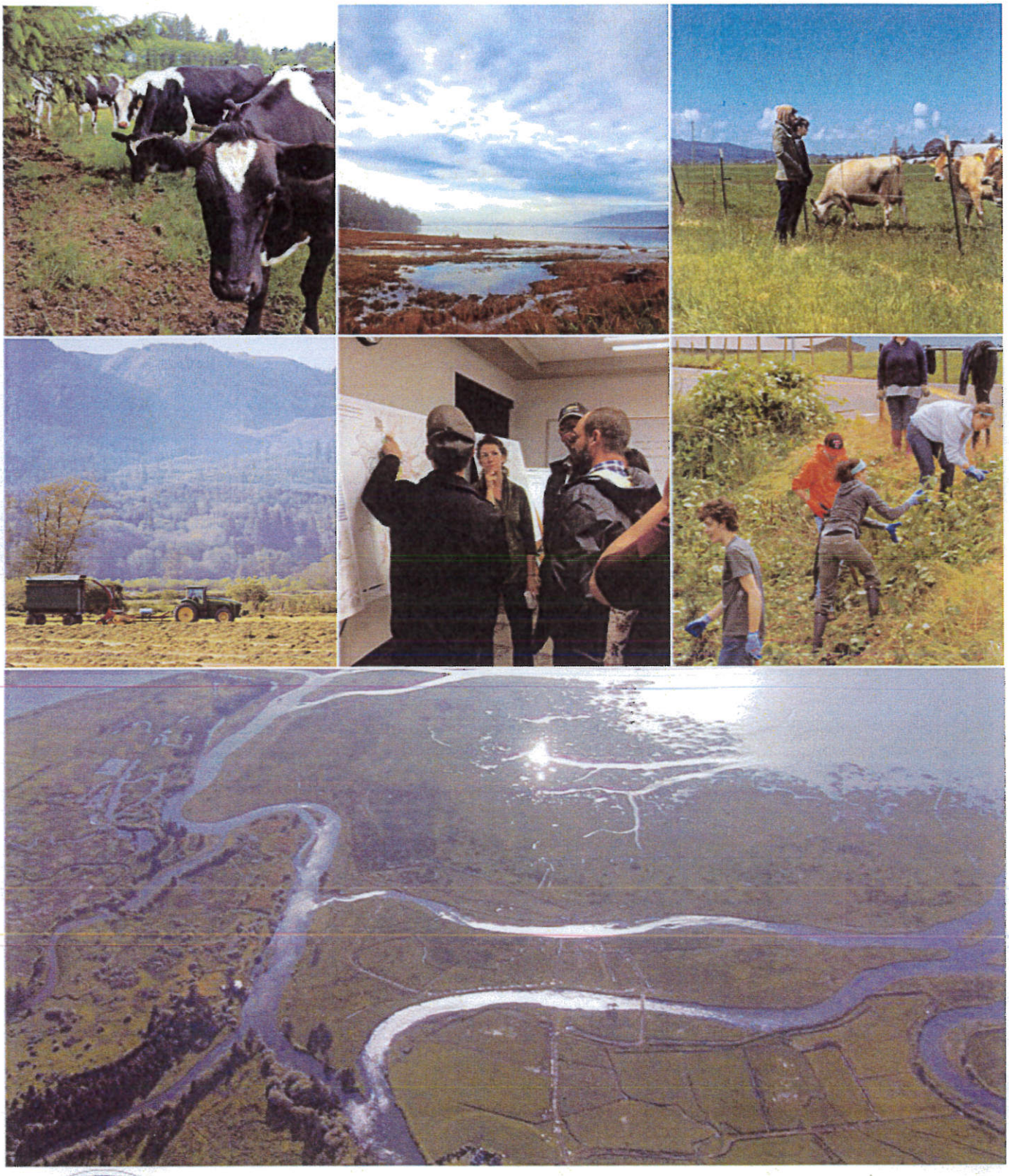

Tillamook County Farm and Wetland (SB 1517) Pilot Program Planning Process

Final Report

February 2019

ACKNOWLEDGEMENTS

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GLOSSARY

Exclusive Farm Use	A land use zoning that counties may apply to agricultural lands protected under Statewide Planning Goal 3. Statewide Planning Goal 3, "Agricultural Lands," requires all agricultural lands to be inventoried and preserved for farm use by adopting exclusive farm use zones. EFU zoning ordinances limit development that could conflict with farm practices and preserve agricultural land for farming and ranching.[1]
Floodplain	For the purpose of this study, floodplain areas are based on geomorphic floodplain features defined in the national soil survey floodplain soils, FEMA special hazard area mapped floodplains, and areas subject to tidal inundation up to highest measured tide.
Hydrodynamic modeling	A mathematical model of a river and floodplain system for analyzing the system's hydraulic conditions and water levels over time, including flood levels, water velocities, and scour. Hydrodynamic modeling is valuable for evaluating a proposed restoration project's water inundation patterns, depths, and frequencies, all of which can influence wetland vegetation and other characteristics such as fish access to the restoration area.
Modified wetlands	Modified wetlands are defined as wetlands that still retain some wetland function but are modified through farming or other activities that change the wetland's hydrologic regime and/or plant community. Modification of the wetlands is usually due to partial filling of the wetland, the installation of dikes, or ditching.
Non-tidal wetlands	Wetlands present along rivers, streams or floodplains above the highest measured tide. Non-tidal wetlands are also referred to as freshwater wetlands.
Tidal area	The portion of rivers, streams, and floodplains below the highest measured tide.
Tidal influence	For the purposes of this study, rivers or streams, or portions of watersheds, are identified as subject to tidal influence if the area is below the highest measured tide (HMT). The highest measured tide was determined to be 11.62 feet, North American Vertical Datum of 1988 (NAVD 88).[2]
Tidal wetlands	Wetlands within rivers, streams or floodplains below the highest measured tide.

1. Oregon Department of Developing and Land Conservation and Development, Farmland Protection webpage, https://www.oregon.gov/lcd/FF/Pages/Farmland-Protection.aspx
2. HMT was determined using the National Oceanic and Atmospheric Administration (NOAA) tidal station located at Garibaldi, Oregon.

ABBREVIATIONS

CAFO	Confined Animal Feeding Operation
DLCD	Department of Land Conservation & Development
EFU	Exclusive Farm Use
FEMA	Federal Emergency Management Agency
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
ORS	Oregon Revised Statute
SB 1517	Senate Bill 1517, Tillamook County Wetlands and Exclusive Farm Use Land Pilot Project
SSURGO	Soil Survey Geodatabase
TAC	Technical Advisory Committee

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PROJECT OVERVIEW

Tillamook County Exclusive Farm Use (EFU) agricultural lands are economically important, particularly in supporting the local dairy industry, which in turn, supports the Tillamook County Creamery Association and many farm-related businesses in the County. Nearly all dairies in Tillamook County and high value farmland with good soil quality are located on the County's 37,589 acres of EFU lands. In 2012, the year with the most recent data available, milk production from these dairies was valued (in 2018 dollars) at $112.1 million. This milk production value is equivalent to approximately 87 percent of total County agricultural production value and 20 percent of total state milk production value (US Census of Agriculture, 2012).[3]

Many of these lands are also ecologically important, as EFU lands are typically located in or near low-lying estuarine and river floodplain areas, many of which were historically wetlands before drainage for agricultural production and other land uses (Figures 1 and 2). Estuarine and floodplain wetlands are central to ecological and hydrological processes that support diverse fish and wildlife habitat and floodwater storage, which reduces flooding in other areas (ODFW 2016 and EPA 2008). These ecological functions also support economic values related to recreational and commercial fishing, shellfish industries, general recreation and tourism, and avoided flood damage costs to property and infrastructure. Wetlands and floodplains are also important in enhancing coastal resilience in the face of sea level rise brought on by the impacts of climate change (EPA 2008).

Over the last decade in Tillamook County, there have been a number of multi-benefit wetland projects that, with broad community support, have improved fish and wildlife habitat, reduced flood damage to infrastructure, and benefited some agricultural lands. Over the previous decade, more than 30 large and small wetland restoration projects have been completed in the county, including river and floodplain restoration in freshwater areas above tidal influence and estuary restoration projects in areas subject to tidal influence (Appendix B). Many farmers are also actively enhancing water quality and habitat on private lands. However, because of the overlap between high-value wetland restoration sites and high-value agricultural lands, conflicts regarding land use for these two activities have arisen. These conflicts have occurred, and have the potential to continue to occur, when restoration activities include conversion of EFU agricultural land and/or possible impacts on adjacent agricultural land.

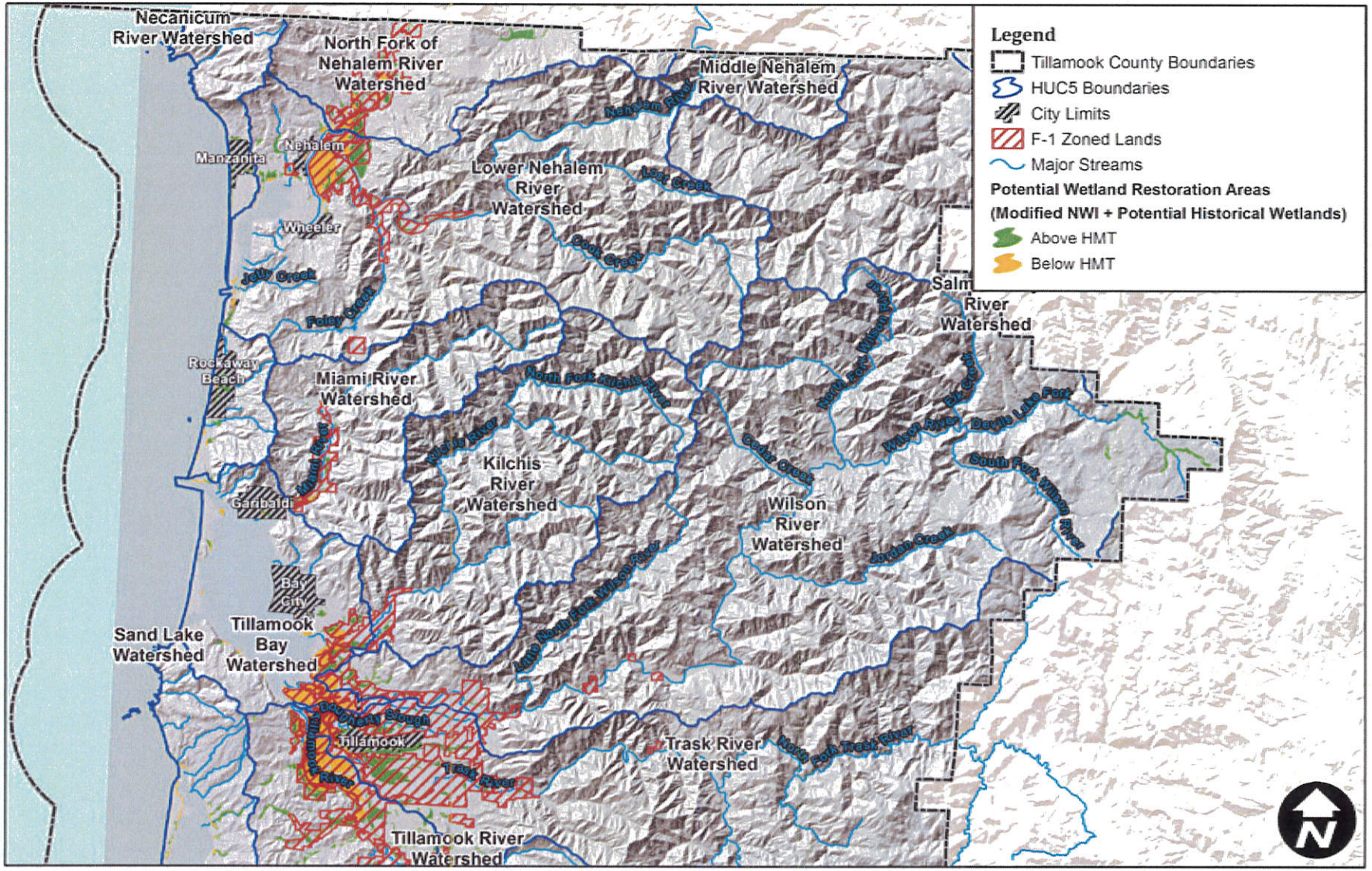
Senate Bill 1517

In 2016, the Oregon Legislature approved Senate Bill 1517 (SB 1517) calling upon farmers, agencies, and conservationists to engage in a dialogue around decisions that impact farming and wetland habitat restoration actions in Tillamook County. SB 1517 authorized Tillamook County to establish a 10-year pilot program in the County for developing and applying a conditional use review to wetland restoration in areas zoned for exclusive farm use. The bill precludes the County from imposing standards in addition to the standards described in ORS 215.296 (1), which reads, in part, that the use may be approved only where the local governing body or its designee finds that the use will not:

a. Force a significant change in accepted farm or forest practices on surrounding lands devoted to farm or forest uses; or

b. Significantly increase the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use.

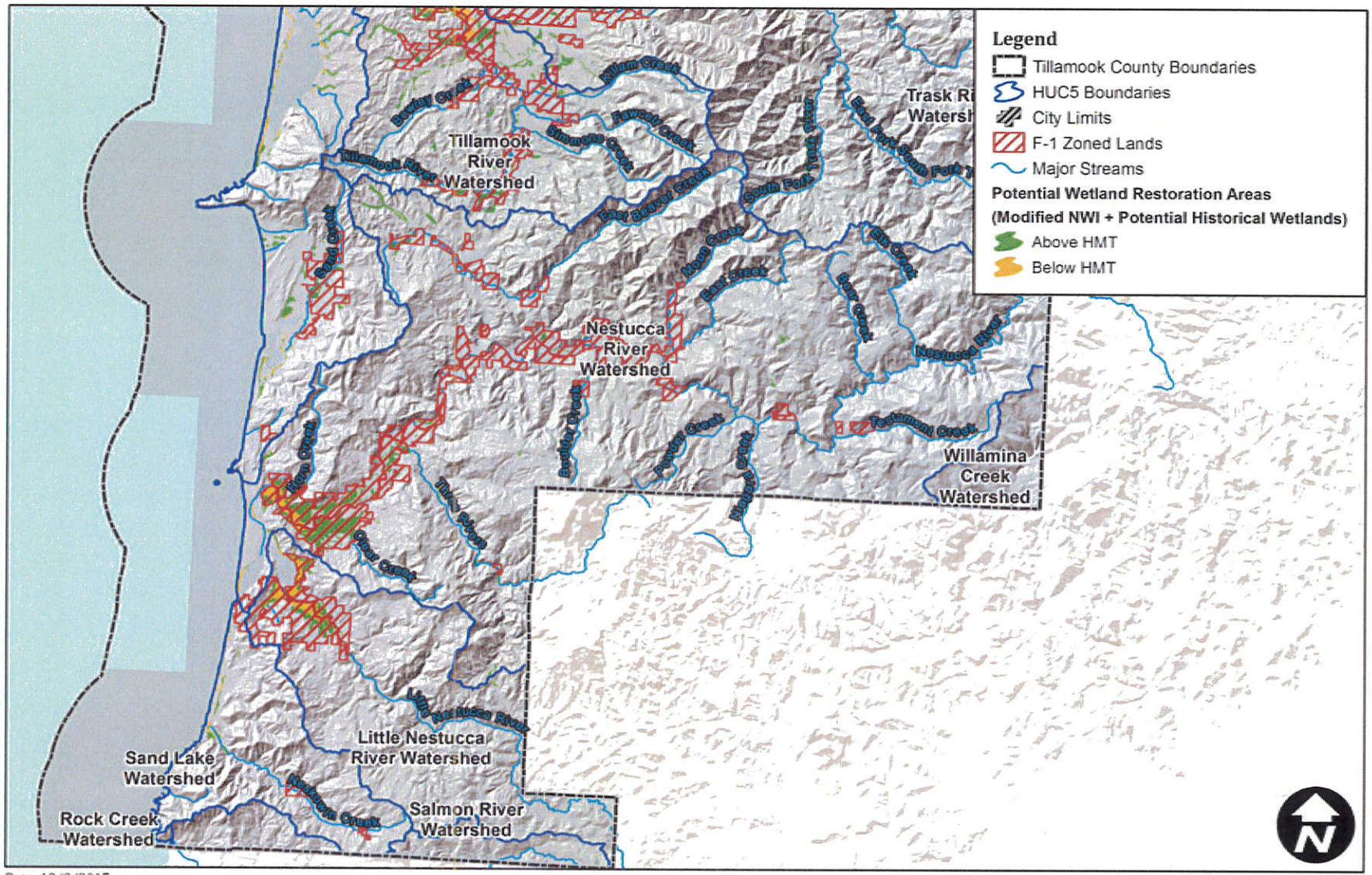
3. The value of farm products in Tillamook County in 2012 was $117.1 million. Inflated to 2018 dollars this is equal to $128.9 million. The value of milk production in Tillamook County in 2012 was $101.9 million. Inflated to 2018 dollars this is equal to $112.1 million.



Date: 12/8/2017
Scale: 1 inch = 3 miles
Data Source: ESRI, 2017; USGS, NHD, 2014; Tillamook County, 2016

F-1 Zoning and Potential Wetland Restoration Areas in Northern Tillamook County

Figure 1. The Northern Section of Tillamook County Showing Streams, EFU (F-1 Zoned) Lands, Potential Tidal and Freshwater (above HMT) Wetland Restoration Areas



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Scale: 1 inch = 3 miles
Data Source: ESRI, 2017; USGS, NHD, 2014; Tillamook County, 2016

F-1 Zoning and Potential Wetland Restoration Areas in Southern Tillamook County

Figure 2. The Southern Section of Tillamook County Showing Streams, EFU (F-1 Zoned) Lands, and Potential Tidal and Freshwater (above HMT) Wetland Restoration Areas

One of the tasks set forth in the bill was to conduct a planning process to identify areas zoned for EFU that are suitable for future wetland creation, restoration or enhancement projects (hereafter "wetland restoration") and identify other EFU areas as priority areas for maintenance of agricultural use. Through this process, Tillamook County and the other stakeholders hoped to identify locations and/or approaches where wetland restoration and farming are compatible, providing co-benefits to both wetland habitats and land use patterns that support agricultural stability.

Section 2 of SB 1517 states:

> *It is therefore in the public interest to establish a pilot program in Tillamook County that applies conditional use review for the creation, restoration or enhancement of wetlands on lands zoned for exclusive farm use, and that incorporates a means for stakeholders to engage in a collaborative process for ensuring the protection and enhancement of agricultural land uses and wetlands.*

Specifically, Section 5 calls on Tillamook County to initiate a planning process to:

- Engage stakeholders, including, but not limited to, representatives of conservation interests and agricultural interests, state and federal agencies and Indian tribes.
- Identify areas zoned for exclusive farm use that are suitable for future wetland creation, restoration or enhancement projects and designate areas zoned for exclusive farm use as priority areas for maintenance of agricultural use.
- Consider the following:
  - The historic location and quantity of wetlands within the county;
  - The location and quantity of wetlands within the county at the time the planning process is initiated;
  - Agricultural interests within the county, and the land use patterns necessary for the stability of agricultural and associated farming practices;
  - The amount and location of potential wetland projects that would provide the greatest benefits to fish recovery, fish and wildlife habitat, flood mitigation and other values;
  - Locations where future wetland projects would be most likely to provide the greatest benefits to fish recovery, fish and wildlife habitat, flood mitigation and other values while remaining compatible with the land use patterns necessary for the stability of agricultural and associated farming practices;
  - Locations where the creation, restoration or enhancement of wetlands is likely to materially alter the stability of the agricultural land use patterns or cause a significant change to farming practice, alone or in combination with other wetlands in the area; and
  - Locations or land-use arrangements, opportunities, conditions or approaches that could best enable benefits to fish recovery, fish and wildlife habitat, flood mitigation and other values in a manner that complements the land use patterns necessary for the stability of agricultural and associated farming practices.

Scope of Work for Consultants

After convening a Technical Advisory Committee (TAC), Tillamook County enlisted the assistance of a consultant to help carry out the work of SB 1517. The consultant was funded by Tillamook County, Tillamook County Creamery Association, The Nature Conservancy, Tillamook County Farm Bureau, Tillamook Bay Flood Improvement District, Oregon Community Foundation and the Oregon Watershed Enhancement Board. Based on the planning elements described above, the consultant scope of work included the following tasks:

1. **TAC and Community/Stakeholder Outreach.** Help set agendas, prepare meeting materials and make presentations at up to eight TAC meetings. Prepare outreach materials and conduct up to six public meetings at key decision points in the process.
2. **Inventories: Wetlands and Agricultural Use.** Develop an inventory of historical and current tidal and freshwater wetlands in Tillamook County. Map and classify past wetland restoration projects on EFU lands. Develop an inventory of current agricultural uses and key aspects of EFU lands in Tillamook County.
3. **Assessments: Agricultural Patterns and Potential Wetland Service.** Assess the quantity and location of potential wetland restoration projects on EFU land in Tillamook County. Develop a map that illustrates restoration priority levels (low, medium, high) of EFU lands throughout the County. Assess land use patterns on EFU lands as it relates to the continued value and stability of the agricultural economy in Tillamook County. Develop a map that illustrates the agricultural stability contribution (low, medium, and high) of EFU lands throughout the County.
4. **Compatibility Assessment.** Identify locations where high-value wetland projects and agricultural land use are and are not compatible. Develop a map of EFU lands in Tillamook County that identifies the range in compatibility of increasing restoration value while maintaining agricultural stability. Identify "creative arrangements" to increase compatibility.
5. **Draft and Final Reports and Recommendations.** Develop a draft and final report, including a description of the process, findings, community comments and recommended Comprehensive Plan and Zoning map changes.

Report Purpose

This final report has three purposes: 1) document the work that was done to address each item outlined above, whether or not those efforts were successful and why; 2) identify lessons learned that may be pertinent to other jurisdictions, and 3) recommend next steps for the Tillamook County SB 1517 Pilot Program Planning Process. It is important to note that Tillamook County is somewhat unique in the uniformity (i.e., dairy focus) of its agricultural economy, extensive salt- and fresh-water estuarine areas, and importance to agricultural production of flood control and flow conveyance systems.

WORK COMPLETED

For each component of the process identified in Section 5 of SB 1517 and presented under that heading above, this section describes the extent to which the work was completed and any impediments that prevented completion.

1. TAC and Stakeholder Engagement

SB 1517 called on the county to "Engage stakeholders in the planning process, including, but not limited to, representatives of conservation interests and agricultural interests, state and federal agencies and Indian tribes." The Pilot Program Planning Process was guided by a Technical Advisory Committee (TAC) that met twelve times between May 2017 and August 2018 to provide strategic direction on research activities, review and comment on draft products, and advise on community outreach activities. Before engaging a consultant, the County assembled the TAC.

The County submitted an invitation to the Confederated Tribes of the Siletz Indians to join the TAC, but they did not participate. Additional outreach activities by the County included presentations to the Tillamook Bay Watershed Council, Lower Nehalem Watershed Council and Nestucca, Neskowin & Sand Lake Watershed Council, and a webinar hosted by The Nature Conservancy for members of the Oregon Central Coast Estuary Collaborative.

A public workshop with the Board of County Commissioners was held on March 29, 2017 to discuss timing of the implementation of the SB 1517 Ordinance Amendments. Initially, there was disagreement among TAC members about whether the Ordinance Amendments should be adopted at the outset of the process or following its completion. On March 29th, 2017 the Tillamook County Board of County Commissioners listened to public comments and discussion on the merits of moving forward with the Ordinance Amendment process in advance of the other work prepared as part of the Planning Project. All comments and testimony presented at the March 29th, 2017 workshop were supportive of moving forward with the Ordinance Amendments to implement the Conditional Use process. Following public comment and discussion, the Commissioners voted to direct Community Development Staff to initiate the Ordinance Amendment process. Public hearings on the Ordinance Amendments required to implement the SB1517 Conditional Use Process were held before the Tillamook County Planning Commission on July 13, 2017 and before the Tillamook County Board of County Commissioners on August 2, 2017. No oral or written comments were received opposing the adoption of the Ordinance Amendments in advance of the planning process or expressing concern with the proposal. The Ordinance Amendments became effective on August 16th, 2017.

In addition to engaging with the TAC at meetings and through individual interviews and meetings, the consultants met with the Tillamook agricultural community at a regularly scheduled Farm Bureau meeting to discuss initial results of the agricultural assessment, including draft maps of relative low, medium, and high-value EFU lands for agricultural stability. County staff also made a public presentation in Salem directed at state agencies and other non-local stakeholders.

The County hosted an open house for the public on October 2017. The Tillamook community was invited to learn about the SB 1517 Pilot Program, review wetland and agricultural land inventories, and help identify areas where wetland restoration is and is not compatible with farming practices. The feedback from the public meeting was considered when preparing wetland and agricultural assessments.

2. Wetland and Agricultural Inventory

The inventory of wetland features and agricultural uses covered all of Tillamook County, with an emphasis on Exclusive Farm Use (EFU or F-1 zone) lands in the county (hereafter referenced as "Agricultural Lands" or "EFU"). The inventory (Appendix A) was based on existing data, reports, and aerial imagery. The wetland inventory characterized current and historical wetlands and other features that shape wetland and associated stream and river habitat restoration potential within EFU lands. The agricultural use inventory compiled information on agricultural uses on EFU lands to classify and describe key aspects of agricultural land uses. Information from the wetland and agricultural use inventories provided the foundation for the subsequent assessment of agricultural land use patterns, wetland values, habitat restoration benefits, and agricultural economic values.

The inventory evaluated a wide range of spatial datasets to summarize wetland and agricultural use characteristics, with key datasets (described in detail in Appendix A) including:

- US Natural Resource Conservation Service Soil Survey Geographic Database (soil characteristics including information on drainage and potential yield and animal waste management capacity)
- US Department of Agriculture 2016 Cropscape geospatial data (agricultural cropping and land use patterns)
- Oregon Department of Agriculture Confined Animal Feedlot Program data (location and characteristic of dairies and other animal operations)
- The Coastal and Marine Ecological Classification Standard (CMECS dataset) that is a national standard for categorizing estuarine habitats

These datasets used for GIS analysis and mapping were created relatively recently (i.e., after 2000), spatially extensive (i.e., covers at least a large portion of the County), and technically sound (i.e., based on accepted and documented scientific and technical methods). The primary available GIS data sets for the wetland and agricultural lands assessment are the Natural Resources Conservation Service (NRCS) soil survey database (SSURGO) for Tillamook County, the National Wetland Inventory (NWI), and CMECS. All of these data sources had limitations in coverage and data quality. The CMECS data, for example, provided information on the status and location of tide gates and other estuarine features, but in some cases the most recent information on these features was not available. The wetland and agricultural land use inventory GIS data and a mapping application is provided on the Tillamook County Website:

http://tillamookcountymaps.co.tillamook.or.us/geomoose2/geomoose.html

The County covers approximately 718,719 acres, of which 37,589 acres (5.23%) are EFU. Of the 18 watersheds in the county, 11 contain EFU lands. The watersheds with a high proportion of EFU lands: Little Nestucca River (9.3%); North Fork Nehalem River (11.4%); Tillamook Bay (9.2%); and Tillamook River (15.2%).

There is significant overlap between EFU lands and potential (existing and historical) wetlands, particularly in the lower portions of watersheds. For the most part, EFU lands are concentrated in the valley bottoms, often within tidally-influenced estuary areas and freshwater floodplains adjacent to rivers and streams. Nearly 50% of the County's EFU lands are within freshwater floodplains or tidally-influenced areas. Overall, 16% of the County's EFU lands are within areas periodically subject to tidal influence. Historical and current wetlands are concentrated in floodplains and areas subject to tidal influence.

SB 1517, Section 5(3)(a): The Historic Location and Quantity of Wetlands within the County

Tillamook County encompasses both tidal and non-tidal freshwater wetlands associated with streams and rivers. The County also contains freshwater wetlands that are not directly influenced by rivers or streams. While these upland freshwater wetlands are an important habitat type, the wetland assessment focused on historical tidal wetlands and freshwater wetlands that are within floodplain areas associated with streams and rivers because these wetland types are highly complex and ecologically productive areas that support unique habitats and other important functions and values. Historically, a large proportion of Tillamook County was covered by tidal and freshwater wetlands, with much of the area concentrated in the lower portions of river valleys or estuarine areas. Nearly 50% of Tillamook County's EFU lands are within historical freshwater floodplains or tidal areas, ranging from 84.5% of the area in the Tillamook Bay Watershed to 3.4 percent in the Sand Lake Watershed. Figure 3 illustrates the overlap of floodplains EFU lands in central Tillamook County.

SB 1517 Section 5(3)(c): Agricultural Interests within the County

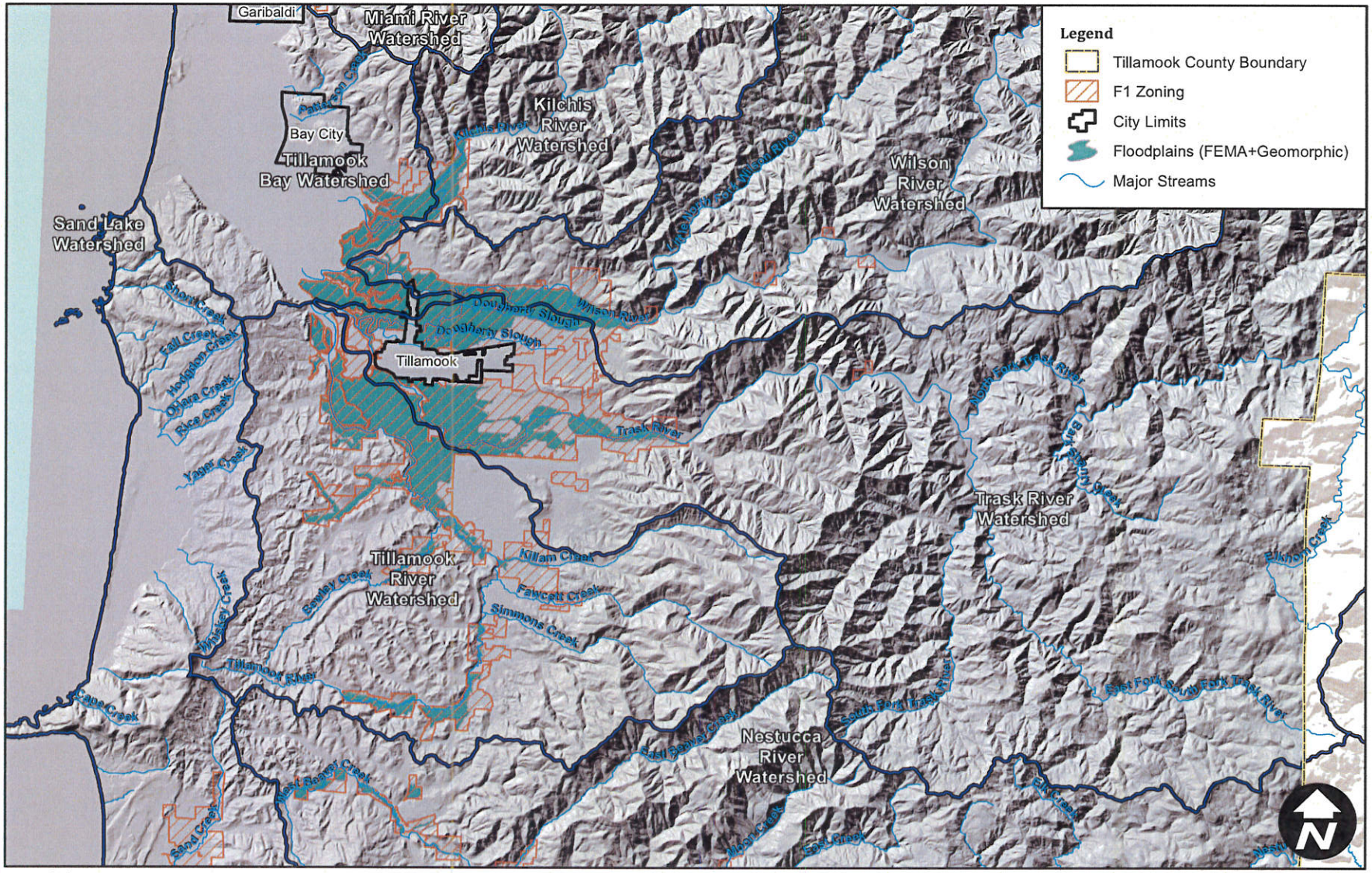
The agricultural inventory quantitatively described current land uses and characteristics of EFU lands, primarily based on NRCS data. The Oregon legislature created the EFU zone to provide areas for continued practice of commercial agriculture and is intended to be applied to resource lands with high-value farm soils. Of the 37,590 acres currently in the EFU zone, all but 84 acres are high-value agricultural lands.

The number of acres in the EFU zone has been steady over time. The majority (22,700 acres or 60%) of EFU lands are in three watersheds: Nestucca River, Tillamook River, and Trask River. An additional 11,500 acres (31%) are in the Little Nestucca, Lower Nehalem, Wilson River, Sand Lake, and Tillamook Bay watersheds. The remaining 1,390 acres of EFU lands are in the Miami River and Kilchis River watersheds.

Dairy farming has long provided the vast majority of agricultural value in Tillamook County; according to the 2012 Census of Agriculture, milk from cows accounted for 87% of total county agricultural value, or $112.1 million (in 2018 dollars). Current data indicate that there are 174 Confined Animal Feeding Operations (CAFO) dairy operations in Tillamook County, with 45,151 permitted animals. Approximately 99% of permitted animals are located on farms with a base of operations located in the EFU zone. Of the mapped CAFO operations in the County, 87% of the lands used for manure management are in the EFU zone.

Two management challenges to Tillamook County farmers include maintenance of drainage of agricultural lands and manure management. Inventory findings highlight these challenges: based on soil class, approximately 47 percent of EFU crop and pasture lands have soils that are somewhat to very poorly drained or are excessively drained. In addition, approximately 70% of EFU crop and pasture lands have soils that are rated by NRCS as 'very limited' for manure management, with the remaining 30% of these lands rated 'somewhat limited'. Farmers in the County have adapted to these soil characteristics and improved drainage and waste management capacity on their lands through drainage infrastructure and active management. Communication with farmers indicated that the soil survey data may not be accurate at the parcel-level, and also does not indicate the actual productive capacity of lands in the county, since site management and drainage infrastructure play such an important role in determining agricultural productivity of the land.

Approximately three quarters of EFU crop and pasturelands do not have access to supplemental irrigation water. However, given the current climate and growing conditions in the County, even non-irrigated yields are relatively high. In terms of yield potential, approximately 89% of EFU crop and pasture lands have medium to high expected yields for important forage crops such as grass silage and pasture.



Date: 8/8/2017
Scale: 1 inch = 3 miles
Data Source: ESRI, 2017; USGS, NHD, 2014; FEMA, 2016

FEMA Special Flood Hazard Areas (Preliminary) and Geomorphic Floodplains in Central Tillamook County

Figure 3. Floodplains within EFU Lands in Central Tillamook County.

3. Wetland and Agricultural Assessment

The goals of the wetland and agricultural lands stability assessment (Appendix B) were to: 1) describe the functions, values, and benefits of wetlands and wetland restoration projects from an ecological and socio-economic perspective; 2) identify EFU lands in Tillamook County that are high priority for maintaining the stability of the County's agricultural economy, based on metrics for agricultural land quality/production potential, production costs, and current land use; and 3) outline the limitations of the available data for evaluating wetland restoration opportunities and priorities for maintaining agricultural lands.

It is worth noting that while there was discussion of the potential role that sea level rise may play in assessing the compatibility of wetlands projects on agricultural lands, particularly in the Tillamook Basin, that sea level rise models were not included in the assessment for a number of reasons: the short duration of the pilot project relative to rise scenarios, the wide range of model scenarios available and particularly the uncertainty around assumptions related to the maintenance and/or improvement of existing drainage infrastructure.

SB 1517 Section 5(3)(d): Wetland Functions and Benefits

Estuaries and river floodplains provide complex and productive habitats important for fish and wildlife populations and can provide places of refuge for juvenile fishes during periods of high river flows. Tidal wetlands include freshwater areas influenced by the tide and estuary areas that are subject to a range of water salinity levels. Tidal wetlands are one of the most productive wetland types from the perspective of plant growth, nutrient and carbon dioxide (a greenhouse gas) uptake, and associated accumulation of organic matter. They act as mixing zones between upstream areas and the ocean where nutrients and organisms between land and sea meet. By some estimates, tidal wetlands support up to three-quarters of all harvested fish species, largely due to their high productivity and diversity of habitats.

Non-tidal freshwater wetlands associated with floodplains are also very productive ecosystems. This wetland type is hydrologically connected to rivers and streams. Floodplains support nutrient absorption, high levels of primary productivity, aquatic insect production, and detrital inputs to the river system. River-associated wetlands include off-channel wetlands, sloughs, and side-channels. Non-tidal wetlands provide a diversity of habitats for juvenile salmon and steelhead, including high-water refugia where fish can reside and feed during flood events.

Tidal and non-tidal wetlands areas are critical habitats for juvenile salmon and steelhead growth and survival to maturity. These habitats provide a very productive and important environment as the fish feed, grow, and transition to the ocean environment. For example, one study observed juvenile coho salmon that doubled in size during the 28-day residence within tidal wetlands (Jones et al. 2009).

Tidal and non-tidal wetlands also contribute to flood attenuation, aquifer recharge, and other hydrologic benefits. Because tidal and floodplain wetlands are located within a relatively flat landscape, their surface area expands and contracts as rivers rise and fall, allowing for the storage of large volumes of water. Consequently, these wetlands serve as a moderator of flood variability—storing flows and reducing flow velocities during flood events. In addition, these wetland areas create low-velocity environments that are important for trapping nutrients and sediments that have positive impacts in mitigating for sea level rise.

