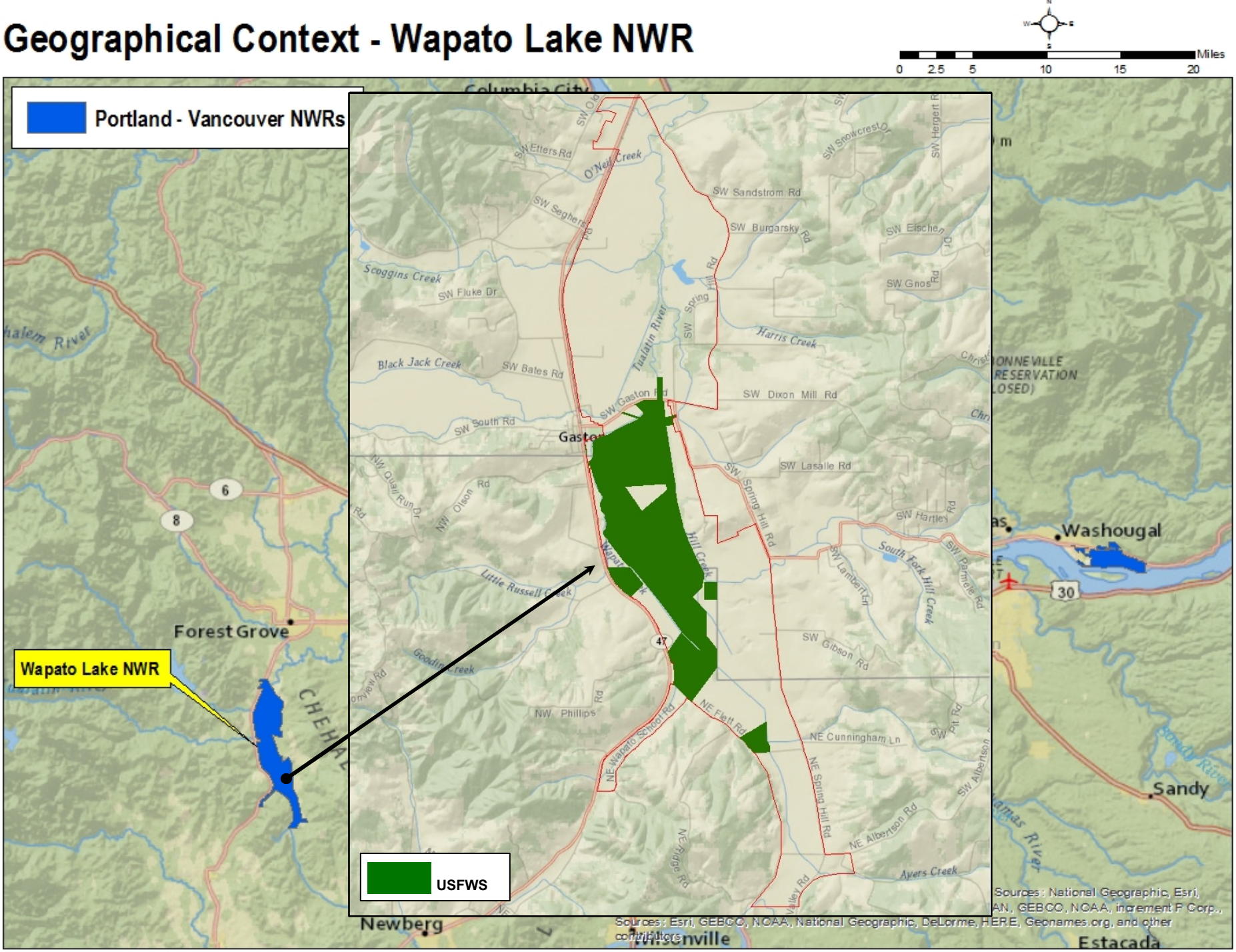
Restoration Planning at

WAPATO LAKE NWR

National Wildlife Refuge System - to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Tualatin River Watershed Council
July 1, 2015
Hillsboro, OR

Geographical Context - Wapato Lake NWR

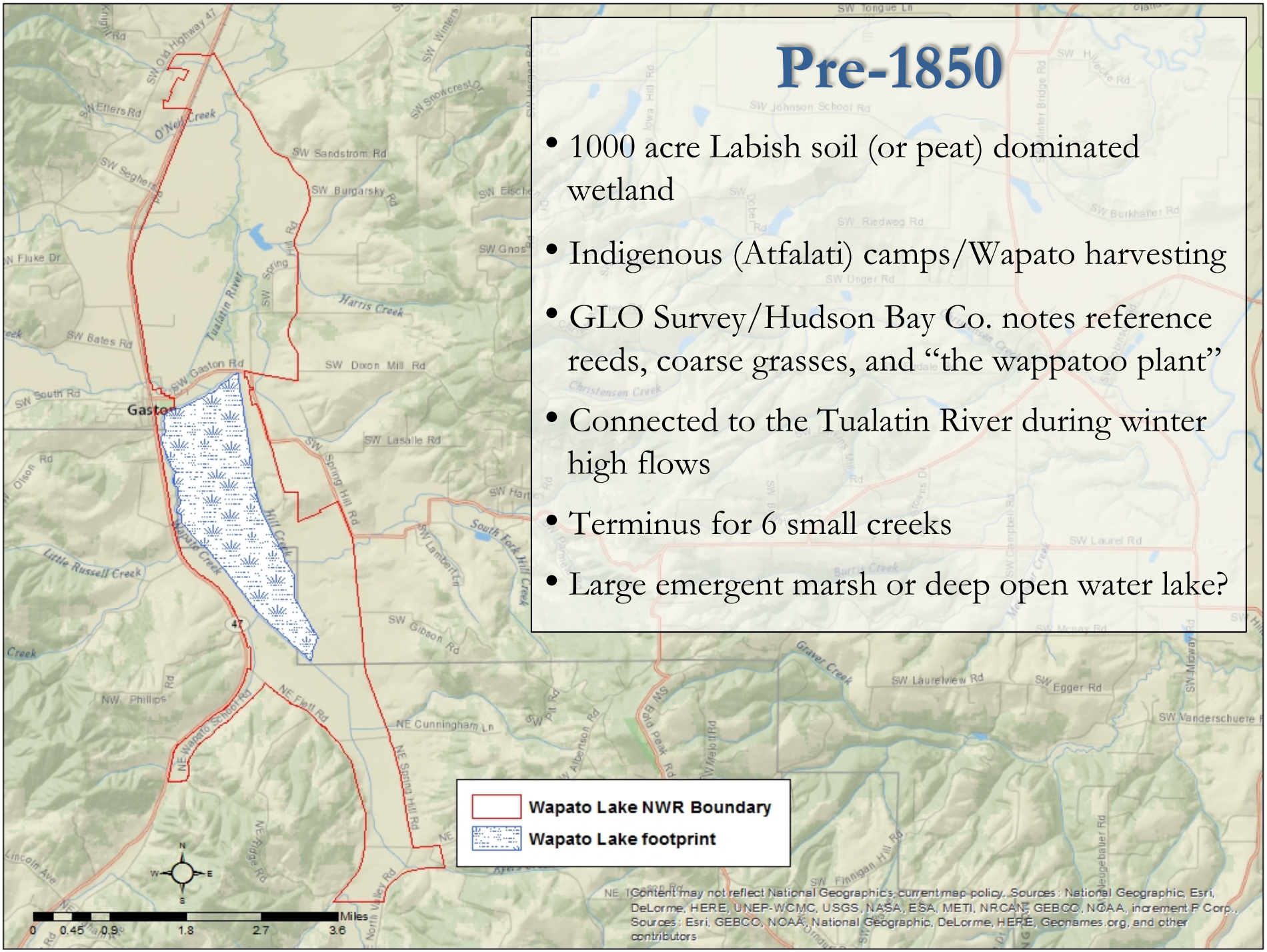


Why Wapato?

- USFWS interest dates back to 1930s
- Large scale conservation opportunity
- Migratory waterfowl
- Rare and unique wetland
- Diversity of other wetland dependant fish and wildlife
- Outdoor recreation /education
- Connectivity to other Tualatin Basin conservation efforts
- Cultural significance
- Water quality

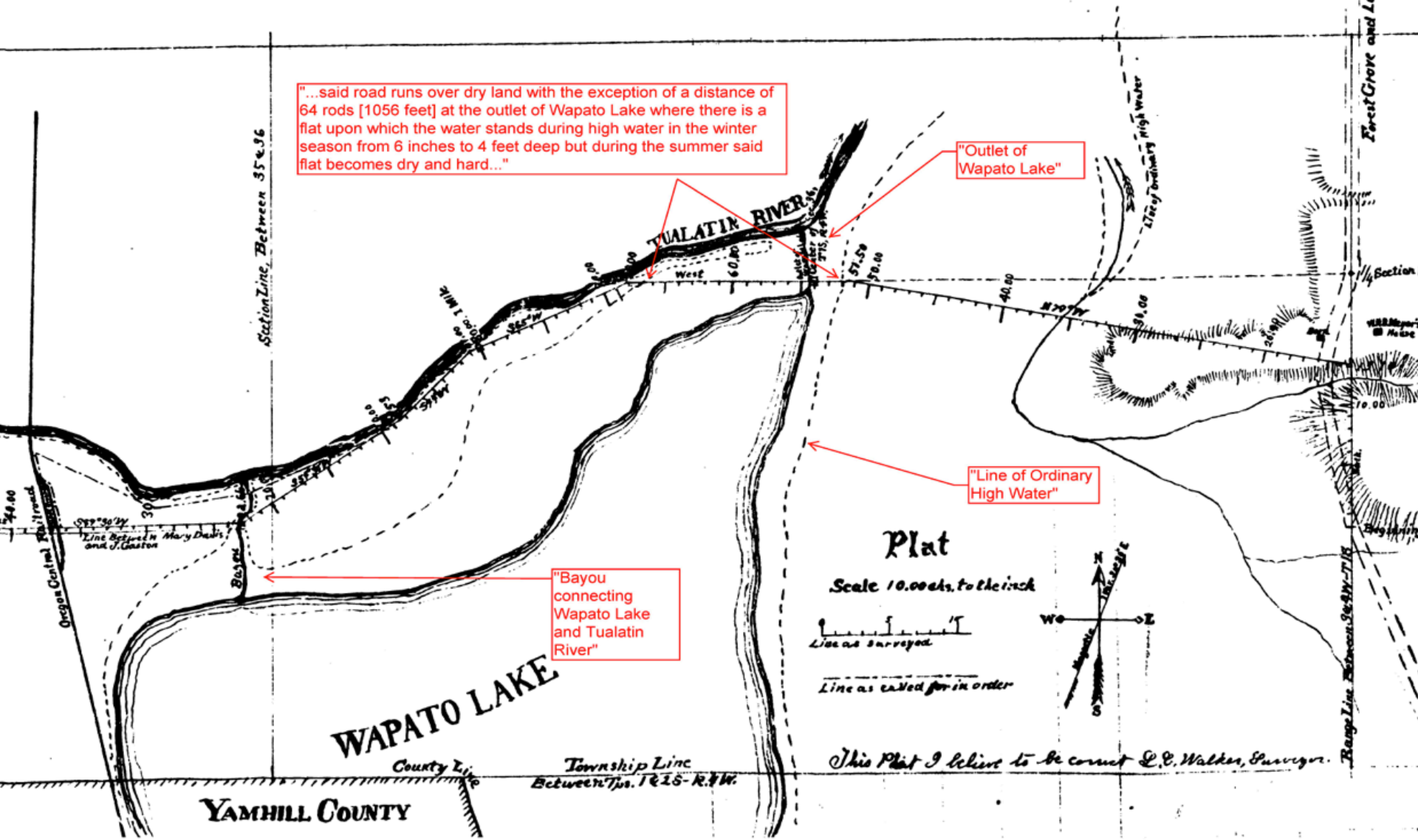
Pre-1850

- 1000 acre Labish soil (or peat) dominated wetland
- Indigenous (Atfalati) camps/Wapato harvesting
- GLO Survey/Hudson Bay Co. notes reference reeds, coarse grasses, and "the wappatoo plant"
- Connected to the Tualatin River during winter high flows
- Terminus for 6 small creeks
- Large emergent marsh or deep open water lake?

