primary source of mitigation in Southeast Alaska to date.

The resources necessary to restore or enhance wetlands in Southeast Alaska, due to such factors as limited or remote access, mobilization logistics, weather constraints, and terrain, magnify the significance, and therefore the value, of those restoration and enhancement opportunities that do exist. A bank or in-lieu fee program offering some restoration or enhancement opportunities, even if proportionally less than that provided by preservation, and considering the overall constraints to mitigation banking specific to Southeast Alaska, is given preference in the determination of credit generation ratios when a lift in functions can be achieved. There are proposed private mitigation banks in Southeast Alaska that could provide restoration and enhancement opportunities. When avoidance and minimization have been addressed and wetland impacts remain in a proposed project, the primary mitigation option for wetlands within the CBJ remains fee-in-lieu until a wetland mitigation bank with a service area reaching Juneau is approved.

The 2016 JWMP, the mapping of wetlands and their functional scoring according to WESPAK-SE, provides CBJ and private landowners, mitigation bankers and in-lieu fee providers, with important information to target areas for development, conservation through avoidance, and mitigation. The mapped extent of wetlands within the Priority Areas (PA's) will help focus development in areas where there are less wetlands, or in areas where wetland function scores are lower thereby reducing development pressure on higher functioning wetlands. Watershed impacts can also be quickly compared by reviewing the amount of wetland coverage within each watershed, and the scores for water-related and fish-related functions in WESPAK-SE, for example Water Storage & Delay, Stream Flow Support, Anadromous Fish Habitat and Resident Fish Habitat. High functioning wetlands and the watersheds in which they occur, where avoidance efforts will likely be focused, can be targeted by mitigation bank and in-lieu providers for preservation credit.

Conversely, impacted watersheds and wetlands can be similarly targeted for restoration credit. With the information in the 2016 JWMP, CBJ and private landowners can determine what the highest and best value may be for their property, either for development entitlements or as mitigation value through a mitigation bank or in-lieu fee transaction.

CBJ strives to protect higher-scoring wetlands while allowing impacts, with avoidance and mitigation, to some lower-scoring wetlands. The planning category to which a wetland will be assigned will be decided through review of its function scores and ratings, as implemented through a public process. The public process will identify those wetland functions which most require avoidance and minimization, likely through a wetland categorization process described in the next section. In addition, where impacts to a wetland are unavoidable, the WESPAK-SE information from this report will tell the landowner and the CBJ which functions need to be replaced in mitigation to achieve the Army Corps' longstanding national goal of "no net loss."

7.7 Alaska Regional Examples of Wetland Management Plans, and Description of Prior CBJ Army Corps General Permit 2012 Matanuska-Susitna (Mat-su) Borough's (MSB) Wetlands Management Plan (MSBWMP, HDR, 2012).

<u>The purpose of the MSBWMP document is stated as :</u>
This plan serves primarily as an educational tool and promotes coordination among all entities involved in wetland management. This plan does not propose or include any new regulations or permitting requirements. It encourages voluntary practices to conserve and protect wetland resources within the Mat-Su.

In addition to wetland and watershed mapping, the MSB Assembly passed several ordinances related to wetlands conservation and protection. Topics of these ordinances include flood control, shoreline setbacks, Best Management Practices (BMPs) for development, mitigation banking, and watershed classifications.

The overarching goals of wetlands planning in the MSBWMP involves taking a long-term management approach using three main goals; identify, assess, and protect. The MSB encompasses a much larger area than the CBJ. The goal is to identify wetlands at a planning scale of information that involves determining size, boundary and type of wetlands. Assessing wetlands for MSB involves developing unique functional assessment methodology. Lastly, implementing conservation and protection efforts includes the input of an advisory committee for avoiding, minimizing or compensating impacts on-site, participating in an in-lieu fee program, and creating wetland banks.