In terms of benefits to agriculture, wetland restoration projects can reduce damage to infrastructure as well as well as generate other benefits to agricultural land uses. The primary potential benefits to agricultural lands are 1) reduced flooding and 2) improved water quality in local waterways. Wetlands store water and can reduce downstream flooding; depending on the location of restored wetlands relative to agricultural lands, wetland restoration may reduce flooding and associated water management

challenges on agricultural lands. Second, wetlands, which provide a buffer between upland areas and rivers, can help attenuate bacteria and nutrient concentrations and reduce water temperature by creating cool water refuge for fish in re-connected side channels and other habitats. These water quality improvements can benefit agriculture by helping producers and local waterways meet state water quality standards for fecal bacteria and nutrients. Water quality enhancements also support commercial shellfish harvesting, which can be harmed by impairment of bay waters, chiefly due to bacteria.

SB 1517 Section 5(3)(b): Location and Quantity of Wetlands and Restoration Opportunities at the Time the Planning Process was Initiated

Potential wetland restoration areas are defined as locations where wetland functions and/or extent has been lost or reduced; this includes modified wetlands and potential historical wetlands locations that contain soils that indicate past wetland status. Modified wetlands are defined as wetlands that still retain some wetland function but are degraded or modified through activities such as diking, ditching, or partial filling that change the wetland's hydrologic regime and/or plant community. Most of Tillamook County's high-value restoration areas are concentrated in historical or current tidally-influenced wetlands and non-tidal wetlands connected to floodplains or streams.

Nearly 50% of the County's EFU lands are within freshwater floodplains or tidal areas. Watersheds with the largest estuary and floodplain area (tidal and freshwater) as a percent of total EFU lands are as follows: Tillamook Bay (84.5%); Lower Nehalem River (75.5% percent); Kilchis River (72.8%); and North Fork of the Nehalem River (66.4%).

Overall, there are 12,691 acres of estimated current and historical tidal and non-tidal wetlands located in the County's EFU lands, or approximately 42 percent of the estimated 29,900 acres of EFU cropland (Appendix B, page 5). Almost all of these estimated historical tidal wetlands in the EFU zone have been lost or modified. Of the 4,782 acres historical and current tidal wetlands on EFU lands, 4,171 acres (87%) have been modified (Appendix B, page 9). Most of the modified tidal wetlands that have been converted to freshwater wetlands as a result of dikes, drainage ditches, or other modifications.

Within the County's EFU lands, there are 4,171 acres of potential tidal wetland restoration areas. The TAC agreed that most significant loss of historical wetland area and function in the County has been in tidally-influenced salt- and freshwater wetlands.

There are 7,909 acres of potential non-tidal wetland restoration area within EFU lands. Non-tidal wetlands associated with floodplains and streams also are very productive environments and high priority for restoration.

A large number of restoration projects, encompassing more than ten thousand acres of restored tidal and non-tidal wetlands, have been completed in Tillamook County on EFU and other lands (Appendix B, Table 6). Much of the effort has been focused on restoring tidally influenced wetlands. The Southern Flow Corridor project is the largest restoration project completed to date in Tillamook County: 642 project acres, of which 519 acres were restored to full tidal inundation and 86 acres are in agricultural use.

SB 1517 Section 5(3)(c): Land Use Patterns Necessary for the Stability of Agricultural and Associated Farming Practices

The purpose of this portion of the assessment (Appendix B) was to identify lands that are high priority for maintaining the stability of the County's agricultural economy. The assessment aimed to identify the relative priority of EFU lands based on potential indicators of relative agricultural productivity potential and relative cost of agricultural production (i.e., the higher the production potential and the lower the cost of production, the higher the priority of a given EFU land area and vice versa). As in the inventory (Appendix A), the key available datasets for spatial analysis of agricultural lands were the NRCS soil survey geographic database (SSURGO), the USDA cropscape-cropland data, and Oregon

Department of Agriculture CAFO (confined animal feeding operations) data (a full description of datasets is provided in Appendix A). These datasets were supplemented with interviews with NRCS, Oregon Department of Agriculture, the Farm Bureau, and local farmers.

These datasets were analyzed for correlations between drainage and yield, drainage and manure management capacity, and yield and manure management capacity. Based on these characteristics, initially 5,269 acres of EFU cropland were categorized as potentially lower priority lands. Of the potentially lower priority lands, there were 438 acres in drainage districts, and 534 acres with irrigation water rights. In terms of spatial distribution, there was a concentration of potentially low priority EFU croplands near Tillamook Bay, with the remainder interspersed throughout the EFU lands. Some of the areas identified as relatively lower priority near Tillamook Bay are in the Southern Flow Corridor project area (at the time of the analysis, the spatial data outlining the extent of that and other restoration projects was not available to overlay with the results of this analysis).

As noted above, the methods and data used in the agricultural lands assessment were presented at a meeting with the Tillamook agricultural community in September of 2017. Input and feedback provided at this meeting indicated that the available spatial data and the associated assessment provided poor indications of actual, on-the-ground agricultural production potential and costs. As an alternative approach, the agricultural community noted that site-specific factors are likely the most important attributes of farmland in determining its priority level. Specific location affects the ease of access to the farmland, the types of surrounding land uses (complementary and potentially conflicting), and the potential magnitude of third party impacts from restoration (e.g., conversion of isolated farmlands are likely to have limited third-party impacts). In reviewing the EFU lands, there were few such isolated tracts of EFU lands located in the low-lying valley floodplains and tidally-influenced areas with high restoration potential. Another important factor, albeit without available county-wide data, is the level and condition of on-site infrastructure, particularly drainage infrastructure.

4. Compatibility Assessment

At project outset, the aim of the compatibility assessment was to identify EFU lands with high habitat restoration potential that could be restored with low impact to agricultural stability and surrounding land use practices and costs. To achieve this, the analysis approach, with TAC agreement, focused on three steps: 1) prioritizing habitat restoration potential across EFU lands, 2) prioritizing contribution of EFU lands to agricultural stability, and 3) identifying locations where third-party impacts of restoration on adjacent EFU lands would be positive or where adverse impacts to farming practices and costs would be minimal. As described in detail below, while the first step is achievable, the second and third steps were not due to data constraints and site-specific factors for which no adequate datasets currently exist. The inability to adequately identify (at the landscape level) priority agricultural lands or the expected effect of restoration on adjacent agricultural lands resulted in the inability to then adequately determine where there may be high potential compatibility.

The inventories and assessments (see Appendices A and B) revealed that there is broad spatial distribution of EFU lands that have high habitat restoration potential; however, these lands generally are not isolated from other EFU lands with active agricultural operations. As a result, existing landscape-level data are insufficient to identify specific locations where restoration and agricultural uses are inherently compatible. Potential impacts of restoration on adjacent agricultural lands depend on site-specific characteristics (including management practices, infrastructure, soil type, slope and, likely most of all, hydrology), while the importance of specific EFU lands for agriculture also depends on site-specific characteristics that are not provided in the available landscape-level data. For example, the agricultural assessment identified areas on EFU lands that Natural Resource Conservation Service (NRCS) data indicate have relatively poor drainage characteristics and yield potential based on soil and other site characteristics. However, when maps of these data were shown to the farming community, they noted: 1) the data are often not accurate at the parcel-level resolution, and 2) site management and drainage infrastructure, for which data are not available, are more important in determining the value of a site for agricultural stability than the soil and other site characteristics. Farmers also suggested that priority farmland and water quality management together with a viable program for strategic flood control and drainage infrastructure upgrades would be more important than evaluating soil type in determining production potential and importance of specific areas of Tillamook County EFU lands for the long-term maintenance of dairy-oriented land uses.

Given the reliance of the Assessment on soil type, as it was the only pertinent and available landscape-level GIS data, and the lack of available landscape-level data on individual farm practices related to water quality management, flood control and drainage infrastructure for use in the Assessment, it was difficult to adequately prioritize various areas of EFU land and their contribution to the stability of agricultural land use patterns. As noted above, this inability to adequately identify priority agricultural lands was an important factor obstructing progress in determining where there was high potential compatibility.

There are also considerable data limitations for accurately identifying both historical and current wetlands. Important data limitations include potential underestimation of both potential historical wetland areas (i.e., areas that are not existing wetlands but were historically), and existing, modified wetlands (i.e., areas where ditching, levee construction, filling and other actions have resulted in significant loss of wetland function). The data also may include some sites that are erroneously classified as potential or existing wetland. As a consequence, while the wetland findings presented here provide a broad picture of wetland status and restoration opportunities throughout the County and for specific watersheds, the findings are not suitable for evaluation of wetland status and restoration opportunities at finer spatial scales such as landownership parcels or site-specific areas.

As such, the analysis concluded that identifying areas where restoration is compatible with agriculture (i.e., where restoration may have little negative impact on agricultural practices or the cost of those practices or may even benefit agricultural production on adjacent lands) likely requires collecting and developing higher resolution and more site-specific data on farm operations, hydrology, flooding and other factors that are not currently available for Tillamook County at the finer scale of evaluation. In particular, site-specific hydrological analysis is required in many cases to identify the potential type and magnitude of restoration effects of any given project on water tables, drainage, and flooding on surrounding farm or forest lands (Appendix B, page 12).

Due to these limitations, it was not feasible to evaluate compatibility factors at a fine scale (e.g., landownership parcels or site-specific areas). Instead, a series of "compatibility factors" were developed to identify key project characteristics and effects that the County would use to evaluate compatibility based on the two criteria set forth in ORS 215.296 (1) and determine whether a proposed wetland restoration project would be granted a conditional use permit under the revised Land Use Ordinance. The framework is intended to provide wetland restoration applicants with some guidance on information and issues that may need to be addressed in developing an application for Conditional Use review for their potential projects. The information sheet 'Applying for Wetlands Restoration, Creation and Enhancement Projects in Tillamook County's Farm (F-1) Zone' lists some of the factors and is included as Appendix C.

While developing the factors, Department of Land Conservation and Development (DLCD) provided feedback that setting standards including quantitative thresholds and/or adopting additional criteria would be counter to the language of SB 1517 which prohibits adopting standards other than the decision criteria set forth in ORS 215.296 (1). At the same time, several TAC members viewed the information sheet as being subjective and as providing too little guidance on the type and level of analysis and potential mitigation required for conditional use approval of proposed restoration projects. During one TAC meeting, the consultant team and TAC conceptually applied the factors framework to the existing Miami River restoration project and an early-stage project proposed in the Tillamook River Freshwater Wetlands. This example process highlighted the potential variation in what might be required to demonstrate compliance with the criteria for decision.

SB 1517 Section 5(3)(e): Locations where future wetland projects would be most likely to provide the greatest benefits to fish recovery, fish and wildlife habitat, flood mitigation and other values while remaining compatible with the land use patterns necessary for the stability of agricultural and associated farming practices.

SB 1517 Section 5(3)(f): Locations where the creation, restoration or enhancement of wetlands is likely to materially alter the stability of the agricultural land use patterns or cause a significant change to farming practice, alone or in combination with other wetlands in the area.

SB 1517 Section 5(1)(a,b): Identify areas zoned for exclusive farm use that are suitable for future wetland creation, restoration or enhancement projects and designate areas zoned for exclusive farm use as priority areas for maintenance of agricultural use.

Identifying the locations where future wetland projects are compatible with the land use patterns necessary for the stability of agriculture and priority areas for maintenance of agricultural uses are key goals of both SB 1517 and the scope of work. However, as noted above, this analysis did not identify specific locations or develop maps of relative compatibility due to the following factors: 1) absence of accurate data indicating if there are EFU locations that may have low value for agricultural stability resulting in high compatibility for restoration, and 2) the determination that site-specific data and analysis, particularly related to hydrologic impacts, are required to identify the level of compatibility of restoration with the stability of agriculture at any given location.

The analysis did conclude that EFU lands overlap extensively with historical wetlands and floodplains, which are generally important locations with a high benefit for restoring fish and wildlife habitat and other wetland functions. Most of the loss of historical wetlands on EFU lands has been in estuary areas, with the greatest losses of tidal wetlands in the Tillamook River Watershed (1,399 acres), Tillamook Bay Watershed (800 acres), and the Lower Nehalem River Watershed (596 acres) (Appendix B, page 9). The wetland assessment found that, because the greatest loss of wetlands has been in estuary areas, the locations for future wetland projects that would provide the most significant benefits to fish and wildlife are in areas that historically were subject to tidal-flows but are now drained and protected behind dikes or other flood infrastructure (Appendix B). This finding is consistent with current and past Tillamook County restoration priorities: Most of the restoration projects in the County have focused on tidal wetland areas.

As noted above, EFU lands are predominantly used to support dairy operations, including land for the operations themselves as well as lands for crops to feed animals and lands to spread manure. Countywide, only four dairy operations are located outside the EFU zone, but numerous dairies do rely on pasture and croplands outside the EFU zone to manage animal waste. Two key management challenges for Tillamook County farmers are drainage of agricultural lands and animal waste disposal. Both challenges may be affected, both adversely and positively, by restoration projects, as restoration projects can alter drainage, groundwater table and overland flow. These changes in turn can affect costs and management practices associated with yields, drainage management, water quality management, soil suitability for manure management and setback requirements for animal nutrient management operations.

In order to identify locations suitable for wetland restoration that may have high compatibility with agricultural stability, the assessment focused on identifying agricultural lands that may have relatively less value for agricultural production. The draft agricultural assessment findings indicate, based largely on NRCS GIS data and ratings, that approximately two-thirds of EFU lands have relatively high value, with one-third of EFU lands either not in cropland or rated as relatively lower priority croplands. The GIS-based analysis identified approximately 5,270 acres of relatively lower priority croplands (Appendix B, Table 8), with a concentration of potentially low priority EFU croplands near Tillamook Bay and the remainder interspersed throughout the EFU lands.

This approach to identifying restoration locations with high compatibility with agricultural stability was not possible given the character of agricultural operations in this area. As noted above, feedback from the agricultural community indicated that the GIS-based analysis was not an accurate representation of agricultural land priority in the county for any specific site. At TAC meetings and the public open house, members of the agricultural community indicated that all EFU lands are important for agriculture. Feedback on the specific factors affecting which EFU lands are prioritized by the agricultural community include: 1) areas protected by drainage infrastructure and levees/tiling should be prioritized, as there is a cultural desire not to see one hundred years of work undone and these drainaged locations can be very productive for agricultural operations, and 2) areas contiguous to other agricultural properties and transportation infrastructure. Figures 1 and 2 illustrate that most EFU lands are contiguous and not isolated in small parcels. As such, locations where restoration of wetlands may be most compatible with agricultural stability and associated farming practices may be on the 'fringes' of agricultural production areas. Restoration in these fringe areas could result in fewer potential adverse impacts and could minimize disruption of manure management relationships between farms.

SB1517 Section 5(3)(g): "Creative Arrangements"

"Creative arrangements" are non-regulatory approaches and/or programs that can be applied to enhance compatibility of wetland restoration with agricultural land uses. Creative arrangements essentially are intended to create conditions that benefit fish or other resources while also improving on-site or adjacent agricultural practices. Examples include promoting activities that accommodate both agricultural activities and restored habitat at the same site, but separated by timing (e.g., seasonal grazing in riparian areas and wetlands while accommodating flooding and fish access during other portions of the year) or enhancing agricultural activities with areas adjacent to the restoration site (e.g., improving transportation access to adjacent agricultural lands). When appropriately applied, creative arrangements can be designed to address limiting factors for fish (e.g., access to productive wetland and floodplain habitats), while also addressing the factors limiting agricultural productivity (e.g., enhancing drainage). Project work on creative arrangements focused on identifying examples of creative arrangements and case studies, such as the Skagit Valley in Washington, that highlight how other areas have identified compatibility and win-win wetland restoration coupled with agricultural stability. These creative arrangements are intended to be a consideration for conditional use applicants in designing project-specific arrangements, conditions and approaches that could best enable both restoration goals and stability of agriculture. TAC discussion noted that in many cases it may be helpful for an applicant to convene an informal meeting early in the process with neighboring landowners and agencies to discuss the proposed project to identify project-specific creative arrangements.

Example project-specific creative arrangements include:

- The installation of new tide gate systems and bridges in a manner that improves fish passage to floodplain/tidal habitats and enhances water control and land drainage for individual agricultural landowners.
- Increasing the amount of time cattle can spend on a site in the spring and summer by improving drainage, while allowing the site to become inundated during high-water periods when the cattle are not grazing.
- Improving flood infrastructure on properties adjacent to a restoration project site. For example, enhancing an adjacent dike that has been degraded through erosion or other issues.
- Payments to landowners, including working land easements, for enhancing habitat or other actions that enhance ecosystem function.
- Providing improved transportation to properties adjacent to the restoration site. For example, creating a new dike that protects adjacent properties that incorporates an access road on the dike that improves access to adjacent agricultural areas.

In addition to project-specific arrangements, the TAC noted that compatibility may be increased through community-scale initiatives that address the relationship between agricultural stability and land base. These include digesters that may reduce reliance on lands for manure management, land swaps, easements, and other initiatives that are beyond the scope of project-specific review contemplated in the pilot program. It is important to note that community-scale initiatives and innovation are happening in a broader context in Tillamook County (e.g., digesters, land swaps, conservation easements) beyond the scope of project-specific review contemplated by this program. The 'compatibility factors' developed through this work were intended to direct applicants towards project-specific arrangements, conditions and approaches that could best enable both restoration goals and maintenance of agricultural practices. It will be helpful in many cases for an applicant to convene an informal meeting to discuss the proposed project and design with neighboring landowners and agencies early-on in the process to review the potential for project-specific arrangements.

LESSONS LEARNED

Legislation

Clearly Connect Planning Process and Land Use Review Standards

The language within SB 1517 presented significant challenges to the planning process. Specifically, Section 5 of SB 1517 describes a broad planning process that considers, among other data, "locations where future wetland projects would be most likely to provide the greatest benefits to fish recovery, fish and wildlife habitat, flood mitigation and other values while remaining compatible with the land use patterns necessary for the stability of agricultural and associated farming practices." However, Section 4 of the bill, which defines the Conditional Use review process to be adopted, states that "ordinances or regulations adopted by the governing body under the pilot program may not establish standards in addition to the standards described in ORS 215.296 (1) for approving the creation, restoration or enhancement of wetlands in areas zoned for exclusive farm use." This restricts the approval of the proposed wetland restoration projects to consideration of the significance of potential impacts to the costs of farming or agricultural practices on surrounding farm or forest lands and does not allow for the adoption of criteria related to other wetlands values such as habitat and flood protection for surrounding lands that could result from a potential wetlands project. The language of Section 5 also prevents the establishment of standards that could provide more clarity to potential applicants on how to meet the criteria for decision. The disconnect between the planning process described in Section 5 of the Act, the prescriptive/limited Conditional Use criteria and procedures described in Section 4 of the Act left the TAC unable to integrate data regarding restoration benefits and community-wide agricultural stability gathered in the planning process into the Conditional Use review process. As such, the planning process de-emphasized aspects such as identifying locations for wetland restoration with greatest general benefit and identifying land use patterns necessary for stability of agriculture.

Provide Less Ambiguous Definitions within ORS 215.296 (1)

Standards for what should be considered a 'significant' impact are not provided in ORS 215.296 (1). The ambiguity in the definitions of these terms decreases certainty for wetland restoration applicants as to the extent of documentation required to meet these thresholds. As noted above, the process would have benefited from more flexibility to allow for the adoption of additional standards or criteria which could have been incorporated as part of the in the conditional use review process. Although outside of the scope of SB1517, a legislative effort to further define significance in this context would be beneficial to this, as well as other, land use review processes.

Sequence Land Use Ordinance Amendment After the Planning Process

A typical planning process begins with identifying desired outcomes, documenting historic and existing conditions, evaluating alternatives for achieving the desired outcomes and then selecting and implementing a course of action. In implementing the SB 1517 Pilot Project land use ordinance amendment to make wetland restoration on EFU lands a conditional use as described in Section 4 of the Act was enacted at the project outset. The expectation at the time of amendment enactment was that the planning process would provide data that would support the conditional use review process. However, as noted above, due to a lack of site-specific data and other challenges, the planning process resulted in relatively little concrete guidance on how to satisfy the Conditional Use criteria or limits to the applicability of the conditional review

process. Some members of the TAC have since expressed concern that, without more clarity on how to meet the conditional use criteria, very few restoration projects may be proposed in Tillamook County given the potential additional costs necessary to successfully complete the conditional use review process. Additionally, funders of restoration projects have expressed reservations in supporting wetland projects in Tillamook County due to the high levels of uncertainty.

TAC and Stakeholder Engagement

Goals and Metrics

The TAC participated in and documented a goal-setting, opportunities and challenges exercise at the project outset. It would have been beneficial to discuss the project goals on a regular basis with the TAC throughout the project to ensure that the planning process and assessment criteria aligned to meet these goals and interests. It also could have helped to identify the specific goals and interests held in common by all stakeholders. For example, a key stumbling block to identifying compatibility was the inability to differentiate between high and low priority agricultural lands. When stakeholders focus on their common goals and interests, it increases the incentive to find win-win scenarios that meet these goals and interests. In particular, identifying sources and magnitude of restoration benefits to agriculture and to certain policies, such as identifying zones for restoration that are instead subject to a Type I administrative review process, may enhance the effectiveness of future planning efforts.

Stakeholder representation and participation

While the TAC included a good representation of the stakeholder community, having alternates designated may have improved TAC attendance at meeting and on conference calls. Additional communication and engagement strategies may have improved the participation of stakeholders and the broader public in the project. Additional communications tools could have included newsletters, publicly circulated TAC meeting summaries and other regular project updates. Engagement strategies could have included additional workshops and targeted outreach to a broader range of stakeholder groups, such as recreation and tourism agencies and recreational and commercial fishing/shellfish communities.

Consultation with the broader affected communities

In consultation with the TAC, it was decided first to develop agricultural assessment maps based on TAC-approved criteria and then reach out to the agricultural community for feedback on the draft results. In hindsight, it may have been more beneficial to consult with the affected communities to solicit their input on how to prioritize lands, the validity of various datasets, and what areas they would collectively say may be good or bad for restoration prior to conducting technical analysis on the relative priority of lands for restoration/agricultural use. Also, stakeholder feedback on issues they are struggling with that may be helped with restoration would have been beneficial, as well as information on what they would view as win-win scenarios and best possible outcomes.

Data presentation

Draft wetland and agricultural assessment results were initially presented in maps with low, medium, and high ratings shaded, respectively, as red, yellow and green. Due to negative connotations associated with the color red, as well as the stark contrast in green versus red ratings, maps may have been better received by stakeholders if they had been shaded in a continuum of one color, such as blue or green (map colors were revised subsequently).

Wetland and Agricultural Inventory

Data inaccuracies and lack of site specificity

There are considerable data limitations identified for the characterization of wetlands and agricultural lands. For wetlands, important data limitations include potential underestimation of both potential historical wetland areas (i.e., areas that are not existing wetlands but were historically), and existing, modified wetlands (i.e., areas where ditching, levee construction, filling and other actions have resulted in significant loss of wetland function). The data also may include some sites that are erroneously classified as potential or existing wetland. As a consequence, while the findings of the wetland assessment presented here provide a broad picture of wetland status and restoration opportunities throughout the County and for specific watersheds, the findings are not suitable for evaluation of wetland status and restoration opportunities at finer spatial scales such as land ownership parcels or site-specific areas. It is important to note that there are other studies that use site-specific, local information to identify wetland restoration locations and priorities. For example, a tidal wetland restoration prioritization has been completed that focuses on protecting existing high quality tidal wetlands within the Tillamook River estuaries (Ewald and Brophy 2012).

There are similar problems with the data used in the agricultural lands assessment and are discussed in Appendix B. Feedback from the agricultural community indicates that the available GIS data for agricultural lands provide poor indications of actual, on-the-ground agricultural production potential and costs. While the NRCS soil survey database provides excellent site-specific data on soil type, the agricultural community commented that the NRCS data on the productivity and suitability of land for dairy agricultural uses, including ratings for soil drainage, crop yields, and suitability for spreading animal waste, which are based largely on soil type, are not reliable at the site level. The agricultural community provided input that site management is more important than soil type in determining the production potential and importance of Tillamook County EFU lands for dairy uses. This has implications for future farm and wetland planning projects: generating an accurate county-wide map of priority EFU agricultural lands will be more feasible in areas where the value and quality of agricultural lands is largely determined by soil type, slope, and other factors with excellent and available site-specific GIS data on the county scale. Given the importance of site management factors that are often dependent on operator characteristics, there are not GIS data available that would fill the data gaps in Tillamook County to identify relative priority of agricultural land that would be acceptable to the agricultural community. To overcome this data gap would likely require significant collaboration and input from the agricultural community and/or the Tillamook County Creamery Association on the relative productivity of EFU lands and farms. As this information may be proprietary or confidential, and private lands and farmers may be reluctant to classify their own or others' lands as relatively lower value, this information may be challenging to obtain, apart from market-based evidence on specific parcels such as the level of agricultural users' interest in purchasing a given EFU farmland parcel that is for sale.

Compatibility Assessment

Site- and river reach-specific information is required to assess proposed restoration project compatibility with adjacent agricultural land uses

Site- and river-reach specific information is required to assess proposed restoration project compatibility with adjacent agricultural land uses. Landscape-scale inventories and assessments are useful for evaluating restoration opportunities in the broad context of agricultural land uses, but information on drainage infrastructure, levee locations, roads and other factors must be evaluated at the site-specific level to determine potential adverse impacts of wetland restoration on surrounding lands that affect agricultural production costs or land use patterns. Site-specific wetland restoration and agricultural use information will help to inform which areas of EFU land may or may not be compatible with restoration.

A basin-scale hydrodynamic model may be necessary for identifying restoration areas and evaluating compatibility with agricultural land uses

Due to the complexity, particularly in areas where you have both fresh and tidally influenced river systems, hydrodynamic modeling is often required to evaluate the benefits and risks associated with flooding, downstream scour, drainage and other issues. Hydrodynamic modeling is also valuable for evaluating inundation patterns, depth, and frequency that influence wetland vegetation and habitat restoration. To identify costs and benefits of restoration and potential for creative arrangements, hydrologic effects of restoration are necessary. Without this information, there may be little agreement between stakeholders on which sites should be prioritized for restoration or what the potential for impacts, positive or negative, to adjacent uses might be.

RECOMMENDED NEXT STEPS

The following recommendations are intended to help Tillamook County complete the work needed to fulfill the charge of SB 1517.

Continue the Work of the Technical Advisory Committee

Convene the TAC, with new members as needed, on a regular basis to continue discussions about win-win compatibility scenarios, priority areas for maintenance of agricultural uses, and criteria for determining the areas where restoration would be compatible with sustaining Tillamook County's agricultural economy. Revisit the goal-setting document to ensure desired outcomes are achieved. When preparing regular reports to the legislature in odd years, conduct a public workshop and targeted outreach to ensure participation from affected communities. A key part of the TAC's continuing process should be increasing certainty about the information necessary to satisfy the conditional use criteria including requirements, expectations and costs. Concerns about the uncertainty of the potential additional costs necessary to successfully address the conditional use review criteria could be addressed through community outreach that provides restoration proponents with an understanding of how to meet the conditional use review criteria and highlights win-win scenarios for restoration and agriculture.

Learn from other examples of agricultural and restoration communities working together on win-win solutions

There are other areas in the Pacific Northwest where ecological restoration is taking place on or adjacent to agricultural lands in a manner compatible with agricultural stability. There are likely lessons to be learned from other communities that are exploring approaches for sustainable agriculture while also restoring fish habitat. Research these efforts in the form of presentations, white papers and/or learning series and include best practices in reports to legislature. The Tillamook Working Lands and Waters Group would be an appropriate entity to lead these efforts. See the Southern Flow Corridor Project case study on the following page.

Explore the feasibility of developing a basin-scale hydrodynamic model

In most cases, hydrodynamic modeling will be required to support the design of wetland restoration projects and make quantitative predictions of flood reduction benefits or any increased flood risks. The level of hydrodynamic modeling will vary depending on the size and complexity of the project. The approach to hydrodynamic modeling also will vary depending on whether there is existing hydraulic data available for the proposed project area. There are a number of small-scale hydrodynamic models that have been completed for portions of Tillamook County that could be expanded upon, which could reduce modeling costs. The hydrodynamic modeling would be carried out for a variety of flow scenarios for both existing conditions and various project alternatives to evaluate project effects.

Hydrodynamic modeling will help support the compatible use determination and is often needed to support project-related permits. In particular, any restoration project that occurs in a Federal Emergency Management Agency (FEMA) mapped floodplain (Special Flood Hazard Area) must obtain a floodplain development permit from the local jurisdiction. In Tillamook County floodplain regulations are contained in Tillamook County Land Use Ordinance Section 3.510 Flood Hazard Overlay Zone. Any project that involves construction in a Regulatory Floodway or alteration or relocation of a watercourse also requires a hydraulic analysis.

The Southern Flow Corridor Project

NEEDS

Flood Mitigation

Recent decades have seen a number of damaging floods occur in Tillamook County. The 1996 flood in particular was noted for its long duration and extensive damages. Since then, large floods have occurred in 1998 and most recently in 2006 and 2007, causing further damages. The lower valleys of the Wilson, Trask, and Tillamook rivers merge to form a broad floodplain at the head of Tillamook Bay on which the City of Tillamook is located. The Wilson River flows through a steep canyon out of the mountains and does not have any significant floodplain until around six miles above the bay. The river channel is perched, meaning it runs in a channel with natural banks that are higher than the floodplains around it. Consequently, flood flows that leave the Wilson River, especially to the much larger southern floodplain, never return to the channel but flow south to the lowest part of the valley and west to meet the Trask and Tillamook Rivers. Highway 101 crosses the Wilson River floodplain at grade and so suffers frequent deep inundation across its lowest portions between Hoquarton and Dougherty Sloughs.

Habitat Loss & Declining Fish Populations

Listed as "threatened" under the federal Endangered Species Act, Oregon coastal coho populations have been severely impacted by the loss of off-channel and tidal wetland habitats. In few places is this impact more pronounced than in Oregon's Tillamook Bay, where almost 90% of the estuary's tidal wetlands have been lost to agricultural and urban/residential development.

The resulting lack of available tidal wetland habitats has been a primary contributor to the decline of Tillamook Bay coho, and today's runs (just over 2,000 fish in 2012) represent a fraction of estimated historic abundance (~200,000). Likewise, the lack of available tidal wetland habitats has been identified as a key impediment to species recovery. These tidal habitat losses have impacted the Bay's four other anadromous species, as well, particularly Chinook which use tidal wetlands extensively for rearing.

SOLUTION

The primary intent of Southern Flow Corridor-Landowner Preferred Alternative Project (SFC-LPA) is to remove manmade impediments to flood flows to the maximum extent possible in the lower Wilson River floodplain. The project accomplishes this by extensive removal of existing levees and fill. New setback tidal dikes are required to protect adjacent private lands from inundation from daily tides.

Areas outside the setback levees will be restored to tidal marsh. Working with a diverse set of partners, Tillamook County intends to permanently protect and restore the 522 acres of restored tidal marsh habitats at the confluence of the Bay's two most productive salmon systems, the Wilson and Trask Rivers. Representing 10% of the watershed's historic tidal acreage and a far greater percentage of the "restorable" tidal lands, the project site contains an expansive mosaic of tidal wetlands, disconnected freshwater wetlands, and drained pasture lands. Once restored to a tidal regime, the resulting range of habitats (including mud flats, aquatic beds, emergent marsh, scrub-shrub wetlands, forested wetlands and sloughs) will provide substantial habitat benefits to not only Threatened coho, but also chum and Chinook salmon, and cutthroat trout.

In order to address concerns related to the conversion of agricultural lands to restored marsh as a result of the proposed levee removals the project team evaluated the hydraulic impacts of the SFC on its own as a standalone project and alternatives that minimized the amount of agricultural lands that might be lost. The findings demonstrated that the SFC did indeed provide flood level reduction benefits on its own, and that alternatives were available that allowed some of the originally targeted agricultural lands to remain as such rather than being acquired and converted to salt marsh. With this information, Tillamook County purchased three properties outright for the project and planned modified the project design which was renamed the Southern Flow Corridor – Landowner Preferred Alternative (SFC-LPA). In addition to its extraordinary habitat benefits, the SFC-LPA project was shown to be the most cost-effective flood level reduction measure by creating a flow corridor from Highway 101 out to Tillamook Bay.

RESULTS

Long-term ecological and socio-economic outcomes include:

- Reduced flooding in the Highway 101 business corridor and adjacent residential/agricultural lands, including measureable reductions in flood elevation and duration;
- Improved freshwater and estuarine water quality, including reductions in temperature, dissolved oxygen, and turbidity;
- Increased habitat complexity and availability across the range of tidal wetland habitats; and
- Enhanced ecological function benefitting other aquatic, terrestrial, and avian species.

Because most wetland restoration projects will require the development of a hydrodynamic model, there would be efficiencies in creating a hydrodynamic model that covers a large area. Some hydrodynamic modeling studies have been completed in the County, particularly in the lower portions of the Tillamook Basin. There is the potential to integrate these past modeling efforts, combined with modeling to fill in gaps, to create a basin-wide hydrodynamic model.

It is feasible to evaluate hydrodynamic model parameters and outputs over a large area encompassing an extensive river and floodplain system. A broad-scale hydrodynamic model would produce a number of benefits including the following:

- Provide a framework for evaluating the flood impacts for a variety of potential wetland restoration projects at the scale of a river reach, watershed, or basin. Wetland projects that modify flood patterns can interact in ways that are both positive (e.g., overall net reduction in flooding) and negative (e.g., increased scour and erosion on existing dikes). A broad-scale hydrodynamic model could be used as a planning tool to evaluate trade-offs between projects and identify projects with the greatest benefits for flooding and fish habitat.
- With a broad-scale hydrodynamic model in place, project proponents could build upon the model's framework and data as a by adding the site-specific project information (e.g., the location where flooding would be restored). This creates efficiencies and possible cost-savings for site-specific restoration projects.

Support initial project(s) to go through the conditional use process; monitor the effectiveness of and identify needed improvements to the conditional use process

Given that it is a new process and that there are concerns about how to successfully navigate the review process and address the conditional use criteria, it will be advantageous to incorporate an adaptive learning approach to improve the process over time. It also will be helpful to the process for the TAC to provide support with information and stakeholder communication to initial projects that go through the conditional use process. These projects can test the effectiveness of the review process and provide information on how to improve it to meet the needs of restoration and agricultural interests. Additionally, such entities as the Tillamook Working Lands and Waters Group could seek grants and other sources to fund pilot projects.

Suggest the legislature clarify the wording and intent of certain sections of SB 1517

Work with appropriate parties to seek direction from the legislature on ambiguous aspects of SB 1517, including, but not limited to:

- Whether the intent was for the County Land Use Ordinance to be amended before or after the planning process.
- Resolve the apparent discrepancy in the scope of the planning analysis and the scope of the review criteria that will inform the role of such factors as restoration benefits and benefits to agricultural stability.
- Whether or not SB 1517 should allow for the development of standards and review criteria in addition to ORS 215.296 (1).
- Whether the legislature should appropriate funding to support critical data needs such as basin-specific hydrologic models.

Improve data quality and accuracy of site-specific information that will help support evaluation of restoration compatibility

Site-specific information that would support the evaluation of restoration compatibility could be gathered through a county-wide effort in the short term or collected for specific sites over time. Site-specific information that would help support the evaluation of restoration compatibility includes the following:

- Areas with poor drainage within, or adjacent to, historical wetlands and floodplains.
- Information on the function of tide-gates and other drainage infrastructure. Is the infrastructure functioning as intended for agricultural practices and for fish fish passage (if designed for this purpose)?
- Local flooding patterns, including identifying any problem areas where periodic flooding is interfering with agricultural practices or roads.
- The condition of the flood infrastructure. Are there areas where the dikes or other structures are in need of maintenance due to scour, erosion or other issues that reduce the infrastructure's effectiveness or risk of failure?

Seek clarification on key terms in Oregon Revised Statute 215.296

Encourage DLCD to prepare a guidance document addressing terms in Oregon Revised Statute 215.296, including "significant" and "surrounding." The forthcoming state Supreme Court decision in Stop the Dump Coalition v. Yamhill County may help provide clarity.

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APPENDIX A

Tillamook SB 1517 Pilot Project: Wetland and Agricultural Use Inventory

John Runyon, Cascade Environmental Group, and Barbara Wyse, Highland Economics

Introduction

This memo describes the inventory of wetland features and agricultural uses on Exclusive Farm Use (EFU or F-1 zone) lands in Tillamook County (hereafter referenced as "Agricultural Lands" or "EFU"). The purpose of the wetland feature inventory step is to use existing data, reports, and aerial imagery to characterize current and historical wetlands and other features that shape wetland and associated stream and river habitat restoration potential within EFU lands. The purpose of the agricultural use inventory is to compile information on agricultural uses on EFU lands and classify and describe key aspects of agricultural land uses.

Information from the wetland and agricultural use inventories will provide the foundation for the subsequent assessment of agricultural land use patterns, wetland values, habitat restoration benefits, and agricultural economic values. The purpose of the inventory is to present the data, but not to analyze it. In other words, each inventory provides little to no analysis of the relationships between different characteristics or land use patterns. Such analysis will be provided in the next step, assessment of EFU Agricultural Lands and assessment of wetlands.

The memo starts with methods and data (page 1), and then presents an overview of the County's watersheds and EFU agricultural lands (page 11). After these introductory sections, the wetland inventory (page 16) agricultural inventory (page 30) are presented. Some of the datasets are important to both the wetland inventory and the agricultural inventory. As such, these data, including information on drainage and drainage districts, are provided in both the wetland and the agricultural inventory. This is done in order to ensure that the sections of the memo focusing on each inventory are complete and can stand alone for readers potentially interested in focusing on one inventory or the other.

Methods Overview

The inventory evaluated a wide range of spatial datasets for the purpose of summarizing wetland and agricultural use characteristics. The datasets chosen for GIS analysis and mapping were selected based on the following criteria: 1) The dataset was created relatively recently (i.e., after 2000); 2) the dataset is spatially extensive (i.e., covers at least a large portion of the County); and 3) the dataset is technically sound (i.e., based on accepted and documented scientific and technical methods).