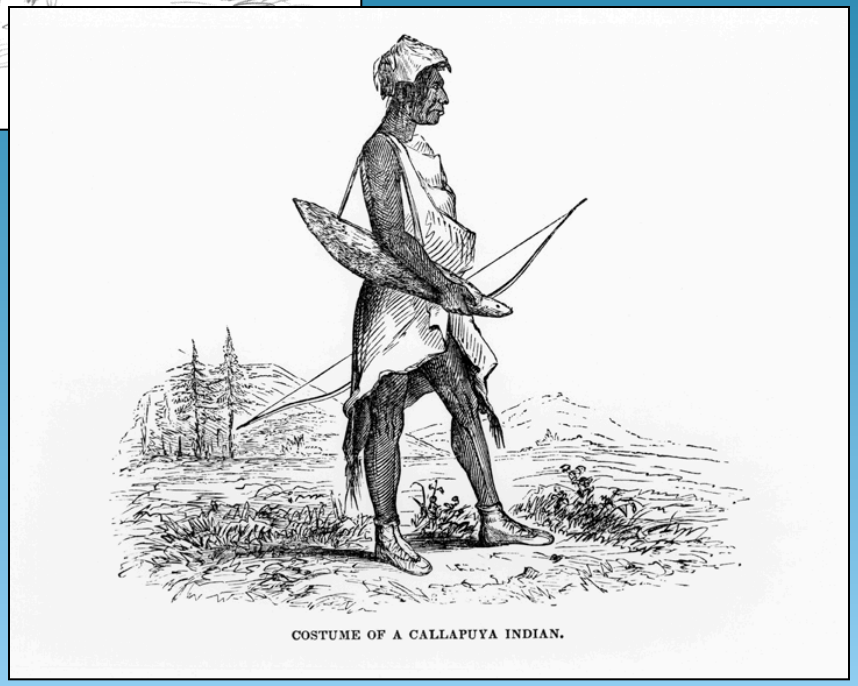


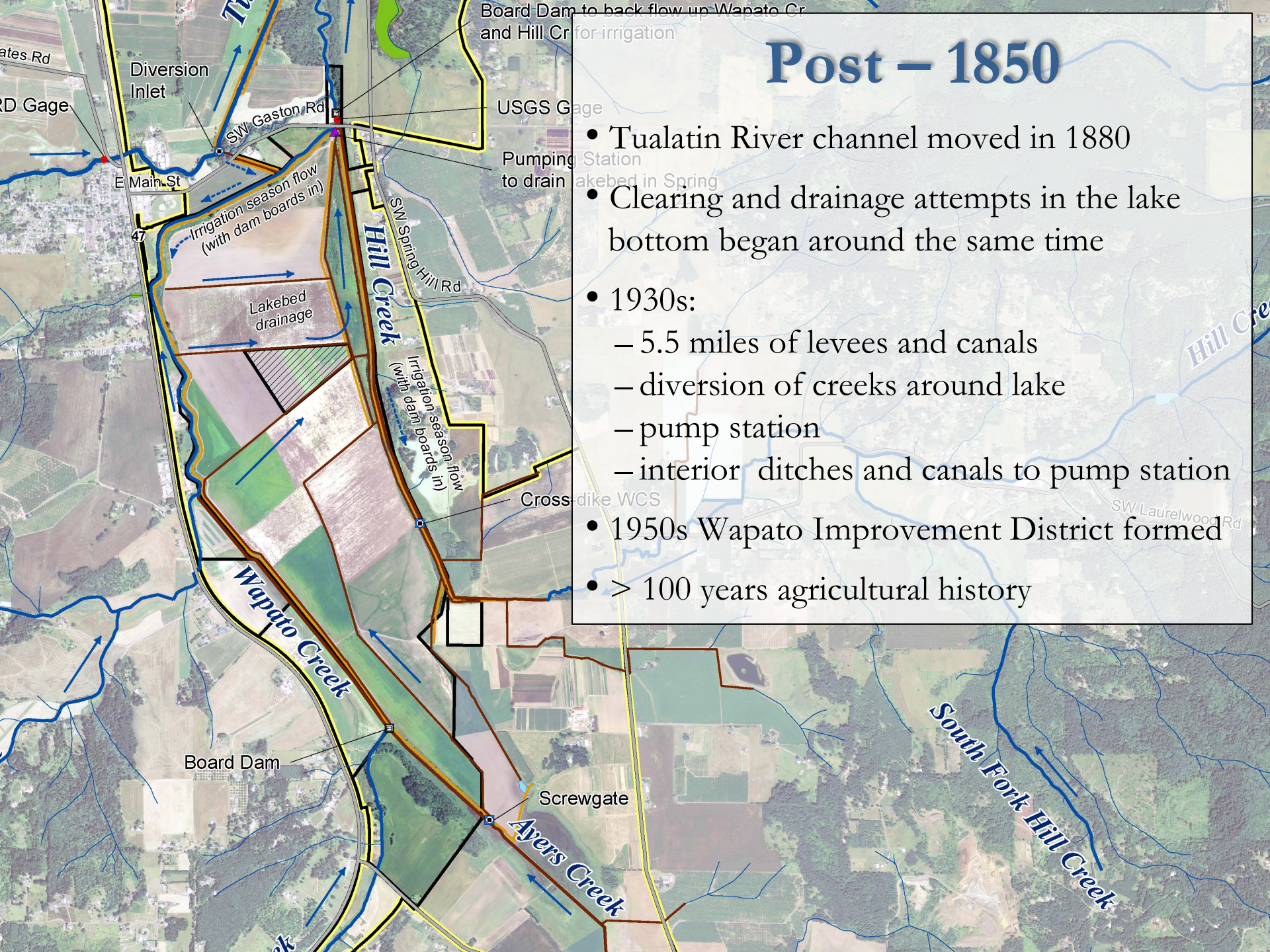
PACKET

CR-A-143



Wapato





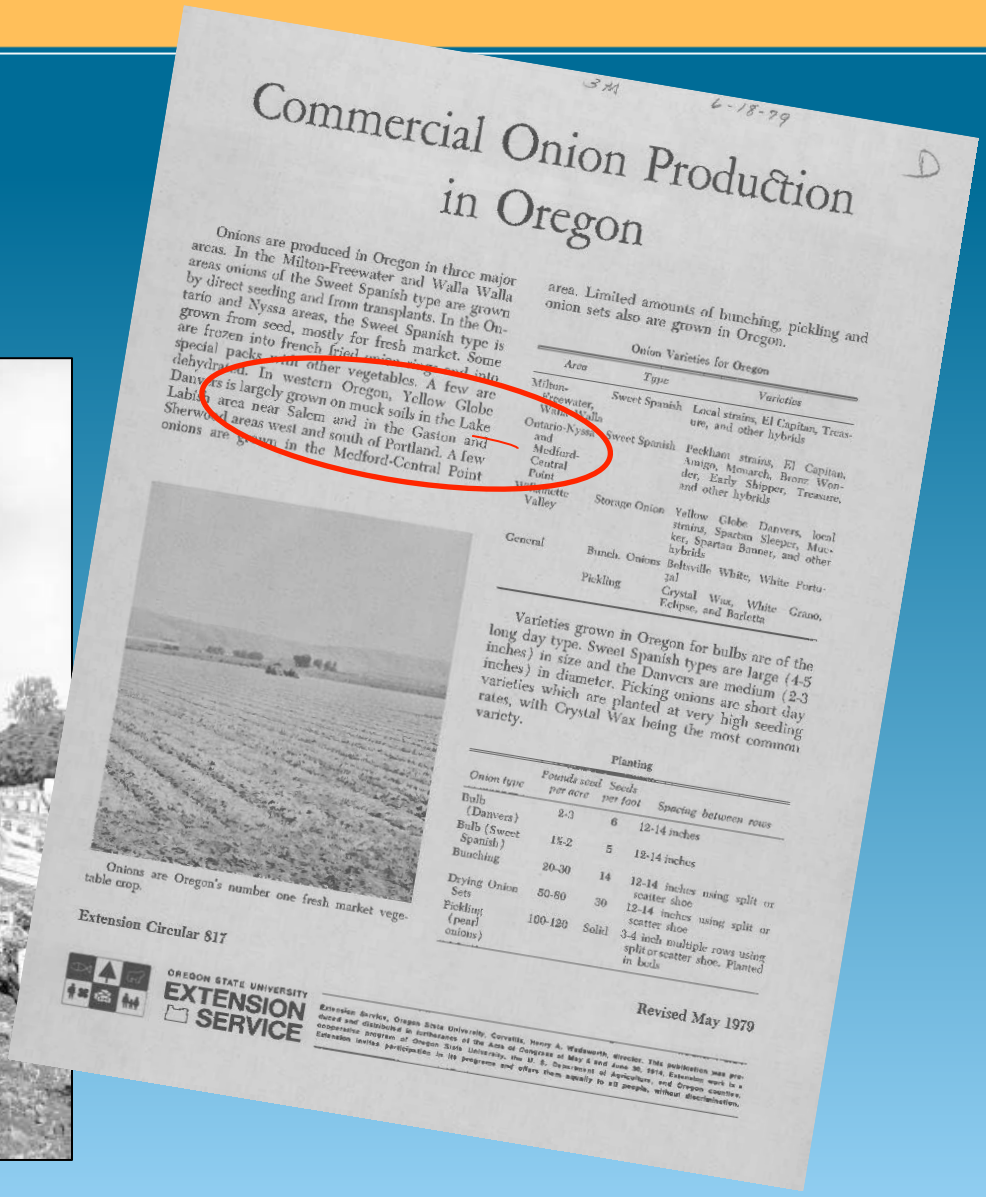
Post – 1850

- Tualatin River channel moved in 1880
- Clearing and drainage attempts in the lake bottom began around the same time
- 1930s:
  - 5.5 miles of levees and canals
  - diversion of creeks around lake
  - pump station
  - interior ditches and canals to pump station
- 1950s Wapato Improvement District formed
- > 100 years agricultural history

Infrastructure

Agricultural History

Photo credit: Salem Public Library Historic Photograph Collections, Salem Public Library, Salem, Oregon



Commercial Onion Production in Oregon

Onions are produced in Oregon in three major areas. In the Milton-Freewater and Walla Walla areas onions of the Sweet Spanish type are grown by direct seeding and from transplants. In the Ontario and Nyssa areas, the Sweet Spanish type is grown from seed, mostly for fresh market. Some are frozen into french fried onions and packed into special packs and other vegetables. A few are dehydrated. In western Oregon, Yellow Globe Danvers is largely grown on muck soils in the Lake Labish area near Salem and in the Gaston and Sherwood areas west and south of Portland. A few onions are grown in the Medford-Central Point area. Limited amounts of bunching, pickling and onion sets also are grown in Oregon.

Onion Varieties for Oregon

Area	Type	Varieties
Milton-Freewater, Walla Walla	Sweet Spanish	Local strains, El Capitan, Treasure, and other hybrids
Ontario-Nyssa and Medford-Central Point	Sweet Spanish	Peckham strains, El Capitan, Amigo, Monarch, Bronz Wonder, Early Shipper, Treasure, and other hybrids
Willamette Valley	Storage Onion	Yellow Globe Danvers, local strains, Spartan Sleeper, Mucker, Spartan Banner, and other hybrids
General	Bunch. Onions	Bellsville White, White Portugal
	Pickling	Crystal Wax, White Grano, Eclipse, and Barletta

Varieties grown in Oregon for bulbs are of the long day type. Sweet Spanish types are large (4-5 inches) in size and the Danvers are medium (2-3 inches) in diameter. Picking onions are short day varieties which are planted at very high seeding rates, with Crystal Wax being the most common variety.

Planting

Onion type	Pounds seed per acre	Seeds per foot	Spacing between rows
Bulb (Danvers)	2-3	6	12-14 inches
Bulb (Sweet Spanish)	1½-2	5	12-14 inches
Bunching	20-30	14	12-14 inches using split or scatter shoe
Drying Onion Sets	50-80	30	12-14 inches using split or scatter shoe
Pickling (pearl onions)	100-120	Solid	3-4 inch multiple rows using split or scatter shoe. Planted in beds

Onions are Oregon's number one fresh market vegetable crop.

Extension Circular 817

OREGON STATE UNIVERSITY EXTENSION SERVICE

Revised May 1979

The End of an Era

so, that your organization proceed with acquisition in a most expeditious manner. For time is of the essence, since one lakebed property is currently listed with a realtor, as is at least one adjacent upland area.

Sincerely,

ESTIMATED

cc:
Oregon

Region
Chairm
Chairm
Direct

Wapato Lake Improvement District
8070 SW Spring Hill Road
Gaston, OR 97119

September, 2000

RECEIVED-REGION-ARS
OCT 03 2000
FWS PORTLAND, OR

Mrs. Jamie Clark
Director
US Fish & Wildlife Service
Department of the Interior
1849 C Street NW
Washington, D.C. 20240

Dear Mrs. Clark;

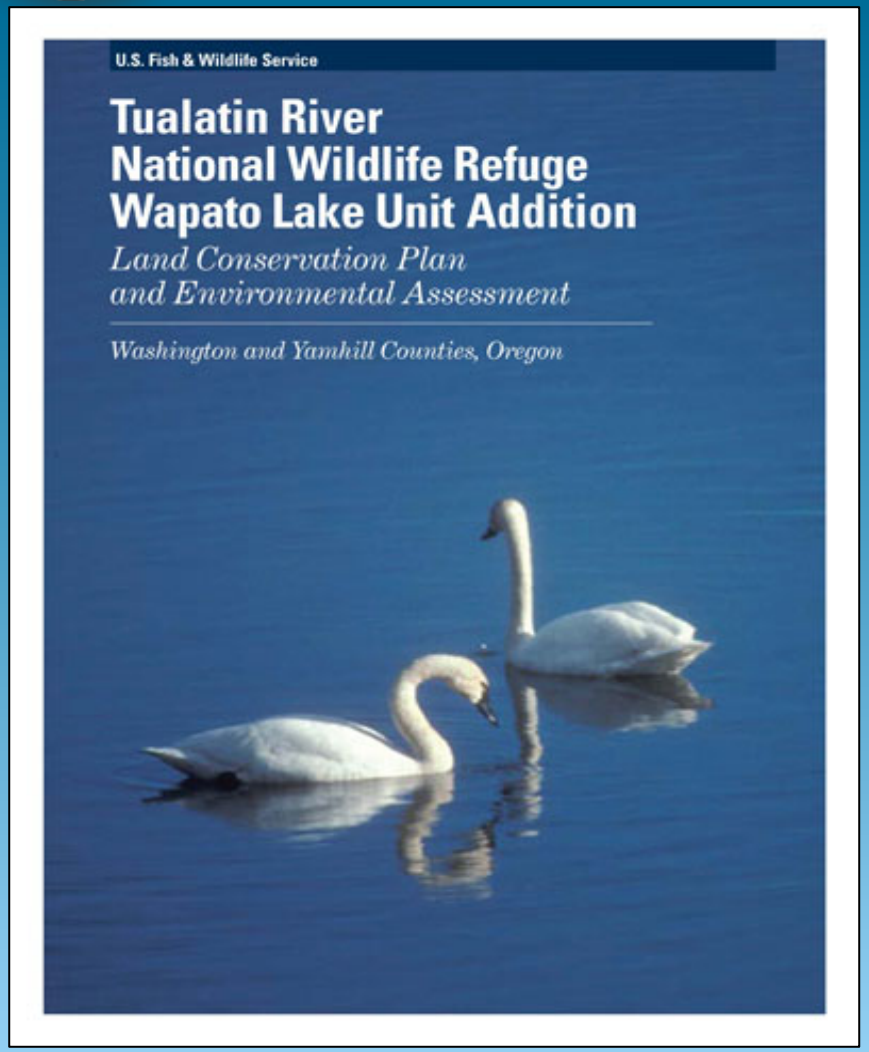
As you and your staff may already know, what is now known as the old Wapato lakebed near Gaston, Oregon, many years ago use to be a natural lake. It was/is an adjunct to the Tualatin River that flows by the City of Gaston and now passes within yards of the north end of the lakebed. In the mid 1930's the Wapato Lake Improvement District was formed to drain the lake so that agricultural crops could be grown using water from the River for irrigation of the 700+/- acre lakebed. Prior to that time, the lake teemed with waterfowl and other wildlife species throughout the year, but the most spectacular use was during the fall and winter months.