<u>2014 Anchorage Wetland Management Plan (AWMP).</u>
A regional example is the 2014 Anchorage Wetland Management Plan (AWMP). Anchorage currently has General Permits issued to the municipality for lower valued wetlands, just as Juneau used to have. Using General Permits in wetland regulation requires agreed-upon wetland categories for the Army Corps and CBJ to then designate which agency will be in charge of issuing wetland permits for each category of wetland. Since WESPAK-SE is a wetland assessment tool designed only for the Southeast Alaska region, Anchorage has created its own wetland assessment methodology, Anchorage Wetlands Assessment Methodology (AWAM) as well as a credit-debit method for mitigation, Anchorage Debit-Credit Method (ACDM). AWAM devised three categories of wetland, A, B, and C. The Army Corps issued General Permits for Anchorage to administer wetland fill permits for category C wetlands.

Additionally, the AWMP uses a watershed approach and accounts for regional characteristics in compliance with the 2008 Federal Rule. It also established procedures to determine debits and credits for impacts/mitigation regardless of whether it's a mitigation bank, in-lieu fee program or permittee-responsible mitigation. The AWMP aligns with a General Permit as it also identifies the higher functioning and lower functioning wetlands, allowing impacts to lower quality wetlands and offering more protection for the higher quality wetlands. While it discusses the 2008 Federal Rule, the AWMP does not emphasize the specifics of the Rule, especially the order of mitigation preference of banks first, in-lieu fee programs second and permittee-responsible approaches third.

It is important to note that the AWMP only acknowledges mitigation banking and in-lieu fee programs as tools for wetland preservation, when in fact the 2008 Federal Rule, as noted above, prioritizes mitigation banks and lists preservation as a last priority for mitigation type. For parts of Alaska, wetland restoration and enhancement opportunities have been difficult to find and successfully implement; preservation has instead been the focus. The preservation- only approach, does not meet the no-net-loss standard of the CWA (the foundation of the 2008 Federal Rule) because preservation does not restore or enhance wetland functions. Thus, when wetland impacts occur, no corresponding increase in function is provided to off-set the impact, only preservation of land already undeveloped. While the AWMP generally is consistent with the 2008 Federal Rule approach, the lack of restoration and enhancement opportunities has made the mitigation approach focus mostly on preservation only, which in the 2008 Federal Rule is the last approach in the order of preference .

Excerpt from expired Army Corps General Permit for the City and Borough of Juneau:
"On June 30, 1995, the Corps of Engineers issued General Permit 92-1 for wetlands that are classified as Category C, D, and EP in the Revised Juneau Wetlands Management Plan. On July 24, 2000, the Corps of Engineers issues four General Permits (2000-01, -02, -03 and -04) that replaced 92-1. On May 24, 2006, three of the General Permits (GP) were renewed: GP 2000-01, -02, -03. GP 2000-04 was not renewed due to lack of use. The General Permits authorize the discharge of fill material into wetlands, for the purpose of creating foundation pads for structures, utilities, associated roads, driveways, parking areas, and other domestic, governmental, and commercial development, as well as enhancement of certain environmental situations. These GPs authorize mechanized land clearing and other activities that could result in a re-deposition of fill material.

The Corps of Engineers has authorized the CBJ Wetlands Review Board to administer the General Permit through the permitting process outlined in this plan. The Board has the authority to issue wetland permits locally for the discharge of dredged or fill material in these lower value and enhancement wetlands (Category C, D and EP) for the purposes listed in the General Permit. The Board will issue permits in compliance with the enforceable policies of this plan and the specific and general conditions included in the General Permit.

For the Category C, D and EP wetlands, the CBJ has become a 'one-stop' wetlands permitting agency, greatly reducing permit processing time. No individual permit from the Corps of Engineers, consistency determination from the Alaska Department of Natural Resources, Office of Project Management and Permitting, nor individual water quality certification ("401 certification") from the Alaska Department of Environmental Conservation, is required for development in these wetlands. However, other local, State and federal permits may be needed for the project and it is the responsibility of the applicant to obtain all required permits.

For development proposals in Category A and B wetlands, and for any wetlands that are not within the Juneau Wetlands Management Plan study area or are not classified under the plan, a permit must still be obtained from the Corps of Engineers. The enforceable policies of the wetlands plan will be applied when those permit applications are reviewed by the Corps of Engineers."