This document includes example maps showing wetland and agricultural land use characteristics for one area of the County. The wetland and agricultural land use inventory GIS data and a mapping application is provided on the Tillamook County Website:
http://tillamookcountymaps.co.tillamook.or.us/geomoose2/geomoose.html

County and Watershed Inventory Reporting Framework

The wetland and agricultural inventory results are summarized at two spatial scales: County-wide and for each of the watersheds that drain areas within the County. Hydrologic Unit Codes (HUC) is the national standard for delineating watersheds. For this study, the County is covered by eighteen 5th-field HUCs

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(Figure 1). The system is hierarchical such that smaller watersheds nest into river basins (i.e., 1st- or 2nd-field HUCs, such as the Columbia or Willamette river basins) or watersheds (3rd- or 4th-field HUCs). For example, the Wilson-Trask-Nestucca 4th-field HUC encompasses nine 5th-field watersheds[1].

In general, the 5th-field hydrologic units (hereafter referenced as "watersheds") within Tillamook County are delineated such that all surface drainage within each watershed converges at a single outlet point. It was not always possible, however, to delineate watersheds in this way while adhering to the size and subdivision standards of the system, so there are some watersheds that do not follow the single outlet point. There are "remnant areas" along the coast where individual streams are too small for the given watershed. Such remnants are combined into a single watershed if they are adjacent to one another and could be combined. (e.g., Necanicum River watershed is mostly in Clatsop County but has one stream within Tillamook County that flows into the Pacific Ocean). A number of watersheds similarly encompass drainages in both Tillamook County and adjoining counties.

In addition to typical watershed drainage systems, some Tillamook County watersheds encompass estuaries and other areas that are subject to saltwater and freshwater tidal inundation. Some of the tidal areas are where multiple river systems come together. For example, the Tillamook Bay watershed covers the tidally-influenced portions of the Miami, Kilchis, Wilson, Trask, and Tillamook rivers.

For the purposes of the inventory, watersheds, or portions of watersheds, are identified as "tidal" or "freshwater" based, respectively, on whether the areas are below or above the highest measured tide (HMT), also referenced as "head tide". This method is in accordance with the Oregon Department of State Lands (DSL) definition of tidal and freshwater wetlands (DSL 2016). Other County wetland studies have also used this method for defining tidal wetland extent (e.g., Ewald and Brophy 2012). The HMT was determined to be 11.62 feet, NAVD88[2].

All the wetland and agricultural inventory results are summarized by the eighteen HUCs within the County[3]. While the focus of the analysis is on EFU lands, for context at the County level, the inventory also includes a summary of much of the data for Non-EFU lands.

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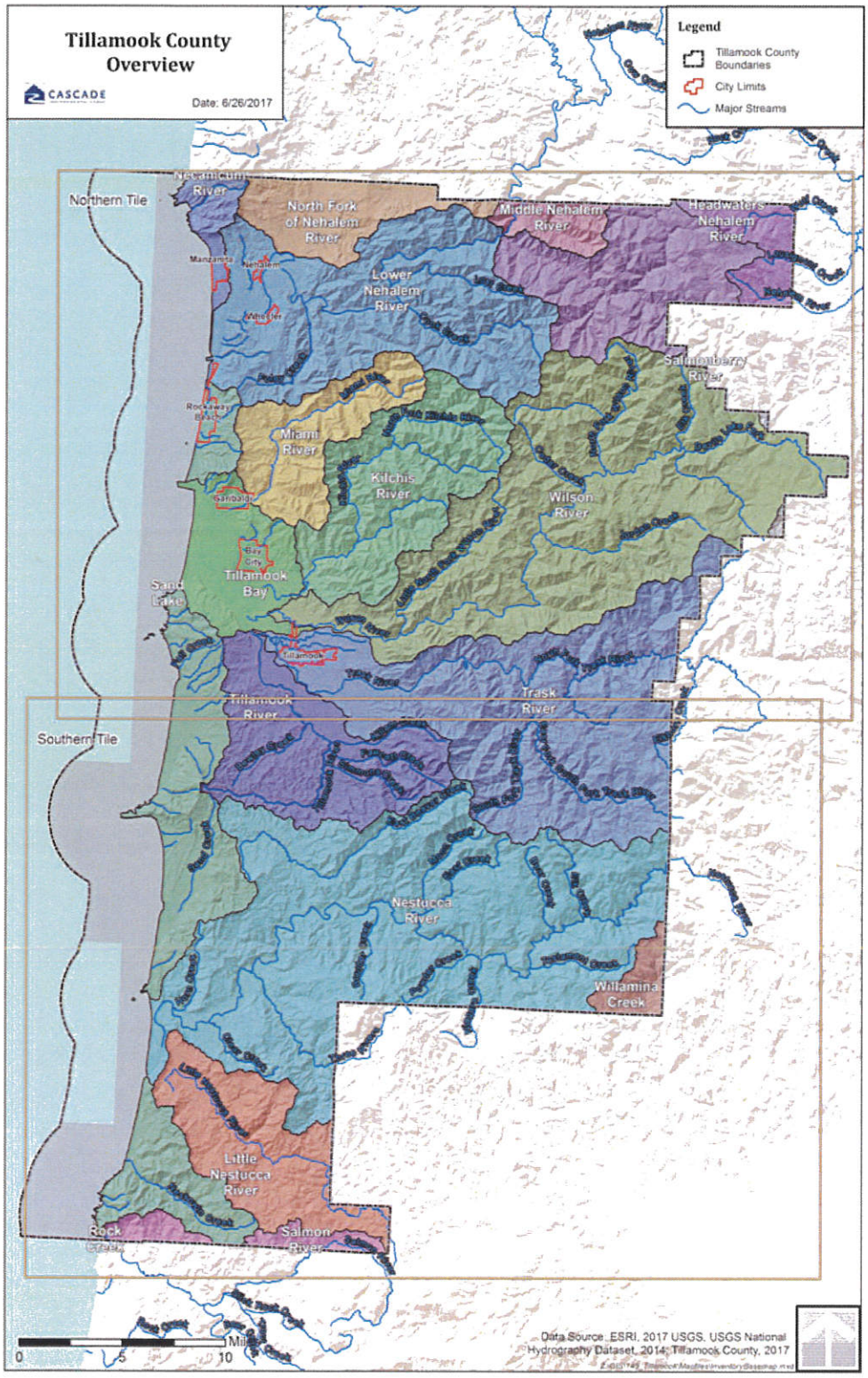
[1] Little Nestucca River, Sand Lake, Nestucca River, Tillamook River, Wilson River, Kilchis River, Miami River, Tillamook Bay, and Trask River watersheds

[2] HMT was determined according to methods described by DSL (2010) using the National Oceanic and Atmospheric Administration (NOAA) tidal station located at Garibaldi. The tidal station at Garibaldi was chosen to represent the entire County, as it is the sole station with a published "Highest Observed Water Level" value. The value of 15.91 feet, standard datum, was converted first into feet, mean lower low water (MLLW), then into feet, North American Vertical Datum of 1988 (NAVD88) with NOAA's online horizontal and vertical transformation utility, VDatum (https://vdatum.noaa.gov/vdatumweb/), to yield a value of 11.62 feet, NAVD88. The value of 11.62 feet was then applied to a 10-meter resolution raster-based digital elevation model (DEM) sourced from the National Elevation Dataset (USGS 2013; available at: https://viewer.nationalmap.gov/basic/#productSearch) in ESRI ArcGIS 10.1 software to identify areas above and below HMT.

[3] Two watersheds that are primarily within Washington County were not included in this study because they cover a very small area in Tillamook County and do not include any Agricultural Lands: Gales Creek (222 acres) and Scoggins Creek-Tualatin River (476 acres).

Figure 1. An overview of Tillamook County Streams and Watersheds. The Northern and Southern Tiles Delineate the Focus Areas for the Following Two Figures



Inventory Data Sources and Methods

Table 1 summarizes the inventory data sources and mapped characteristics.

Table 1. Wetland Inventory Datasets, and Mapped Characteristics

Dataset	Source	Mapped Characteristics and Derivative(s)	Summary
HUC5 (5th field watersheds)	National Hydrography Dataset, (USGS, 2016)	Watershed boundaries	HUC is the national standard for delineating watersheds. The County includes eighteen 5th field HUCs. A number of other HUCs encompass both the County and adjoining counties. The total HUC area (acres) includes just the portion within the County.
Streams	StreamNet Mixed Scale Hydrography V3.1, 2012	Major streams – named streams greater than 0.5 mile in length	The approximate location of stream channels.
F-1 Zoning	Tillamook County, 2017	Areas within F-1 zoning designation	Areas within F-1 zoning that are designated EFU.
Topographic Elevations	LiDAR (USGS, 2013)	Areas below/above highest measured tide (HMT), 11.62 ft. NAVD88	11.62 feet, which is the HMT, is used as an approximation of the head of tide. Elevations below this point are assumed to represent areas that historically could have been subject to tidal influence. Many of these areas have been leveed, drained, or filled so that they are no longer subject to tidal inundation.
Soils	USDA, NRCS gridded Soil Survey Geographic (gSSURGO) for Tillamook County, 2016	Geomorphic floodplain; soils drainage class; potential historical wetland areas	Geomorphic floodplain is a landform classification based on historical processes and does not reflect the current status of the floodplain (e.g., areas that have been leveed or drained). The geomorphic floodplain is determined based on soil types that correspond with historical floodplain deposition from rivers or streams inundating the floodplain during flood events. Soil hydric classification provides information on the potential for the soil to support wetlands. Soil drainage class (5 categories) is useful for understanding where the water table is in relation to the surface: e.g., for poorly drained soils the water table is close to the surface (or at the surface, at least for part of the year); well drained soils are characterized by a deeper water table. Historical wetlands depict areas that are not currently classified as NWI wetlands and have a large proportion of hydric soils. These areas have a high probability of containing historical wetlands.
National Wetland	USFWS, 2016	NWI mapped freshwater and tidal wetlands; modified	The existing wetland inventory was based on the USFWS' NWI spatial dataset updated in 2016. This dataset was determined to

Dataset	Source	Mapped Characteristics and Derivative(s)	Summary
Inventory (NWI)		freshwater and tidal wetlands within the NWI wetland classification	provide the greatest accuracy and coverage of all available datasets. The NWI dataset was classified into "tidal" or "freshwater" categories based each wetland's location either below or above highest measured tide (HMT), respectively, in accordance with the DSL definition of tidal wetlands (DSL 2016). Modified NWI areas are within the NWI wetland classification and characterized as wetlands but with modified hydrology as a result of levees, fill or other activities.
Levees / Fill Areas	Russell Scranton, 2004	Constructed levees; railroad embankments; other areas where fill has been placed to raise surface elevations	Levees, railroad embankments, or fill in areas that are designed to prevent flooding and protect lands that are adjacent to rivers and streams that historically would flood with some frequency.
Tide Gates	Russel Scranton, 2004	Tide Gate locations	Tide gates drain tidelands (areas that incoming tides regularly cover) for agricultural or other uses. On tidewater side of the pipe there is a hinged door which opens outwards towards the bay or estuary. When water levels are higher on the side of the pipe towards the drained area, the weight of the water holds the door open, allowing water to flow out into the bay or estuary. When the tide rises, the level of water on the tidewater side becomes higher than on the drained area side, holding the door closed so water does not flow back into the drained area. With traditional tide gates, passage of fish between the tidewater and the drained area is limited.

Dataset	Source	Mapped Characteristics and Derivative(s)	Summary
Stream Intrinsic Potential (IP)	Coastal Landscape Analysis and Modeling Study (CLAMS), 2008	Coho Intrinsic Potential (IP) >= 0.8; high IP	Coho salmon intrinsic potential (IP) is a measure of historical habitat quality in terms of supporting Coho adult spawning and juvenile rearing. IP is an attribute modeled from GIS data based on key geomorphic and other characteristics: channel and valley constraint, channel gradient, and mean annual water discharge. High IP Coho habitats are characterized by river and stream channels that are low-gradient (less than 4%); have unconstrained channels (e.g., absence of features that constrain channel movement so that the channel is free to meander across a wide valley floodplain); and have sufficient flow, as determined by upstream watershed area, to support both spawning and rearing. IP is based on historical potential and does not account for current features (e.g., levees) that can constrain channel movement, reduce floodplain access by fish during high-flow periods (e.g., tide gates), or other activities that modify historical habitat quality.
Drainage Districts	Tillamook County, 2017	Active drainage districts	Drainage districts are local bodies formed for the purpose of creating and maintaining levees, and draining, ditching, and other activities intended to improve water movement and drainage for agricultural and other land uses.
Tiger 2010 Streets	U.S Census Bureau, 2010	Road locations	Street locations and names.
Sea-Level Rise	National Oceanic and Atmospheric Administration (NOAA), Coastal Services Center, 2012	3-foot (~1m) sea-level rise	There is very high confidence (greater than 90% chance) that global mean sea level will rise at least 8 inches (0.2 meters) and no more than 6.6 feet (2 meters) by 2100. The actual amount of sea level change at any one region and location greatly varies in response to regional and local conditions. Forecasting sea level rise at the scale of the County is helpful for evaluating the impact of restoration projects on attenuating flooding related to sea level rise.
Restoration Projects	Oregon Watershed Restoration Inventory (OWRI), OWEB 2014.	Restoration project location and boundaries	The location and boundaries for habitat restoration projects within Agricultural Lands that significantly changed drainage through levee removal and other drainage modifications to allow tidal and river inundation.

Dataset	Source	Mapped Characteristics and Derivative(s)	Summary
USDA Cropscale Cropland	United States Department of Agriculture(USDA), 2016	Crop and other land uses	The spatial area of 41 crop types and other land uses in Tillamook county agricultural areas, including 30 crop types, 4 different types of development and 7 types of natural areas. We grouped these into 8 categories, 6 for crops and one each for developed areas and natural areas.
NRCS Soil Survey gSSURGO			
CAFO points	Oregon Department of Agriculture, 2017	Location of CAFO operations	Point data of base of operations for confined animal feeding operations (CAFO) in Tillamook County.
CAFO digitized lands	Oregon Department of Agriculture, 2017	Land area used for manure management by CAFO operations	Polygon data showing spatial extent of lands used for manure management by CAFOs in in Tillamook County. These data were digitized by Oregon Department of Agriculture for only some watersheds in Tillamook County.
Irrigation water rights	Oregon Water Resources Department, 2017	Point of use of irrigation water rights.	Polygon data showing the place of use of irrigation water rights in Tillamook County, as recognized by the Oregon Water Resources Department.

Wetland Inventory: Methods for Existing Tidal and Freshwater Wetlands

The existing wetland inventory is based on the U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) spatial data. These data were updated in 2016. We evaluated various wetland data for Tillamook County and determined that the NWI provides the greatest accuracy in terms of delineating existing wetlands and the most extensive coverage of all available data. Other information considered for the wetland inventory includes the tidal wetlands spatial data developed by Russell Scranton (2004), *The Application of Geographic Information Systems for Delineation and Classification of Tidal Wetlands for Resource Management of Oregon's Coastal Watersheds*, and the tidal wetlands spatial data developed as part of a restoration prioritization study for the Tillamook Bay Estuary (Ewald and Brophy 2012).

The Scranton (2004) data does not provide a framework for determining the scope and extent of existing wetlands in the County because it does not thoroughly capture the range of freshwater wetlands. The study's mapping resolution and margin of error are too great to support the desired wetland details and level of certainty. Ewald and Brophy's (2012) data also does not provide a framework for the inventory because it does not capture freshwater wetlands and is limited to the Tillamook and Nehalem Systems.

For the purpose of the inventory, the NWI data is classified into "tidal" (below HMT) or "freshwater" (above HMT) categories based on each wetland's location either below or above HMT, in accordance with the DSL definition of tidal wetlands (DSL 2016). Ewald and Brophy (2012) also used this method for defining tidal wetland extent.

Acreage of NWI wetlands is determined based on tidal and freshwater status and watershed location. Wetlands mapped within the NWI are classified according to the USFWS Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979). The Cowardin classification system is a hierarchical habitat-based classification that incudes categories for vegetation cover, hydrological regime, and water regime modifiers. Modified NWI wetlands are identified by querying the following NWI water regime modifiers: diked/impounded; partially drained/ditched; excavated; and farmed. The modified wetlands are then identified based on modified status and watershed location.

Wetland Inventory: Methods for Historical Tidal and Freshwater Wetlands

Historical wetlands were defined for the purposes of this inventory as 1) areas that are not currently identified in the NWI as supporting wetland vegetation or hydrological characteristics; and 2) areas that include hydric soils as defined and mapped by the USDA Natural Resource Conservation Service (NRCS). Hydric soils meet one or more of the NRCS-defined hydric soil indicators (NRCS 2017). Mapped hydric soils are selected as an indicator for potential historical wetland presence because hydric soils typically develop under long-sustained wet conditions. Once hydric soils develop, they maintain relic hydric characteristics indefinitely even if the area is drained, diked, or grazed.

Hydric soils are delineated in a manner that indicates the proportion of the map unit components, or soils types, that meet hydric soil criteria. For example, a map unit component that is dominantly

hydric soils may have small areas of non-hydric soils within the mapped landform. The hydric soils within a mapped unit are rated based on the following criteria:

- Hydric: All components in the map unit are hydric
- Predominantly hydric: 66%-99% of the components in the map unit rated hydric
- Partially hydric: 33%-66% of the components in the map unit rated hydric
- Predominantly non-hydric: 1%-33% of components in the map unit rated hydric
- Non-hydric: no components rated hydric

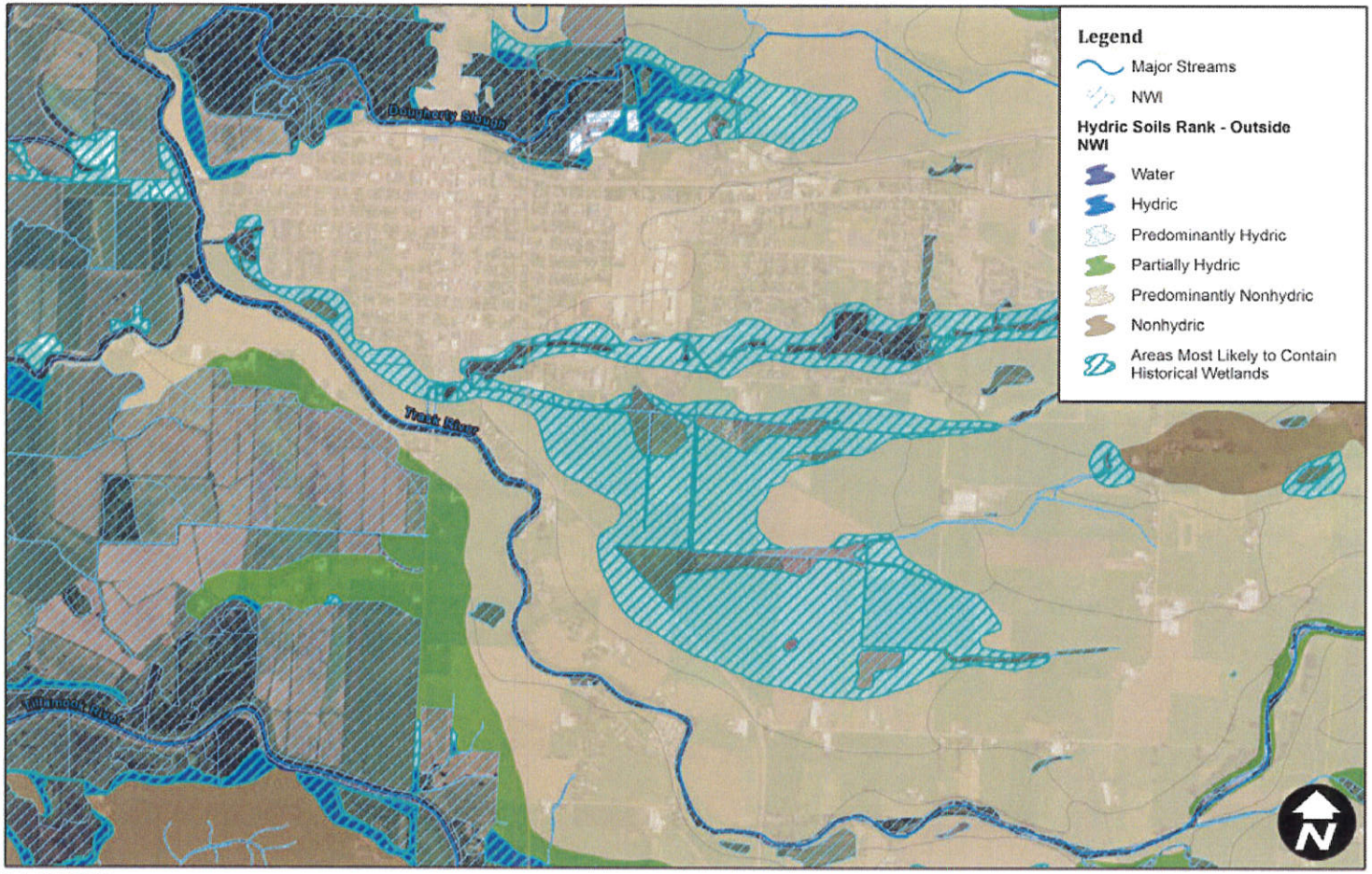
To represent areas likely to have supported historical wetlands, all **hydric** and **predominantly hydric** ranked soils that do not occur within NWI wetlands (i.e., existing identified wetlands) are mapped. To quantify potential historical wetland areas, the median of the range of hydric rating values within each hydric rank is calculated and multiplied by the total acreage of the rank. For example, if there are 1,200 acres of predominantly hydric soils (containing 66%-99% hydric components) mapped outside of NWI wetlands within the County, the total acreage for that rank was multiplied by the median value of the hydric class (calculated from the actual values; in this case 85%), to yield a total of 1200*0.85 = 1,020 acres.

The method of applying the median of each hydric class results in a conservative estimate of potential historical wetland acreage. A more refined estimate of historical wetlands requires corroborating data or detailed field observations. In addition, based on the nature of the NRCS gSSURGO soil database, which only includes hydric classes as an attribute of each soil map unit, it was not possible to map the actual locations of hydric components within each soil map unit. Thus, mapped polygons representing predominantly and partially hydric soils are presented as a probability of historical wetland presence. Mapped units with hydric and predominantly hydric soils have a very high probability of containing historical wetlands, but the exact location cannot be determined with this method.

To augment the inventory of historical wetland presence, filled areas as mapped by Scranton (2004) are included in the inventory. The filled lands data were developed using the DSL 1972 Ownership and Filled Lands Inventory and a selection of historical photographs available from the U.S. Army Corps of Engineers and other sources. The filled lands data include features such as dikes, dirt and paved roads, railroads, highways, gravel driveways, golf courses, dredging spoils, marina jetties, and buildings. It is assumed that areas of fill placement located in low-lying, floodplain areas have a high probability of supporting wetland characteristics, even if they no longer support wetland characteristics. However, because it was not possible to conclusively identify hydric soils within the mapped filled areas, the fill areas are presented as a separate dataset and are not included in the mapping or quantification of historical wetlands.

Figure 2 illustrates an example of the historical wetland classification for a portion of central Tillamook County.

Figure 2. An Example of the Historical Wetland Classification for Agricultural Lands in Central Tillamook County



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Scale: 1 inch = 2,000 feet
Data Source: ESRI, 2017; USGS, NHD, 2014; Soil Survey Staff, 2017

Historical Wetlands and Hydric Soils in Central Tillamook County

CASCADE ENVIRONMENTAL GROUP

0 1,000 2,000 4,000 Feet

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Overview of Tillamook County's Watersheds and EFU Agricultural Lands

Table 2 summarizes the County's eighteen watershed areas and the proportion of each watershed designated as EFU. The County covers approximately 718,719 acres, of which 37,589 acres (5.23%) are EFU (Figures 3 and 4).

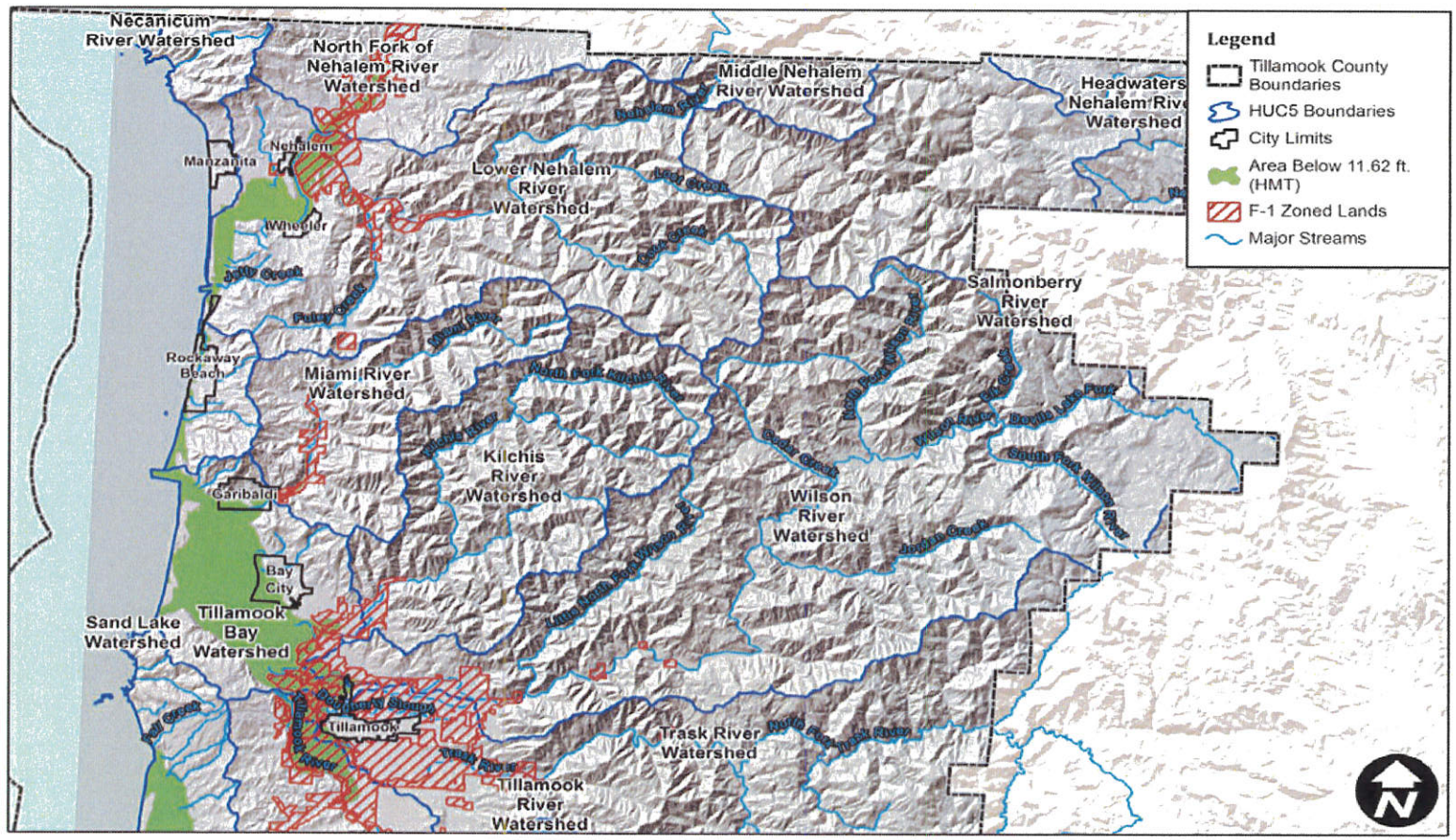
The proportion of each watershed in EFU varies dramatically (Figure 5). Eleven watersheds have some portion of area within Agricultural Lands. There are six watersheds with at least 7% of their area in EFU, with the largest proportion in the Tillamook River Watershed (15.23%). There are no EFU in the following seven watersheds: Headwaters Nehalem River, Middle Nehalem River, Necanicum River, Rock Creek, Salmon River, Salmonberry River, and Willamina Creek.

For the most part, EFU are concentrated in the valley bottoms, often within floodplains adjacent to rivers and streams. In addition to the river valleys, a large proportion (15.55%) of the County's EFU lands are below HMT (11.62 feet, NAVD88). The areas below HMT include lands that were historically tidally influenced; in many instances land drainage has been altered (e.g., levees or other modifications) to limit tidal inundation and accommodate agricultural land uses (Figures 3 and 4). Ten watersheds have some portion of EFU below HMT (Figure 6).

Table 2. Summary of Tillamook County Watershed Areas, Agricultural Lands (EFU), and Areas Below HMT (below Head of Tide)

Watershed (5th-Field HUC)	Watershed Area (Acres)	Agricultural Lands (Acres)	Percent Watershed within Agricultural Lands	Watershed Area Below HMT (Acres)	Agricultural Lands Below HMT (Acres)	Percent Agricultural Lands Below HMT
Headwaters Nehalem River	9,928	-	0.00%	-	-	-
Kilchis River	41,280	557	1.35%	-	-	-
Little Nestucca River	32,413	3,021	9.32%	987	459	15.21%
Lower Nehalem River	70,078	2,714	3.87%	4,053	1,000	36.85%
Miami River	23,052	831	3.61%	79	54	6.47%
Middle Nehalem River	6,943	-	0.00%	-	-	-
Necanicum River	6,389	-	0.00%	120	-	-
Nestucca River	139,693	9,736	6.97%	1,115	279	2.86%
North Fork Nehalem River	17,574	1,994	11.35%	733	570	28.60%
Rock Creek	125	-	0.00%	6	-	-
Salmon River	7,108	-	0.00%	19	-	-
Salmonberry River	34,896	-	0.00%	-	-	-
Sand Lake	53,885	1,718	3.19%	4,909	1	0.06%
Tillamook Bay	21,255	1,948	9.17%	10,954	1,057	54.27%
Tillamook River	39,361	5,968	15.16%	1,995	1,669	27.97%
Trask River	90,666	7,008	7.73%	861	561	8.01%
Willamina Creek	5,439	-	0.00%	-	-	-
Wilson River	118,634	2,094	1.77%	312	196	9.36%
SUM TOTAL	**718,719**	**37,589**	**5.23%**	**26,142**	**5,847**	**15.55%**

Figure 3. The Northern Section of Tillamook County Showing Streams, EFU Agricultural Lands, and Areas below HMT (below Head of Tide)



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Scale: 1 inch =4 miles
Data Source: ESRI, 2017; USGS, NHD, 2014

F-1 Zoning and Streams in Northern Tillamook County

CASCADE ENVIRONMENTAL GROUP

0 1 2 4 Miles

Tillamook County SB1517 Pilot Project

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Figure 4. The Southern Section of Tillamook County Showing Streams, EFU Agricultural Lands, and Areas below HMT (below Head of Tide)

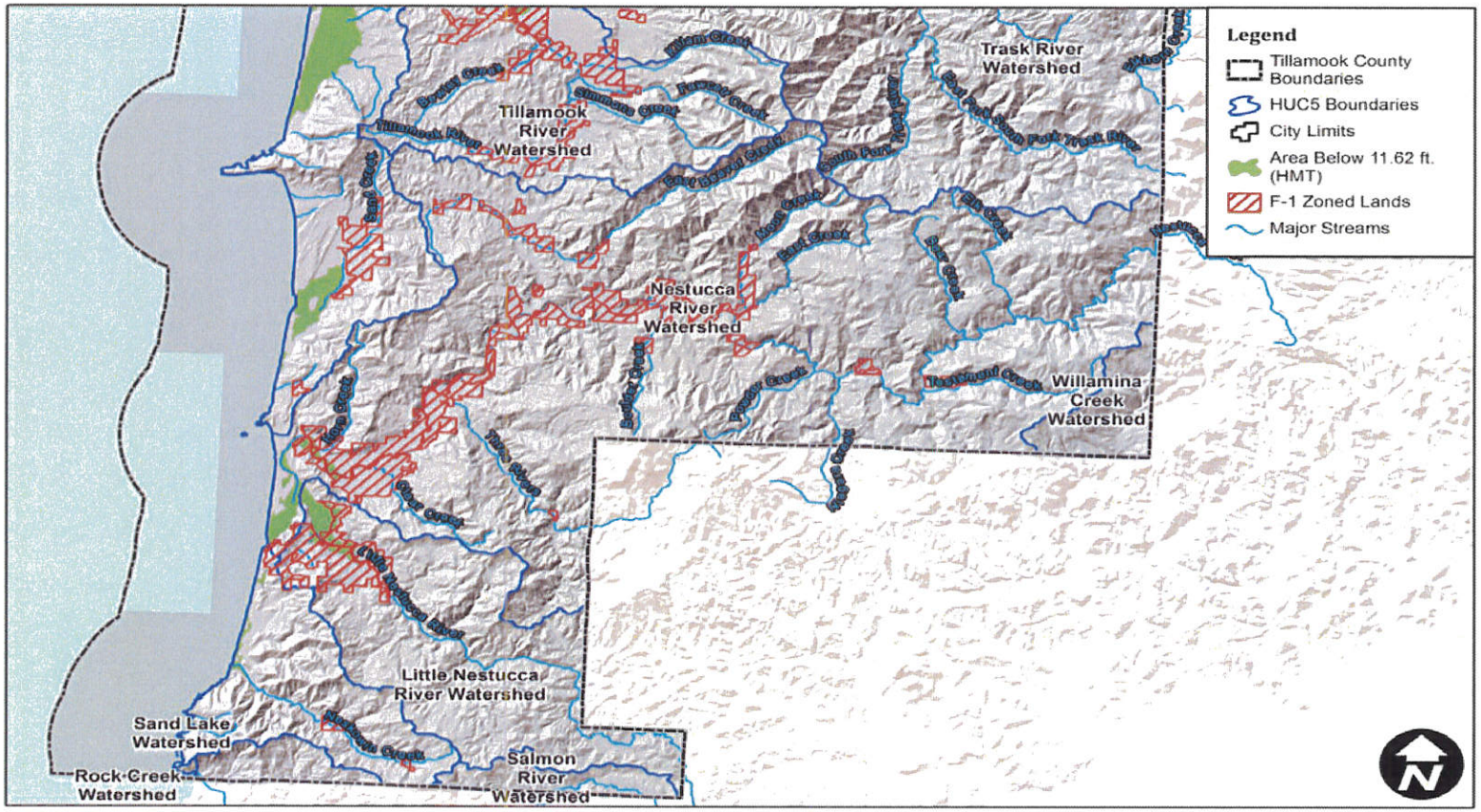


Figure 5. EFU Agricultural Lands as a Percent of Watershed Area

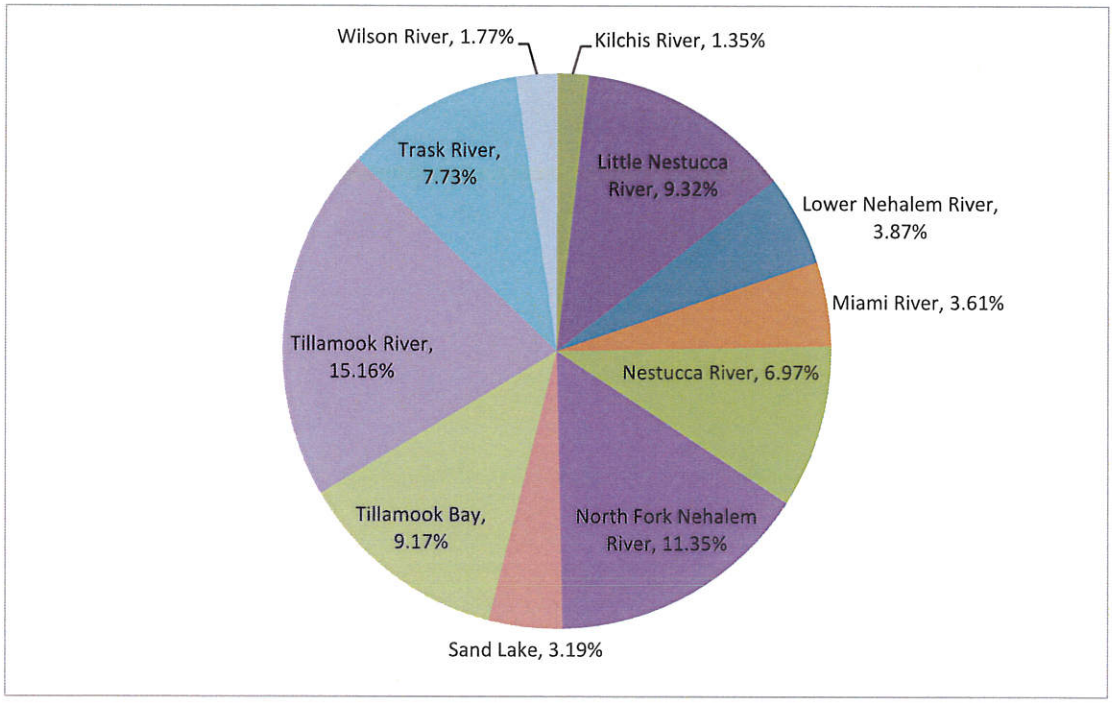
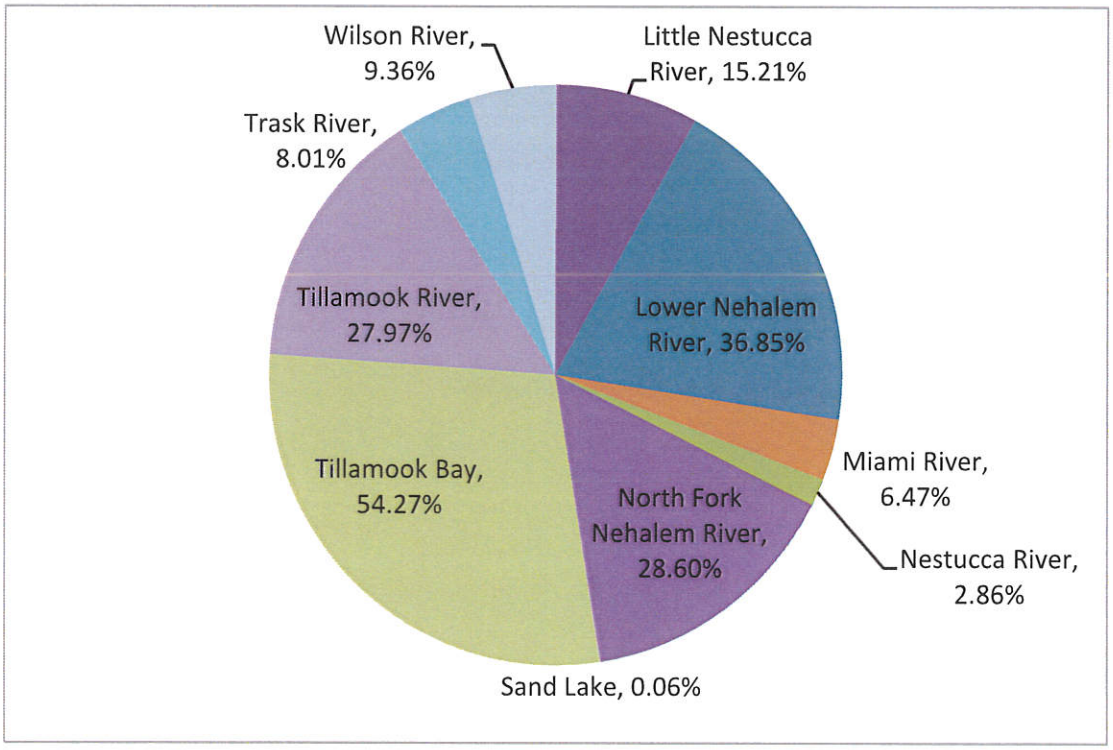


Figure 6. Percent EFU Agricultural Lands in Each Watershed below HMT



Wetlands Inventory

For each characteristic or attribute of wetlands, the wetland inventory presents information first for the EFU lands. For context, the inventory then includes wetland information on other, non-EFU lands.