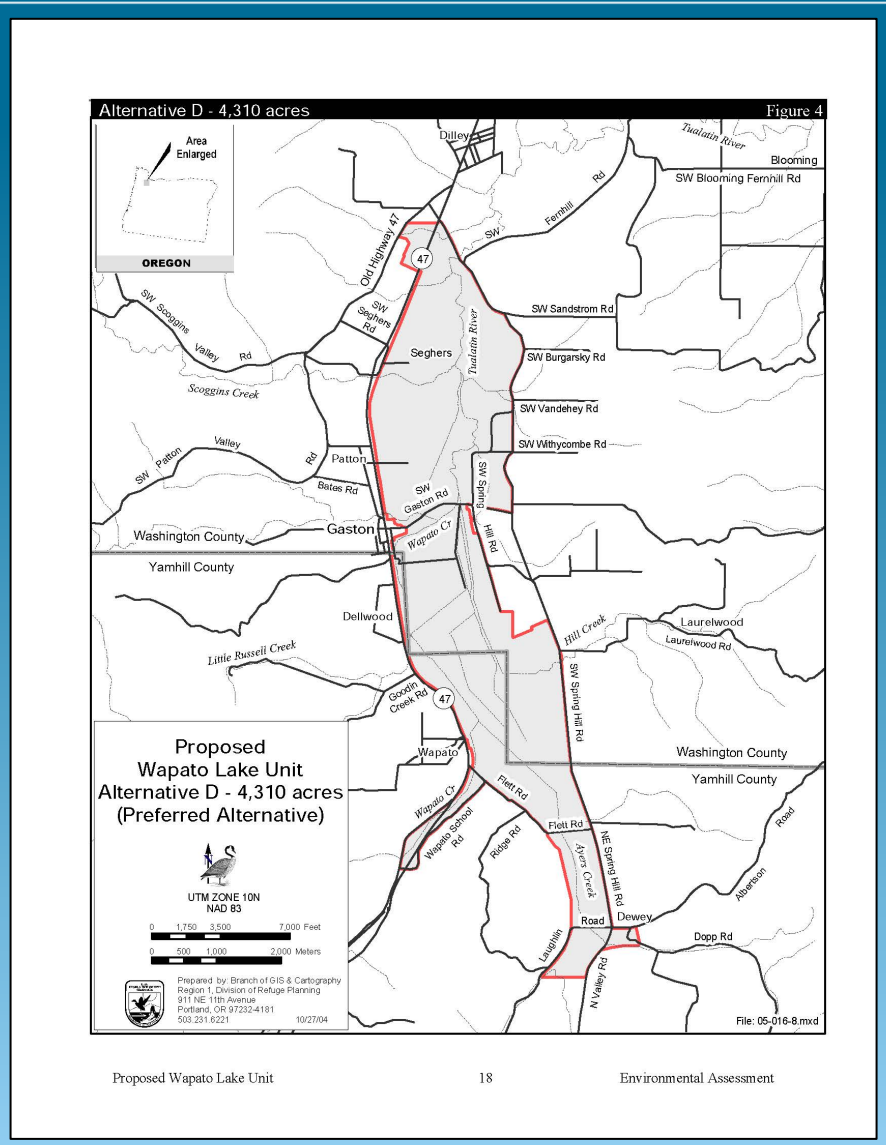
Some, if not the majority of us have known and been associated with the Lake and the Improvement District all or much of our lives. For the most part, it has been good to us. We've known what it was like before the days of farming, as well as having used the lakebed to provide a substantial portion if not all of our livelihoods. However, now there are some of us that want to retire and others that would like to move on to other activities. All due in part to a number of factors; poor farm prices, poor health, our heirs probably couldn't pay the inheritance taxes to keep on farming even if they might be interested (for the most part we've provided them an education whereby they realize that easier money can be made elsewhere without the backbreaking and interminable hours required to farm), etc., etc. Also, due to a default on a Farmers Home Loan several years ago, the U.S Fish and Wildlife Service already has a presence with 108 lakebed acres and 12 upland acres owned in fee title, and an easement on an additional 32 acres of adjacent upland.

And so it is with mixed feelings that we seek your assistance. We are aware that the lake has been identified long ago as a potential wildlife refuge. Indeed, there have been queries in the past by Fish and Wildlife folks to that end, but until now there was no consensus by the owners of the lakebed to sell. For the above mentioned reasons and more, it is our feeling at this time that one of the best things that could be done is to make it into a wildlife refuge. We feel as do many people in the surrounding community(s) that it would be quite beneficial to the folks in the area, and more importantly, it would be of significant value to waterfowl, primarily as a wintering area, were it to be managed for that purpose.

Therefore we ask that you pursue ascertaining whether it would make a significant contribution to your refuge system and to the waterfowl and other migratory birds of the Pacific Flyway, and if

Full Circle

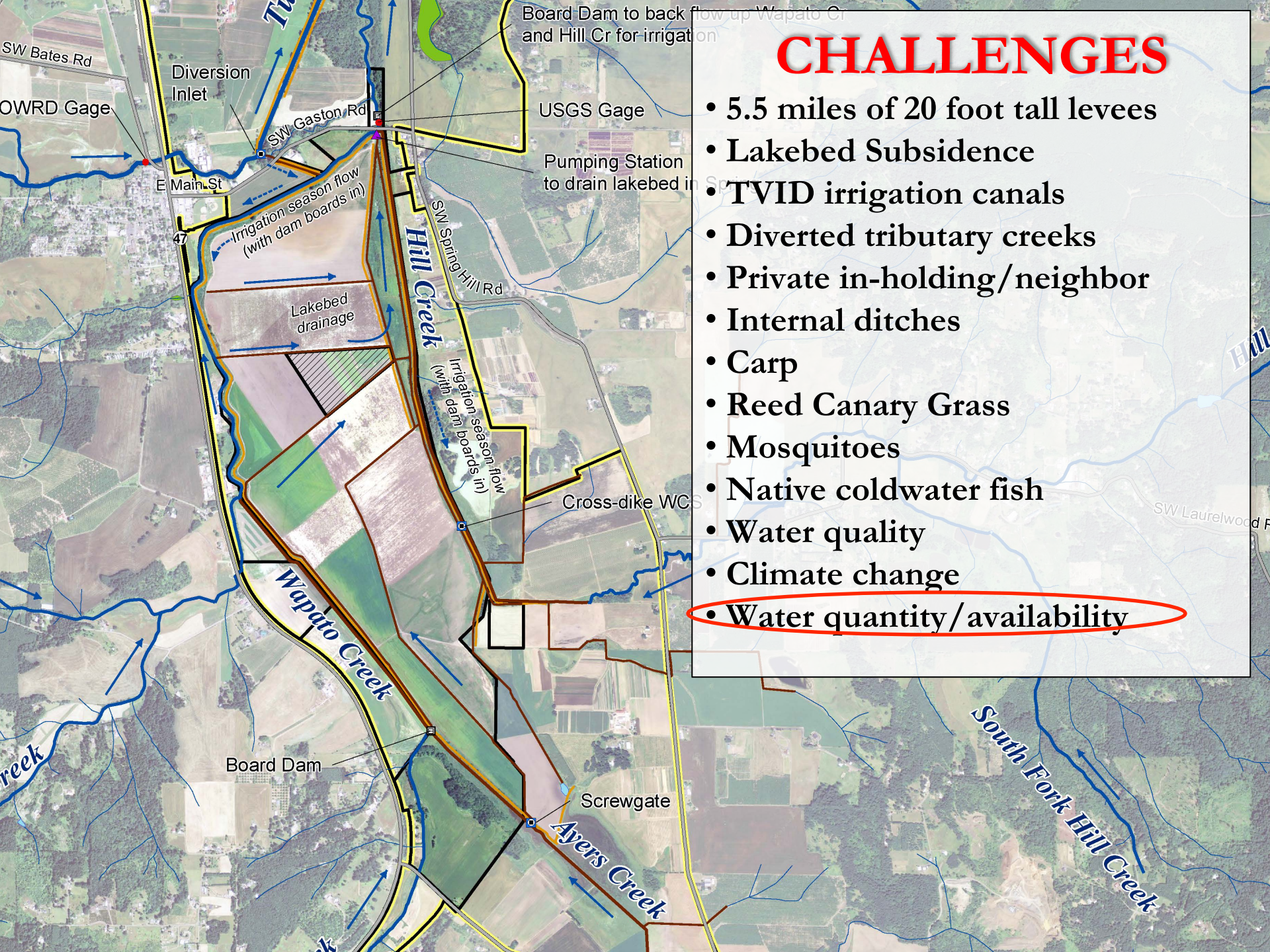

U.S. Fish & Wildlife Service
Tualatin River
National Wildlife Refuge
Wapato Lake Unit Addition
Land Conservation Plan
and Environmental Assessment
Washington and Yamhill Counties, Oregon


Alternative D - 4,310 acres
Figure 4
Area Enlarged
OREGON
Proposed
Wapato Lake Unit
Alternative D - 4,310 acres
(Preferred Alternative)
UTM ZONE 10N
NAD 83
Prepared by: Branch of GIS & Cartography
Region 1, Division of Refuge Planning
911 NE 11th Avenue
Portland, OR 97232-4181
503.231.6221
10/27/04
File: 05-016-8.mxd
Dilley
Blooming
SW Blooming Fernhill Rd
Tualatin River
Fernhill Rd
SW
Old Highway 47
47
SW Sandstrom Rd
SW Burgarsky Rd
SW Vandehey Rd
SW Withycombe Rd
SW Seghers Rd
Seghers
SW Scoggins Valley Rd
Scoggins Creek
SW Patton Valley Rd
Patton
Bates Rd
SW Gaston Rd
Gaston
Wapato Cr
SW Spring Hill Rd
Washington County
Yamhill County
Dellwood
Little Russell Creek
Hill Creek
Laurelwood
Laurelwood Rd
Goodin Creek Rd
Wapato
Flett Rd
Wapato School Rd
Ridge Rd
Ayers Creek
NE Spring Hill Rd
Road
Dewey
Albertson
Dopp Rd
Laughlin
N Valley Rd

Wapato Lake NWR
Interim Management

Cooperative Farming

- Weed abatement
- Food source for wintering waterfowl
- Good will with the local community



CHALLENGES

- 5.5 miles of 20 foot tall levees
- Lakebed Subsidence
- TVID irrigation canals
- Diverted tributary creeks
- Private in-holding/neighbor
- Internal ditches
- Carp
- Reed Canary Grass
- Mosquitoes
- Native coldwater fish
- Water quality
- Climate change
- Water quantity/availability

Tools Needed

Goal: Restoration!

USFWS needs data and insights based on sound science to properly plan for future management and restoration of Wapato Lake NWR.

Questions

- How much water is available?
- What restoration scenarios are possible?
- What types of habitat can be provided?
- Are pumps and levees needed?

Photo by USFWS

Build a water budget

- Build digital elevation model of lakebed
- Measure lake levels
- Quantify inputs and outputs
- Estimate unknown rates/parameters

Build planning tools

- Evaluate water-management scenarios
- Model downstream connections
- Assess quality of habitats

Wapato Lake Today

- Levees and canals, pump station, gages
- Diverted tributaries:
  - Ayers Creek
  - Wapato Creek
  - Hill Creek
  - Goodin Creek
  - Olsen Creek
  - “unnamed” creek
- Lakebed elevations measured with LiDAR

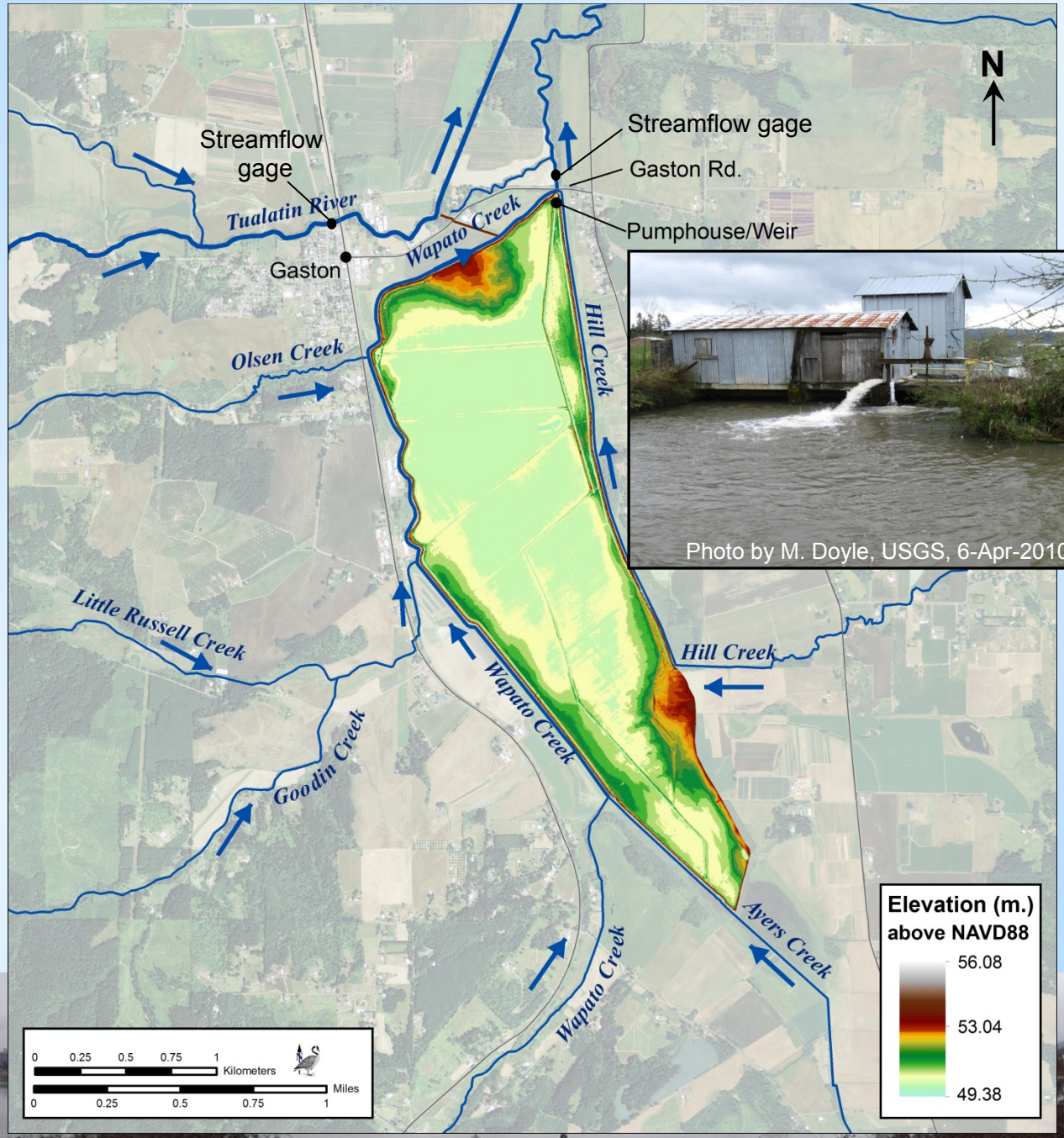


Photo by M. Doyle, USGS, 6-Apr-2010

Map from USFWS, 2015

Flow/Stage Monitoring Network

- Lake stage
- Streamflow:
  - downstream outflow

photo from USGS

Photo by M. Doyle, USGS, 6-Apr-2010

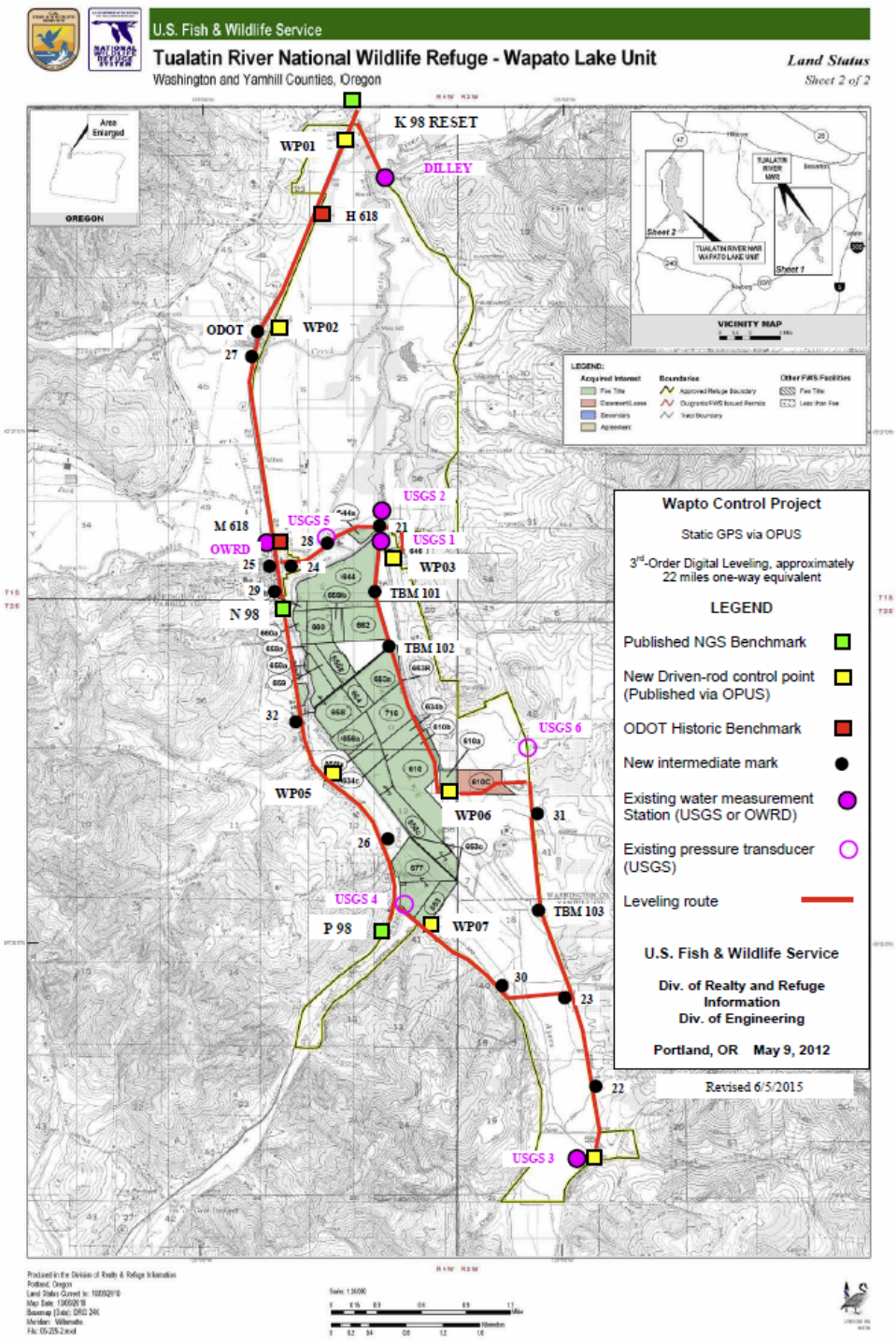
photo from USGS

map from Google

LiDAR Acquisition

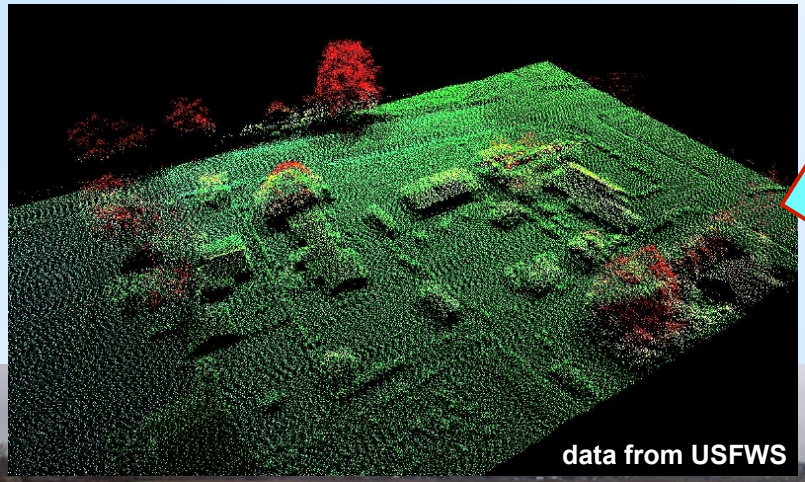
- Objective
  - determine land-surface topography including lakebed bathymetry
- USFWS surveying
  - precise leveling around lakebed
  - installed new benchmarks

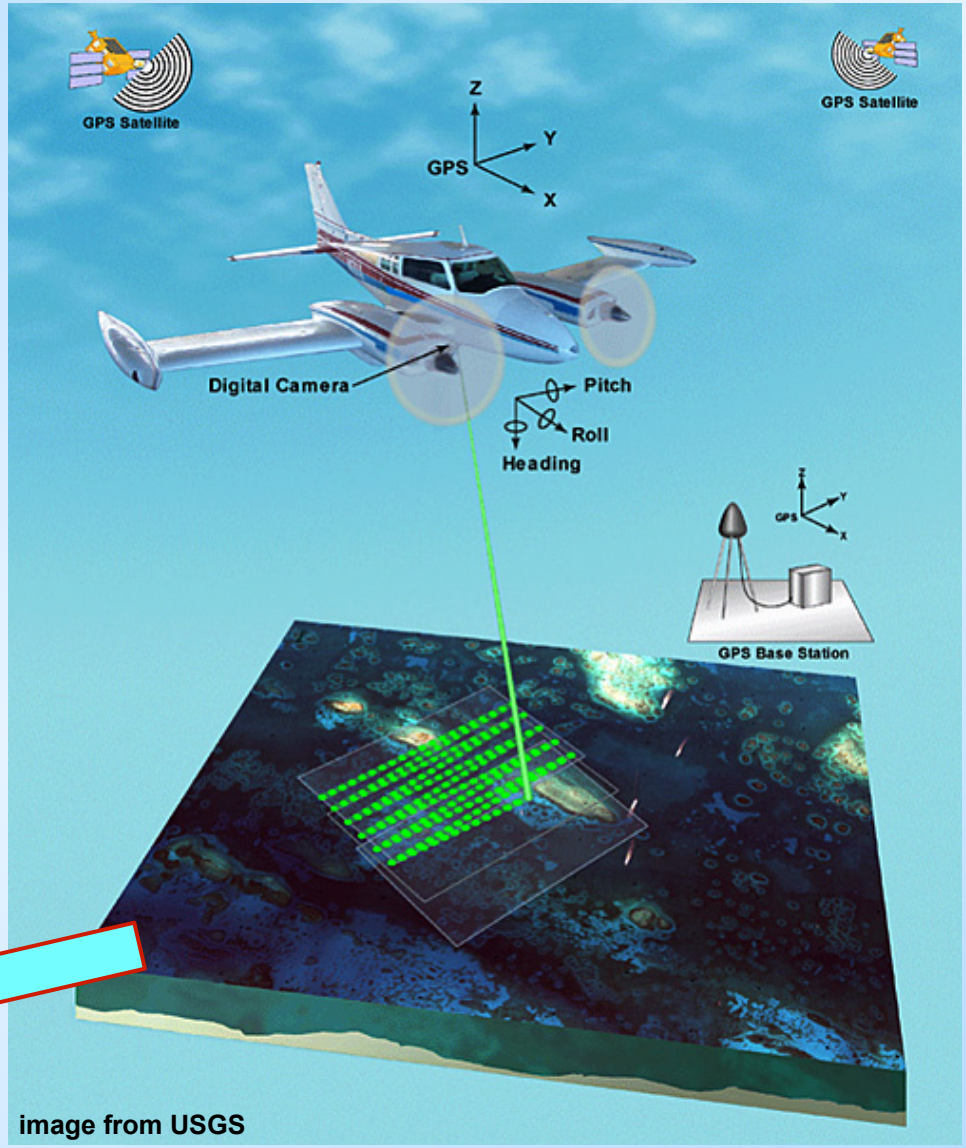
photos and map from USFWS



LiDAR Acquisition

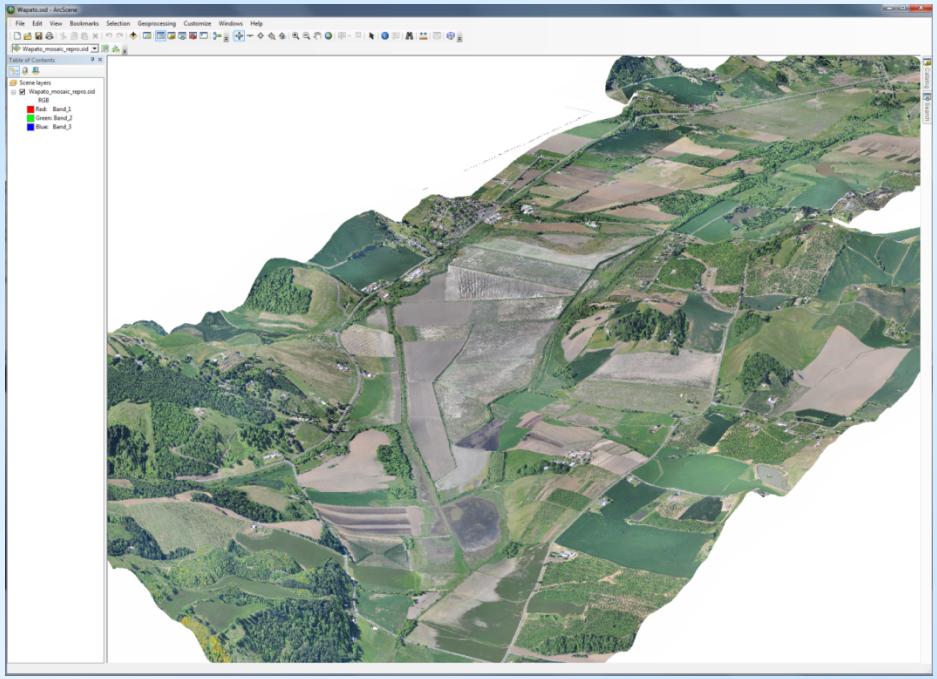
- Objective:
  - determine land-surface topography including lakebed bathymetry
- USFWS surveying:
  - precise leveling around lakebed
  - installed new benchmarks
- LiDAR acquired: May 15, 2012
  - 19.24 square miles
  - 30-60 pts/m^2
  - mean vertical accuracy: 0.142 feet