EFU Lands: Wetland and Floodplain Characteristics

Table 3 summarizes wetland and floodplain characteristics for EFU lands. NWI wetlands are summarized for areas below HMT and above HMT. It is important to note that for wetlands below HMT, there is a high probability that they are, or were historically, tidal. We do not, however, define them as exclusively tidal because the data do not have the resolution to make the determination of whether or not specific areas are subject to tidal inundation. Areas above HMT are characterized as freshwater wetlands because there is a high degree of confidence that these areas are not tidally inundated.

There are 4,087 acres of NWI wetlands below HMT within the County's Agricultural Lands. The area of NWI wetlands below HMT ranges from no acreage in the Kilchis River, North Fork Nehalem River, and Sand Lake Watersheds to 1,444 acres in the Tillamook River Watershed. Of the 4,087 acres of wetlands below HMT identified in the NWI, 3,478 acres (85%) have been modified. Most of the modified wetlands identified in the NWI are tidal wetlands that have been converted to freshwater wetlands as a result of levees or other modifications. The largest concentration of NWI modified wetlands under HMT are in the Tillamook Bay Watershed (738 acres) and Tillamook River Watershed (1,265).

There are 5,009 acres of NWI freshwater wetlands in the County's Agricultural Lands. The area of NWI freshwater wetlands ranges from 99 acres in the Kilchis River Watershed to 1,694 acres in the Nestucca River Watershed. There are no NWI freshwater wetlands in the North Fork Nehalem River Watershed.

In comparison to NWI wetlands below HMT, there is less modification of freshwater wetlands. Of the 5,009 acres of freshwater wetlands identified in the NWI, 2,435 acres (48%) are modified. Most of the modified Agricultural Land freshwater wetlands identified in the NWI are wetlands that have been altered as the result of drainage modifications. Figure 7 illustrates areas under HMT and NWI freshwater wetland locations for an Agricultural Land area along the Wilson River.

Geomorphic floodplains cover 12,400 acres of the County's Agricultural Lands. The area within geomorphic floodplains ranges from 24 acres in the Sand Lake Watershed to 3,074 acres in the Trask River Watershed.

Filled areas encompass 624 acres of the County's Agricultural Lands. The fill areas range from no acres of fill in the Sand Lake Watershed to 129 acres in the Tillamook Bay Watershed.

Non-Agricultural Lands: Wetland and Floodplain Characteristics

Table 4 summarizes wetland and floodplain characteristics for the County's Non-Agricultural Lands. There are 18,614 acres of NWI wetlands below HMT within Non-Agricultural Lands. The area of NWI wetlands below HMT ranges from 5 acres in the Rock Creek Watershed to 9,356

acres in the Tillamook River Watershed. In comparison to Agricultural Lands, there has been dramatically less modification of wetlands below HMT within Non-Agricultural Lands. Of the 18,614 acres of wetlands below HMT identified in the NWI, only 349 acres (2%) are modified. Most of the modified wetlands identified in the NWI are tidal wetlands that have been converted to freshwater wetlands as a result of drainage modifications. The Tillamook Bay Watershed has the largest area with modified NWI tidal wetlands (145 acres).

There are 15,597 acres of NWI freshwater wetlands within Tillamook County's Non-Agricultural Lands, which is more than triple the acreage of freshwater wetlands identified within Agricultural Lands (5,009 acres). The area of NWI freshwater wetlands ranges from 1 acre in the Rock Creek Watershed to 3,079 acres in the Sand Creek Watershed.

In comparison to NWI wetlands below HMT, there has been less modification of freshwater wetlands. Of the 15,597 acres of freshwater wetlands identified in the NWI, only 486 acres (3%) are modified. Most of the modified Non-Agricultural Land freshwater wetlands identified in the NWI are wetlands that are altered as the result of drainage modifications.

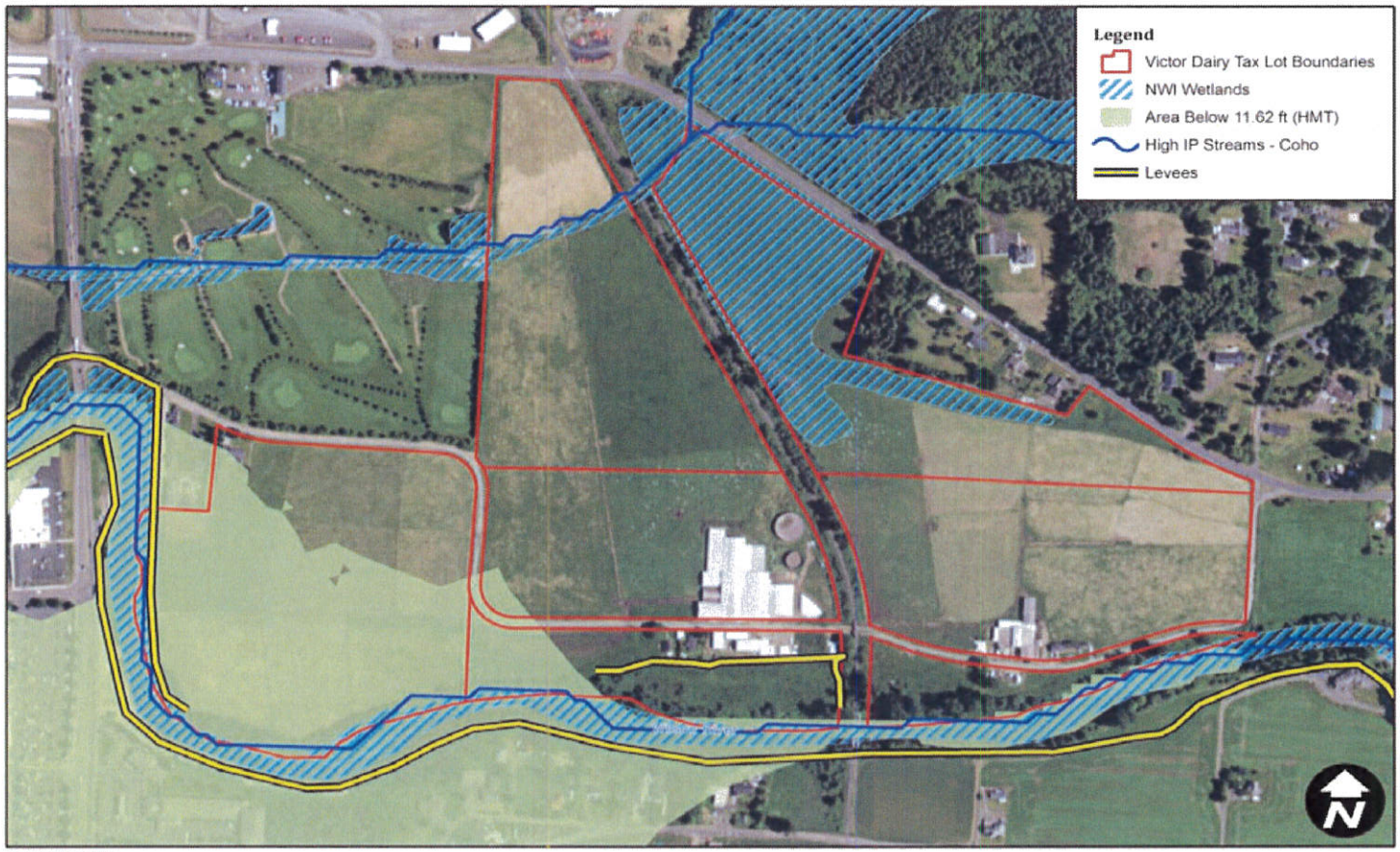
Geomorphic floodplains cover 6,738 acres of the County's Non-Agricultural Lands, which is about half of the acreage of geomorphic floodplain identified within Agricultural Lands (12,400). The area within geomorphic floodplains ranges from 1 acre in the Rock Creek Watershed to 3,079 acres in the Sand Lake Watershed.

Filled areas encompass 611 acres of the County's Non-Agricultural Lands. The fill areas range from no acres in several watersheds to 241 acres in the Tillamook Bay Watershed.

Table 3. Wetland and Geomorphic Floodplain and Filled Area Characteristics for Agricultural Lands. (n/a = No EFU Agricultural Lands Present in Watershed)

Watershed (5th-Field HUC)	NWI Wetlands Below HMT (Acres)	NWI Wetlands Below HMT Modified (Acres)	NWI Freshwater Wetlands (Acres)	NWI Freshwater Wetlands Modified (Acres)	Geomorphic Floodplain (Acres)	Filled Areas (Acres)
Headwaters Nehalem River	n/a	n/a	n/a	n/a	n/a	n/a
Kilchis River	-	-	99	9	374	8
Little Nestucca River	431	361	549	405	249	30
Lower Nehalem River	597	405	361	115	1,117	126
Miami River	23	14	153	46	342	2
Middle Nehalem River	n/a	n/a	n/a	n/a	n/a	n/a
Necanicum River	n/a	n/a	n/a	n/a	n/a	n/a
Nestucca River	258	255	1,694	1,064	2,690	18
North Fork Nehalem River	-	-	-	-	655	16
Rock Creek	n/a	n/a	n/a	n/a	n/a	n/a
Salmon River	n/a	n/a	n/a	n/a	n/a	n/a
Salmonberry River	n/a	n/a	n/a	n/a	n/a	n/a
Sand Lake	-	-	444	35	24	-
Tillamook Bay	831	738	280	215	877	129
Tillamook River	1,444	1,265	692	387	1,855	91
Trask River	394	343	487	133	3,074	124
Willamina Creek	n/a	n/a	n/a	n/a	n/a	n/a
Wilson River	109	95	251	27	1,143	79
SUM TOTAL	**4,087**	**3,478**	**5,009**	**2,435**	**12,400**	**624**

Figure 7. An Example of Areas under HMT (below Head of Tide) and NWI Freshwater Wetland Locations for Agricultural Lands Adjacent to the Lower Wilson River



Date: 6/23/2017
Scale: 1 inch = 450 feet
Data Source: ESRI, 2017; Tillamook County, 2017; USFWS National Wetlands Inventory, 2016; CLAMS, 2009

Case Study: Victor Dairy, LLC - Wetlands and Waters

CASCADE ENVIRONMENTAL GROUP

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Tillamook County SB1517 Pilot Project

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Table 4. Wetland and Floodplain Characteristics on Non-Agricultural Lands

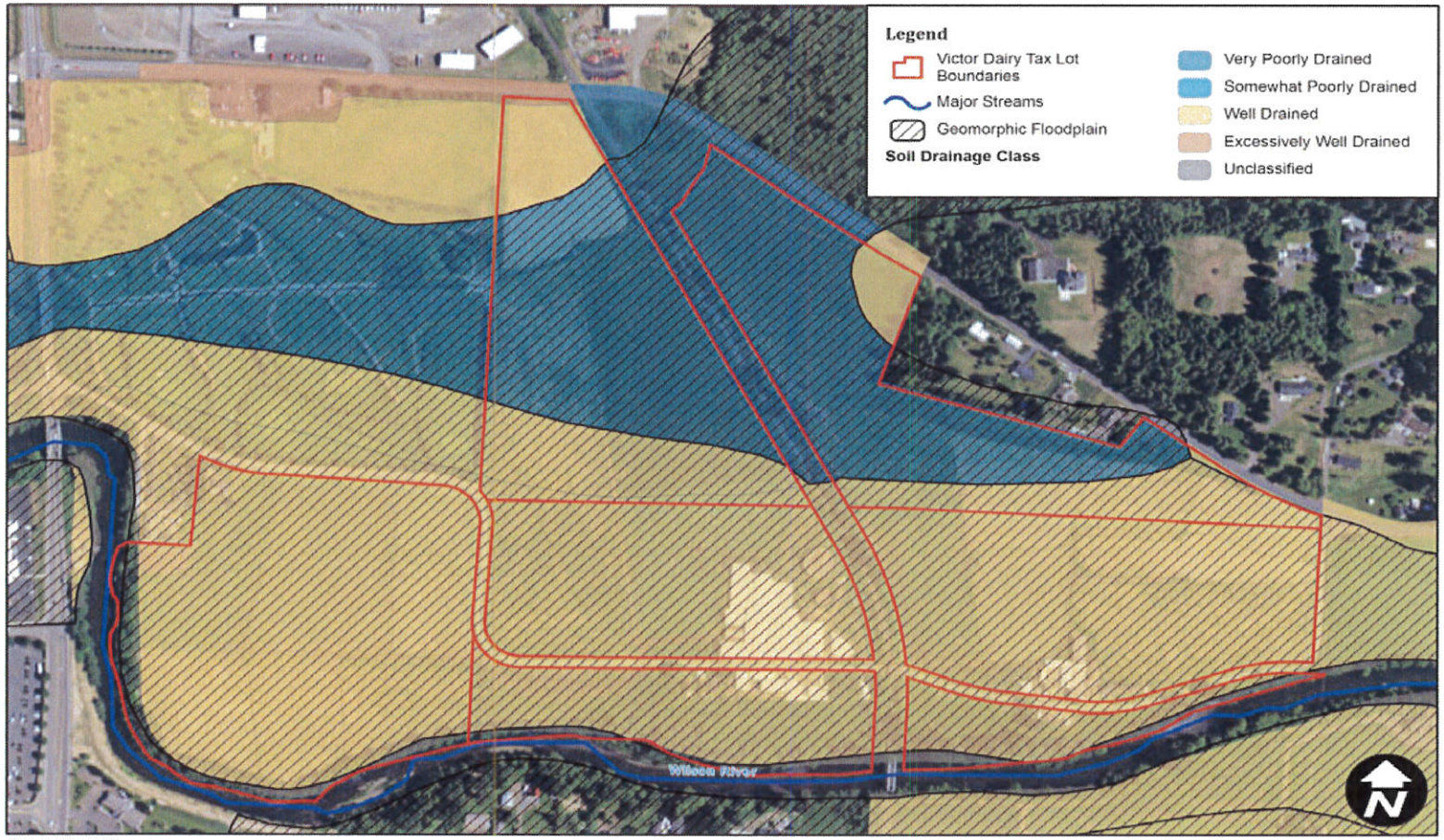
Watershed (5th-Field HUC)	NWI Wetlands Below HMT (Acres)	NWI Wetlands Modified Below HMT (Acres)	NWI Freshwater Wetlands (Acres)	NWI Freshwater Wetlands Modified (Acres)	Geomorphic Floodplain (Acres)	Filled Areas (Acres)
Headwaters Nehalem River	-	-	88	1	24	-
Kilchis River	-	-	539	1	143	4
Little Nestucca River	515	3	602	9	447	5
Lower Nehalem River	2,777	22	1,839	120	761	91
Miami River	13	5	413	7	94	2
Middle Nehalem River	-	-	133	1	-	-
Necanicum River	71	-	235	11	-	1
Nestucca River	725	10	2,272	38	1,193	-
North Fork Nehalem River	374	48	728	126	970	7
Rock Creek	5	-	1	-	-	-
Salmon River	16	-	96	-	170	38
Salmonberry River	-	-	385	-	-	-
Sand Lake	4,201	9	3,079	58	531	9
Tillamook Bay	9,356	145	805	38	246	241
Tillamook River	296	47	1,379	52	1,265	43
Trask River	222	58	1,116	24	449	91
Willamina Creek	-	-	47	-	-	-
Wilson River	42	2	1,841	2	444	80
SUM TOTAL	**18,614**	**349**	**15,597**	**486**	**6,738**	**611**

Agricultural Lands: Soil Drainage Characteristics

Table 5 summarizes soil drainage classes for the County's Agricultural Lands. Soil drainage classification is an indicator of the soil's distance to the water table. Poorly drained soils are closer to the water table than well drained soils.

Soils classified as very poorly drained cover 10,832 acres of Agricultural Lands, ranging from 37 acres in the Kilchis River Watershed to 2,903 acres in the Tillamook River Watershed. There are 2,380 acres with somewhat poorly drained soils. In contrast, there are 23,394 acres with well drained soils and 854 acres with excessively well drained soils. Figure 8 shows an example of soil drainage classes and geomorphic floodplain locations for agricultural lands along the Wilson River.

Figure 8. An Example of Soil Drainage Classes and Geomorphic Floodplain for Agricultural Lands Area along the Wilson River



Date: 6/26/2017
Scale: 1 inch = 450 feet
Data Source: ESRI, 2017; Tillamook County, 2017; USGS, NHD, 2016; Soil Survey Staff, gSSURGO Database for Oregon, 2016

Case Study: Victor Dairy, LLC - Soil Attributes

CASCADE ENVIRONMENTAL GROUP

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Tillamook County SB1517 Pilot Project

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Table 5. Soil Drainage Classes on Agricultural Lands

Watershed (5th-Field HUC)	Very Poorly Drained (Acres)	Somewhat Poorly Drained (Acres)	Well Drained (Acres)	Excessively Well Drained (Acres)	Not Classified (Acres)
Headwaters Nehalem River	n/a	n/a	n/a	n/a	n/a
Kilchis River	37	20	463	36	
Little Nestucca River	895	118	2,006	-	3
Lower Nehalem River	1,214	46	1,348	57	48
Miami River	97	1	592	142	
Middle Nehalem River	n/a	n/a	n/a	n/a	n/a
Necanicum River	n/a	n/a	n/a	n/a	n/a
Nestucca River	1,744	90	7,669	233	2
North Fork Nehalem River	946	192	846	-	9
Rock Creek	n/a	n/a	n/a	n/a	n/a
Salmon River	n/a	n/a	n/a	n/a	n/a
Salmonberry River	n/a	n/a	n/a	n/a	n/a
Sand Lake	265	104	1,310	19	20
Tillamook Bay	1,049	153	740	3	3
Tillamook River	2,903	502	2,542	-	20
Trask River	1,453	1,068	4,289	188	10
Willamina Creek	n/a	n/a	n/a	n/a	n/a
Wilson River	228	86	1,590	175	16
SUM TOTAL	**10,832**	**2,380**	**23,394**	**854**	**131**

Agricultural and Non-Agricultural Lands: Management and Infrastructure

Table 6 summarizes the area within drainage districts, number of tide gates, and length of levees for Agricultural and Non-Agricultural Lands.

There are 8,779 acres managed by drainage districts in the County. The area managed by drainage districts is mostly concentrated on Agricultural Lands (7,947 acres), with much less area (832 acres) managed by districts within Non-Agricultural Lands. The Agricultural Lands under drainage district management are concentrated in the Little Nestucca River Watershed (731 acres); Lower Nehalem River Watershed (1,273 acres); Nestucca River Watershed (1,646 acres); Tillamook Bay Watershed (787 acres); Tillamook River Watershed (1,804 acres); and the Trask River Watershed (1,341 acres). The Non-Agricultural Lands under drainage district management are, for the most part, extensions of the same districts, and thus concentrated in the same watersheds: Lower Nehalem River Watershed (125 acres); Nestucca River Watershed (19 acres); Tillamook Bay Watershed (437 acres); Tillamook River Watershed (30 acres); and the Trask River Watershed (176 acres).

Tide gates, by definition, are located in areas subject to tidal inundation. There are 41 tide gates within Agricultural Lands, with the largest numbers concentrated in the Little Nestucca River Watershed (6 tide gates); North Fork Nehalem River Watershed (9 tide gates); Tillamook Bay Watershed (6 tide gates); and the Tillamook River Watershed (11 tide gates). The total number of tide gates within Non-Agricultural Lands is similar (40 tide gates), with the largest numbers concentrated in the North Fork Nehalem River Watershed (9 tide gates); Tillamook Bay Watershed (10 tide gates); and the Tillamook River Watershed (9 tide gates).

There are 25 miles of levees within the County's Agricultural Lands, primarily concentrated in the Tillamook Bay Watershed (7 miles) and the Tillamook River Watershed (11 miles). There are 38 miles of levees on Non-Agricultural Lands. These levees, which are primarily connected to the levees on Agricultural Lands, are concentrated within the Tillamook Bay Watershed (14 miles) and the Tillamook River Watershed (7 miles).

Table 6. Drainage Districts, Tide Gates, and Levees on Agricultural and Non-Agricultural Lands (n/a = No Agricultural Lands Present in Watershed)

Watershed (5th-Field HUC)	Agricultural Areas in Drainage Districts (Acres)	Non-Agricultural Areas in Drainage Districts (Acres)	Agricultural Areas # Tide Gates	Non-Agricultural Areas # Tide Gates	Agricultural Areas Levees (Miles)	Non-Agricultural Areas Levees (Miles)
Headwaters Nehalem River	n/a	-	n/a	-	n/a	-
Kilchis River	61	0.2	-			
Little Nestucca River	731	8	6	3	-	1
Lower Nehalem River	1,273	125	4	1		4
Miami River	-	-	-	-	-	-
Middle Nehalem River	n/a	-	n/a	-	n/a	-
Necanicum River	n/a	-	n/a	-	n/a	-
Nestucca River	1,646	19	2	2		1
North Fork Nehalem River	-	-	9	9	-	2
Rock Creek	n/a	-	n/a	-	n/a	-
Salmon River	n/a	-	n/a	-	n/a	-
Salmonberry River	n/a	-	n/a	-	n/a	-
Sand Lake	2	-	-	1	0	3
Tillamook Bay	787	437	6	10	7	14
Tillamook River	1,804	30	11	9	11	7
Trask River	1,341	176	3	4	3	4
Willamina Creek	n/a	-	n/a	-	n/a	-
Wilson River	300	37	-	-	4	2
SUM TOTAL	**7,947**	**832**	**41**	**40**	**25**	**38**

Agricultural and Non-Agricultural Lands: Restoration Projects, Fish Habitat, and Sea Level Rise

Table 7 summarizes restoration projects, fish habitat, and expected Sea Level Rise for Agricultural and Non-Agricultural Lands.

The restoration projects included in the inventory focus on levee removal and other actions designed to restore historical drainage patterns. Restoration projects that meet these criteria cover a total of 872 acres within the County[4]. All the restoration projects are within tidal areas (below HMT) and are designed to restore tidal processes and wetland functions. The inventory includes one project in the Little Nestucca River Watershed (96 acres); one project in the Miami River Watershed (34 acres); two projects in the Tillamook Bay Watershed (Southern Flow Corridor, 366 acres, and the lower Kilchis River, 67 acres); and one project in the Trask River Watershed (Southern Flow Corridor, 309 acres). Figure 9 shows the restoration project locations.

High Intrinsic Potential (IP) is a measure of the historical potential of the river or stream to support high quality Coho salmon spawning and juvenile rearing habitat. High IP Coho habitat is generally characterized by low-gradient channel areas, wide floodplains, and unconstrained channels that can meander across the floodplain. It is a measure of historical potential and does not reflect levees or other measures that currently constrain channels movement and floodplain inundation.

There are 115 miles of high IP Coho habitat within the County's Agricultural Lands. The greatest extent of high IP areas on Agricultural Lands is concentrated in the Nestucca River Watershed (24 miles); North Fork Nehalem River Watershed (11 miles); Tillamook River Watershed (24 miles); and the Trask River Watershed (15 miles).

There is 181 miles of high IP Coho habitat within the County's Non-Agricultural Lands. The greatest extent of high IP areas on Non-Agricultural Lands is concentrated in the Little Nestucca River Watershed (18 miles); Lower Nehalem River (15 miles); Nestucca River (28 miles); Sand Lake Watershed (31 miles); Tillamook River Watershed (32 miles); Trask River Watershed (14 miles); and Wilson River Watershed (15 miles).

Sea level rise is a measure of the additional area inundated by the ocean under a scenario that assumes a 1 meter (~3-foot) rise in ocean water surface elevations. Overall sea level rise is forecasted to affect 20,790 acres within the County. Sea level rise impacts are most pronounced in the areas adjacent to estuaries and portions of lower river floodplains subject to tidal influence. The watersheds with the largest sea level rise impacts within Agricultural and Non-Agricultural Lands include the Lower Nehalem River Watershed; Nestucca River Watershed; Sand Lake Watershed; Tillamook Bay Watershed; Tillamook River Watershed; and the Trask River Watershed.

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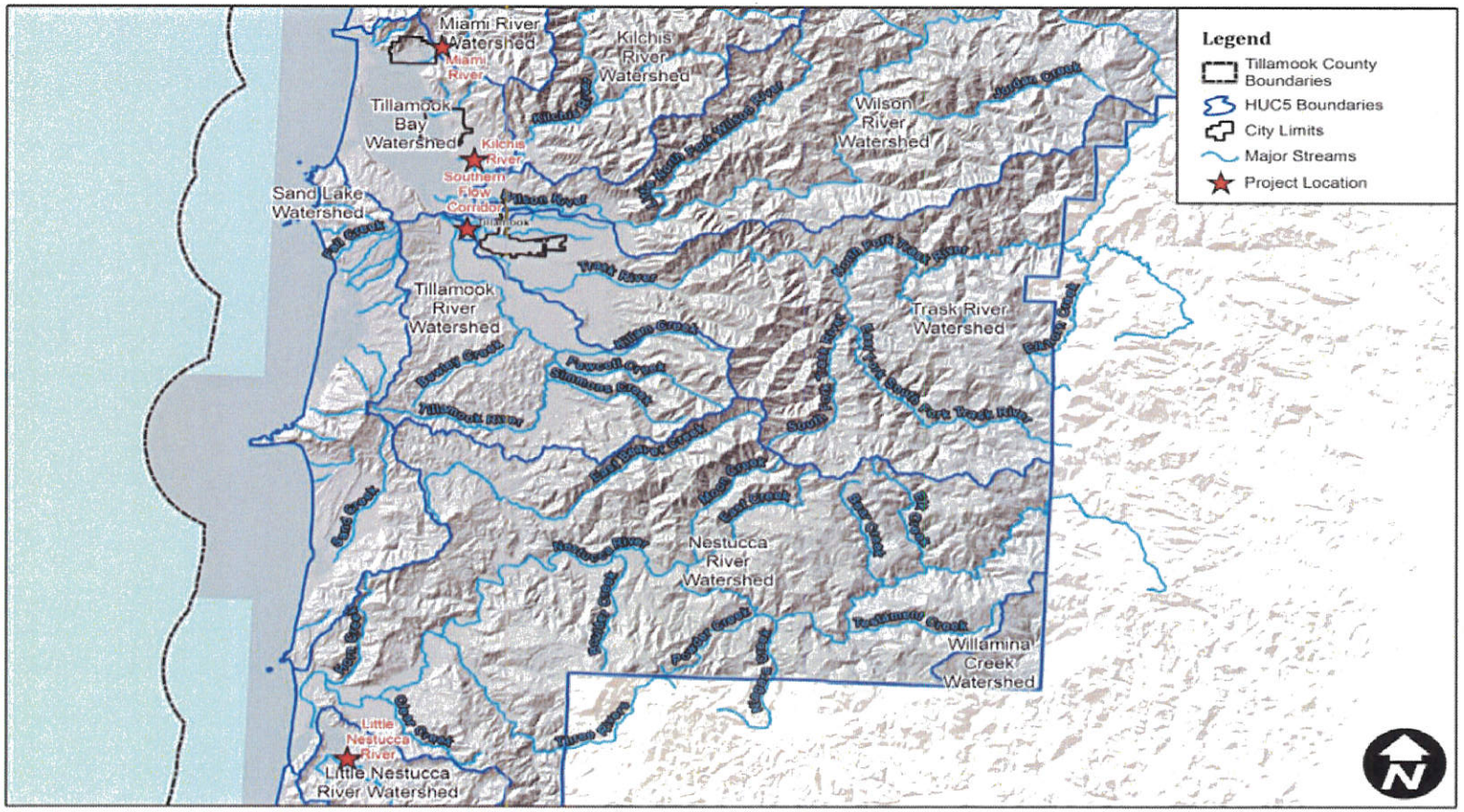
[4] Based on the Oregon Water and Environment Board (OWEB)'s OWRI database of restoration projects in Oregon. The OWEB database did not include some restoration projects that meet the criteria. These gaps will be addressed during the wetland assessment phase.

Table 7. Restoration Projects, Fish Habitat, and Sea Level Rise within Agricultural and Non-Agricultural Lands

Watershed (5th-Field HUC)	Restoration Areas (Acres)	Agricultural Lands High IP Coho Habitat (Miles)	Non-Agricultural Lands High IP Coho Habitat (Miles)	Agricultural Lands Sea Level Rise (1m) (Acres)	Non-Agricultural Lands Sea Level Rise (1m) (Acres)
Headwaters Nehalem River	-	n/a	1	n/a	-
Kilchis River	-	4	2	2	7
Little Nestucca River	96	8	18	784	564
Lower Nehalem River	-	6	15	1,032	2,989
Miami River	34	5	4	51	17
Middle Nehalem River	-	n/a	0.3	n/a	-
Necanicum River	-	n/a	0.4	n/a	33
Nestucca River	-	24	28	234	798
North Fork Nehalem River	-	11	9	-	798
Rock Creek	-	n/a	-	n/a	735
Salmon River	-	n/a	2	n/a	899
Salmonberry River	-	n/a	1	n/a	-
Sand Lake	-	7	31	20	4,067
Tillamook Bay	433	3	9	1,037	9,092
Tillamook River	-	24	32	1,999	372
Trask River	309	15	14	544	358
Willamina Creek	-	n/a	0.3	n/a	-
Wilson River	-	9	15	169	62
SUM TOTAL	872	115	181	5,871	20,790

Figure 9. Restoration Project Locations (Note: This figure does not include restoration projection locations in the northern portion of Tillamook County)



Agricultural and Non-Agricultural Lands: Historical Wetlands

Table 8 summarizes historical wetlands below HMT (likely tidally influenced) and above HMT (freshwater wetlands) for the County's Agricultural and Non-Agricultural Lands. As noted in the methods section, these areas have a high probability of containing historical tidal or freshwater wetlands that have been converted to areas that no longer function as wetlands. The estimate of historical wetlands presented here is conservative, and there are certainly other areas within Agricultural Lands that contain historical wetlands below HMT, but the data do not provide sufficient resolution to identify specific areas.

There are 694 acres of potential historical wetlands within the County's Agricultural Lands below HMT. The area of potential historical tidal wetlands within Agricultural Lands ranges from no acreage in the Sand Lake Watershed to 201 acres in the North Fork Nehalem Watershed.

There are 445 acres of potential historical wetlands within the County's Non-Agricultural Lands below HMT, which is less than the 694 acres identified on Agricultural Lands. The area of potential historical tidal wetlands within Non-Agricultural Lands ranges from 1 acre in the Miami River and Rock Creek Watersheds to 138 acres in the Sand Lake Watershed.

There are 2,900 acres of potential historical freshwater wetlands within the County's Agricultural Lands. The area of potential historical freshwater wetlands within Agricultural Lands ranges from 39 acres in the Kilchis River Watershed to 822 acres in the Trask River Watershed.

There are 3,608 acres of potential historical freshwater wetlands within the County's Non-Agricultural Lands. The area of potential historical freshwater wetlands within Non-Agricultural Lands ranges from 1 acre in the Rock Creek Watershed to 560 acres in the Trask River Watershed.

The potential historical wetlands identified in the inventory focuses on areas that are converted to non-wetland habitats. In addition to wetland loss there has also been loss of wetland function. As noted above, a large proportion of the NWI wetlands have been altered as a result of levees or other drainage modifications. The combined area of historical and modified NWI wetlands provides a perspective on potential areas where wetland functions can be restored or enhanced. Figures 9 and 10 summarize the watershed areas for combined historical and modified wetlands below HMT (likely tidally influenced) and above HMT (freshwater wetlands) on Agricultural Lands.

Table 8. Historical Wetlands below HMT and Freshwater Wetlands for Agricultural and Non-Agricultural Lands (n/a = No Agricultural Lands Present in Watershed)

Watershed (5th-Field HUC)	Agricultural Lands: Potential Historical Wetlands Below HMT (Acres)	Agricultural Lands: Potential Historical Freshwater Wetlands (Acres)	Non-Agricultural Lands: Potential Historical Wetlands Below HMT (Acres)	Non-Agricultural Lands: Historical Freshwater Wetlands (Acres)
Headwaters Nehalem River	n/a	n/a	-	36
Kilchis River	-	39	-	38
Little Nestucca River	27	96	10	268
Lower Nehalem River	191	312	65	272
Miami River	7	42	1	28
Middle Nehalem River	n/a	n/a	-	13
Necanicum River	n/a	n/a	25	85
Nestucca River	7	535	39	400
North Fork Nehalem River	201	239	15	231
Rock Creek	n/a	n/a	1	1
Salmon River	n/a	n/a	2	57
Salmonberry River	n/a	n/a	-	4
Sand Lake	-	54	138	596
Tillamook Bay	62	67	92	165
Tillamook River	134	568	22	510
Trask River	54	822	24	560
Willamina Creek	n/a	n/a	-	3
Wilson River	12	125	10	339
SUM TOTAL	**694**	**2,900**	**445**	**3,608**

Figure 10. Watershed Acreage for Combined Historical and Modified NWI Wetlands below HMT on Agricultural Lands

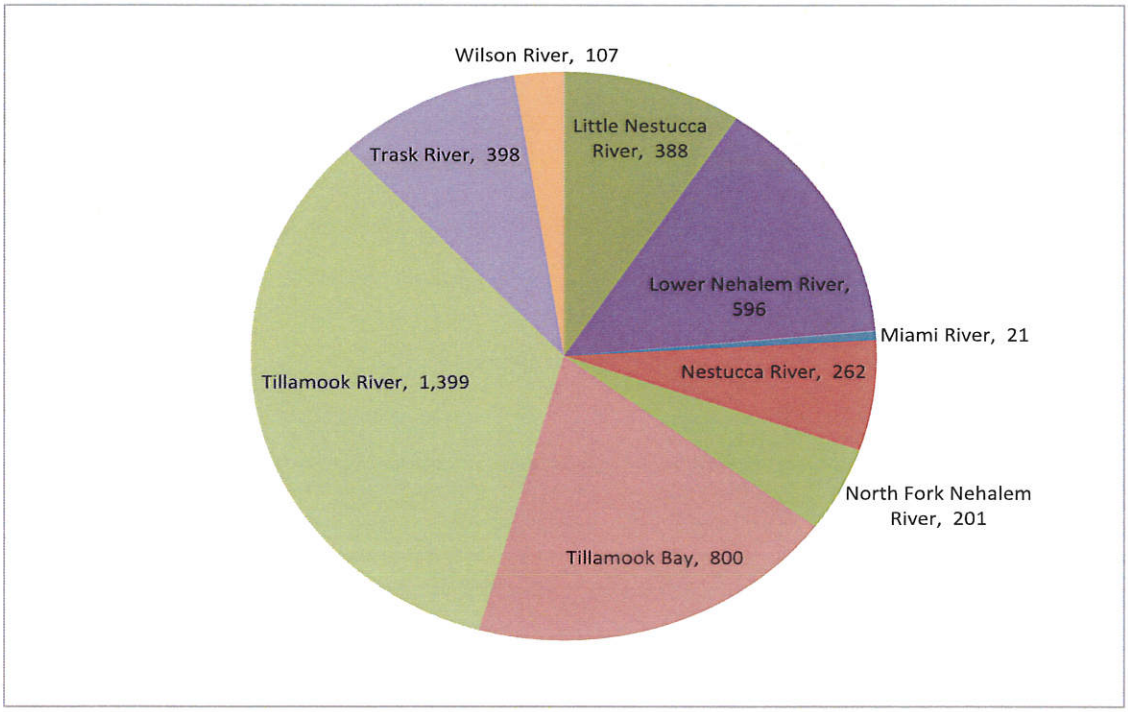
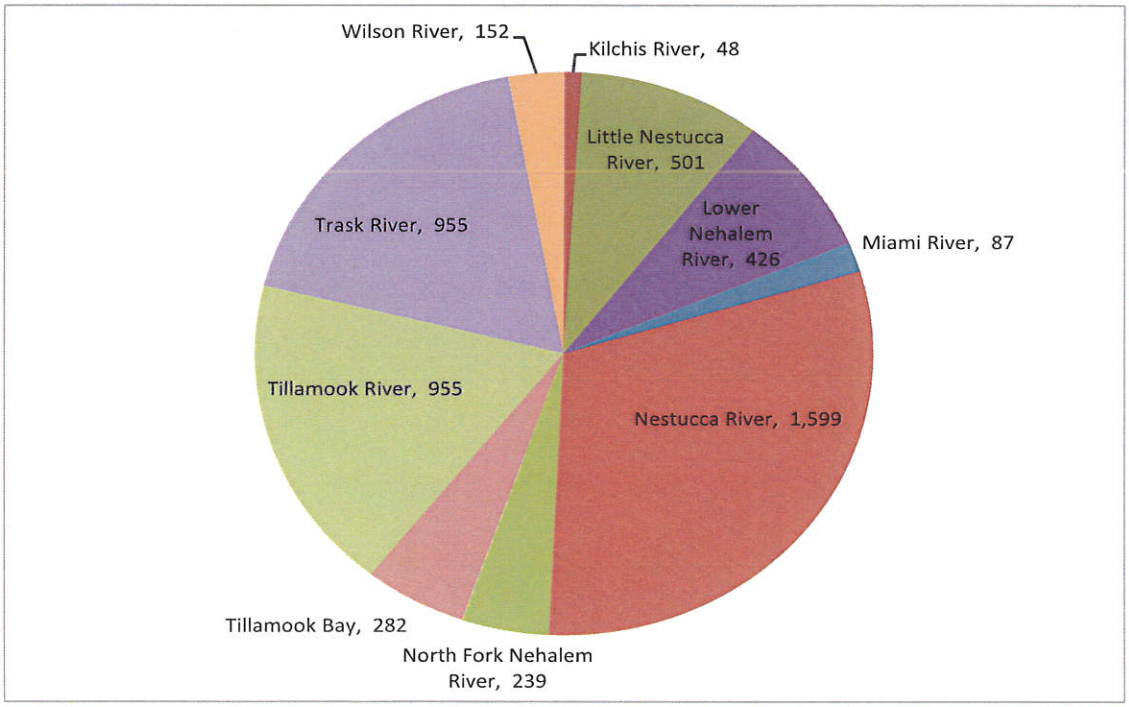


Figure 11. Watershed Acreage for Combined Historical and Modified NWI Freshwater Wetlands (above HMT) on Agricultural Lands



Agricultural Lands Inventory

As described in the methods above, and consistent with the wetland inventory, the agricultural inventory quantitatively describes current land uses and characteristics of EFU lands by watershed (at the 5th field HUC). Following an overview of EFU lands and their relationship with high value farmland, the agricultural lands inventory focused on six aspects of EFU lands:

1. Dairy operations, including the number of operations and permitted animals by watershed. The data on dairy operations are from the Oregon Department of Agriculture (ODA) Confined Animal Feedlot Operation (CAFO) program.
2. Land use and crops grown on EFU Lands by watershed. The data source is the United States Department of Agriculture Cropscape 2016 geospatial dataset.
3. Irrigation water rights on EFU lands by watershed. The data source is Oregon Water Resources Department database on water rights by point of use (POU).
4. Expected crop yields on EFU lands by watershed. The data source is the NRCS soil survey dataset, SSURGO, which is contains information about soil, including expected grass silage and pasture yields, as collected by the National Cooperative Soil Survey.
5. EFU lands in diking districts by watershed. Based on a data layer provided by the County.
6. Animal waste management potential on EFU lands by watershed. The data source is the NRCS soil survey dataset, SSURGO, which contains information about soil, including the capacity of soils to absorb liquid animal waste.