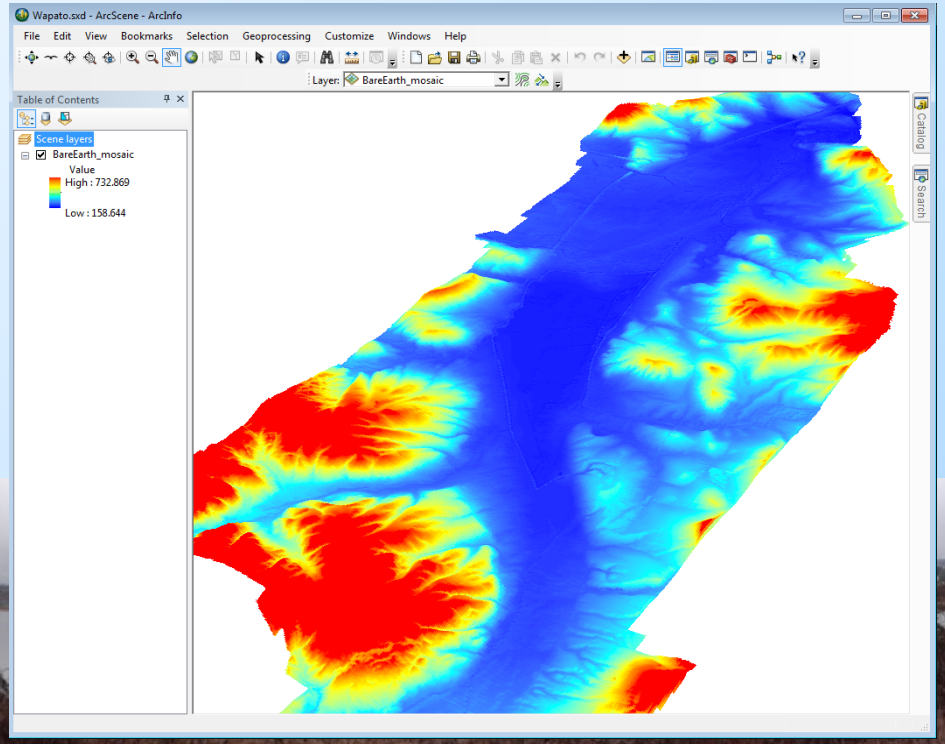




LiDAR Acquisition

- Objective:
  - determine land-surface topography including lakebed bathymetry
- USFWS surveying:
  - precise leveling around lakebed
  - installed new benchmarks
- LiDAR acquired: May 15, 2012
  - 19.24 square miles
  - 30-60 pts/m^2
  - mean vertical accuracy: 0.142 feet
- Developed digital elevation model
  - needed to assess water depth, lake area, lake volume, and habitat in lake as function of lake surface elevation

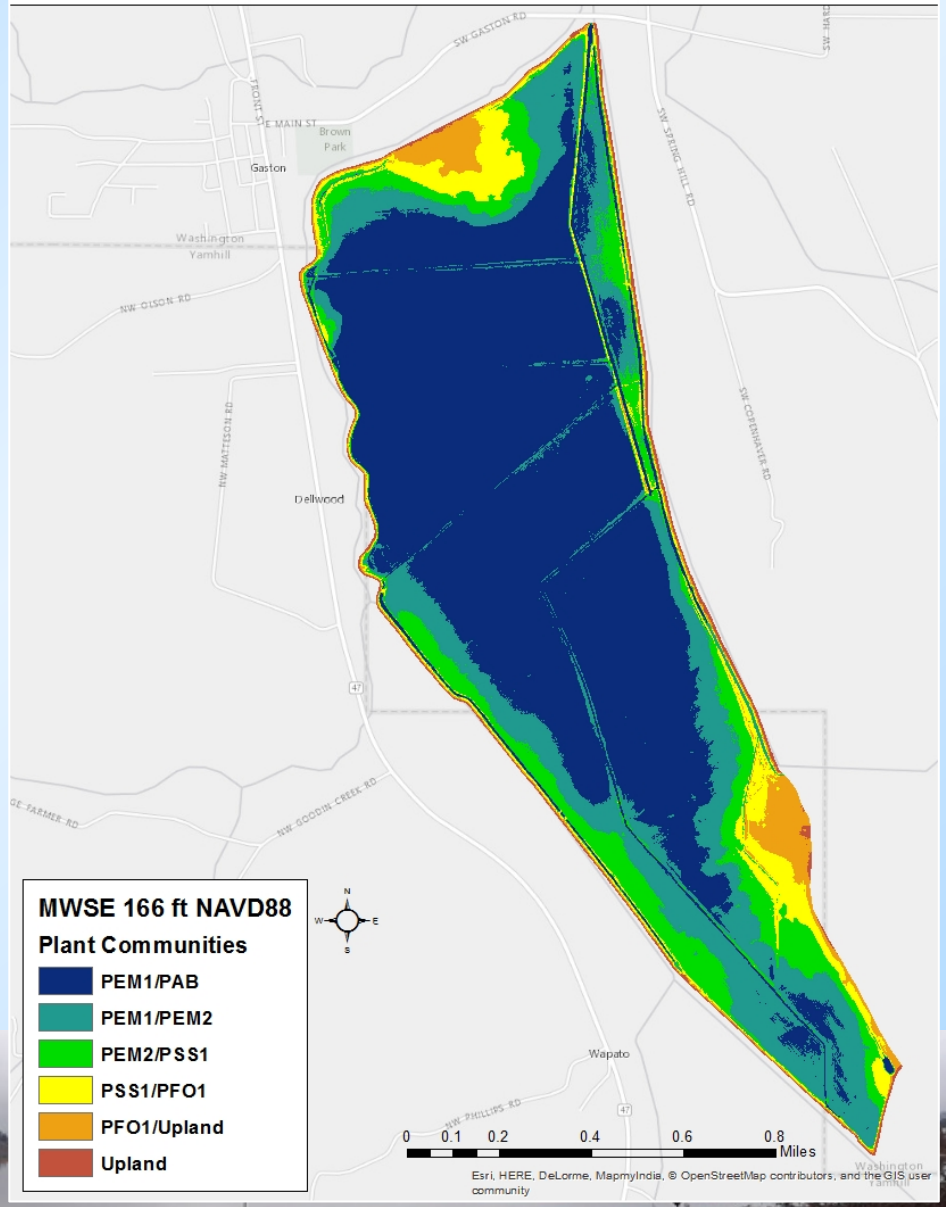




images from USFWS

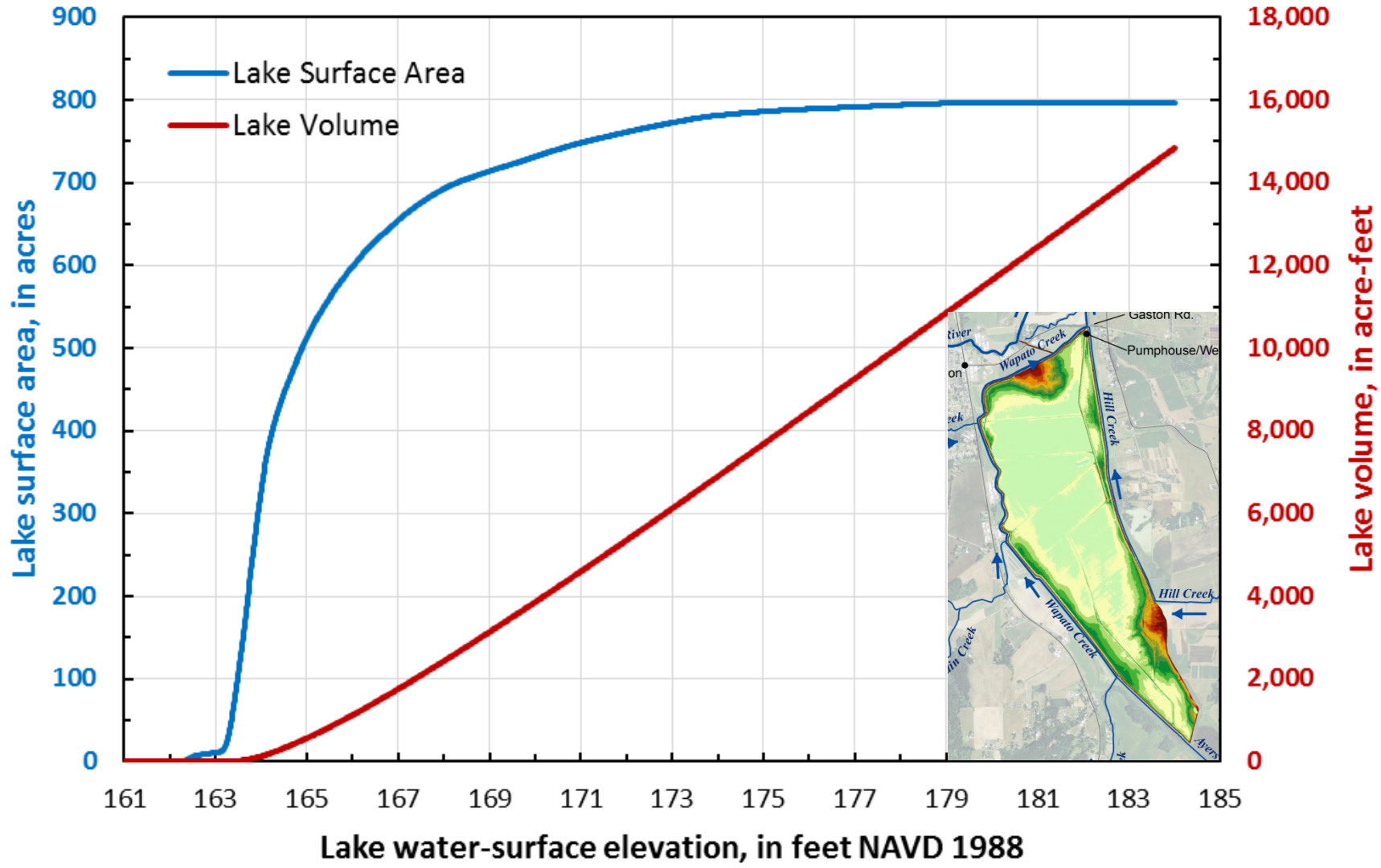
Shoreline Management Tool

- Preliminary analysis of lake stage-to-volume relation conducted using the USGS Shoreline Management Tool.
- GIS based program developed to assess the effects of changes in surface-water stage on water depth and inundated area of a site.
- SMT can be used to identify aquatic or terrestrial habitat areas as defined by user-specified criteria including variables such as water depth and land-surface slope.



map from USFWS

Lake Surface Area and Volume



Provisional data, subject to revision

Wapato Lake Water Budget Components

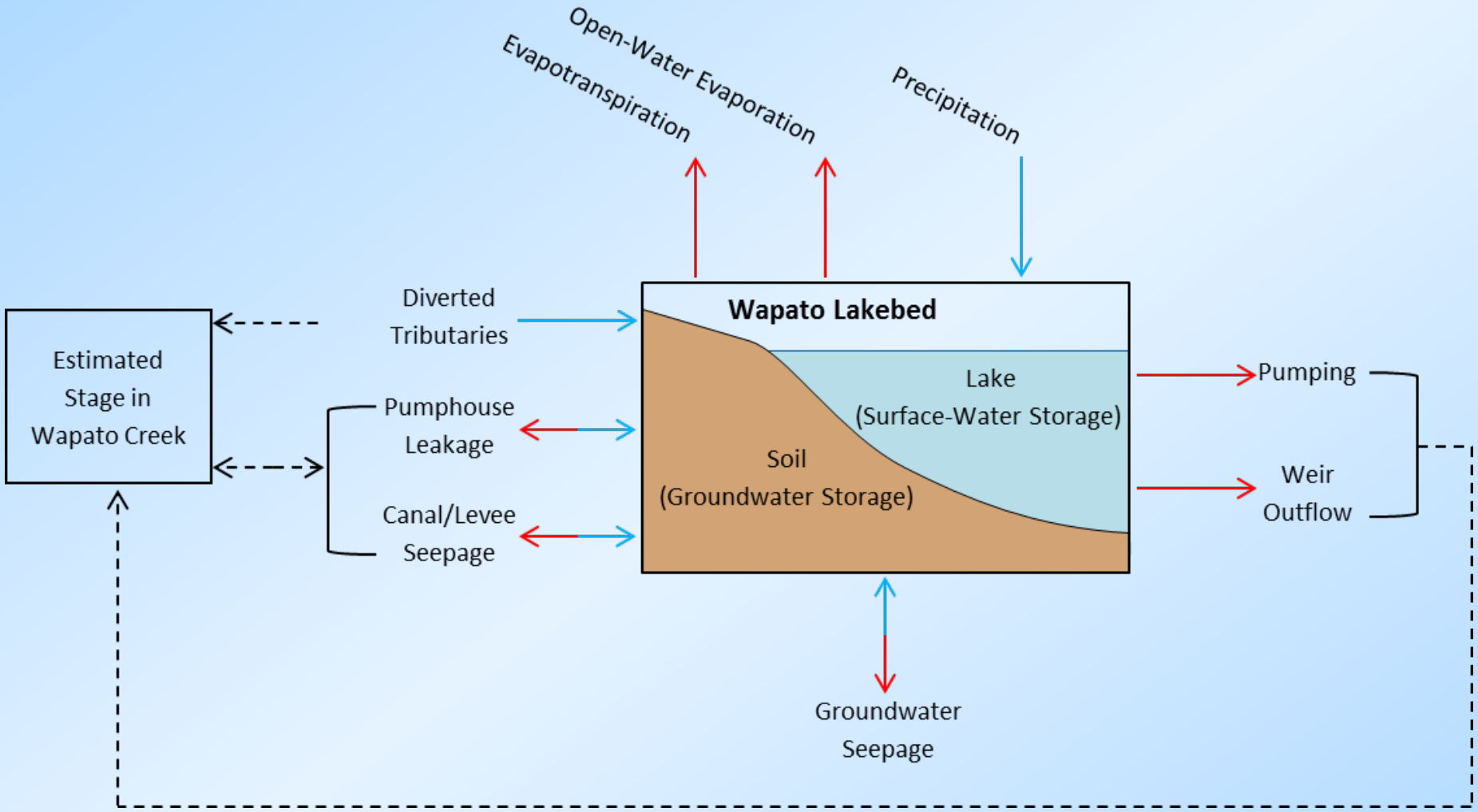


diagram from USGS

Unsaturated Zone Water Budget

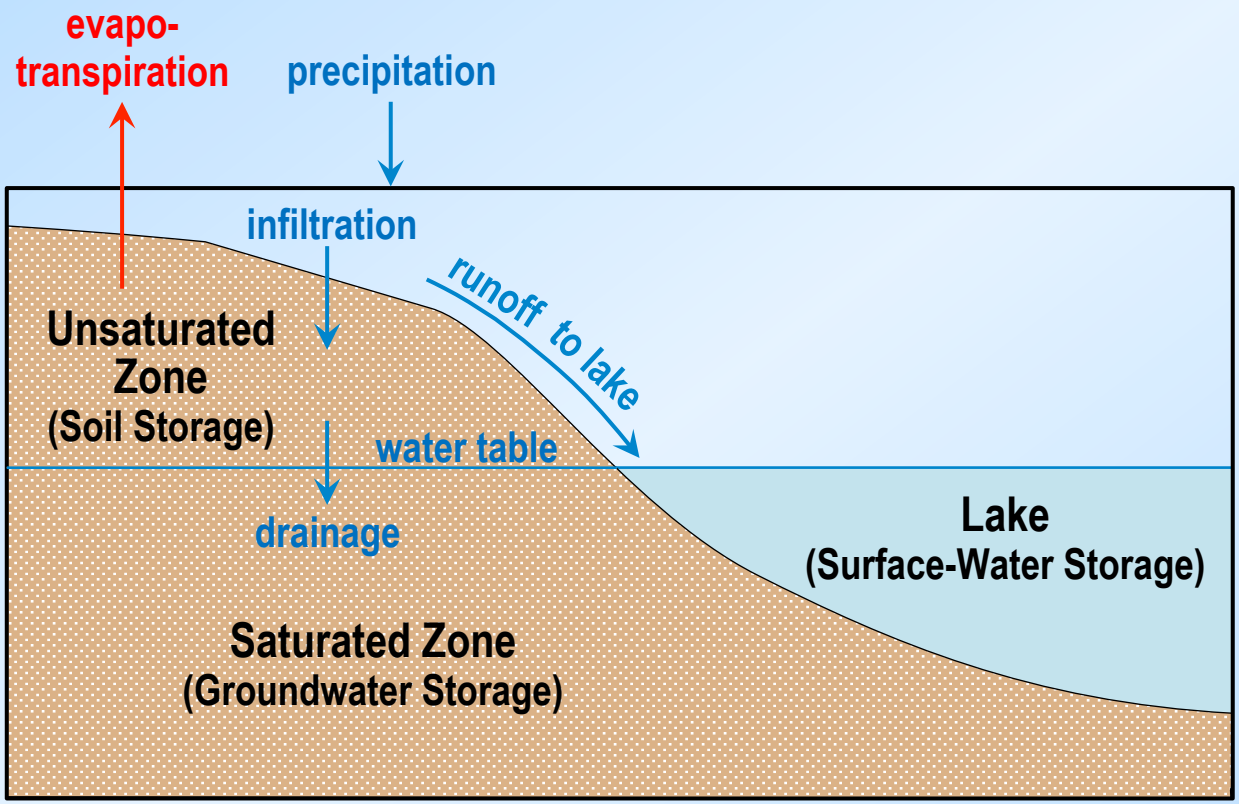
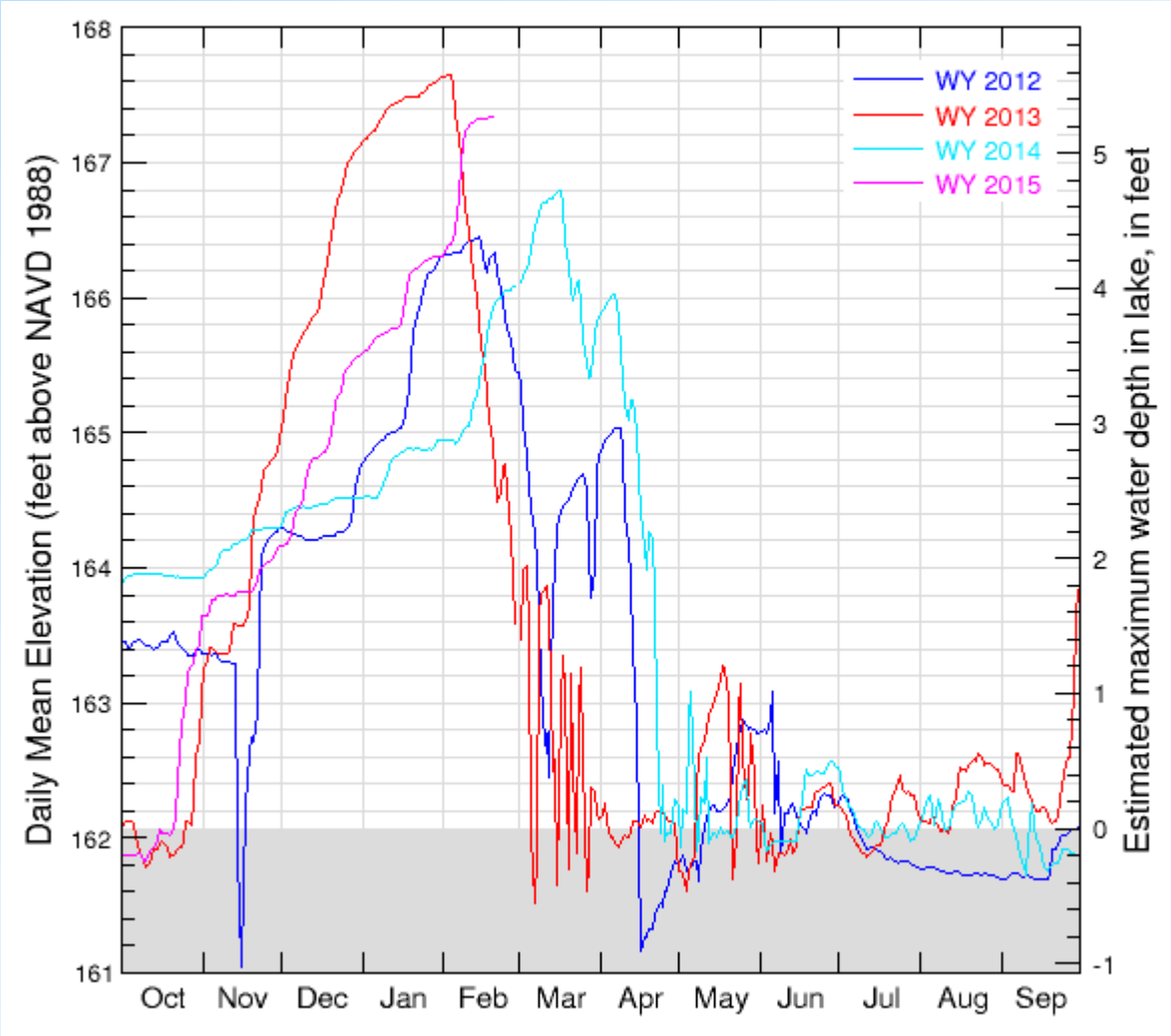


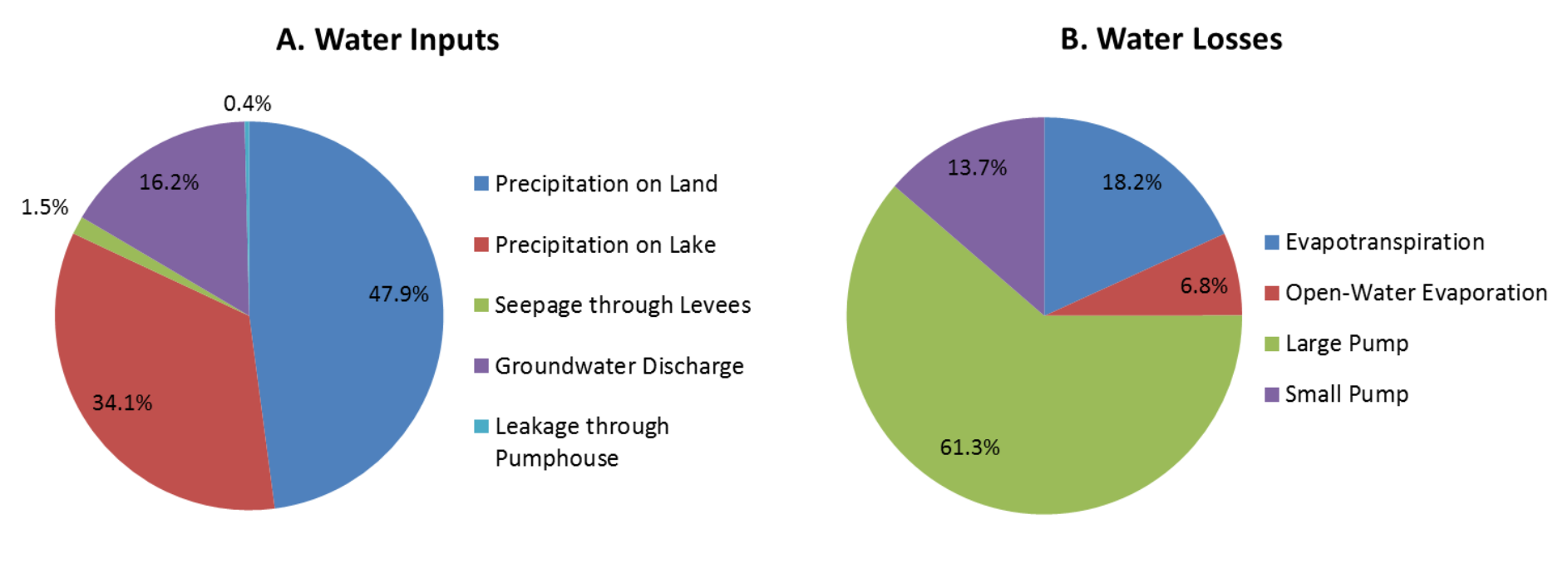
diagram from USGS

Lake Levels, 2011-2015



data from USGS National Water Information System

Inputs and Losses, 2011-2014



- Currently, rainfall is the dominant input to the lake (82% of all inputs), and pumping is the major loss process (75% of all losses).
- For 10/2011 thru 3/2014, tributary flows were 8 times larger than rainfall inputs.