EFU and High Value Farmland Distribution

The Oregon legislature created the EFU zone to provide areas for continued practice of commercial agriculture, and is intended to be applied to areas with high-value farm soils. Currently there are 37,590 acres in the EFU zone. The number of acres in the EFU zone has been steady over time. For example, in 1978, there were approximately 35,500 acres in the EFU in Tillamook County (Tillamook County, 1982). The EFU acreage is consistent with data from the US Census of Agriculture, which found approximately 32,700 acres of cropland and pasture in the County in 2012 and approximately 39,000 acres of cropland and pasture in 2007.

In Tillamook County, there are approximately 29,000 acres of high value agricultural lands (defined by state statute primarily based on soil type). The distribution of EFU and high value agricultural acreage by watershed is shown in Table 9. As shown in the table, all but 84 acres of high value agricultural lands in the County are in the EFU zone, with no more than 25 acres in any one basin. This indicates that there may be limited potential to increase agricultural production outside EFU lands in order to compensate for conversion of EFU agricultural lands to other uses. However, as discussed below, there are lands outside the EFU zone that are used for managing animal waste. Also, there are approximately 8,590 acres of EFU lands that are not classified as high value agricultural lands based on soil type, which conversely may potentially indicate that these lands are marginal production for agriculture.

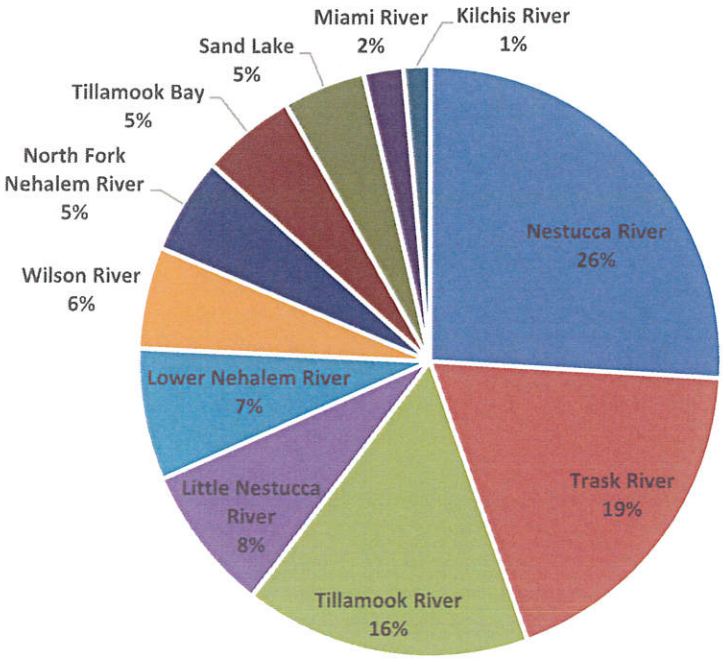
Table 9 and Figure 11 also highlight that the majority (22,700 acres or 60 percent) of EFU lands are in three watersheds: Nestucca River, Tillamook River, and Trask River. An additional 11,500 acres (31 percent) are in the Little Nestucca, Lower Nehalem, Wilson River, Sand Lake, and Tillamook Bay watersheds. The remaining 1,390 acres of EFU lands are in the Miami River and

Kilchis River watersheds. There are seven watersheds with no EFU lands: Headwaters Nehalem River, Middle Nehalem River, Necanicum River, Rock Creek, Salmon River, Salmonberry River, and Willamina Creek. As there are likewise no commercial dairies and only 4.6 acres of high value farmland in total across these seven watersheds, we conducted no further agricultural analysis of these watersheds.

Table 9. Distribution of EFU and High Value Farmland across Tillamook Watersheds

Watershed (5th field HUC)	EFU Lands		High Value Farmland in EFU		High Value Farmland Outside EFU	
	Acres	% of County Total	Acres	% of County Total	Acres	% of County Total
Nestucca River	9,736.20	26%	6,509.50	23%	15.6	19%
Trask River	7,008.40	19%	6,681.20	23%	12.2	15%
Tillamook River	5,967.50	16%	4,909.50	17%	13.3	16%
Little Nestucca River	3,021.20	8%	1,664.60	6%	1.8	2%
Lower Nehalem River	2,714.00	7%	2,073.50	7%	2.2	3%
Wilson River	2,094.00	6%	1,470.00	5%	25	30%
North Fork Nehalem River	1,993.80	5%	1,686.00	6%	2.1	2%
Tillamook Bay	1,948.10	5%	1,802.70	6%	0.8	1%
Sand Lake	1,718.20	5%	1,102.70	4%	5	6%
Miami River	831.3	2%	514.6	2%	0.4	1%
Kilchis River	556.6	1%	489.5	2%	0.8	1%
Headwaters Nehalem River	0	0%		0%	1	1%
Middle Nehalem River	0	0%		0%	0.4	1%
Necanicum River	0	0%		0%	0.6	1%
Rock Creek	0	0%		0%	0.4	1%
Salmon River	0	0%		0%		0%
Salmonberry River	0	0%		0%	1.8	2%
Willamina Creek	0	0%		0%	0.3	0%
SUM TOTAL	37,589.30	100%	28,903.90	100%	83.9	100%

Figure 12. Proportion EFU Lands by Watershed



Dairy Operations

Dairy farming has long provided the vast majority of agricultural value in Tillamook County. According to the 2012 Census of Agriculture, the market value of milk from cows was valued at $101.9 million. This is 87 percent of the 2012 total market value of all county agricultural products sold of $117.1 million. Recognizing the importance of the dairy industry to the stability of agriculture in the County, this section includes analysis of the spatial distribution of dairy farms and dairy animals across the County.

Using permit data from the ODA CAFO program, we present data in Table 10 and Figure 12 on the location of dairies and the number of permitted animals by watershed. Current data indicate that there are 174 CAFO dairy operations in Tillamook County, with 45,151 permitted animals. The actual number of animals on Tillamook CAFO operations may be less than the number of permitted animals. Based on count data from ODA inspections in 2016, there are approximately 40,500 cows in the County in CAFO operations, of which approximately 26,150 are adults and 14,300 are heifers/calves.[5] This roughly corresponds to the 2012 Census of Agriculture data that estimated approximately 25,000 milk cows and 18,900 'other cattle' that are not beef cows or milk cows.

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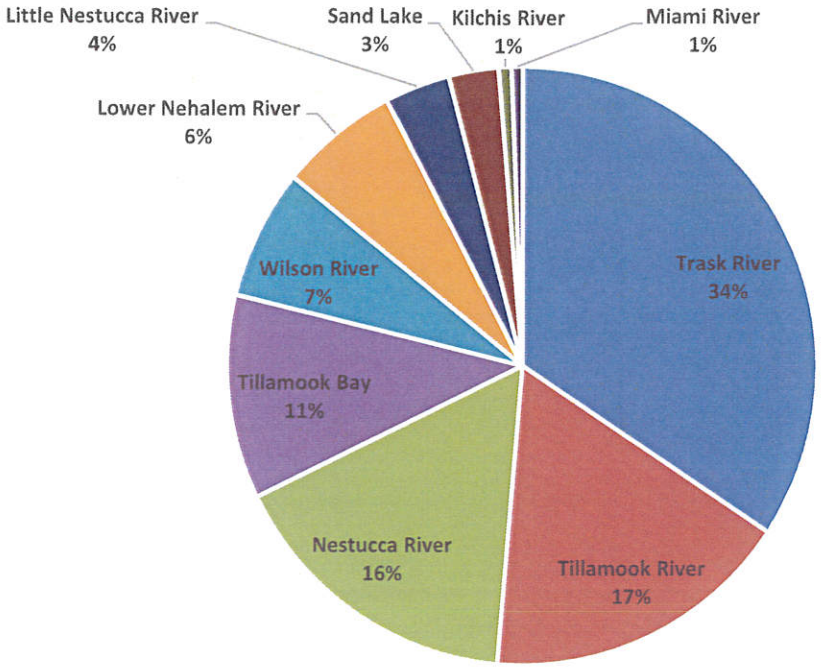
[5] Data from 2016 inspections identified 40,500 animals currently on the dairy CAFO operations, of which up to 150 may be horses, goats, beef cows, sheep/lambs (based on the number of permitted animals of these types on dairy CAFO operations).

Table 10. Distribution of Dairy Cows and Dairy Operations across Tillamook Watersheds

Watershed (5th Field HUC)	CAFO in EFU		CAFO Outside EFU	
	CAFO, # Operations	CAFO, # Permitted Cows	CAFO, # Operations	CAFO, # Permitted Cows
Trask River	52	15,508	1	105
Tillamook River	38	7,673		
Nestucca River	37	7,421	2	225
Tillamook Bay	16	4,985		
Wilson River	10	3,175		
Lower Nehalem River	8	2,940	1	135
Little Nestucca River	4	1,625		
Sand Lake	5	1,234		
Kilchis River	2	310		
Miami River	2	280		
North Fork Nehalem River				
Total	**174**	**45,151**	**4**	**465**

As shown in Figure 12, approximately one-third of permitted cows and CAFO operations are in the Trask River watershed. The Trask River and five other watersheds (Tillamook River, Nestucca River, Tillamook Bay, Wilson River, and Lower Nehalem River) account for 92 percent of all permitted animals and 93 percent of CAFO operations. Approximately 99 percent of permitted animals are located on farms with base of operations located in the EFU zone; only four CAFO operations with 465 permitted animals are located outside the EFU zone. However, as described in Table 11, some CAFO operations located in EFU lands also utilize lands outside the EFU zone for manure spreading.

Figure 13. Percent of Permitted Cows in CAFO Operations in Tillamook County by Watershed



For three watersheds in Tillamook County (Trask River, Tillamook River, and Tillamook Bay), the ODA CAFO program has mapped the lands that CAFO operations use to manage animal waste. This 'waste wastement' acreage is shown in Table 11 for the mapped watersheds (note, some acreage has also been mapped in the Wilson River and Kilchis River watersheds; these data are also included in Table 11). Of the mapped CAFO operations in the County, 87 percent of the lands used for managing animal waste are in the EFU zone. For a given watershed, this proportion may vary from approximately 80 percent (Tillamook River) to 100 percent (Kilchis River) reliance on EFU lands.

Table 11. Distribution of CAFO Manure Management Lands on EFU and non-EFU Zoned Lands

Watershed	In EFU (Acres)	Outside EFU (Acres)	% in EFU
Trask River	4413.8	450.5	91%
Tillamook River	2670.3	674.8	80%
Tillamook Bay	773.3	121.7	86%
Kilchis River	305.6	0.9	100%
Wilson River	135.1	16.3	89%
Nestucca River	N/A	N/A	N/A
Lower Nehalem River	N/A	N/A	N/A
Little Nestucca River	N/A	N/A	N/A
Sand Lake	N/A	N/A	N/A
Miami River	N/A	N/A	N/A
North Fork Nehalem River	N/A	N/A	N/A
5-Basin Total	8,298.20	1,264.30	87%

N/A: Not Available.

Land Use on EFU Lands

Table 12 shows results of an analysis of the USDA Cropscape geospatial data for crop acreage in Tillamook County. The Cropscape data is at a very coarse scale. The raw data showed over 22,000 acres of the approximately 37,600 EFU acres as natural vegetation (forest, wetland, scrubland, etc). As this seemed an anomaly to our project team, we reviewed aerial photos of the landscape in conjunction with the Cropscape data. This process revealed that many of the lands classified as natural vegetation communities were in fact diked and appeared to be used as cropland; over 11,820 acres of these lands were digitized as cropland, forming the new category "Digitized cropland" (see Figure 13, which highlights these digitized cropland areas for a farm in the Wilson River watershed).

In total, including the digitized cropland acreage, there are an estimated 24,650 acres of cropland farmed in the EFU zone. Nearly all of this land is hay, corn, grain, or pasture land supporting animal operations. The remainder of EFU lands are predominantly natural or developed, with some also categorized as barren or as water (see Figure 14). (Note that 'natural' lands, of which there are 10,200 acres in the EFU zone, include the following Cropscape categories: clover/wildflowers, deciduous forest, evergreen forest, herbaceous wetlands, mixed forest, shrubland, and woody wetlands). As shown in the last column of Table 12, the majority (62 percent) of EFU crop and pasture lands are in three watersheds: Trask River, Nestucca River, and Tillamook River (the same three watersheds that contain 67 percent of permitted dairy animals).

Figure 14. USDA Cropscape Data on Crops and Other Land Use in an Area of the Wilson River Watershed

Date: 6/27/2017
Scale: 1 inch = 450 feet
Data Source: ESRI, 2017; Tillamook County, 2017; ODF, 2016; USDA Cropland Data Layer, 2016

USDA Cropscape Mapping of Cropping Pattern at Victor Dairy, LLC

CASCADE ENVIRONMENTAL GROUP

0 200 400 800 Feet

Tillamook County SB1517 Pilot Project

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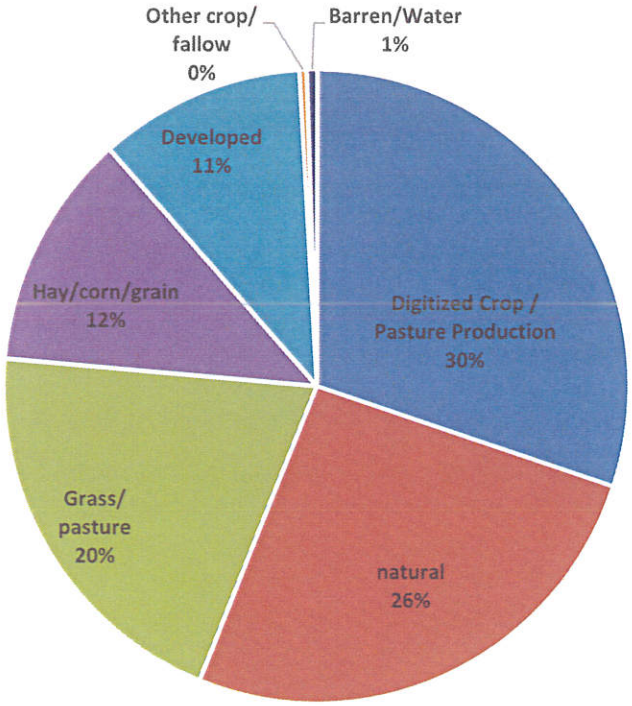
Table 12. Acres of Crop Type on EFU Lands by Watershed

Watershed (5th Field HUC)	Grass/ pasture	Hay/corn/ grain	Digitized Cropland	Other crop/ fallow	Total Crop/Pasture Acres	% of EFU Crop/Pasture Acres
Trask River	2,846.40	1,788.00	1,122.00	22.2	5,778.60	23%
Nestucca River	1,678.20	643.9	2,889.60	74.4	5,286.00	21%
Tillamook River	1,260.90	974	2,142.40	21.6	4,398.90	18%
North Fork Nehalem River	415.4	121.2	1,244.60	0.2	1,781.40	7%
Lower Nehalem River	447.9	326.1	990.7	1.3	1,766.00	7%
Little Nestucca River	286.5	71.6	1,089.20	4.5	1,451.90	6%
Wilson River	491.7	353.8	490	12	1,347.40	5%
Tillamook Bay	242.3	253.3	806.3	11.8	1,313.70	5%
Sand Lake	103.9	38.9	563.8	0.7	707.3	3%
Kilchis River	132.4	143.3	158.7	0.2	434.6	2%
Miami River	46.5	12.5	325.7	0	384.7	2%
SUM TOTAL	**7,952.00**	**4,726.60**	**11,822.90**	**149**	**24,650.50**	**100%**

Figure 15. Proportion of Land Use in EFU Zone Countywide



Outside the EFU zone, according to the raw Cropscape data, there are approximately 11,980 acres of cropland and pasture (non-EFU natural areas were not reviewed and digitized with aerial photos, so this may be an underestimate of crop/pasture acres on non-EFU lands).[6] In total then, our review of the Cropscape data identifies approximately 36,630 acres of cropland in the County, of which approximately 24,650 acres (67 percent) are within the EFU zone and 11,980 (33 percent) are located outside the EFU zone; within any given watershed approximately 41 percent to 90 percent of crop and pasturelands are within the EFU zone (see Table 13). (It is important to note, that as presented in Table 9, there are few high value agricultural lands with good soil quality outside the EFU zone).

For cross-reference with other data sources, the total County crop and farmland acreage roughly corresponds with data from the Census of agriculture: the average of the 2007 and 2012 Census of Agriculture estimate that, respectively, there were 39,000 acres and 32,700 acres of cropland and pasture in the County in those years. [7]

Table 13. Crop / Pasture Acreage on EFU Lands versus Non-EFU Lands by Watershed

Watershed (5th Field HUC)	Total Crop/Pasture Acres			EFU Lands as a % of Total County Crop/Pasture Acres
	EFU Lands	Non- EFU Lands	Tillamook County	
Trask River	5,778.60	2,663.30	8,441.90	68%
Nestucca River	5,286.00	875	6,161.00	86%
Tillamook River	4,398.90	1710.6	6,109.50	72%
North Fork Nehalem River	1,781.40	305.2	2,086.60	85%
Lower Nehalem River	1,766.00	1280.6	3,046.60	58%
Little Nestucca River	1,451.90	168.1	1,620.00	90%
Wilson River	1,347.40	1947.1	3,294.50	41%
Tillamook Bay	1,313.70	235.3	1,549.00	85%
Sand Lake	707.3	727.3	1,434.60	49%
Kilchis River	434.6	113.8	548.4	79%
Miami River	384.7	264.1	648.8	59%
SUM TOTAL	24,650.50	11,980.80	36,631.30	67%

[6] Of these 11,980 acres, 11,200 acres or 93 percent, are identified in Cropscape as grass or pasture lands and approximately 780 acres are in hay/corn/grain or other crops.
[7] Revised memo will include information on the zoning class for the 11,980 acres of crop and pasture located outside the EFU zone.

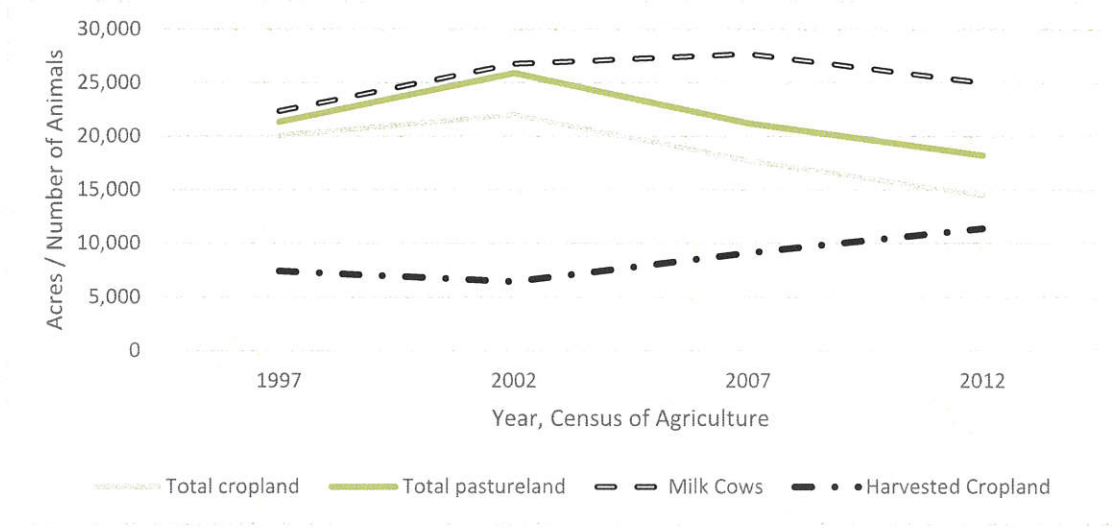
Table 14 presents the EFU crop/pasture acreage by watershed in another context: as a percent of total watershed area. As shown in Table 14, countywide, EFU acreage that is in crop and pastureland represents just 3 percent of total land area, varying from 0 percent to 11 percent, depending on the watershed.

Table 14. Crop / Pasture Acreage on EFU as a Proportion of Watershed Area

Watershed (5th Field HUC)	Watershed Acreage	Crop/Pasture in EFU	% Watershed in EFU Crop/Pasture
Trask River	90,666.50	5778.6	6%
Nestucca River	139,693.10	5286	4%
Tillamook River	39,360.80	4398.9	11%
North Fork Nehalem River	17,573.50	1781.4	10%
Lower Nehalem River	70,078.30	1766	3%
Little Nestucca River	32,413.40	1451.9	4%
Wilson River	118,634.50	1347.4	1%
Tillamook Bay	21,254.80	1313.7	6%
Sand Lake	53,885.00	707.3	1%
Kilchis River	41,279.80	434.6	1%
Miami River	23,051.80	384.7	2%
Other Watersheds	70,827.80	0	0%
Total	**718,719.30**	**24650.5**	**3%**

Figure 15 gives historical context from the US Census of Agriculture for milk cows and acreage over the last 20 years in Tillamook County. As shown by the dashed lines in the figure, agricultural outputs, in terms of the number of milk cows and harvested crop acres, has either been steady or slightly rising since 1997. However, as measured by the Census of Agriculture and shown with the solid lines, the agricultural land base in terms of the number of acres in pastureland or cropland has declined since 2002.

Figure 16. Acreage and Milk Animals Over Time in Tillamook County



Irrigation Water Rights on EFU Lands

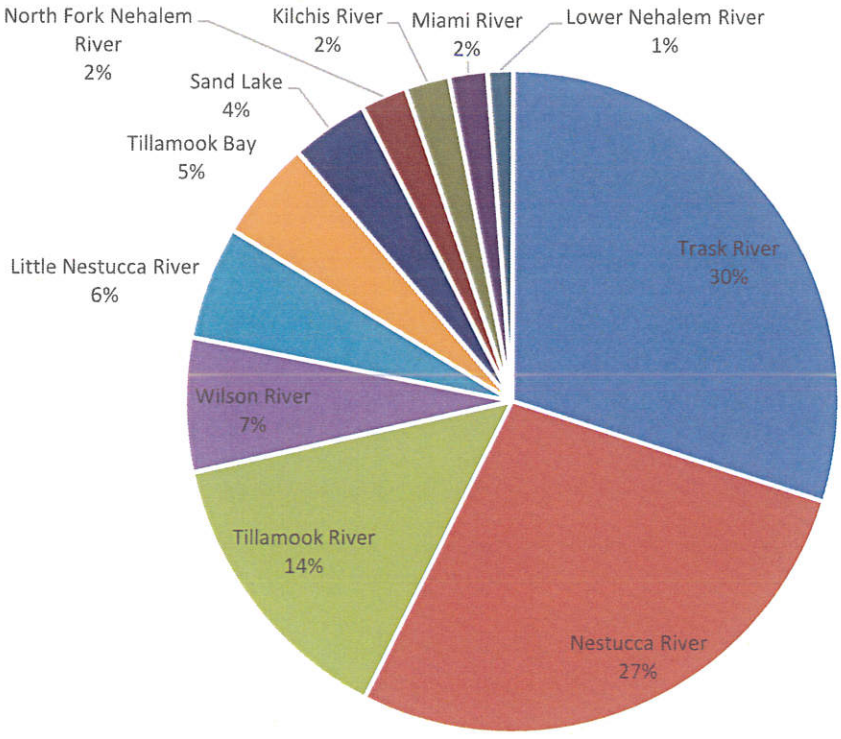
Table 15 presents the total acreage on EFU lands with irrigation water rights by watershed and crop type. As shown in the table, the Oregon Water Resources Department database indicates that there is a total of 7,250 acres with irrigation water rights.[8] However, based on Cropscape data, there are just over 6,220 acres of EFU crop/pasture lands with irrigation water rights, representing 25 percent of the total 24,650 acres of EFU crop/pasture lands. As shown in Figure 16, of EFU crop and pasture land with access to irrigation water, 71 percent are concentrated in the Trask River, Nestucca River, and Tillamook River watersheds (30 percent are in the Trask River watershed, 27 percent are in the Nestucca River watershed, and 14 percent are in the Tillamook River watershed).

[8] Water rights with the following use descriptions were included in this analysis: irrigation; supplemental irrigation; irrigation and domestic; irrigation, livestock, and domestic; and storage.

Table 15. Acres of Point of Use (POU) Irrigation Water Rights on EFU Lands by Land Use Type

5th field HUC	Barren	Developed	Crop/ Pasture	Natural Areas	Water	Total
Trask River	3.26	206.11	1,858.50	46.8	4.3	2,118.90
Nestucca River	7.37	195.46	1,712.80	129.6	0.94	2,046.20
Tillamook River	2.75	95.91	879	32.1	0.19	1,009.90
Wilson River	1.32	33.19	406.8	20.7	0.08	462.1
Little Nestucca River	0.45	23.12	345.2	9.3		378.1
Tillamook Bay	4.2	25.21	307.2	1.2	0.17	338
Sand Lake	1.54	33.03	238.3	31.7		304.5
North Fork Nehalem River		6.08	143.1	0		149.2
Kilchis River		5.15	135.9	20.4	0.26	161.7
Miami River	0.8	6.04	117.9	21.4		146.2
Lower Nehalem River	0.4	10.8	78.2	46.5		135.9
SUM TOTAL	**22.1**	**640.1**	**6,222.90**	**359.8**	**5.9**	**7,250.80**

Figure 17. Proportion of Water Rights on EFU Crop/Pasture Lands by Watershed



Yields on EFU Lands

The NRCS soil dataset provides information on the expected yields for irrigated and non-irrigated grass silage and pasture. Approximately 27,560 acres are rated for yield, (roughly corresponding to the 24,650 acres of crop and pasture land in the Cropscape dataset). The NRCS soil dataset provides yields in terms of tons of grass silage and Animal Unit Months (AUM's, a measure of the amount of forage required by one animal unit for one month) for pasture. We categorized the yield data into low, medium, and high yield levels using the yield cutoffs shown in Table 16. These cutoffs were based, as closely as possible, on distinct tiered classification as provided by NRCS. For example, for non-irrigated pasture, there are three classifications for Tillamook County: 5, 7, or 9 AUM, providing three clear levels of yield that reflect low, medium, high levels feasible within the county. For other yields, such as irrigated grass pasture, cutoffs were chosen such that there was at least one unit of yield difference between low and medium classifications to ensure clear differentiation in yield lands rated 'low'.

Table 16: Yield Classification by Crop

Crop Type	Yield Unit	Yield Classification		
		Low	Medium	High
Irrigated Pasture	AUM	N/A*	N/A*	13
Non Irrigated Pasture	AUM	5	7	9
Irrigated Grass Silage	Ton	3.0 – 4.0	5	5.5 – 6.0
Non-Irrigated Grass Silage	Ton	6	7	7.5 - 8.0

*All irrigated pasture yields on EFU lands in the database had a yield of 13.0 AUMs.

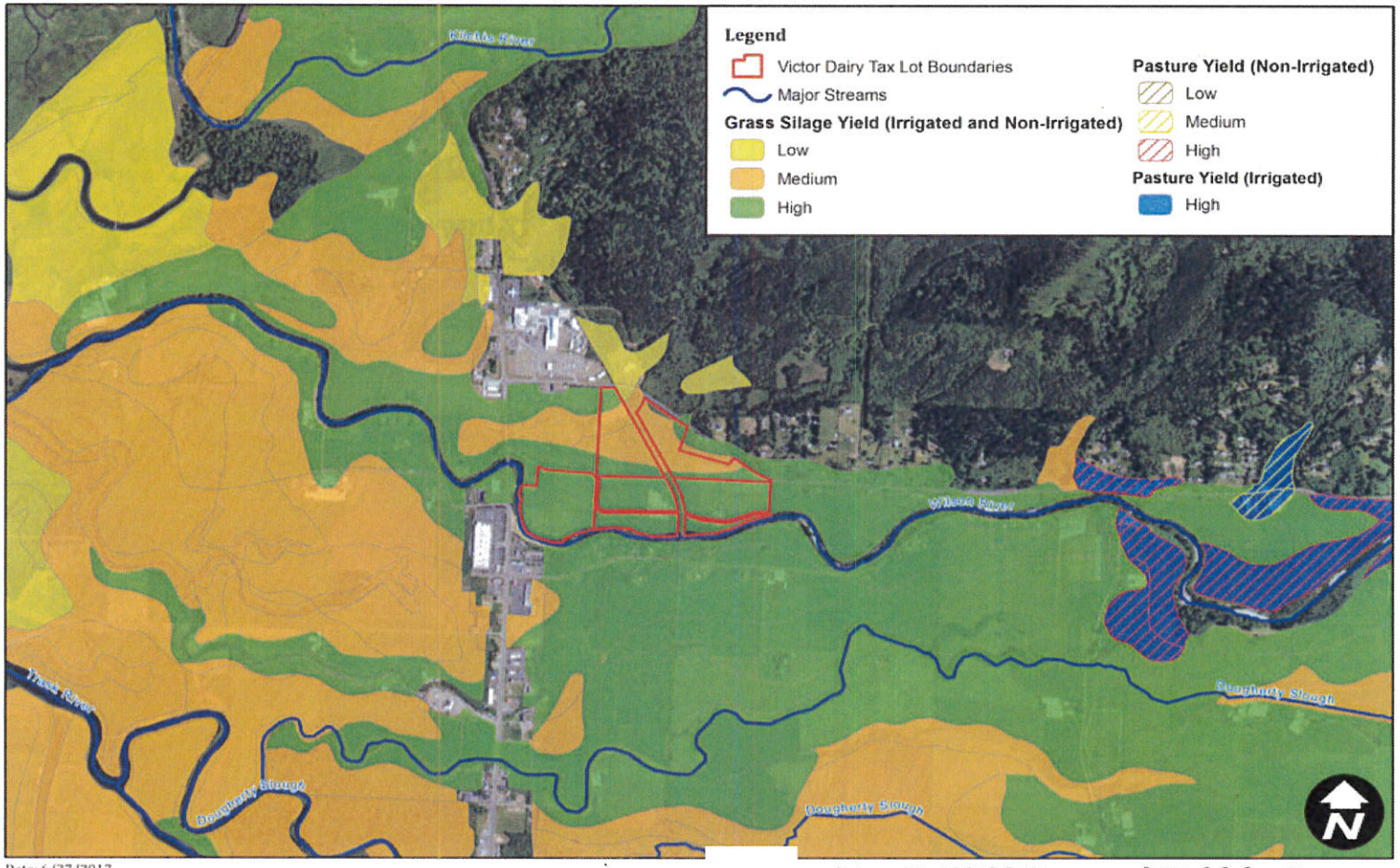
Most EFU lands have NRCS data on expected yields for just one of the four rated crop types (irrigated grass silage, irrigated pasture, non-irrigated grass silage, and non-irrigated pasture. As such, Table 17 shows the yield production potential for the EFU lands for either grass silage or pasture.[9] Of the 27,562 acres rated by NRCS for yield, 12,992 acres (47 percent) are rated high, approximately 11,404 acres (42 percent) are rated medium, and 3,165 acres (11 percent) are rated low. Figure 17 illustrates the yield data as provided by NRCS for an area along the Wilson River.

[9] There are approximately 5,260 acres of pasture or grass silage with ratings for both irrigated and non-irrigated expected yields, the yield rating for irrigated and non-irrigated production on these lands is the same (i.e., both high, both medium, or both low).

Table 17. Expected Grass Silage and Pasture Yield Level on EFU Lands

Watershed	High (Acres)	Medium (Acres)	Low (Acres)	Acreage with Yield Rating	Of Rated Lands, % Rated High or Medium
Trask River	3,725.10	2,268.10	706.8	483.6	93%
Nestucca River	3,038.40	2,131.30	755.1	1,662.10	82%
Tillamook River	1,698.20	2,925.80	260.1	1,882.60	88%
Wilson River	899.2	401.4	85.7	498.2	70%
Tillamook Bay	743.2	534.3	525.2	5,924.70	87%
Lower Nehalem River	680.1	980.6	222	1,683.10	94%
North Fork of Nehalem River	584	996.3	102.8	654.2	96%
Sand Lake	564.1	66.4	23.7	1,802.70	71%
Kilchis River	402.9	44.6	36.1	4,884.20	95%
Little Nestucca River	398	964.1	300	6,699.90	89%
Miami River	258.6	92.1	147.4	1,386.30	94%
Total	**12,991.70**	**11,404.90**	**3,164.90**	**27,561.50**	**89%**

Figure 18. Map of NRCS-Rated Expected Yields for Pasture and Grass Silage: Example of a Wilson River Farm



Date: 6/27/2017
Scale: 1 inch = 2,000 feet
Data Source: ESRI, 2017; Tillamook County, 2017; ODF, 2016; NRCS Soil Survey Data, 2017

Map X: NRCS Expected Yield for Pasture and Silage at Victor Dairy, LLC

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0 1,000 2,000 4,000 Feet

Tillamook County SB1517 Pilot Project

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Drainage and Diking Districts

As discussed in earlier sections of this memo, much of the EFU zone is in a floodplain and drainage of water is a constant management factor for agricultural operators in these areas. The NRCS soil dataset categorizes soils into seven classes of natural soil drainage (based on the frequency and duration of wet periods in the dominant condition): excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. Human management of water, either through drainage or irrigation, does not affect the drainage class, unless the morphology of the soil itself is changed through such management (Natural Resource Conservation Service, 2017), such as through compaction or development of a hardpan surface layer.

Table 18 presents an overview of soil drainage class by watershed, grouping the seven soil classes into four categories. We present drainage class only for the 27,562 acres that the NRCS has evaluated for crop or pasture yield. Across these EFU lands, 53 percent are well drained or moderately well drained, with the portion varying from 31 percent in Tillamook River watershed to 81 percent in the Kilchis River watershed.

Table 18. NRCS Soil Drainage Class on EFU Lands by Watershed

5th field HUC	Very Poorly Drained / Poorly Drained (Acres)	Somewhat Poorly Drained (Acres)	Well Drained/ Moderately Well Drained (Acres)	Excessively Drained/ Somewhat Excessively Drained (Acres)	Total (Acres)	% Well Drained / Moderately Well Drained
Kilchis River	36.8	20.2	390.6	36.1	483.57	81%
Little Nestucca River	878.8	118	665.4	-	1,662.12	40%
Lower Nehalem River	1,097.60	29.4	726	29.7	1,882.64	39%
Miami River	57.8	0.5	298	141.8	498.15	60%
Nestucca River	1,702.10	89.9	3,953.40	179.2	5,924.73	67%
North Fork Nehalem River	941.8	191.8	549.4	-	1,683.09	33%
Sand Lake	48.2	103.6	489.6	12.8	654.19	75%
Tillamook Bay	928.7	149.3	724.6	-	1,802.66	40%
Tillamook River	2,883.90	500.8	1,499.40	-	4,884.15	31%
Trask River	1,451.30	1,065.40	4,119.70	63.5	6,699.93	61%
Wilson River	225.9	86.1	1,065.70	8.6	1,386.28	77%
SUM TOTAL	**10,253.00**	**2,354.90**	**14,481.80**	**471.8**	**27,561.52**	**53%**

There are several drainage/diking districts in the County that manage drainage on approximately 2,216 acres of EFU lands. Table 19 summarizes EFU acreage in diking districts by watershed. Diking districts are located in the Trask, Tillamook Bay, Wilson River, and Kilchis River watersheds. Agricultural drainage elsewhere in the County is managed by the individual agricultural operator.