Provisional data, subject to revision

Water Management Scenario Tool

Goals

- Answer basic questions about restoration possibilities
- Inform resource managers of lake characteristics over time:
  - Period of inundation
  - Lake level
  - Available habitat
  - Downstream flow
- Compare different restoration strategies across a climatic gradient

USGS
science for a changing world

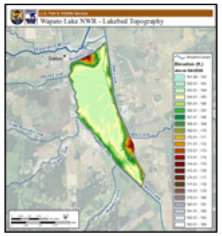
U.S. FISH & WILDLIFE SERVICE

Lake and Wetland Water Management Scenarios Tool
Version 10.3 for the Wapato Lake National Wildlife Refuge, Oregon
Prepared in Cooperation with the U.S. Fish and Wildlife Service

U.S. Geological Survey - Oregon Water Science Center
By Stewart A. Rounds, Daniel T. Snyder, T. Zach Freed, Casie D. Smith, Micelis C. Doyle

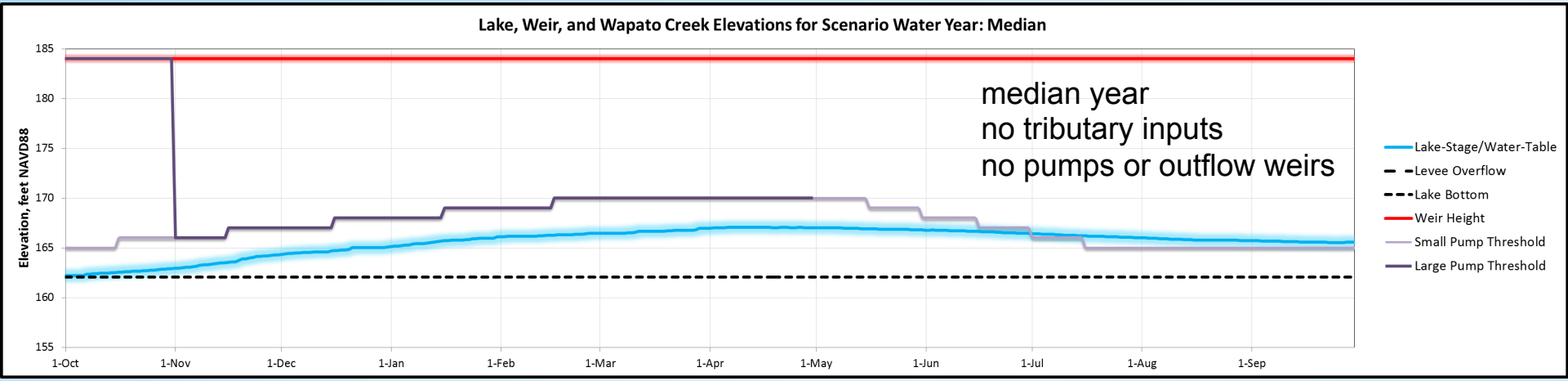
The objective of the Lake and Wetland Water Management Scenarios Tool was to develop an interactive tool that can be used to model the daily inflows and outflows to Wapato Lake (figure 1) over the course of a water year to determine the resulting daily surface-water level. This information can be used by land- and water-resource managers to quickly and easily determine the constraints with regard to surface-water levels given the range of scenarios consisting of the possible climatologic and hydrologic conditions and management options. Scenarios include options to select precipitation/streamflow regimes, starting surface-water elevation, inflows from diversion of tributaries, and outflows to pumping or over weirs. The user-specified selections are implemented through the use of a water-budget model that considers each component of the water-budget (inflows, outflows, and storage) as illustrated in the figure 2 below. Results are presented in tabled and graphical formats with links to maps showing the resulting extent of inundation and water depths.

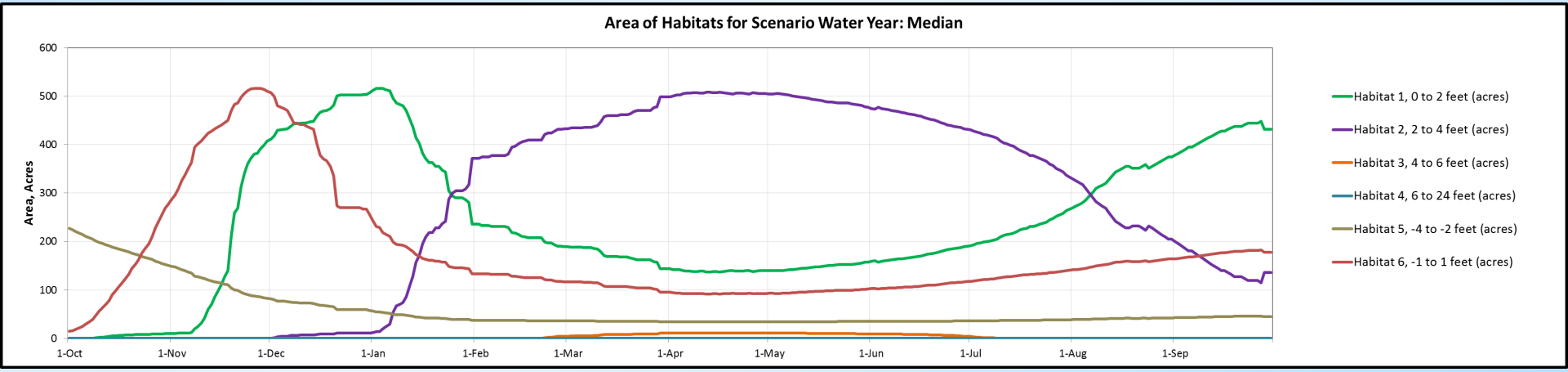
Figure 1: Map showing land-surface elevation of Watapo Lakebed.
(Click on thumbnail figure to right for hyperlink to full-size version.)



Introduction | Dashboard | Water Balance | Water Balance Figures | Multiple-Year Figures | Water Balance Statistics
Input- Precipitation | Input- Tributaries | Input- Other | Loss- ET | Loss- Pumps | Loss- Weir | Habitat | Unsaturated Zone | Calculated Storage

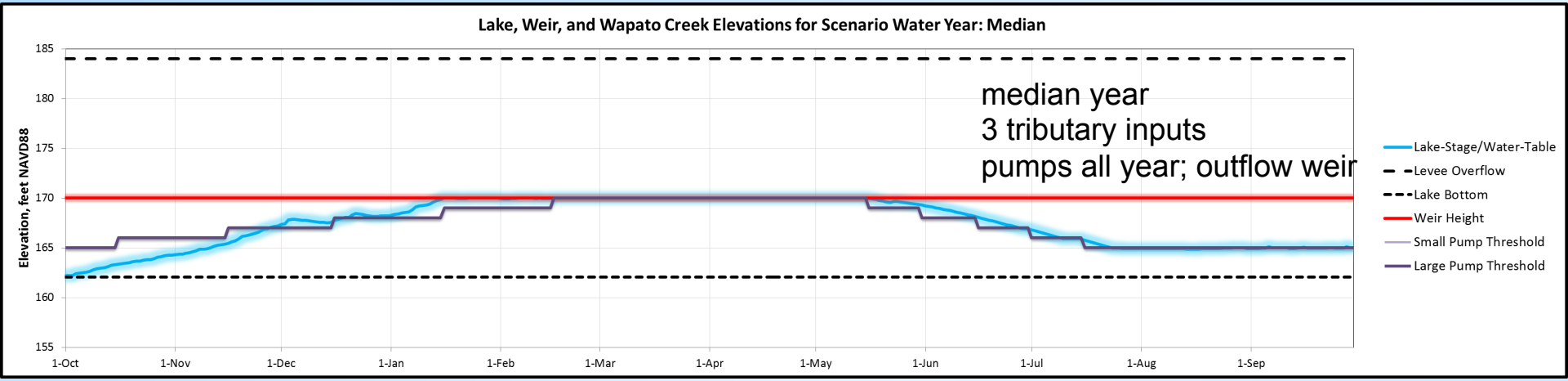
Median Year, No Tribs, No Pumps/Weirs

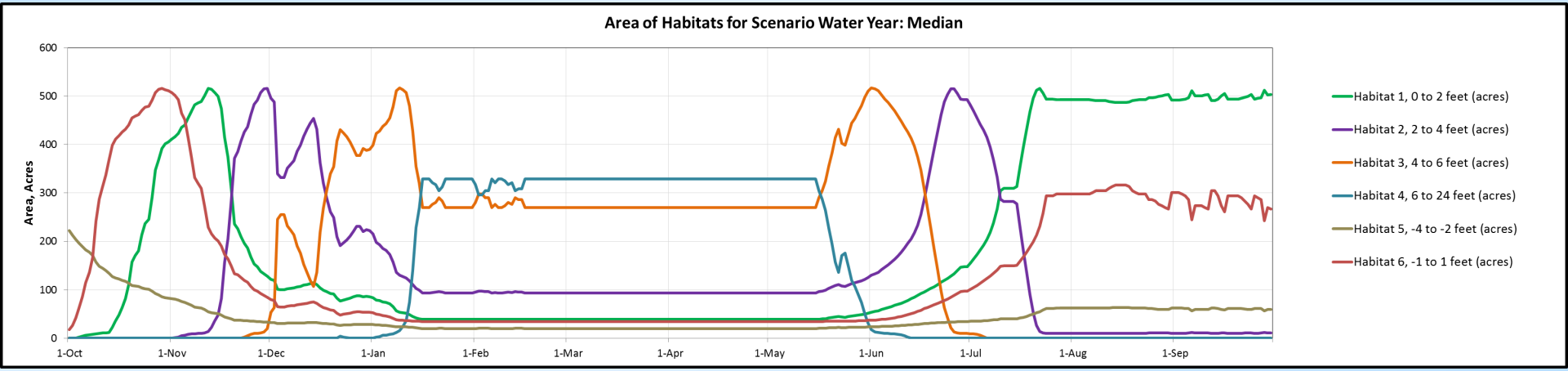




Provisional data, subject to revision

Median Year, Three Tribs, Pumps/Weir Present

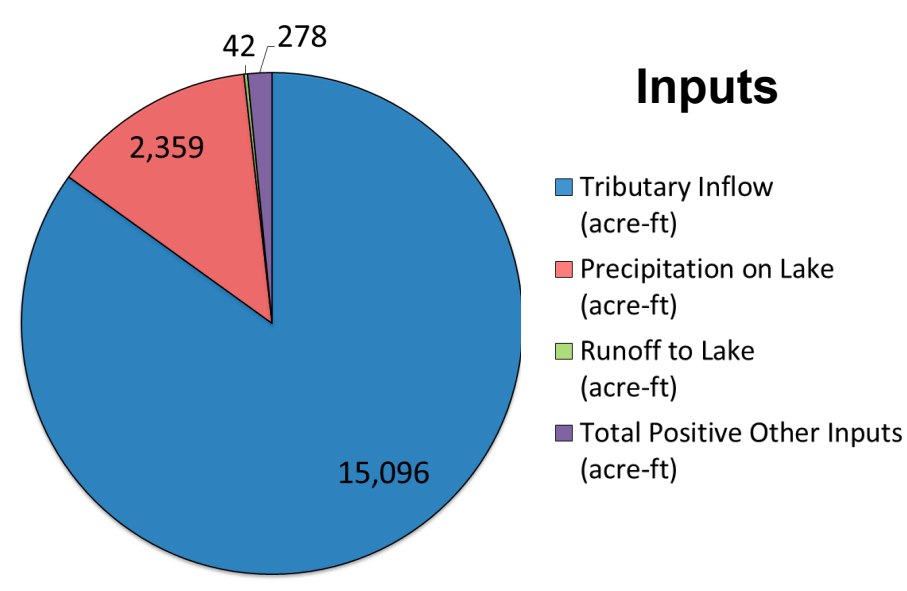


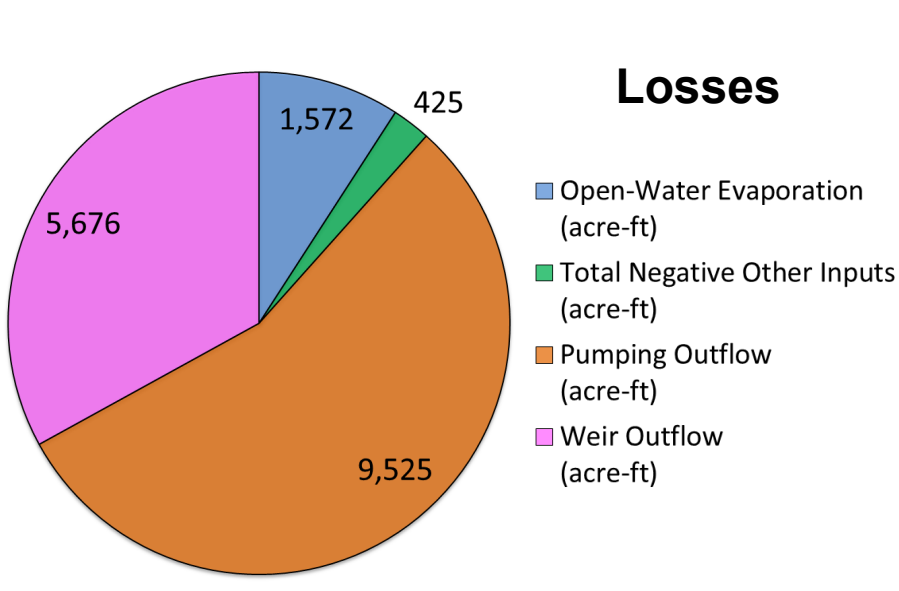


Provisional data, subject to revision

Water Budget Information

median year, three tributaries, pumps and weir present





- Tributary inflows provide a substantial amount of water to the lake.
- Pumping, outflow weirs, or an open connection downstream would likely dominate the loss processes.