Table 19. EFU Lands in Diking Districts

5th field HUC	Acreage	% of EFU Diked Acreage
Trask River	1,066.90	48%
Tillamook Bay	787	36%
Wilson River	300.8	14%
Kilchis River	61.1	3%
Other watersheds	0	0%
SUM TOTAL	**2,215.90**	**100%**

Waste Management on EFU Lands

The NRCS dataset also includes rating of soils for the capacity to assimilate manure and food processing wastes. According to the NRCS, the ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The waste management assimilation capacity is classified into three categories by NRCS. As defined by NRCS (Natural Resource Conservation Service, 2017).

- "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.
- "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.
- "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

As shown in Table 20, of the 27,562 EFU lands identified as pasture or grass silage lands in the NRCS dataset, 8,283 acres are classified as 'somewhat limited' (30 percent) and 19,253 acres (70 percent) are classified as 'very limited' for disposal of animal waste. This highlights the challenge to dairy operators of managing animal waste on EFU lands in Tillamook County.

Table 20. Animal Waste Management Capacity (Acres)

Row Labels	Somewhat limited	Very limited	Total
Kilchis River	325.2	158.3	483.6
Little Nestucca River	169	1,493.20	1,662.10
Lower Nehalem River	597.9	1,284.80	1,882.60
Miami River	258.6	239.6	498.2
Nestucca River	2,674.30	3,250.40	5,924.70
North Fork of Nehalem River	415.4	1,267.60	1,683.10
Sand Lake	120.6	533.6	654.2
Tillamook Bay	244.5	1,558.20	1,802.70
Tillamook River	827.3	4,056.90	4,884.20
Trask River	2,170.20	4,504.90	6,699.90
Wilson River	480.4	905.9	1,386.30
Grand Total	**8,283.40**	**19,253.40**	**27,561.50**

Summary

In summary, the agricultural lands inventory highlights the following characteristics of EFU lands in Tillamook County:

1. EFU lands of 35,690 acres represent five percent of total land area in Tillamook County, and include nearly all high valued farmlands (as defined by State statue based primarily on soil type) in the County.

2. EFU lands are concentrated in the valley bottoms near rivers and streams. In addition to the river valleys, a large proportion (15.55%) of Tillamook County's agricultural lands is below HMT (11.62 feet, NAVD88).

3. EFU acreage that is in crop and pastureland, approximately 24,650 acres, represents three percent of total county land area, varying from zero percent to 11 percent of land area for any given watershed.

4. Approximately 11,980 acres of crop/pasture lands are located outside the EFU zone; this figure may underestimate the total non-EFU crop/pasture lands.

5. There are seven watersheds in the County with no EFU lands: Headwaters Nehalem River, Middle Nehalem River, Necanicum River, Rock Creek, Salmon River, Salmonberry River, and Willamina Creek. As such, we concentrate the inventory (and the remainder of the analysis for this project) on the other 11 watersheds in the County.

6. EFU lands are predominantly used to support dairy operations, including land for the operations themselves as well as lands for crops to feed animals and lands to spread manure. Countywide, only four dairy operations are located outside the EFU zone, but numerous dairies do rely on pasture and croplands outside the EFU zone to manage

animal waste (there are approximately 12,000 acres of pasturelands and croplands outside the EFU zone).

7. Approximately three quarters of EFU crop and pasturelands do not have access to supplemental irrigation water. However, given the current climate and growing conditions in the County, even non-irrigated yields are relatively high. In terms of yield potential, approximately 89 percent of EFU crop and pasture lands have medium to high expected yields for important forage crops such as grass silage and pasture.

8. The majority of dairy production (as measured by acreage of feed crops/pasture and number of permitted animals), irrigated water rights, and associated agricultural production value is in three watersheds: Trask River, Nestucca River, and Tillamook River.

9. Agricultural production, in terms of the number of milk cows and harvested cropland as measured by the Census, has increased slightly in the period 1997 to 2012. However, also based on Census data, the total cropland and pastureland has declined in the County since 2002.

10. Two management challenges to Tillamook County farmers include drainage of agricultural lands and animal waste disposal. These challenges are highlighted by inventory findings: based on soil class, approximately 47 percent of EFU crop and pasture lands have soils that are somewhat to very poorly drained, or are excessively drained. In addition, approximately 70 percent of EFU crop and pasture lands have soils that are rated by NRCS as 'very limited' for disposal of animal waste, with the remaining 30 percent of these lands rated 'somewhat limited'.

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U.S. Geological Survey, 2013, USGS NED n46w124 1/3 arc-second 2013 1 x 1 degree ArcGrid: U.S. Geological Survey.

APPENDIX B

Wetland and Agricultural Lands Assessment for Tillamook County Senate Bill 1517 Pilot Program Planning Process

John Runyon, Cascade Environmental Group, and Barbara Wyse, Highland Economics

Executive Summary

Introduction

The goals of this wetland and agricultural lands stability assessment are to: 1) describe the functions, values, and benefits of wetlands and wetland restoration projects from an ecological and socio-economic perspective; 2) identify Exclusive Farm Use (EFU or F-1 zone) lands in Tillamook County that are high priority for maintaining the stability of the County's agricultural economy, based on metrics for agricultural land quality/production potential, production costs, and current land use; and 3) outline the limitations of the available data for evaluating wetland restoration opportunities and priorities for maintaining agricultural lands.

Data and Spatial Scale Overview

The wetland and agricultural lands assessment builds on the findings from the *Wetland and Agricultural Use Inventory Memorandum* (Runyon and Wyse July 5, 2017). The primary available GIS data sets for the wetland and agricultural lands assessment are the NRCS soil survey database (GSSURGO) for Tillamook County and the National Wetland Inventory (NWI)[1]. The wetland and agricultural lands assessment results are summarized at two spatial scales: 1) county-wide and 2) for each of the watersheds that drain areas within the County. Hydrologic Unit Codes (HUCs) are the national standard for delineating watersheds, and for this study we use 5th-field HUCs of which there are 18 in the county (see Figure 1). In this assessment, we focus on the 11 watersheds with EFU lands[2]. Wetlands are identified as "tidal" or "freshwater" based, respectively, on whether the areas are below or above the highest measured tide (HMT)[3].

There are considerable data limitations for both wetlands and agricultural lands. For wetlands, important data limitations include potential underestimation of both potential historical wetland areas (i.e., areas that are not existing wetlands but were historically), and existing, modified wetlands (i.e., areas where ditching,

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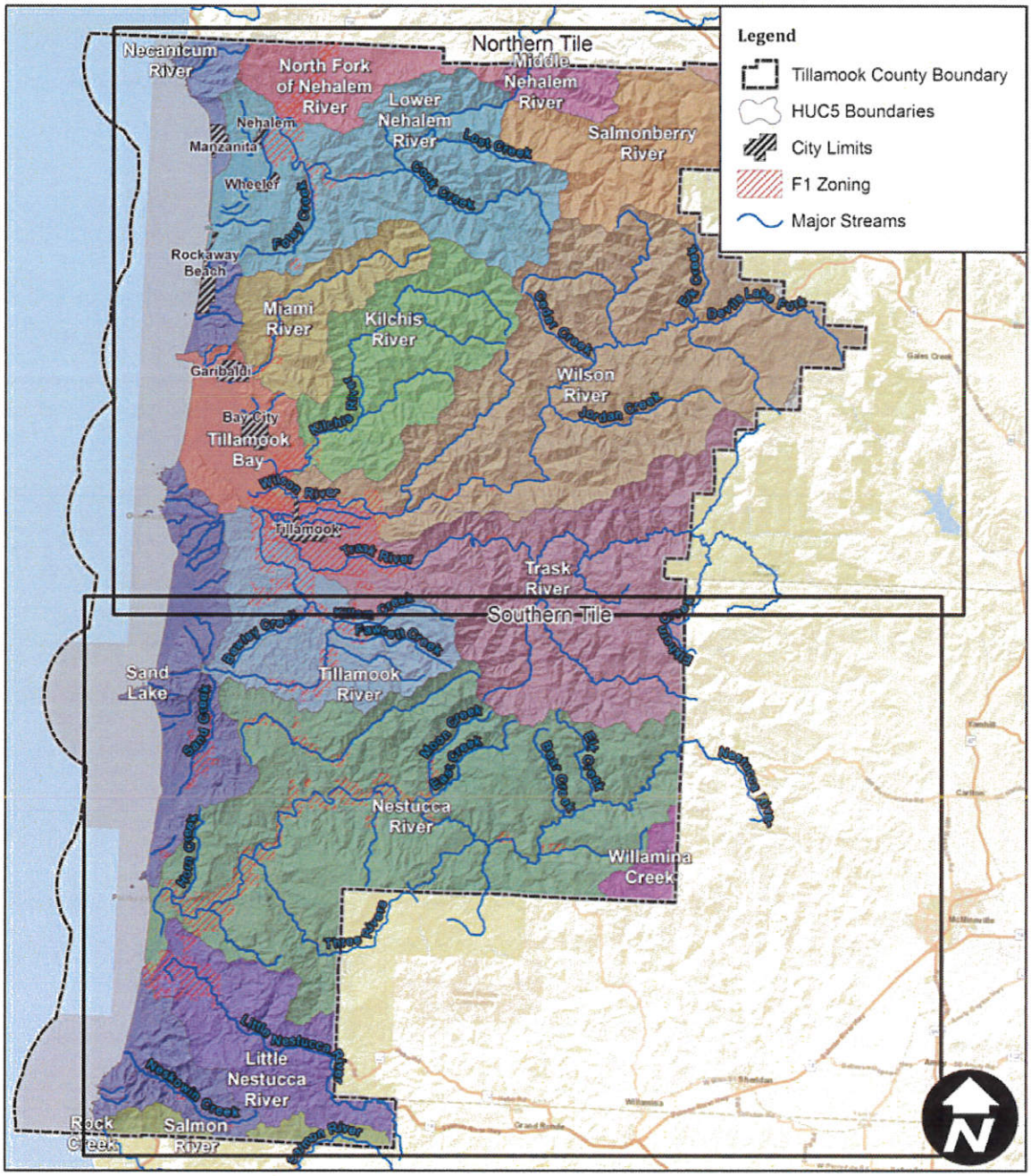
[1] See Runyon and Wyse July 5, 2017 for reference citations.
[2] There are no EFU lands in the following seven watersheds: Headwaters Nehalem River, Middle Nehalem River, Necanicum River, Rock Creek, Salmon River, Salmonberry River, and Willamina Creek.
[3] This method is in accordance with the Oregon Department of State Lands (DSL) definition of tidal and freshwater wetlands. Other County wetland studies have also used this method for defining tidal wetland extent (e.g., Ewald and Brophy 2012). The HMT was determined to be 11.62 feet, NAVD88.

levee construction, filling and other actions have resulted in significant loss of wetland function). The data also may include some sites that are erroneously classified as potential or existing wetland. As a consequence, while the findings of the wetland assessment presented here provide a broad picture of wetland status and restoration opportunities throughout the County and for specific watersheds, the

Figure 1. Overview of Tillamook County Streams and Watersheds. The Northern and Southern Tiles Delineate the Focus Areas for Figures 2 and 3



findings are not suitable for evaluation of wetland status and restoration opportunities at finer spatial scales such as landownership parcels or site-specific areas.

There are similar problems with the data used in the agricultural lands assessment. Feedback from the agricultural community indicates that the available GIS data for agricultural lands provide poor indications of actual, on-the-ground agricultural production potential and costs. While the NRCS soil survey database provides excellent site-specific data on soil type, the agricultural community commented that the NRCS ratings on the productivity and suitability of land for dairy agricultural uses, including ratings for soil drainage, crop yields, and suitability for spreading animal waste, which are based largely on soil type, are not reliable at the site level. The agricultural community provided input that site management is more important than soil type in determining the production potential and importance of Tillamook County EFU lands for dairy uses. This has implications for future farm and wetland planning projects: generating an accurate county-wide map of priority EFU agricultural lands will be more feasible in areas where the value and quality of agricultural lands is largely determined by soil type, slope, and other factors with excellent and available site-specific GIS data on the county scale.

Prioritization of EFU Agricultural Lands and Areas for Wetland Restoration

As described in detail in the agricultural assessment and the wetland assessment, nearly all EFU cropland areas, 29,900 cropland acres of the 37,587 total Tillamook County EFU acres[4], may have high value for agricultural stability, and nearly all wetland areas that have been modified or lost may have high restoration value.

The GIS-based assessment of agricultural lands attempts to rate agricultural land productivity and suitability based on the available county-wide GIS data, which includes current land use (whether in crop production currently), NRCS-rated drainage class, NRCS-rated yield for pasture and silage, and NRCS-rated animal waste management capacity. While the GIS data used in the agricultural GIS-based analysis are not deemed accurate at the site-specific level by the agricultural community, at the county-scale the GIS data indicates that EFU croplands generally are high yielding and have value for agricultural stability; over 80 percent were rated in the GIS-based analysis as medium or high priority. Members of the agricultural community indicate that "all EFU lands are important" for agriculture, but feedback on the specific factors affecting which EFU lands are prioritized by the agricultural community include: 1) areas protected by drainage infrastructure and levees/tiling should be prioritized, as there is a cultural desire to not see one hundred years of work undone, and 2) areas contiguous to other agricultural properties; wetlands projects should be located on the 'fringes' to limit adverse impacts and minimize disruption of manure management relationships between farms.

Similarly, for the wetlands, potential restoration areas are identified for tidally-influenced wetlands and non-tidal freshwater wetlands connected to floodplains or streams, with all of these lands having potential high restoration value. Potential wetland restoration areas are defined as locations where wetland functions and/or extent has been lost or reduced; and include modified NWI wetlands as defined in the NWI and potential historical wetlands or locations that contain soils that indicate past wetland status.

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[4] Nearly all cropland supports the Tillamook County dairy industry. Of the approximately 7,700 acres in the EFU that do not support crop production, most are forested and located higher in the watershed.

Tidal wetland restoration is a high priority as the greatest loss of wetland area and function in the County has been in tidally-influenced salt- and freshwater wetlands. Tidally-influenced wetland types provide important habitat diversity, support key ecological and hydrological functions, and provide essential habitat and food sources for salmon and steelhead populations and other fish and wildlife species. Tidal wetlands act as buffers between upstream areas and the ocean. By some estimates, tidal wetlands support up to three-quarters of all harvested fish species, largely due to the high productivity and diversity of habitats.

Non-tidal freshwater wetlands associated with floodplains and streams also are very productive environments and high priority for restoration. This wetland type is hydrologically connected to rivers and streams. The wetland areas support nutrient absorption, high levels of primary productivity, aquatic insect production, and detrital inputs to the river system. River-associated wetlands include off-channel wetlands, sloughs, and side-channels. Non-tidal freshwater wetlands provide a diversity of habitats for juvenile salmon and steelhead, including high-water refugia where fish can reside and feed during flood events. These wetlands contribute to flood attenuation, aquifer recharge, and other hydrologic benefits. Floodplain-associated wetlands serve as a moderator of flood variability—storing flows and reducing flow velocities during flood events.

Overlap in Tillamook County's EFU Lands and Wetlands

Particularly in the lower reaches of watersheds, there is significant overlap between EFU lands and potential (existing and historic) wetlands. For the most part, EFU lands are concentrated in the valley bottoms, often within floodplains adjacent to rivers and streams. Nearly 50% of the County's EFU lands are within freshwater floodplains or tidal areas; 16% of the County's EFU lands is below high mean tide (HMT) and is periodically subject to tidal influence. Historical and current wetlands are concentrated in floodplains and areas subject to tides.

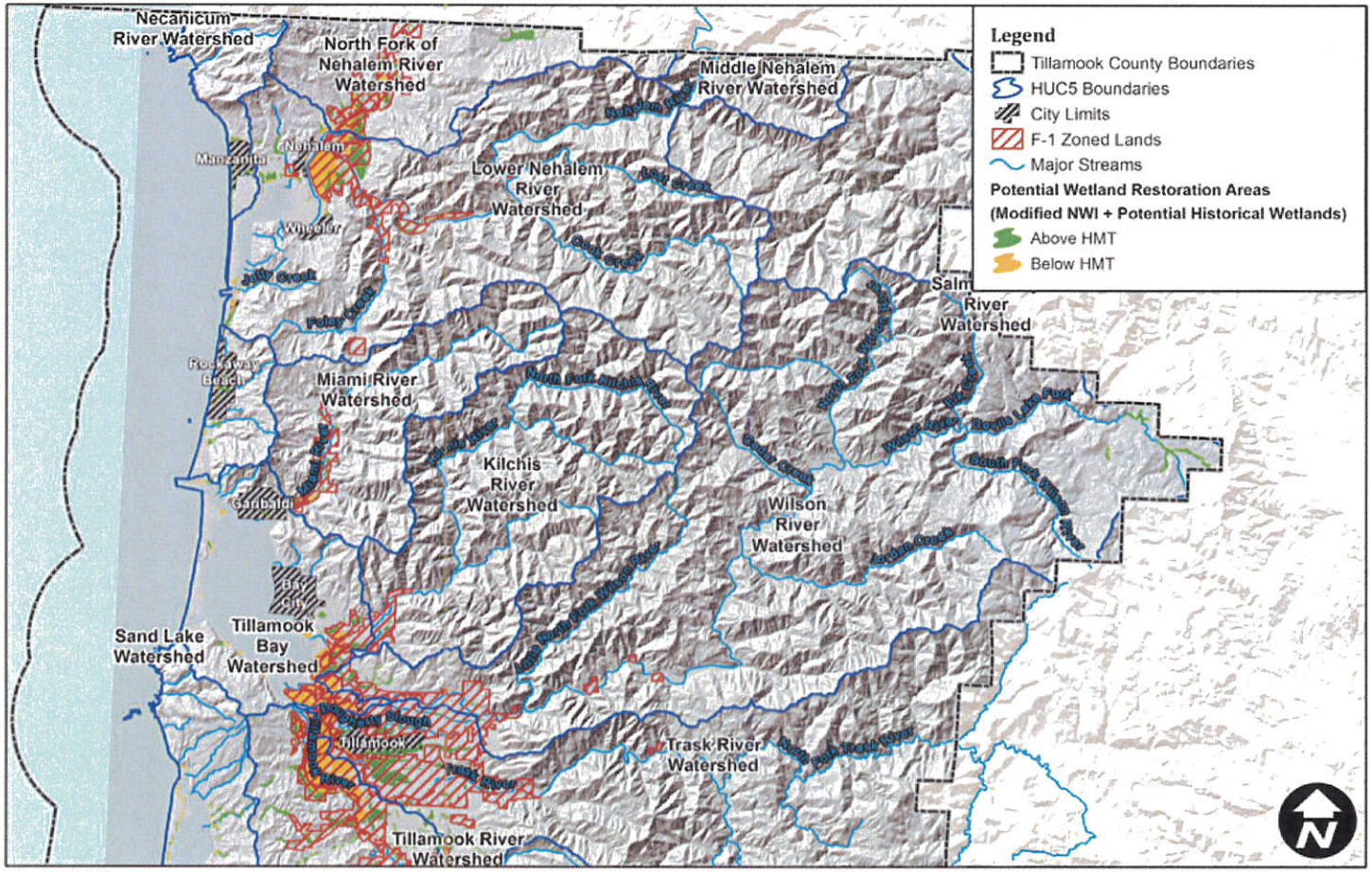
As there are data inadequacies in determining a high resolution, site-specific prioritization framework for both EFU agricultural lands and potential wetland restoration sites, detailed information on the spatial overlap between EFU lands and wetlands provides the most important basis for understanding potential compatibility between EFU land uses and wetland restoration.

Table 1 summarizes amount and proportion of "potential" (NWI and potential historical) tidal and freshwater wetlands located in EFU lands for each of the 11 watershed areas with EFU acreage. As shown in the last column of Table 1, there are 12,691 acres of estimated current and historical wetlands located in the EFU zone, or approximately 42 percent of the estimated 29,900 acres of EFU cropland. Almost all of these estimated historical wetlands in the EFU zone have been lost or modified, as shown in Tables 2 and 3, and thus represent potential wetland restoration areas. Approximately 84 percent of potential tidal restoration areas are in the EFU zone (Table 2); although only 57 percent of potential freshwater wetland restoration areas are in the EFU zone, representing substantial opportunity for restoration of this type of wetland outside of the EFU zone (Table 3). However, in contrast to non-EFU lands, a higher proportion of freshwater restoration opportunities on EFU lands are within floodplains adjacent to rivers and streams which is a higher priority for restoration.

Table 1. Overlap of Tillamook County Wetlands and EFU Lands

Watershed (5th Field HUC)	EFU Estimated Cropland	Estimated Potential Tidal Wetland *(NWI + Potential Historical)*		Estimated Potential Freshwater Wetland *(NWI + Potential Historical)*		Total Potential Wetland Restoration in EFU
		County	EFU	County	EFU	
Tillamook River	5,368	1,896	1,578	3,149	1,260	2,838
Nestucca River	6,576	1,029	265	4,901	2,229	2,494
Trask River	6,800	694	448	2,985	1,309	1,757
Lower Nehalem River	2,055	3,630	788	2,784	673	1,461
Tillamook Bay	1,845	10,341	893	1,317	347	1,240
Little Nestucca River	1,946	983	458	1,515	645	1,103
Sand Lake	923	4,339	0	4,173	498	498
Wilson River	1,549	173	121	2,556	376	497
North Fork Nehalem River	1,791	590	201	1,198	239	440
Miami River	543	44	30	636	195	225
Kilchis River	506	0	0	715	138	138
Other 7 Watersheds with no EFU Land	0	120	0	1,060	0	0
TOTAL	29,900	23,839	4,782	27,113	7,909	12,691

Figure 2. The Northern Section of Tillamook County Showing Streams, EFU (F-1 Zoned) Lands, Potential Tidal and Freshwater (above HMT) Wetland Restoration Areas



Date: 12/8/2017
Scale: 1 inch = 3 miles
Data Source: ESRI, 2017; USGS, NHD, 2014; Tillamook County, 2016

F-1 Zoning and Potential Wetland Restoration Areas in Northern Tillamook County

CASCADE ENVIRONMENTAL GROUP

0 1 2 4 Miles

Tillamook County SB1517 Pilot Project

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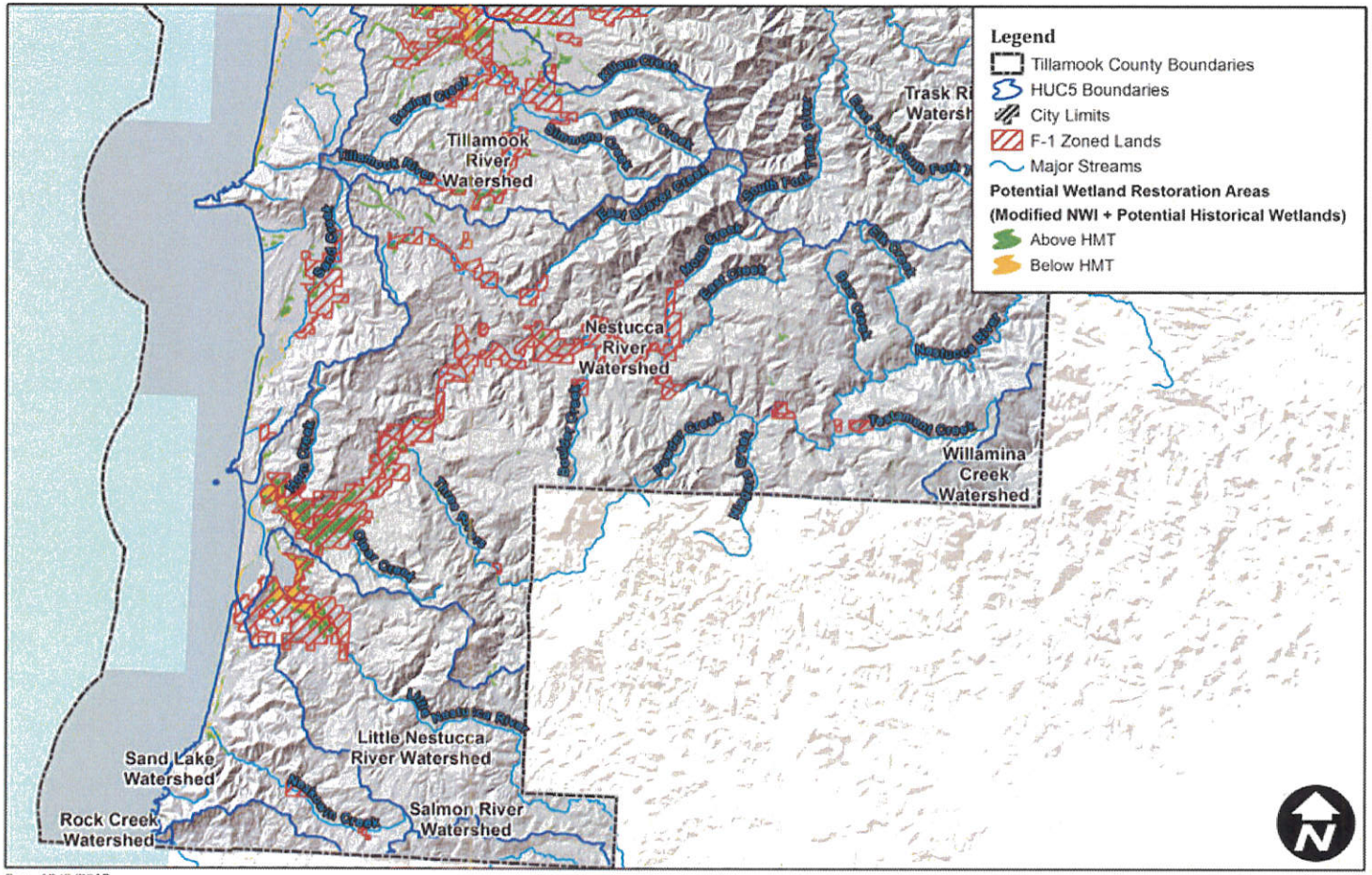
Figure 3. The Southern Section of Tillamook County Showing Streams, EFU (F-1 Zoned) Lands, and Potential Tidal and Freshwater (above HMT) Wetland Restoration Areas



Date: 12/8/2017
Scale: 1 inch = 3 miles
Data Source: ESRI, 2017; USGS, NHD, 2014; Tillamook County, 2016

F-1 Zoning and Potential Wetland Restoration Areas in Southern Tillamook County

CASCADE ENVIRONMENTAL GROUP

0 1 2 4 Miles

Tillamook County SB1517 Pilot Project

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Tables 2 and 3 show that there is substantial current and historical wetland acreage located outside the EFU zone: approximately 80 percent of estimated historical tidal wetlands (19,057 acres of 23,839 acres) and 70 percent of estimated historical freshwater wetlands (19,204 acres of 27,113 acres) are located outside of the EFU zone. In the watersheds without EFU lands, there are only 120 acres of estimated historical tidal wetlands, potentially limiting opportunities for wetland restoration in areas far from agriculture, but there are 1,060 estimated historical freshwater wetlands in these watersheds.

As Table 2 shows, within the County's EFU lands, there are 4,171 acres of potential tidal wetland restoration areas or modified NWI and potential historical tidally-influenced wetlands. The area of potential tidal wetland restoration area ranges from 1,399 acres in the Tillamook River Watershed, to no acreage in the Kilchis River or Sand Lake Watersheds.

For non-tidal freshwater wetlands within EFU lands, there are 5,335 acres of potential non-tidal freshwater wetland restoration area (see Table 3). The area of potential non-tidal freshwater restoration ranges from 1,599 acres in the Nestucca River Watershed to 48 acres in the Kilchis River Watershed.

Wetland restoration projects have been completed on EFU and non-EFU lands. Completed restoration projects include river and floodplain restoration in freshwater areas above tidal influence and estuary restoration projects in areas subject to tidal influence. More than 1,000 acres have been restored on EFU lands: 881 acres of tidal and 473 acres of freshwater restoration. These restoration areas overlap both modified wetland areas and wetlands that have been filled or dramatically altered. Due to challenges identifying the site-specific restoration actions and locations the summary of potential wetland restoration areas, the data presented in Tables 2 and 3 does not account for restoration projects that have been implemented.

The overlap of potential wetland restoration areas and EFU lands provides the context for assessing the compatibility of restoration with agricultural uses and establishing a process for the condition use review. In the compatibility assessment, we expect to define factors, such as drainage infrastructure and levee locations, that can be evaluated at the site-specific level to determine agricultural land priority and potential adverse impacts of wetland restoration on adjacent lands that affect production costs or land use patterns. Both the wetland and agricultural use information will help to inform which areas of EFU land may or may not be compatible with restoration.

Table 2. Tidal Wetland Acreage: Total Historical, Existing Unmodified, and Potential Wetland Restoration for EFU and Non-EFU Lands

Watershed (5th-Field HUC)	Estimated Historical Tidal Wetland *(NWI + Potential Historical)*		Existing Unmodified Wetland *(NWI-NWI Modified)*		Potential Restoration Areas *(NWI Modified + Potential Historical)*		
	County	EFU	County	EFU	County	EFU	% on EFU Lands
Tillamook River	1,896	1,578	428	179	1,468	1,399	95%
Tillamook Bay	10,341	893	9,304	93	1,037	800	77%
Lower Nehalem River	3,630	788	2,947	192	683	596	87%
Trask River	694	448	215	51	479	397	83%
Little Nestucca River	983	458	582	70	401	388	97%
Nestucca River	1,029	265	718	3	311	262	84%
North Fork Nehalem River	590	201	326	0	264	201	76%
Wilson River	173	121	54	14	119	107	90%
Miami River	44	30	17	9	27	21	78%
Kilchis River	0	0	0	0	0	0	0%
Sand Lake	4,339	0	4,192	0	147	0	0%
Other 7 Watersheds with no EFU Land	120	0	92	0	28	0	0%
SUM TOTAL	23,839	4,782	18,875	611	4,964	4,171	84%

Table 3. Freshwater Wetland Acreage: Total Historical, Existing Unmodified, and Potential Restoration or EFU and Non-EFU Lands

Watershed (5th-Field HUC)	Estimated Historical Tidal Wetland *(NWI + Potential Historical)*		Existing Unmodified Wetland *(NWI-NWI Modified)*		Potential Restoration Areas *(NWI Modified + Potential Historical)*		
	County	EFU	County	EFU	County	EFU	% on EFU Lands
Nestucca River	4,901	2,229	2,864	630	2,037	1,599	78%
Tillamook River	3,149	1,260	1,632	305	1,517	955	63%
Trask River	2,985	1,309	1,446	354	1,539	955	62%
Little Nestucca River	1,515	645	737	144	778	501	64%
Lower Nehalem River	2,784	673	1,965	246	819	427	52%
Tillamook Bay	1,317	347	832	65	485	282	58%
North Fork Nehalem River	1,198	239	602	0	596	239	40%
Wilson River	2,556	376	2,063	224	493	152	31%
Sand Lake	4,173	498	3,430	409	743	89	12%
Miami River	636	195	513	107	123	88	72%
Kilchis River	715	138	628	90	87	48	55%
Other 7 Watersheds with no EFU Land	1,060	0	885	0	175	0	0%
SUM TOTAL	27,113	7,909	17,684	2,574	9,429	5,335	57%

Wetland Service Assessment for Tillamook County Farm and Wetland Pilot Planning Project

Introduction

This memo describes the assessment of wetland services on Exclusive Farm Use (EFU or F-1 zone) lands in Tillamook County (County) (hereafter referenced as EFU lands). The purpose of the wetland service assessment is to: 1) describe the functions, values, and benefits of wetlands and wetland restoration projects from an ecological and socio-economic perspective; 2) characterize the quantity and location of potential wetland restoration areas on EFU lands; and 3) outline the limitations of the available data for evaluating wetland restoration opportunities.

Methods Overview

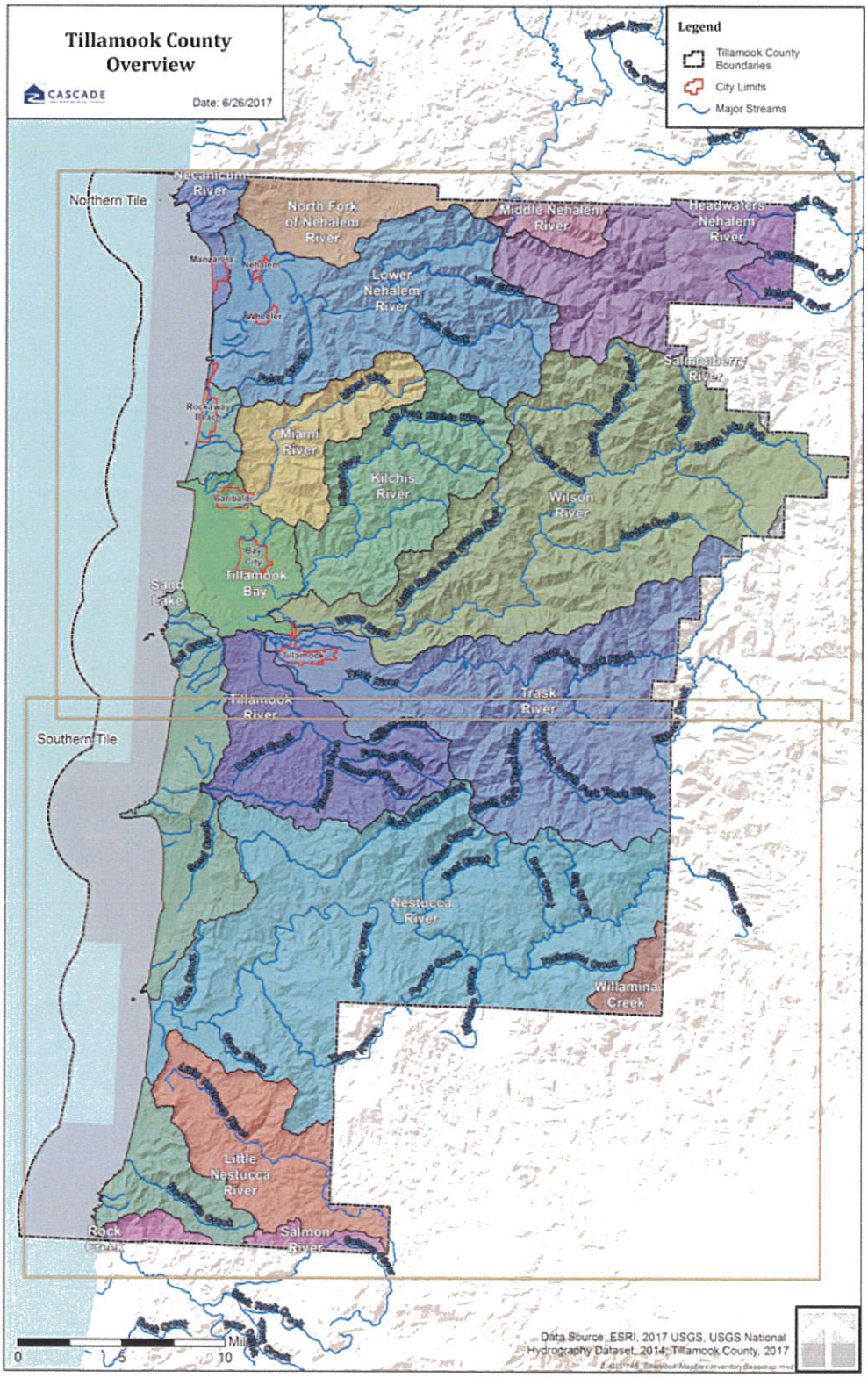
The wetland assessment builds on the findings from the *Wetland and Agricultural Use Inventory Memorandum* (Runyon and Wyse July 5, 2017). The primary available GIS data sets for the inventory and wetland assessment are the NRCS soil survey database (GSSURGO) for Tillamook County (NRCS 2016); and the National Wetland Inventory (NWI) (USFWS 2016). The soil survey database provides spatial information on the extent and location of geomorphic floodplains, soils drainage classes, and potential historical wetland areas. The NWI data are useful for mapping existing and modified (e.g., filled) freshwater and tidal wetlands.

The wetland assessment results are summarized at two spatial scales: County-wide and for each of the watersheds that drain areas within the County. Hydrologic Unit Codes (HUCs) are the national standard for delineating watersheds. For this study, the County is covered by eighteen 5th-field HUCs (Figure 1).

For the purposes of the wetland assessment, portions of watersheds are identified as "tidal" or "freshwater" based, respectively, on whether the areas are below or above the highest measured tide (HMT). This method is in accordance with the Oregon Department of State Lands (DSL) definition of tidal and freshwater wetlands (DSL 2016). Other County wetland studies have also used this method for defining tidal wetland extent (e.g., Ewald and Brophy 2012). The HMT was determined to be 11.62 feet, NAVD88[5].

[5] HMT was determined according to methods described by DSL (2010) using the National Oceanic and Atmospheric Administration (NOAA) tidal station located at Garibaldi, Oregon. The tidal station at Garibaldi was chosen to represent the entire County, as it is the sole station with a published "Highest Observed Water Level" value. The value of 15.91 feet, standard datum, was converted first into feet, mean lower low water (MLLW), then into feet, North American Vertical Datum of 1988 (NAVD88) with NOAA's online horizontal and vertical transformation utility, VDatum (https://vdatum.noaa.gov/vdatumweb/), to yield a value of 11.62 feet, NAVD88. The value of 11.62 feet was then applied to a 10-meter resolution raster-based digital elevation model (DEM) sourced from the National Elevation Dataset (USGS 2013; available at: https://viewer.nationalmap.gov/basic/#productSearch) in ESRI ArcGIS 10.1 software) to identify areas above and below HMT.

Figure 1. Overview of Tillamook County Streams and Watersheds. The Northern and Southern Tiles Delineate the Focus Areas for Figures 2 and 3



Overview of Tillamook County's EFU Lands

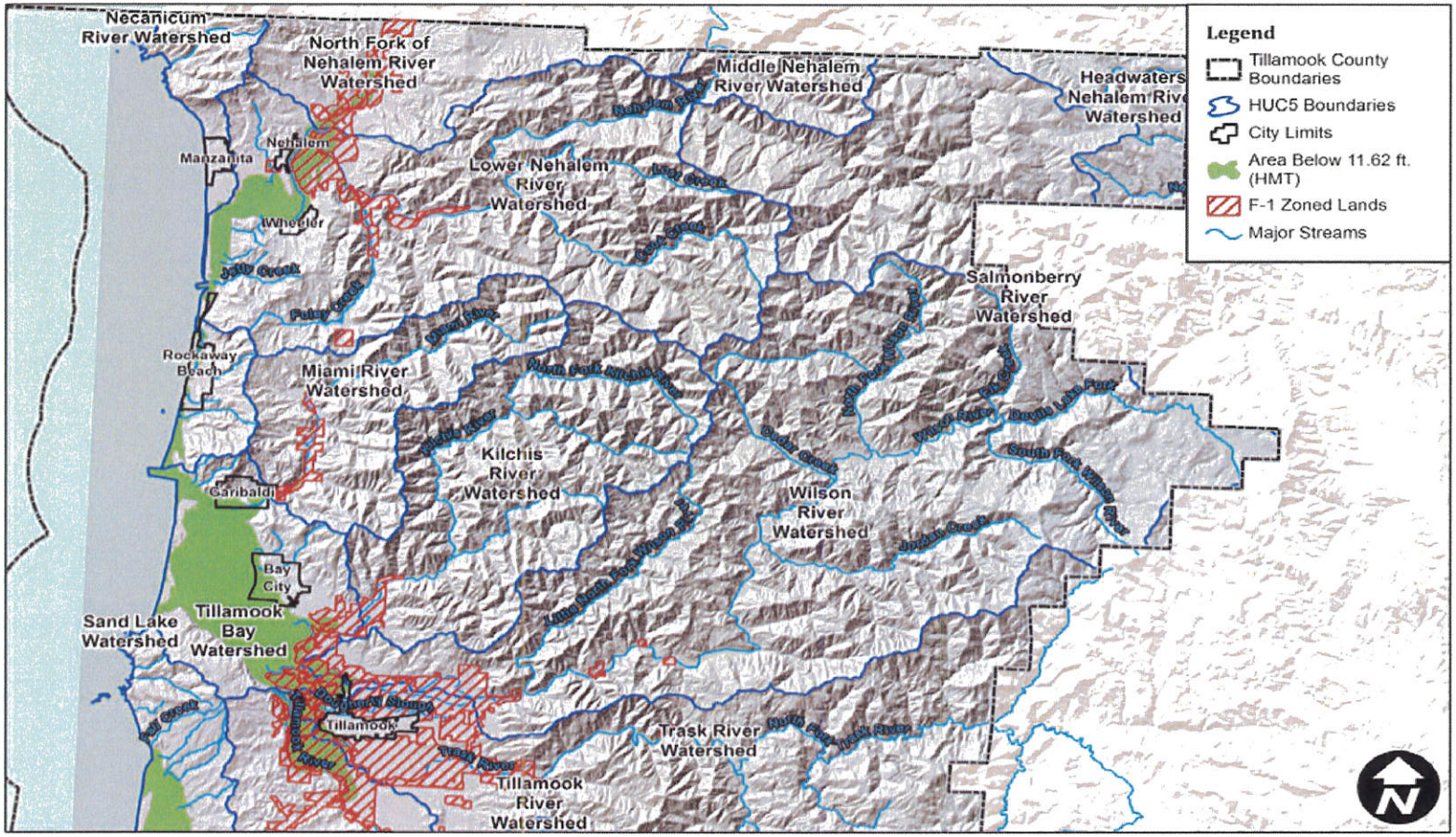
Table 1 summarizes the County's eighteen watershed areas and the proportion of each watershed designated as EFU[6]. The County covers approximately 718,719 acres, of which 37,589 acres (5.23%) are EFU (Figures 3 and 4). There are no EFU lands in the following seven watersheds: Headwaters Nehalem River, Middle Nehalem River, Necanicum River, Rock Creek, Salmon River, Salmonberry River, and Willamina Creek. The wetland assessment focuses on the eleven watersheds with EFU lands present.

Table 1. Summary of Tillamook County Watershed Areas, EFU Lands, and Areas Below HMT. The Seven Watersheds in Bold Type Have No EFU Lands Present

Watershed (5th-Field HUC)	Watershed Area (Acres)	EFU (Acres)	Percent of Watershed within EFU	Watershed Area Below HMT (Acres)	EFU Below HMT (Acres)	Percent EFU Below HMT (Acres)
Headwaters Nehalem River	9,928	-	0.00%	-	-	-
Kilchis River	41,280	557	1.35%	-	-	-
Little Nestucca River	32,413	3,021	9.32%	987	459	15.21%
Lower Nehalem River	70,078	2,714	3.87%	4,053	1,000	36.85%
Miami River	23,052	831	3.61%	79	54	6.47%
Middle Nehalem River	6,943	-	0.00%	-	-	-
Necanicum River	6,389	-	0.00%	120	-	-
Nestucca River	139,693	9,736	6.97%	1,115	279	2.86%
North Fork Nehalem River	17,574	1,994	11.35%	733	570	28.60%
Rock Creek	125	-	0.00%	6	-	-
Salmon River	7,108	-	0.00%	19	-	-
Salmonberry River	34,896	-	0.00%	-	-	-
Sand Lake	53,885	1,718	3.19%	4,909	1	0.06%
Tillamook Bay	21,255	1,948	9.17%	10,954	1,057	54.27%
Tillamook River	39,361	5,968	15.16%	1,995	1,669	27.97%
Trask River	90,666	7,008	7.73%	861	561	8.01%
Willamina Creek	5,439	-	0.00%	-	-	-
Wilson River	118,634	2,094	1.77%	312	196	9.36%
SUM TOTAL	***718,719***	***37,589***	***5.23%***	***26,142***	***5,847***	***15.55%***

[6] Two watersheds that are primarily within Washington County were not included in this study because they cover a very small area in Tillamook County and do not include any Agricultural Lands: Gales Creek (222 acres) and Scoggins Creek-Tualatin River (476 acres).

Figure 2. The Northern Section of Tillamook County Showing Streams, EFU (F-1 Zoned) Lands, and Areas below HMT



Date: 6/26/2017
Scale: 1 inch =4 miles
Data Source: ESRI, 2017; USGS, NHD, 2014

F-1 Zoning and Streams in Northern Tillamook County

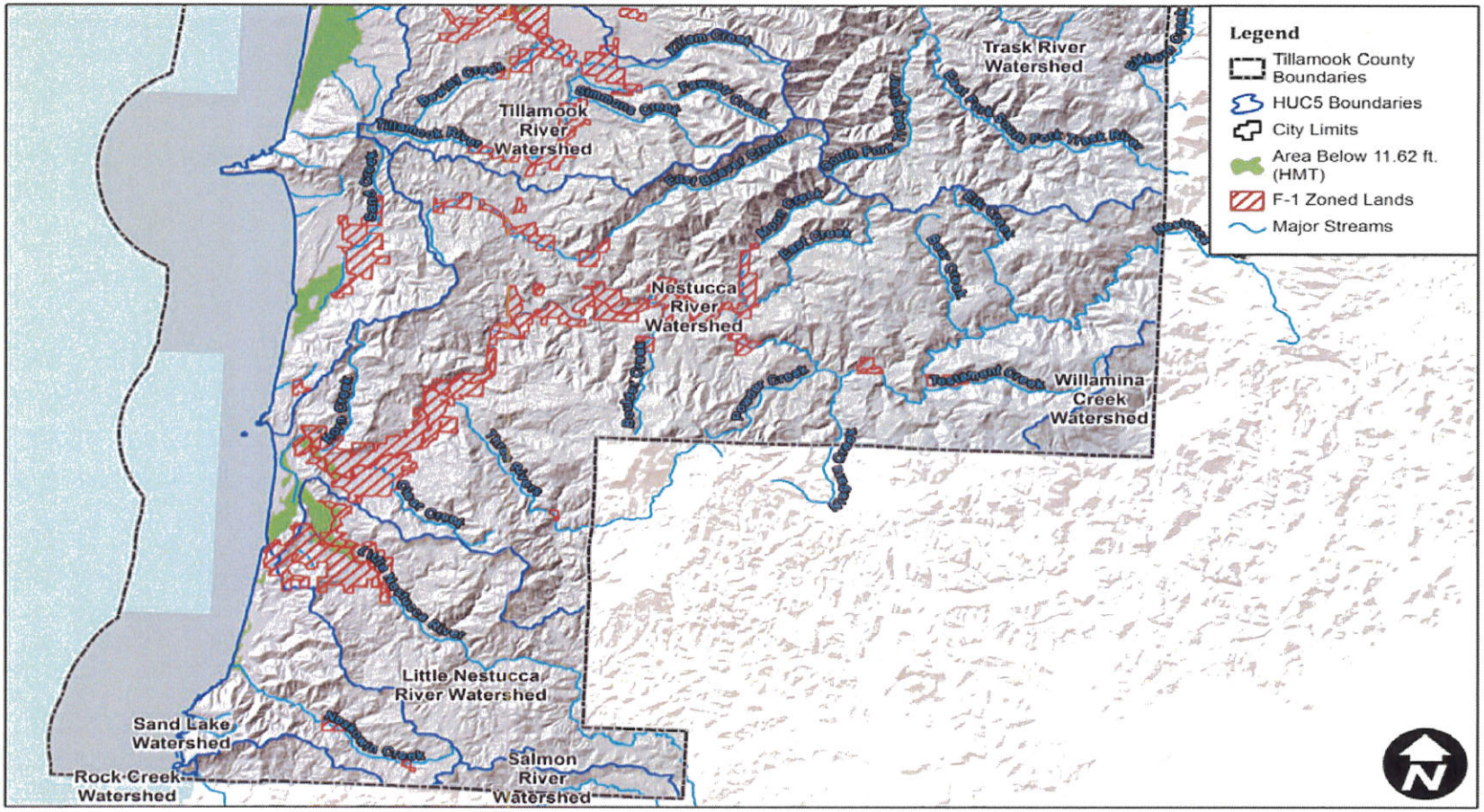
CASCADE ENVIRONMENTAL GROUP

0 1 2 4 Miles

Tillamook County SB1517 Pilot Project

Z:\GIS\145_Tillamook\Mapfiles\InventoryBasemap_Detail.mxd

Figure 3. The Southern Section of Tillamook County Showing Streams, EFU Lands, and Areas below HMT



Date: 6/26/2017
Scale: 1 inch =4 miles
Data Source: ESRI, 2017; USGS, NHD, 2014

F-1 Zoning and Streams in Southern Tillamook County

CASCADE ENVIRONMENTAL GROUP

0 1 2 4 Miles

Tillamook County SB1517 Pilot Project

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For the purposes of the inventory, watersheds, or portions of watersheds, are identified as "tidal" or "freshwater" based, respectively, on whether the areas are below or above the highest measured tide (HMT). This method is in accordance with DSL's definition of tidal and freshwater wetlands (DSL 2016). Other County wetland studies have also used this method for defining tidal wetland extent (e.g., Ewald and Brophy 2012). The HMT was determined to be 11.62 feet, NAVD88.

For the most part, EFU lands are concentrated in the valley bottoms, often within floodplains adjacent to rivers and streams. In addition to the river valleys, a large proportion (15.55%) of the County's EFU lands is below HMT and is periodically subject to tidal influence. The areas below HMT include lands that were historically tidally influenced; in many instances land drainage has been altered (e.g., by levees or other modifications) to limit tidal inundation and accommodate agricultural land uses. Ten watersheds have some portion of EFU below HMT.

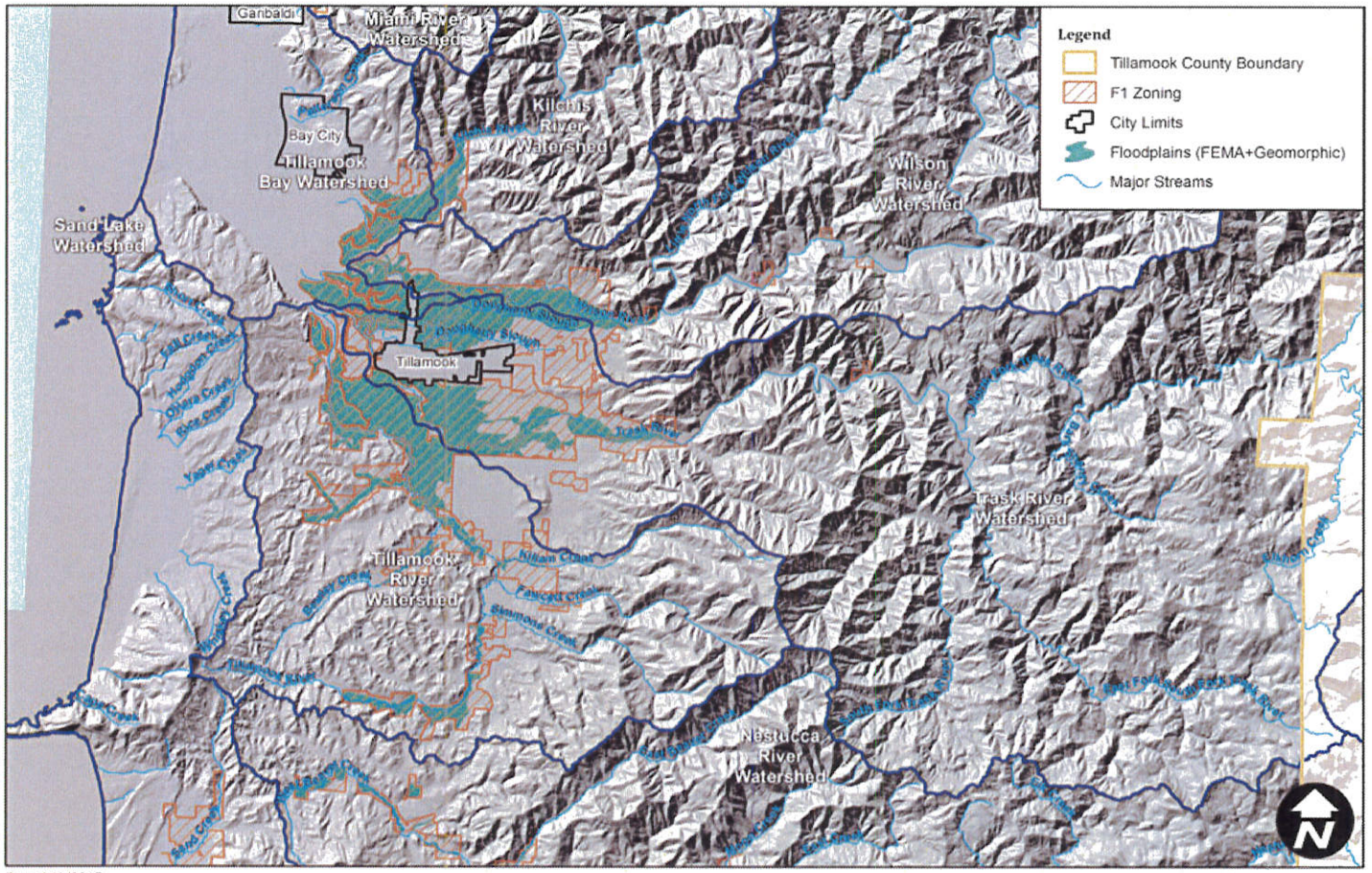
Floodplains are a focus for wetland restoration because these areas are adjacent to rivers, streams and tidal areas that provide complex and productive habitats important for fish and wildlife populations. For the purpose of the wetland assessment, floodplain areas are based on geomorphic floodplain features defined in the national soil survey, FEMA special hazard area mapped floodplains, and areas subject to tidal inundation up to HMT.

Table 2 shows the acreage and proportion of floodplain areas within EFU lands. Nearly 50% of the County's EFU lands are within freshwater floodplains or tidal areas, ranging from 84.5% in the Tillamook Bay Watershed to 3.35% in the Sand Lake Watershed. Figure 4 shows floodplains (including tidal areas) within EFU lands in central Tillamook County.

Table 2. The Acreage and Percent of Watershed Area within Floodplains on Tillamook County EFU Lands

Watershed	Floodplain Area (Acres)	Floodplain Area as Percent of Total EFU Lands
Kilchis River	405	72.80%
Little Nestucca River	1,018	33.68%
Lower Nehalem River	2,048	75.45%
Miami River	463	55.74%
Nestucca River	3,334	34.25%
North Fork of Nehalem River	1,324	66.43%
Sand Lake	58	3.35%
Tillamook Bay	1,646	84.50%
Tillamook River	3,452	57.85%
Trask River	3,581	51.10%
Wilson River	1,199	57.23%
TOTAL	***18,528***	***49.29%***

Figure 4. Floodplains within EFU Lands in Central Tillamook County.



Date: 9/6/2017
Scale: 1 inch = 3 miles
Data Source: ESRI, 2017; USGS, NHD, 2014; FEMA, 2016

FEMA Special Flood Hazard Areas (Preliminary) and Geomorphic Floodplains in Central Tillamook County

CASCADE ENVIRONMENTAL GROUP

0 1 2 4 Miles

Tillamook County SB1517 Pilot Project

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Wetland Functions and Values

The County encompasses both tidal and non-tidal freshwater wetlands associated with streams and rivers. The County also contains freshwater wetlands that are not directly influenced by rivers or streams. While these upland freshwater wetlands are an important habitat type, the assessment is focused on tidal wetlands and freshwater wetlands that are within floodplain areas associated with streams and rivers because these wetland types are highly complex and productive habitats that support unique habitats and other important functions and values.

Tidal wetlands include freshwater areas influenced by the tide and estuary areas that are subject to a range of water salinity levels. Tidal wetlands are the most productive wetland type from the perspective of plant growth, nutrient and carbon dioxide (a greenhouse gas) uptake, and associated accumulation of organic matter (Simpson et al. 1983). Freshwater and saltwater-influenced tidal wetlands act as buffers between upstream areas and the ocean. Primary production and decomposition proceed at high rates and these wetlands are sinks for nutrients and heavy metals. This productive environment supports abundant plant biomass and detrital inputs into the aquatic system, which in turn supports aquatic insects and other sources of food for fish and wildlife. For this reason, tidal wetlands are critical habitat for a variety of fish and wildlife species, including salmon, crabs, and other shellfish, juvenile marine fish, marine mammals, and birds (ODFW 2016). By some estimates, tidal wetlands support up to three-quarters of all harvested fish species, largely due to the high productivity and diversity of habitats (ODFW 2016).

Non-tidal freshwater wetlands associated with floodplains are also very productive environments. This wetland type is hydrologically connected to rivers and streams. These wetland areas support nutrient absorption, high levels of primary productivity, aquatic insect production, and detrital inputs to the river system. River-associated wetlands include off-channel wetlands, sloughs, and side-channels. Non-tidal freshwater wetlands provide a diversity of habitats for juvenile salmon and steelhead, including high-water refugia where fish can reside and feed during flood events (ODFW 2016).

Tidal and non-tidal freshwater wetlands areas are critical habitats for juvenile salmon and steelhead growth and survival to maturity. These habitats provide a very productive and important environment as the fish feed, grow, and transition to the ocean environment. For example, one study observed a juvenile coho salmon that doubled in size during its 28-day residence within tidal wetlands (Jones et al. 2009). Tidal and non-tidal firewater wetlands contribute to the genetic diversity of salmon and steelhead populations by supporting a range life history patterns. For example, studies have identified coho salmon subyearling migrants with estuary-resident life histories that are dependent on access to diverse tidal wetlands (Jones et al. 2009).

Tidal and non-tidal freshwater wetlands also contribute to flood attenuation, aquifer recharge, and other hydrologic benefits. Because floodplain wetlands are located within a relatively flat landscape, their surface area expands and contracts as rivers rise and fall, allowing for the storage of large volumes of water (U.S. EPA 2008). As a consequence, floodplain-associated wetlands serve as a moderator of flood variability—storing flows and reducing flow velocities

during flood events. In addition, these wetland areas create low-velocity environments that are important for trapping nutrients and sediments (U.S. EPA 2008).

The storage of large volumes of water in both tidal and non-tidal freshwater wetlands can contribute to aquifer recharge: aquifers and groundwater are "recharged" with water that resides within wetland areas which then seeps into the ground. Wetlands connected to groundwater systems or aquifers are important areas for groundwater exchange (U.S. EPA 2008).

Tillamook County's EFU Wetlands: Restoration Definition and Evaluation Criteria

This section defines wetland restoration actions and outlines criteria for identifying wetland restoration opportunities and priorities within EFU lands.

Wetland Enhancement and Restoration: Definition and Examples

The County defines wetland "restoration" as encompassing two types of activities, wetland enhancement and wetland restoration:

Wetland Enhancement is the process of improving upon the natural functions and/or values of an area or feature which has been degraded by human activity.

An example of a wetland enhancement project is extending or improving an existing wetland channel and/or drainage network to more closely resemble the historical template. The Nature Conservancy Miami River project, which entailed recreating the historical tidal channel network, is an example of a wetland enhancement project.

Wetland Restoration is the process of returning a disturbed or altered area or feature to a previously existing natural condition. Restoration actions reestablish the ecological structure, function, and /or diversity which occurred prior to impacts caused by human activity.

An example of a wetland restoration project is removing a levee, fill, or other structure to restore historical wetland tidal or riverine hydrology, flooding, drainage patterns, and other processes and functions. The central Tillamook County Southern Flow Corridor Project is an example of a wetland restoration project that restored tidal connectivity to wetland areas that were disconnected from historical tidal processes by removing levees and other structures.

Wetland Restoration Evaluation Criteria

Criteria for identifying wetland restoration opportunities and priorities within the County's EFU lands were developed based on available GIS data. Because the existing data sources have varying levels of spatial resolution and accuracy, the criteria are focused on landscape-level indicators of wetland presence and modification (e.g., filling, levees, or other actions that disconnect or limit hydrologic interaction with tides or river flows), and restoration potential. This approach results in information on wetland status and restoration opportunities that is evaluated and summarized at the County-wide and specific watershed scales.

It is important to note that there are considerable uncertainties in interpreting the GIS data sets at a variety of scales. The uncertainties in interpreting the data include errors of omission and

commission. Errors of omission, for example, involve missing potential historical wetland areas and potential wetland restoration areas. Errors of commission entail identifying areas that, upon further evaluation, are not wetlands or areas suitable for restoration. As a consequence, while the findings of the wetland assessment presented here provide a broad picture of wetland status and restoration opportunities throughout the County and for specific watersheds, the findings are not suitable for evaluation of wetland status and restoration opportunities at finer spatial scales such as landownership parcels or site-specific areas.

Evaluating site-specific areas for restoration benefits and assessing potential impacts on adjacent parcels requires a combination of datasets, depending on the nature of the restoration activities. For example, evaluating an estuary restoration project with the goal of restoring tidal influence to a site could require GIS data (e.g., levee locations), wildlife and fish use surveys, topographic information collected on local features such as drainage networks, data on groundwater levels, and the application of hydraulic modelling to predict upstream and downstream water level changes if the restoration is implemented.

The following is a description of the restoration criteria that are applied at the landscape level[7]:

Is the potential wetland area influenced or historically influenced by tidal flows?

Is the potential tidal wetland area modified or lost?

Rationale: The greatest loss of wetland area and function in the County has been in tidally-influenced salt- and freshwater wetlands (Ewald and Brophy 2012; Scranton 2004). As described above, tidally-influenced wetland types provide important habitat diversity, support key ecological and hydrological functions, and provide essential habitat and food sources for salmon and steelhead populations and other fish and wildlife species.

Methodology**:** 1) Identify and map areas below HMT; 2) For areas below HMT, identify and map NWI wetlands that have been modified (e.g., historical tidal wetlands that have no or limited tidal connectivity due to levees, filling, or channel modifications); and 3) Identify potential historical wetlands adjacent to estuary and tidal systems that have been lost by evaluating the proportion of mapped hydric soils.

Is the potential tidal wetland restoration area adjacent to coho salmon High Intrinsic Potential habitat?

Rationale: Coho salmon Intrinsic Potential (IP) is a measure of historical habitat quality in terms of supporting coho adult spawning and juvenile rearing. IP is an attribute modeled from GIS data based on key geomorphic and other characteristics: channel and valley constraint, channel gradient, and mean annual water discharge. High IP coho habitat also provides an indicator of

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[7] Refer to the ***Wetland and Agricultural Use Inventory Memorandum*** (Runyon and Wyse July 5, 2017) for descriptions of the data sources and analysis methods.

overall historical habitat quality because it captures broad, low-gradient floodplain areas with a diversity of habitat types that also support a variety fish and wildlife species.

Methodology: 1) Identify and map potential tidal wetland restoration areas within 200 feet of high IP coho streams.

Is the potential non-tidal freshwater wetland area influenced by or historically within floodplains and potentially hydrologically connected to river or stream flows?

Is the potential non-tidal freshwater wetland area modified or lost?

Rationale: The second greatest loss of wetland area and function in the County has been in floodplain freshwater wetlands. As described above, these wetland types provide habitat diversity, including off-channel habitats; provide insects and other food sources for fish and wildlife; attenuate flooding and contribute to aquifer recharge; and provide essential habitat, including off-channel areas, for salmon and steelhead populations and other fish and wildlife species.

Methodology**:** 1) Identify and map areas above HMT; 2) For areas above HMT, identify and map NWI wetlands that have been modified (e.g., historical freshwater wetlands that have no or limited hydrologic connectivity due to levees, filling, or channel modifications); and 3) Identify potential historical wetlands adjacent to river or stream systems that have been lost by evaluating the proportion of mapped hydric soils.

Is the potential freshwater wetland restoration area adjacent to coho salmon High Intrinsic Potential habitat?

Rationale: See above.

Methodology: 1) Identify and map potential freshwater wetland restoration areas within 200 feet of high IP coho streams.

Other Wetland Restoration Evaluation Criteria

In addition to the restoration evaluation criteria that are suitable for GIS analysis and mapping, the following criteria were not evaluated because the criteria are best applied at a site-specific level:

How does the wetland restoration project benefit targeted fish and wildlife species?

Rationale: Tidal and non-tidal freshwater restoration projects have the potential to improve habitat for a wide variety of fish and wildlife species. With the exception of high IP coho habitat, other fish or wildlife species' habitat needs and historical habitat quality was not evaluated. Restoration project development at the site-specific level usually considers habitat benefits for a variety of fish and wildlife species and, as part of the restoration design process, develops restoration goals that meet the habitat requirements for targeted fish and wildlife species (e.g., fish, birds, amphibians, etc.).

What is the wetland restoration project size?

Is the restoration project adjacent to a restoration site or intact natural habitat?

Rationale: As a general rule, the larger the restoration site, the greater the value in terms of impact on habitat, fish and wildlife species occupancy and use, and ecological processes. Larger sites are also less susceptible to disturbance from adjacent land uses because the larger size buffers the site, particularly the interior areas, from disturbances. Restoration sites that are adjacent to intact natural habitats or restoration areas also can function essentially as one larger habitat area.

Does the restoration project change flooding, aquifer recharge, or other hydraulic or hydrologic conditions in a beneficial or negative manner?

Rationale: Wetland restoration projects within floodplain environments have the potential to positively or negatively affect flooding, aquifer recharge, and other hydraulic (e.g., downstream levee scour and erosion) or hydrologic (e.g., changing drainage patterns on adjacent properties) processes. Restoration project development considers on-site and off-site flooding and other hydrologic and hydraulic impacts. These impacts are best evaluated at the site-specific and rivers reach scale because the evaluations entail the development of hydraulic models and other analysis methods that require detailed and high resolution information (e.g., topography and elevations, water table depths, drainage patterns, etc.).

EFU Wetlands: Classification and Restoration Potential

Potential restoration areas were evaluated for tidally-influenced wetlands and non-tidal freshwater wetlands. In both cases, modified NWI wetlands and potential historical wetlands are classified and mapped in order to evaluate loss of wetland area and function. Modified NWI wetlands and potential historical wetlands represent areas where wetland functions and/or extent has been lost. Modified NWI wetlands represent areas were ditching, levee construction, filling and other actions have resulted in significant loss of wetland function. For the most part, modified NWI estuarine wetlands (areas below HMT) have been converted to freshwater wetlands as a result of levees blocking tidal flows. This modification represents a loss of tidal wetland function. Similarly, areas of potential historical wetlands (both above and below HMT) contain soils that indicate past wetland status, but wetland functions and area has been lost as a result of ditching, levee construction, filling and other actions.

Table 3 shows the potential tidally-influenced (below HMT) restoration areas for the watersheds with EFU lands present. Within the County's EFU lands, 4,247 acres encompass modified NWI and potential historical tidally-influenced wetlands. The area of potential tidal wetland restoration ranges from 1,399 acres in the Tillamook River Watershed, to no acreage in the Kilchis River Watershed (Figure 5).

Table 3. Tidally-Influenced (Below HMT) Modified NWI Wetlands, Potential Historical Wetlands, and Areas for Both Wetland Types Combined for Watersheds with EFU Lands Present

Watershed (5th field HUC)	Modified NWI Wetlands Below HMT (Acres)	Potential Historical Wetlands Below HMT (Acres)	Modified NWI + Historical Below HMT (Acres)
Kilchis River	0	0	0
Little Nestucca River	361	27	388
Lower Nehalem River	434	191	625
Miami River	14	7	21
Nestucca River	255	7	262
North Fork Nehalem River	46	201	247
Sand Lake	0	0	0
Tillamook Bay	738	62	800
Tillamook River	1,265	134	1,399
Trask River	343	54	398
Wilson River	95	12	107
SUM TOTAL	***3,553***	***694***	***4,247***

Figure 5. Total Area Encompassing Tidally-Influenced (Below HMT) Modified NWI Wetlands and Potential Historical Wetlands

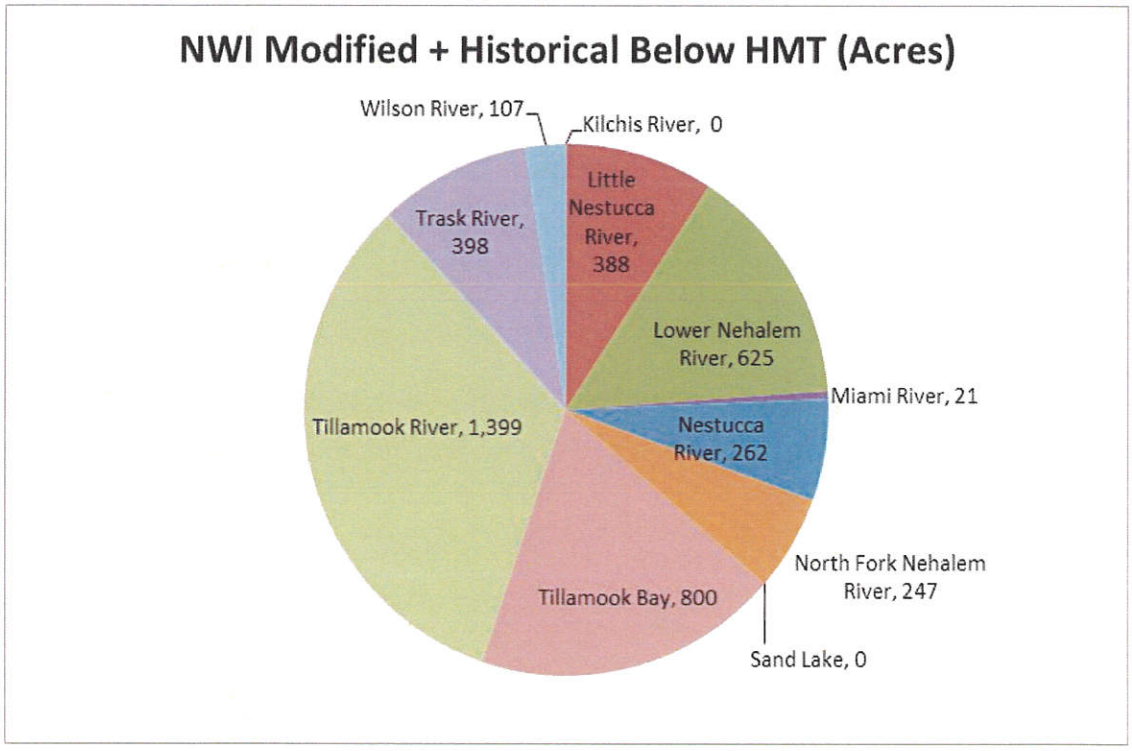


Table 4 shows the potential non-tidal freshwater restoration areas for the watersheds with EFU lands present. Within the County's EFU lands, 5,460 acres encompass modified NWI and potential historical non-tidal freshwater wetlands. The area of potential non-tidal freshwater restoration ranges from 1,599 acres in the Nestucca River Watershed to 90 acres in the Sand Lake Watershed (Figure 6).

Figure 7 illustrates the mapped areas encompassing both tidal (above HMT) and non-tidal freshwater modified NWI and potential historical wetlands for central Tillamook County EFU Lands. Figure 8 shows the range of tidal and non-tidal wetland types that are within 200 feet of high IP coho habitat for central Tillamook County.