Provisional data, subject to revision

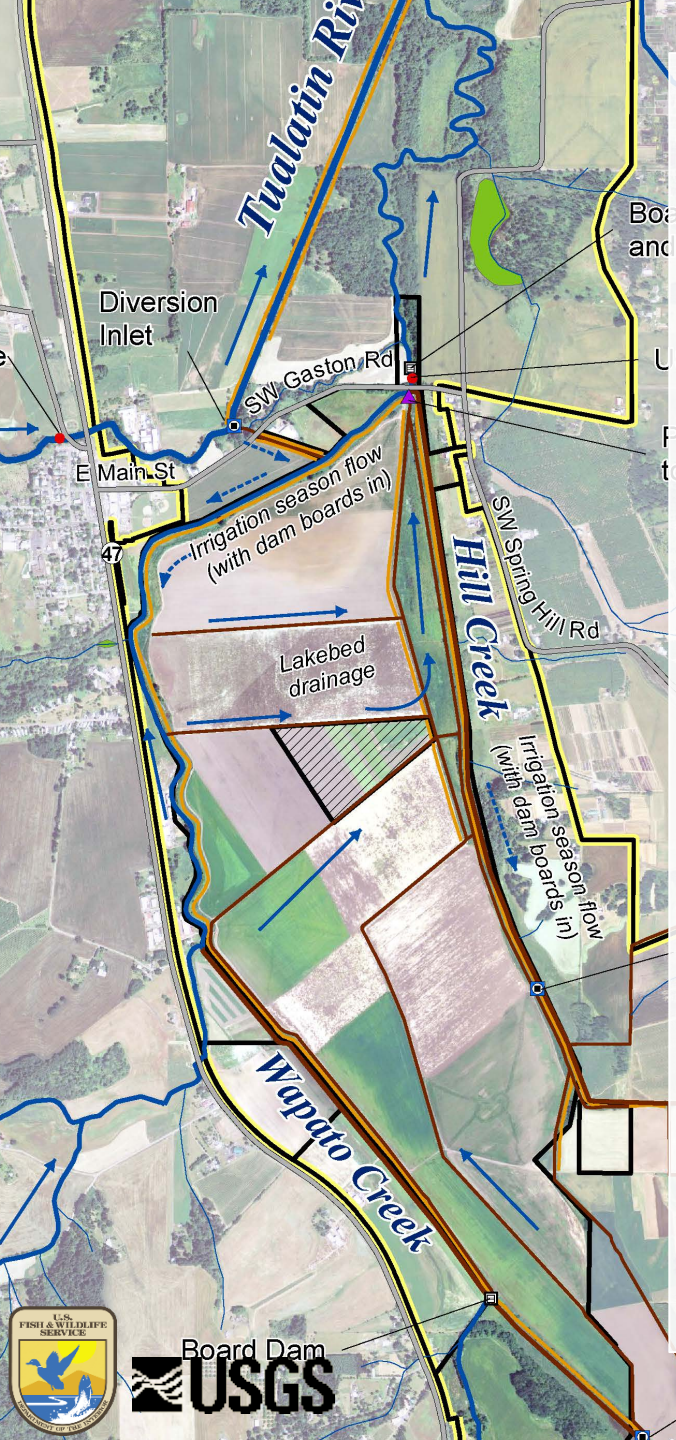
Flow Modeling in Wapato Creek

Goal: Evaluate a restoration scenario where an open downstream connection exists between Wapato Lake and Wapato Creek.

Problem: River and creek levels rise and fall, affecting the rate of exchange between lake and creek.

Consequence: Water level fluctuation and water depths unknown for an important scenario.

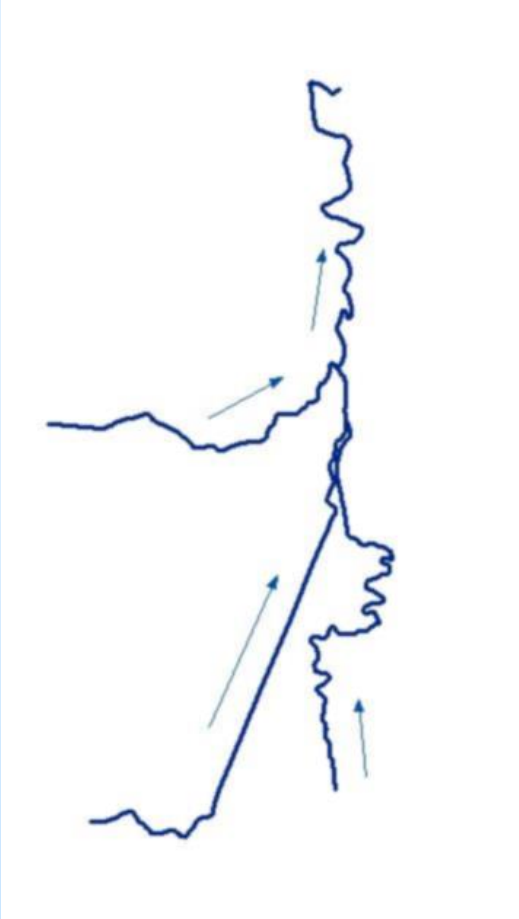
Solution: Use a hydraulic model to simulate an open connection between Wapato Lake and Wapato Creek and compute the amount of water exchanged between the lake and the creek on a daily basis.



map from USFWS

HEC-RAS Model

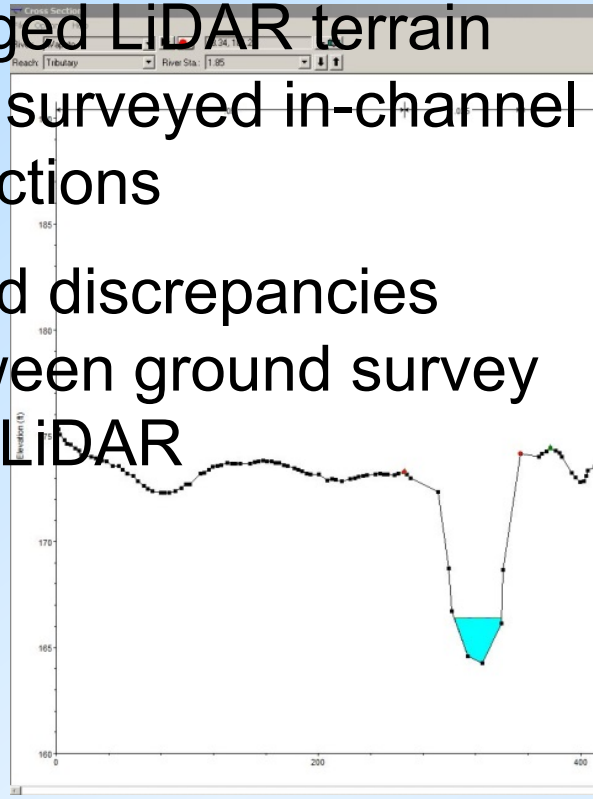
- Developed by U.S. Army Corps of Engineers – public domain
- Hydrologic Engineering Center – River Analysis System
- 1-D hydraulic model
- Unsteady flow (non-constant velocity)
- Numerically solves Saint-Venant Equations for unsteady gradually varied flow

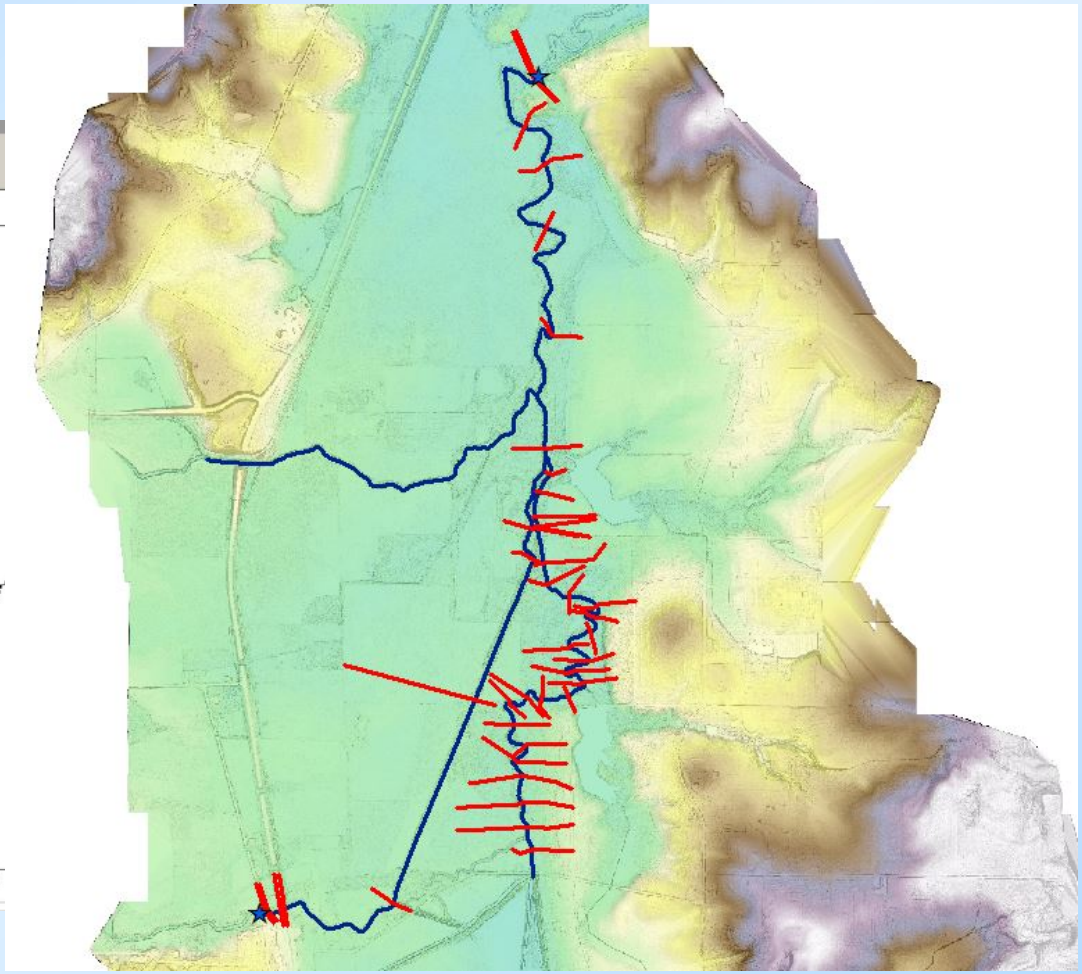


HEC-RAS Model Inputs

Channel Cross-Sections

- Merged LiDAR terrain with surveyed in-channel x-sections
- Fixed discrepancies between ground survey and LiDAR





images from USFWS

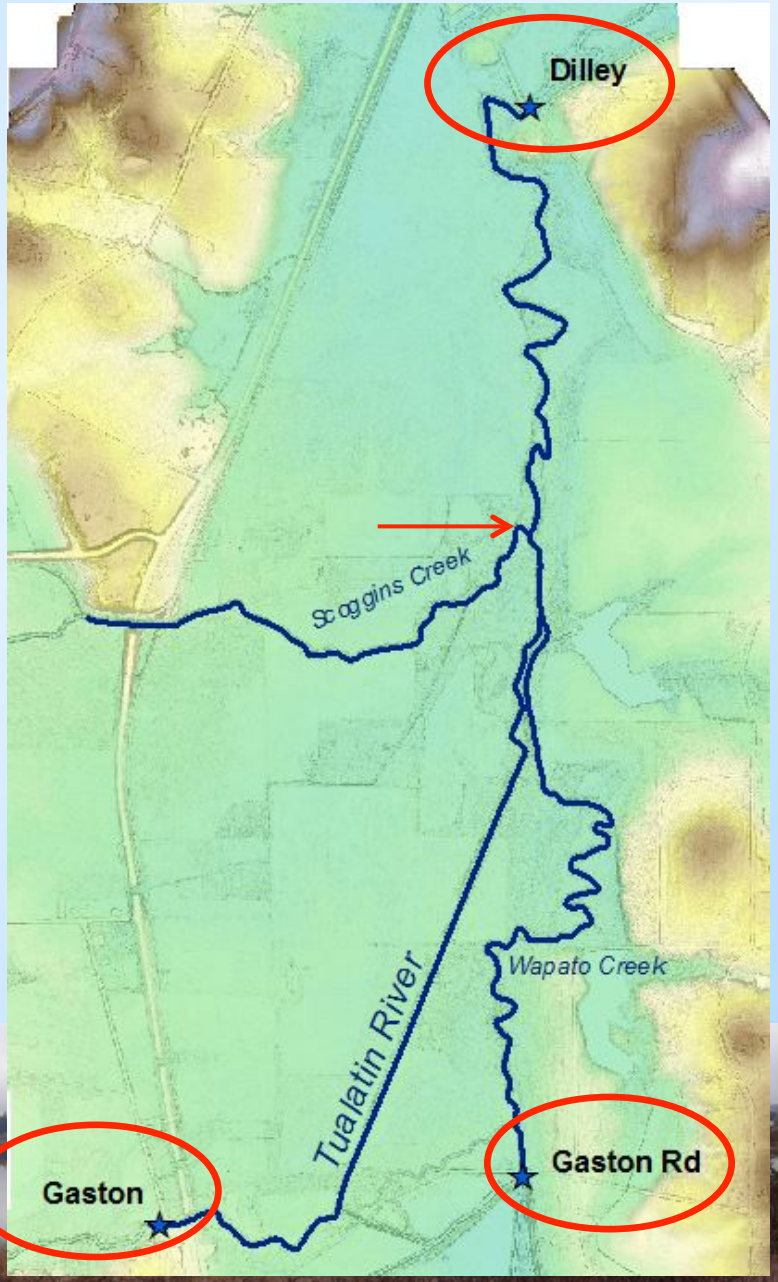
HEC-RAS Model Inputs

Boundary Conditions

- Upstream
  - Flow at Gaston gage on Tualatin River
  - Flow at Gaston Rd gage on Wapato Creek
- Downstream
  - Stage at Dilley gage on Tualatin River
- Tributary
  - Scoggins Creek modeled as lateral input at RM 1.47

Roughness

- Understanding of channel and overbank conditions – frictional losses



map from USFWS

Expected Results of Model

- Simulate interaction of lake and creek/river system in a free-flowing connection
- Help determine usable weir heights if a weir connection is used instead of an open connection
- Determine flood effects on nearby properties, if any

photos from USFWS

Moving Forward

- Public outreach – ongoing
- HEC – RAS modeling - Summer 2015
- Development/Evaluation of restoration alternatives – Summer – Fall 2015
- Draft EA– Fall 2015 -Winter 2016
- Waterfowl hunt plan

Thank You!
Questions?

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

USGS
science for a changing world

Joint Water Commission

Clean Water Services

DUCKS UNLIMITED

Greyhounds

City of Gaston