Table 4. Non-tidal Freshwater Modified NWI Wetlands, Potential Historical Wetlands, and Areas for Both Wetland Types Combined for Watersheds with EFU Lands Present

Watershed (5th field HUC)	Modified NWI Wetlands Above HMT (Acres)	Potential Historical Wetlands Above HMT (Acres)	Modified NWI + Historical Wetlands Above HMT (Acres)
Kilchis River	9	39	48
Little Nestucca River	405	96	501
Lower Nehalem River	115	312	426
Miami River	46	42	87
Nestucca River	1,064	535	1,599
North Fork Nehalem River	125	239	364
Sand Lake	35	54	90
Tillamook Bay	215	67	282
Tillamook River	387	568	955
Trask River	133	822	955
Wilson River	27	125	152
SUM TOTAL	***2,560***	***2,900***	***5,460***

Figure 6. Total Area Encompassing Non-Tidal Freshwater Modified NWI Wetlands and Potential Historical Wetlands

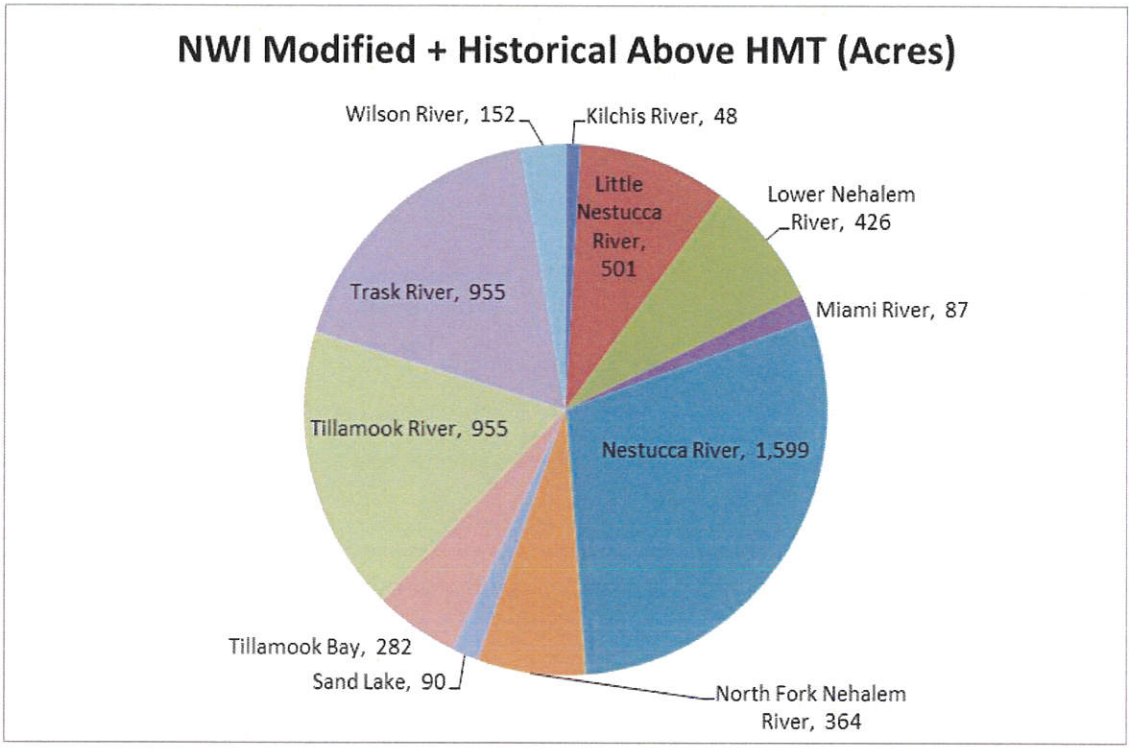
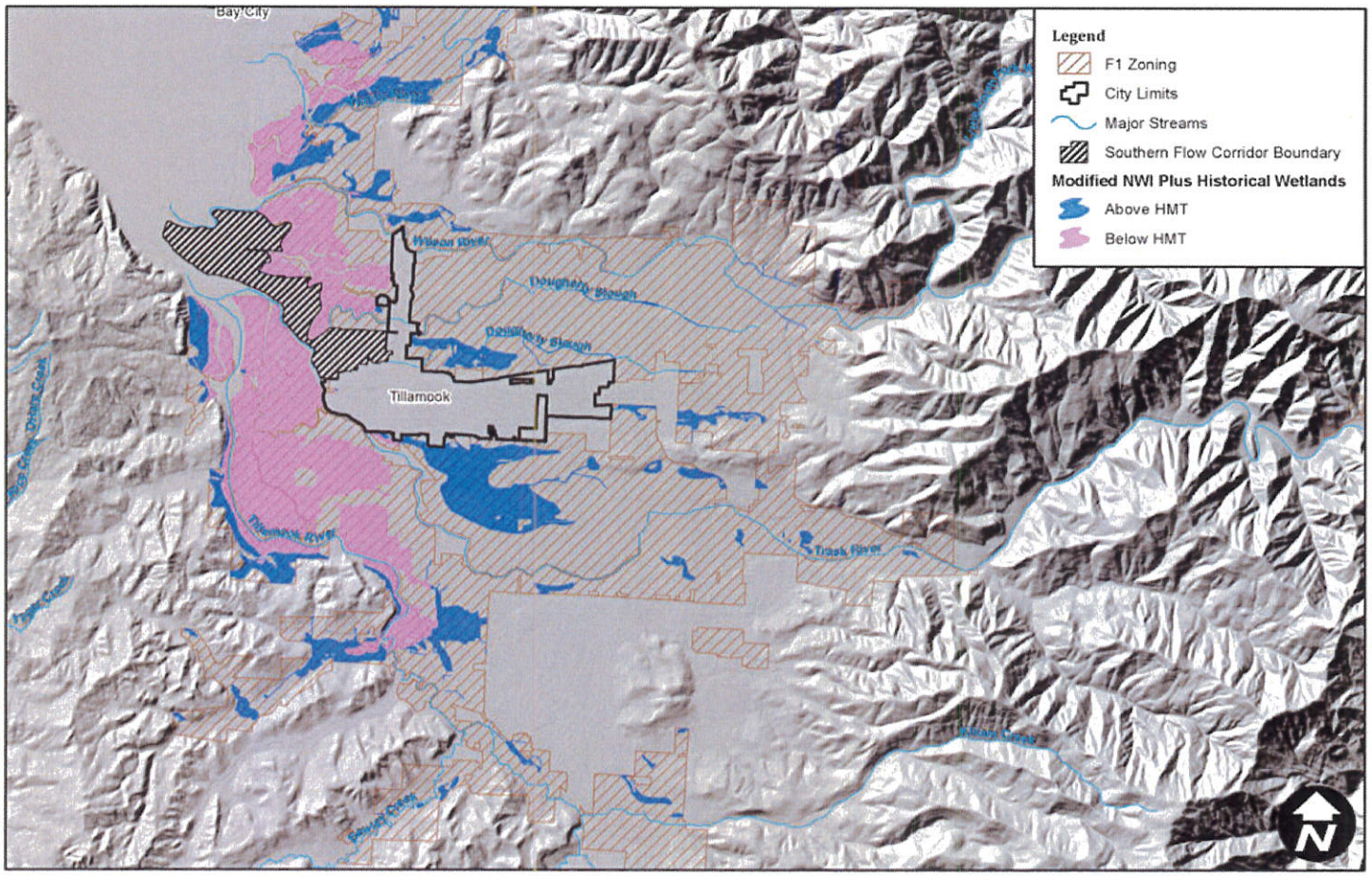


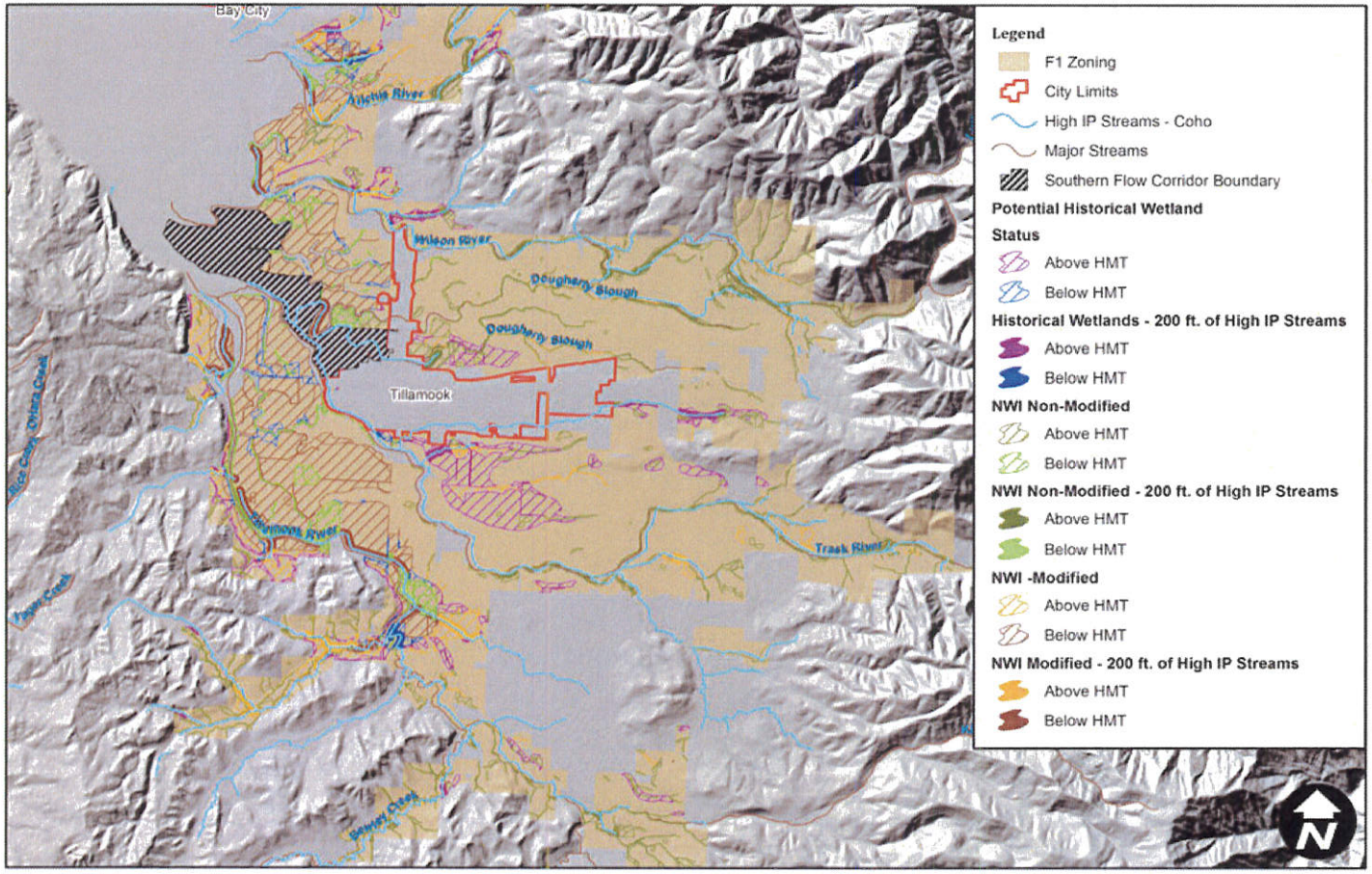
Figure 7. The Area Occupied by Tidal (Above HMT) and Non-Tidal Freshwater Modified NWI and Potential Historical Wetlands for Central Tillamook County EFU Lands



Date: 7/31/2017
Scale: 1 inch = 1 miles
Data Source: ESRI, 2017; USGS, NHD, 2014

Modified NWI and Potential Historical Wetlands
in Central Tillamook County

Figure 8. The Range of Tidal and Freshwater Wetland Types that are Within 200 Feet of High IP Coho Habitat



Date: 11/20/2017
Scale: 1 inch = 1 miles
Data Source: ESRI, 2017; USGS, NHD, 2014

Historical and Existing Wetlands in Central Tillamook County

CASCADE ENVIRONMENTAL GROUP

0 0.5 1 2 Miles

Tillamook County SB1517 Pilot Project

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Restoration Projects

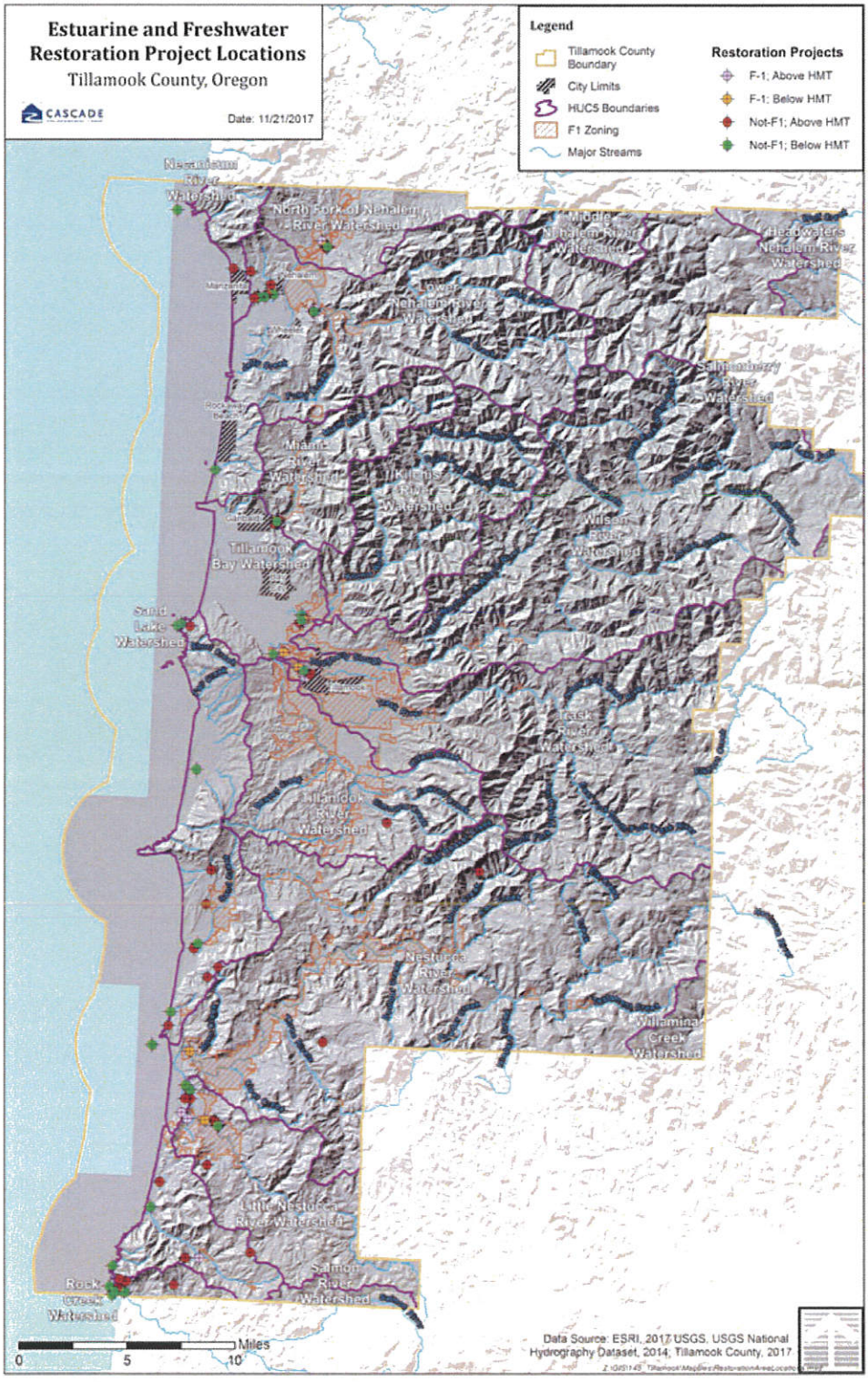
There have been a number of restoration projects implemented in Tillamook County. Completed restoration projects include river and floodplain restoration in freshwater areas above tidal influence and estuary restoration projects in areas subject to tidal influence (below HMT). Table 6 and Figure 9 show the watershed area and locations for completed tidal and freshwater restoration projects for EFU and non-EFU lands. The table and figure include both wetland enhancement and restoration projects. A wide range of restoration activities are summarized, including levee breaching to restore tidal and freshwater connectivity, wetland enhancement, and land protection mechanisms such as conservation easements. It is important to note that while the restoration project information is based on the best available data, there are completed restoration projects that are not included in this summary.

Wetland restoration projects have been completed on EFU and non-EFU lands. The Southern Flow Corridor project (see Figure 8 for location) is the largest restoration project completed to date in Tillamook County: 674.03 acres, of which 365.52 acres are in the Tillamook Bay watershed and 308.51 acres are in the Trask River Watershed, encompassing both EFU and non-EFU lands. The goal of this project is to reduce flooding in areas around the City of Tillamook and improve fish and wildlife habitat by restoring tidal waters into areas that were levee protected and also restoring floodplain freshwater wetlands.

Table 6. Estuary / Tidal (Below HMT) and Freshwater (Above HMT) Restoration and Enhancement Projects Completed in Tillamook County on EFU and Non-EFU Lands. Source: Oregon Watershed Enhancement Board, 2017 and The Nature Conservancy, 2017

Watershed (5th field HUC)	EFU Estuarine / Tidal Restoration Projects (Acres)	Non-EFU Estuarine / Tidal Restoration Projects (Acres)	EFU Freshwater Restoration Projects (Acres)	Non-EFU Freshwater Restoration Projects (Acres)
Little Nestucca River	222	96	260	267
Lower Nehalem River	23	7	32	48
Miami River	12	9	29	2
Necanicum River		2		2
Nestucca River	33	26	106	1,797
North Fk. Nehalem River	69	5	9	0.2
Rock Creek		1		117
Salmon River		3		3,356
Sand Lake		192	0.1	8,127
Tillamook Bay	377	104	33	4
Tillamook River				62
Trask River	145	93	5	99
SUM TOTAL	***881***	***538***	***473***	***13,882***

Figure 9. The Locations of Estuary / Tidal (Below HMT) and Freshwater (Above HMT) Restoration and Enhancement Projects Completed in Tillamook County. Source: Oregon Watershed Enhancement Board, 2017 and The Nature Conservancy, 2017



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Agricultural Assessment for Tillamook County Farm and Wetland Pilot Planning Project

Introduction

This memo presents findings from an assessment of Exclusive Farm Use (EFU or F-1 zone) agricultural lands in Tillamook County. The purpose of the assessment is to identify lands that are high priority for maintaining the stability of the County's agricultural economy. The assessment aims to define EFU lands as low, medium, and high priority lands. The goal of the assessment is to differentiate EFU lands into these three levels based on relative agricultural productivity potential and relative cost of agricultural production (i.e., the higher the production potential and the lower the cost of production, the higher the priority of a given EFU land area and vice versa).

Information from the agricultural use inventory (see previous memo) provides the foundation for this agricultural assessment. The inventory presented the available data for Tillamook County, and this memo provides an analysis of the spatial relationships between different soil and land use characteristics with the goal of determining the priority level of EFU lands throughout the county. The memo briefly summarizes methods and data, presents information on the relationships between key factors differentiating agricultural lands, and then concludes with findings and next steps.

Data and Methods

As presented in the agricultural inventory, the key available GIS (geographic information system) spatial datasets for the agricultural assessment are the NRCS soil survey geographic database (SSURGO), the USDA cropscape-cropland data, and Oregon Department of Agricultural CAFO (confined animal feeding operations) data. Also included in the assessment are data on irrigation water rights (Oregon Department of Water Resources water rights database) and data on drainage district boundaries. As in the inventory, the agricultural assessment summarizes results at two spatial scales: County-wide and for each of the 5th field HUC (Hydrologic Unit Codes) watersheds that drain areas within the County.

As noted above, the goal of the assessment is to differentiate EFU lands into these three levels based on relative agricultural productivity potential and relative cost of agricultural production. Actual agricultural output/productivity and cost of production by geographic area within the county are not available from public data sources (good agricultural production and economic value data are available at the county level only), so we use proxies. Specifically, we focus on NRCS soil data on silage/pasture yield levels and waste management ratings as a measure of the relative land productivity in terms of ability to support cows for a given amount of land (as dairy farms are the primary agricultural activity in Tillamook County now and in the foreseeable future), and we use data on soil drainage class as a proxy for relative production costs on EFU lands throughout the county (given the importance and challenge of drainage for farm operations in Tillamook County). We also focus on current land use (i.e., whether the land has been prepared

for pasture or crop production) as a key indicator of the relative priority of different EFU lands for maintaining agricultural stability.

Specifically, we conducted four steps in the agricultural assessment.

1. **Define existing cropland in the EFU zone.** Only EFU lands that have been identified as currently in crop production or as suitable for crop production in the NRCS soil survey and/or the USDA cropland datasets are analyzed in the assessment. Lands that are not identified as cropland in at least one of the two datasets are classified as low priority for agricultural production (these lands do not have NRCS yield ratings, and most do not have manure management ratings, so we conduct no further analysis of these lands). In other words, we assume that if lands have not been used for pasture or crop production, then they are low priority for agricultural production and stability.
2. **Review characteristics of EFU lands identified for manure management in CAFO manure management plans.** The characteristics of lands currently used for CAFO manure management may provide information on the types of lands that are valued by agricultural operators. This is a partial dataset, as most of the data on CAFO operations are point data that indicate the general location of a dairy rather than the land base used to support the dairy and its operations.
3. **Analyze relationship between drainage, yield, manure management capacity.** We look for correlation between drainage and yield, drainage and manure management capacity, and yield and manure management capacity.
4. **Categorize lands as low, medium, and high based on their drainage, yield, and manure management capacity.** The table below summarizes how agricultural priority is rated.

Table 1. Draft Agricultural Land Priority Rating System

	NRCS Rating		
Priority Rating	**Yield[1]**	**Drainage**	**Waste Management**
High	High/Medium	Well drained OR Moderately Well Drained	Very Limited OR Somewhat limited OR Not Rated
High	Unclassified	Well Drained OR Moderately Well Drained	Somewhat limited
High	High/Medium	Any	Somewhat Limited
Low	Low OR Unclassified	All Drainage Classes	Very Limited
Medium	All other croplands		

1/See inventory memo for definition of yield ratings.

The available county-wide spatial datasets with pertinent information on agricultural lands are limited to those used in this analysis. Given the breadth of factors that may affect the relative priority of agricultural lands, this assessment that is almost exclusively based on NRCS-rated yield potential, manure management, and soil drainage classifications likely provides a restricted and potentially inaccurate assessment of Tillamook County agricultural lands. As discussed in the

final section, to supplement this assessment, the next step is to convene a meeting of agricultural producers in the county to gather additional information to supplement the desktop, GIS data-based analysis presented in this memo.

Analysis

As described above, the first step in the analysis is to define the EFU lands that have been identified as currently in crop production or as suitable for crop production in the NRCS soil survey and/or the USDA cropland datasets. This forms our 'master cropland' dataset of approximately 29,900 acres, or 80 percent of the approximately 37,590 acres of EFU lands. The NRCS soil survey dataset indicates that are approximately 23,760 acres of cropland; using data also from the USDA cropland dataset expands the potential area of cropland to 29,900 acres. Lands not in cropland are typically either developed or are forested and sloped areas higher in the watersheds. As shown in Table 2, nearly two-thirds (63 percent) of the EFU lands that are potentially cropland are located in the Trask River, Nestucca River, and Tillamook River watersheds. (We refer to the 29,900 acres as potential cropland as the USDA cropland dataset is at a fairly gross scale and may classify some lands as cropland that may be in other land uses.)

Table 2. Cropland in EFU

Watershed (5th Field HUC)	Cropland	Non-Crop	Total	% of EFU Land in Cropland	% County EFU Cropland
Trask River	6,800	208	7,008	97%	23%
Nestucca River	6,576	3,161	9,736	68%	22%
Tillamook River	5,368	598	5,966	90%	18%
Lower Nehalem River	2,055	659	2,714	76%	7%
Little Nestucca River	1,946	1,074	3,020	64%	7%
Tillamook Bay	1,845	104	1,949	95%	6%
North Fork of Nehalem River	1,791	202	1,993	90%	6%
Wilson River	1,549	546	2,095	74%	5%
Sand Lake	923	795	1,718	54%	3%
Miami River	543	288	831	65%	2%
Kilchis River	506	51	556	91%	2%
Grand Total	29,900	7,686	37,587	80%	100%

This 29,900 acres of potential cropland is the focus of the agricultural land assessment. In an attempt to identify the land and soil characteristics that may be most important for farming, we first review the characteristics of lands in CAFO manure management plans (i.e., acreage designated as lands for manure management for CAFO operations). Following this discussion, the section analyzes the characteristics of all 29,000 acres of EFU croplands.

Table 3 presents the drainage, yield, and manure management characteristics of the 8,298 acres of CAFO manure management lands that have been mapped by Oregon Department of Agriculture, primarily in the Trask River, Tillamook Bay, and Tillamook River watersheds (and representing only part of the manure management lands in Tillamook County as designated in

CAFO manure management plans). Acreages shaded in green in the table are rated as high priority lands, acreage shaded in blue are rated medium priority lands, and acreage shaded in grey are rated as low priority lands; this acreage by priority rating is also summarized in the bottom rows in the table. Approximately 10 percent of the CAFO lands are rated low, with the remainder split fairly evenly between medium and high priority ratings. There are relatively few CAFO manure management lands in the Trask Wilson, and Tillamook River watersheds with low or unclassified yield ratings (90 percent of lands have a high or medium yield rating). However, approximately one-third of manure management lands (as designated in CAFO plans) have poorly drained or very poorly drained soils (2,665 acres), and two-thirds (5,934 acres) have very limited waste management capabilities.

The fact that there are significant CAFO manure management lands with poor drainage and limited waste management capabilities may indicate that yield is the most important factor (amongst the map-able data available for this analysis) determining relative priority of lands for dairies in Tillamook County. Or it may simply reflect the distribution of all EFU lands: as shown in Table 4 below, the distribution of ratings for drainage, yield, and waste management of all EFU lands are very similar to the distribution of ratings of the CAFO manure management lands. This may either be because 1) there are low priority/marginally productive lands included in the CAFO manure management plans due to the limited total supply of lands or spatial variation of land quality within a parcel of land or 2) the three available characteristics that we have used to try to differentiate the productivity and priority of EFU lands are not the key characteristics that differentiate the priority level of EFU agricultural lands for dairy operations.

Table 3. CAFO Manure Management Lands: Drainage, Yield and Waste Management Rank

	Yield Rank				
Waste Management/Drainage	**High**	**Medium**	**Unclassified**	**Low**	**Total**
Somewhat limited	**2,342**				**2,342**
Somewhat poorly drained	*26*				*26*
Well drained	*2,316*				*2,316*
Very limited	**1,954**	**3,202**	**190**	**589**	**5,934**
Moderately well drained	*44*				*44*
Poorly drained		*1,264*	*4*	*59*	*1,327*
Somewhat excessively drained				*41*	*41*
Somewhat poorly drained	*37*	*982*			*1,019*
Very poorly drained	*352*	*901*	*47*	*38*	*1,338*
Well drained	*1,520*	*55*	*139*	*451*	*2,165*
Not Rated	**1**		**21**		**22**
TOTAL	**4,297**	**3,202**	**210**	**589**	**8,298**
	Priority Rating				
	High	**Medium**	**Low**		
All EFU Manure Management Lands	**3,962**	**3,537**	**799**		**8,298**
% EFU Manure Management Lands	**48%**	**43%**	**10%**		**100%**

Table 4. Drainage, Yield and Waste Management Rank on CAFO Manure Management Lands and All EFU Croplands

Soil Characteristic	Mapped CAFO Manure Management Lands		All EFU Croplands	
	Acreage	% of Acreage	Acreage	% of Acreage
Drainage				
Well Drained/Moderately Well Drained	4,525	55%	16,491	55%
Somewhat Excessively Well Drained/ Somewhat Poorly Drained	1,086	13%	2,965	10%
Excessively Well Drained/Very Poorly Drained/Poorly Drained	2,665	32%	10,391	35%
Not Rated	22	0%	53	0%
	8,298	*100%*	*29,900*	*100%*
Yield				
High	4,297	52%	12,990	43%
Medium	3,202	39%	11,404	38%
Low	589	7%	3,164	11%
Unclassified	210	3%	2,340	8%
	8,298	*100%*	*29,900*	*100%*
Manure Management				
Somewhat Limited	2,342	28%	8,518	28%
Very Limited	5,934	72%	2,1169	71%
Not Rated	22	0%	212	1%
	8,298	*100%*	*29,900*	*100%*

The tables below show the drainage, yield, and manure management ability of all 29,900 acres of EFU croplands. Table 5 presents the acreage by yield and drainage class (based on NRCS ratings), Table 6 presents the acreage by waste management and drainage class, and Table 7 presents the acreage by waste management and yield. Each table presents two of the three characteristics used to rate lands as low, medium, and high. As presented in Table 1, generally, if acreage rates high on two of the three characteristics, it is rated high; this acreage is highlighted in green in the tables below. Acreage that is rated low (regardless of the rating of the third characteristic) is highlighted in grey in the tables below. In terms of drainage and yield (as shown in Table 5 below), 93 percent of high yielding lands have well drained/moderately well drained soils. Conversely, of the well or moderately drained soils, approximately 80 percent provide for high or medium yields and only 8 percent are low yielding (the remainder have unclassified yields). However, low yields can be found on most soil types.

In terms of waste management and yield (as shown in Table 6 below), all soils that are rated as low yielding also have very limited waste management capacity. Nearly all somewhat limited waste management soils (the best waste management rating given by NRCS for EFU soils in

Tillamook County) are high yielding. However, 36 percent of high yielding soils are rated as very limited for waste management, showing that high yields and relatively better waste management capacity do not necessarily go together on all lands. Finally, in terms of waste management and drainage (as shown in Table 7 below), to have relatively better waste management capacity (i.e., somewhat limited waste management rating), fairly well drained soils are necessary (99 percent are located on well drained or moderately well drained soils). All soils that are very poorly or excessively drained and nearly all poorly drained soils are very limited for waste management. However, drainage is not the only factor affecting waste management, as high slopes or other characteristics on well drained soils may result in very limited waste management capacity.

Table 5. EFU Cropland by Drainage Class and Yield

	Silage/Pasture Yield Level					
Drainage Class	**High**	**Medium**	**Low**	**Unclassified**	**Total**	**Proportion**
Well drained	11,827	1,041	1,344	2,010	16,223	54%
Moderately well drained	268				268	1%
Somewhat excessively drained			472	135	607	2%
Poorly drained		4,345	712	68	5,125	17%
Somewhat poorly drained	486	1,868		3	2,358	8%
Very poorly drained	409	4,150	637	67	5,263	18%
Excessively drained				3	3	0%
(blank)				53	53	0%
Total	**12,991**	**11,404**	**3,165**	**2,340**	**29,900**	**100%**
Proportion	43%	38%	11%	8%	100%	

Table 6. EFU Cropland by Drainage Class and Waste Management Rank

	Waste Management Rank				
Drainage Class	**Not rated**	**Somewhat limited**	**Very limited**	**Total**	**Proportion**
Well drained	25	8,209	7,989	16,223	54%
Moderately well drained		205	63	268	1%
Somewhat excessively drained	132	4	472	607	2%
Somewhat poorly drained	**3**	**101**	**2,254**	**2,358**	8%
Poorly drained			5,125	5,125	17%
Very poorly drained			5,263	5,263	18%
Excessively drained			3	3	0%
(blank)	53		1	53	0%
Total	212	8,519	21,169	29,900	100%
Proportion	1%	28%	71%	100%	

Table 7. EFU Cropland by Yield and Waste Management Rank

	Waste Management Rank				
Yield	**Not rated**	**Somewhat limited**	**Very limited**	**Total**	**Proportion**
High	25	8,283	4,683	12,991	43%
Medium			11,404	11,404	38%
Unclassified	187	236	1,917	2,340	8%
Low			3,165	3,165	11%
Total	**212**	**8,519**	**21,169**	**29,900**	100%
Proportion	1%	28%	71%	100%	

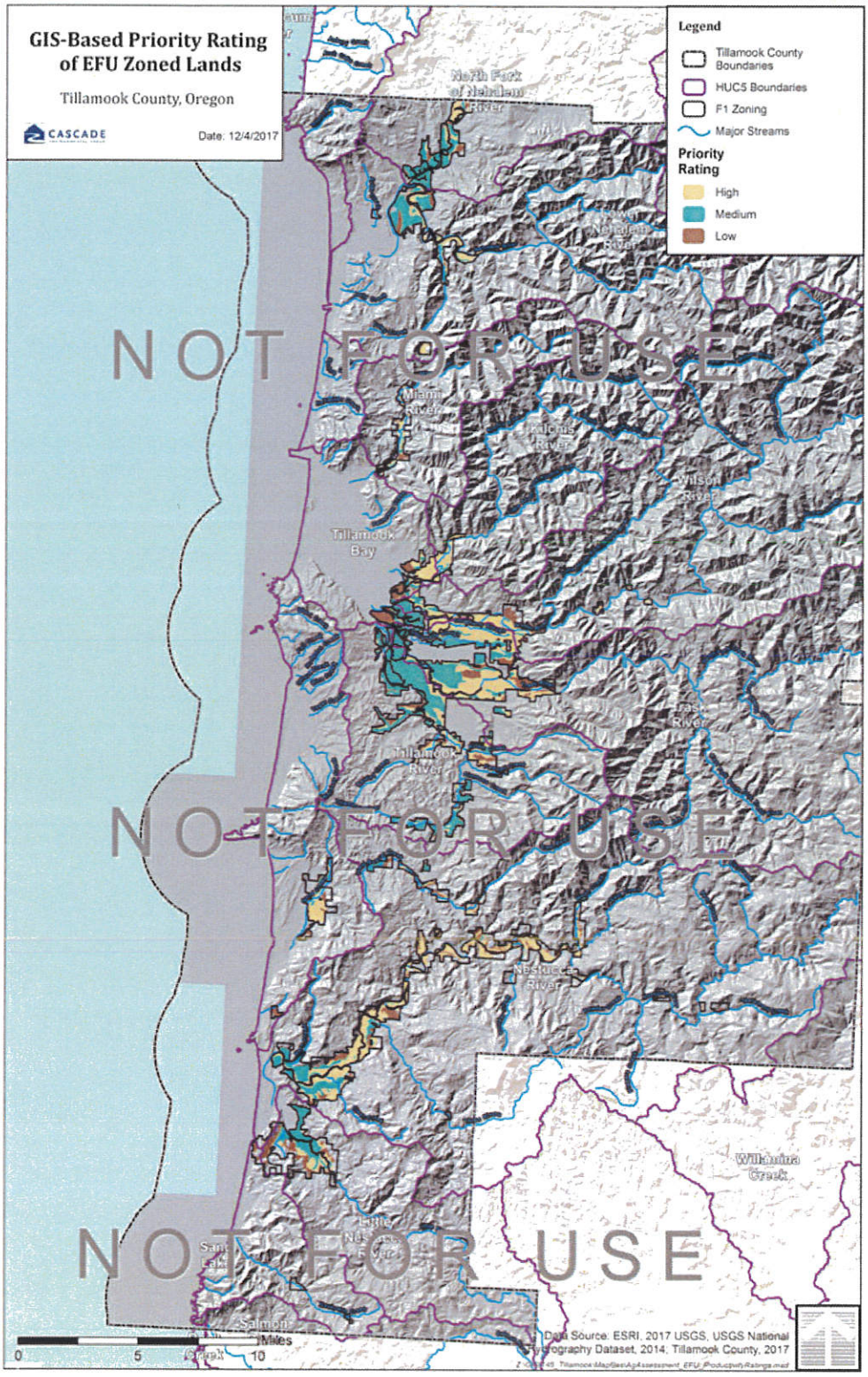
Findings and Implications: EFU Lands Priority Rating

Based on the data presented above and the draft priority rating system for EFU lands provided in Table 1, this section presents the draft results of the agricultural assessment. As shown in Table 8, the draft priority rating of EFU lands shows that approximately two-thirds of EFU lands are high or medium priority, with one-third of EFU lands either not in cropland or rated as low priority croplands. Of the 5,269 acres of potentially low priority croplands, there are 438 acres of land in drainage districts classified as low, and 534 acres with irrigation water rights that are classified as low. In terms of spatial distribution, there is a concentration of potentially low priority EFU croplands near Tillamook Bay and the remainder are interspersed throughout the EFU lands. Some of the lands identified as low priority near Tillamook Bay may already be in the process of being restored to wetlands through the Southern Flow Corridor Project; however, at this time, the spatial data outlining the extent of that and other restoration projects is not available to overlay with the results of this analysis.

Table 8. Draft Priority Rating of EFU Lands

Watershed	High	Medium	Low	Total, Cropland	Non-Cropland	Total
Nestucca River	3,733	1,517	1,325	6,576	3,161	9,736
Trask River	3,539	2,456	804	6,800	208	7,008
Tillamook River	1,435	3,188	745	5,368	598	5,966
Little Nestucca River	440	922	584	1,946	1,074	3,020
Tillamook Bay	743	534	567	1,845	104	1,949
Lower Nehalem River	803	935	316	2,055	659	2,714
Sand Lake	527	141	255	923	795	1,718
Wilson River	1,022	309	219	1,549	546	2,095
North Fork of Nehalem River	516	1,064	210	1,791	202	1,993
Miami River	296	58	190	543	288	831
Kilchis River	415	37	54	506	51	556
Total	13,470	11,161	5,269	29,900	7,686	37,587
Proportion EFU	36%	30%	14%	80%	20%	100%
Proportion Cropland	45%	37%	18%	100%	26%	126%

Figure 1: Map of Draft Priority Rating of EFU Lands



As shown in Table 9 and in Figure 1, watersheds with the most acreage of draft low priority EFU cropland are the Nestucca River, Trask River, Tillamook River, Little Nestucca River, and Tillamook Bay watersheds. Watersheds with the highest concentrations of draft low priority EFU cropland (as a proportion of all EFU cropland in that watershed) are the Miami River, Tillamook Bay, Little Nestucca River, and Sand Lake Watersheds.

Table 9. Distribution of Draft Low Priority EFU Croplands

Watershed	Low Priority Cropland (Acres)	% of County Low Priority EFU Croplands	% of All EFU Cropland in Watershed
Nestucca River	1,325	25%	20%
Trask River	804	15%	12%
Tillamook River	745	14%	14%
Little Nestucca River	584	11%	30%
Tillamook Bay	567	11%	31%
Lower Nehalem River	316	6%	15%
Sand Lake	255	5%	28%
Wilson River	219	4%	14%
North Fork of Nehalem River	210	4%	12%
Miami River	190	4%	35%
Kilchis River	54	1%	11%
Total	5,269	100%	18%

As noted above, the findings of this desktop GIS-based analysis are preliminary and need input from the agricultural community to refine or potentially re-define the priority ratings. As we work to refine the agricultural assessment and look forward to the compatibility phase, we will be focused on gathering input from the agricultural community regarding two aspects of how restoration may affect the agricultural economy and land use stability: 1) potential adverse impacts on adjacent lands that affect production costs or land use patterns, and 2) potential cumulative effects on the stability of the agricultural economy.[8] Then, once this agricultural land assessment is refined, in the next phase of this project, the compatibility assessment, we will be analyzing the spatial relationship and compatibility of potential future restoration on these agricultural lands.

[8] Input from the agricultural community may enable better mapping and definition of low, medium, and high priority agricultural lands, and/or it may provide information on the site-specific characteristics to use in assessing priority and potential adverse impact for a given site once it is proposed for restoration.

APPENDIX C

Applying for Wetlands Restoration, Creation and Enhancement Projects in Tillamook County's Farm (F-1) Zone

If you are planning to restore, create or enhance wetlands on property zoned for farm use in Tillamook County, you may need to obtain a Conditional Use Permit before proceeding with your project.

How do I know if I need a Conditional Use Permit?

You will need a Conditional Use Permit if the following are true:

1. Your project will be located in an area that is under Farm (F-1) zoning designation. County Planning Staff can assist you in determining underlying and overlay zoning designations that apply to your project area; and

2. Your project does not fall into an 'Exempt' category. Exempt projects include the following:
   - Projects involving only the planting of vegetation in a wetland or riparian area.
   - Projects related to operating or establishing a wetland mitigation bank.
   - Projects related to reclamation of land affected by surface mining.
   - Projects required for compliance with a NPDES permit.
   - Projects required for compliances with a DEQ water pollution control facility permit.

What is a Conditional Use Permit?

The 'Conditional Use' category is for uses that are not allowed by right in a certain zone because they have the potential, depending on a number of different considerations, to adversely impact those uses that are permitted by right in that zone. A Conditional Use Review is a public review process conducted to determine the compatibility and suitability of the specific project proposed. Uses are approved if the review authority finds that the proposed use is compatible with uses that are permitted by right in that zone. A finding of compatibility is based the proposal and any additional measures or conditions the review body determines are needed to assure compatibility.

What is the process to obtain a Conditional Use Permit?

The County has very specific procedures that need to be followed in processing an application for Conditional Use Review. In general, an applicant will initially meet with County Planning Staff to review the general proposal and identify all permitting requirements. A wetlands project may also require other County permits such as Flood Development and Estuary Development permits. Then a Pre-Application meeting is scheduled with other agencies who can help identify potential concerns that the applicant may wish to consider before applying. Once the applicant has gathered the information to support their request, they file the formal application, submittal materials and fee... and the process begins. Notice of the application is sent out to surrounding landowners and various agencies. An opportunity for public comment is made available to all interested parties prior to the decision. Once the application is determined by the County to be complete, the County must make a decision within 150 days. If the

application garners a lot of public interest, it may be referred to the Planning Commission for decision at a public hearing.

How is a determination of compatibility made for a wetland project proposed on farmland?

Any decision to approve or deny a Conditional Use is based on pre-defined criteria and only those criteria. In the case of a wetlands project on farmland, the decision is based on whether or not a proposed project will force a significant change in accepted farm or forest practices or significantly increase the cost of accepted farm or forest practices on the surrounding lands that are devoted to farm or forest use.

It is up to the applicant to provide evidence and an argument that their project meets those criteria. This is where the initial meeting with County Planning Staff and the pre-application meeting with agencies can be very helpful in identifying potential concerns that the applicant will want to address in their application submission.

Generally speaking, a proposal for a wetlands project on farmland will need to address some of the following items to support a finding of compatibility with surrounding farm and forest uses.

- A site plan and description of the proposed wetland restoration, enhancement or creation activities.
- If applicable, engineered design drawings.
- A copy of a management plan that describes construction best practices, the long-term maintenance plan, anticipated use of the site (will it be open to the public?) and any access management plan that might be in place.
- A description of surrounding farm and forest uses. This might include things like descriptions of surrounding farming operations and practices, drainage and flood control infrastructure, access roads and internal farm roads and lanes, and farm regulatory obligations like required manure spreading setbacks from wetlands boundaries.
- Identification of any potential or expected project-related changes in water tables, drainage patterns, flood elevations and salinity that might the surrounding area.
- Identification of any other potential or expected project-related impacts to the surrounding area.
- Any other information related to the proposed project that might help in demonstrating that it is compatible with surrounding agricultural operations.

Who do I contact for more information?

Tillamook County Planning Staff are available during normal business hours at our offices located at 1510-B Third Street in Tillamook, by phone at 503-842-3408 or by email (staff email addresses are posted on the Planning Department's website at :

http://www.co.tillamook.or.us/gov/ComDev/planning/default.htm)