Jackson-Frazier Wetland
Phase 1: Long Term Habitat Restoration Project

April 2017- Northwestern Property Boundary

Increase and preserve the diversity, functions, and values within the high priority

Jackson-Frazier Wetland conservation area

Acknowledgements

The protection of Jackson-Frazier for future generations to experience the rare native wetland habitat in the Willamette Valley, is due in large part to Dr. Robert E. Frenkel. Bob passed away on February 20th, 2017. His obituary in the Corvallis Gazette-Times captures how important he was in the conservation of Jackson-Frazier Wetland:

"His fight to protect the Jackson-Frazier Wetland north of Corvallis in Benton County was a notable achievement. The county honored Bob by dedicating the wetland's boardwalk — which Bob planned, raised money for and even helped build — as the "Bob Frenkel Boardwalk" in 2005."

The Division of State Lands, in response to prior landowner impacts to the wetland, funded development of a comprehensive documentation of the wetland and alterations that occurred in 1985. Thirty-one years after the study, this report was vital for informing project objectives and emphasized the importance for solid records that can be helpful decades after their completion.

The Jackson-Frazier Wetland Advisory Committee members, including Dr. Bob Frenkel and many other local and regional conservation and environmental professionals and advocates, led to the development of the management plan that helps guide management to this day. All of their suggestions, and supporting university research efforts guided project work.

During 2017 Phase 1 Technical Team members provided diverse experience and perspective on restoration of wetland resources. Their volunteer support through the meeting discussions and review of project report work to achieve the project vision and goals is much appreciated.

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Executive Summary

Jackson-Frazier wetland is a valuable natural resource for Benton County; it has become a popular natural site for Benton County residents, and if efforts are made to increase on-site water storage capacity and improve/restore the natural hydrology and habitat of the site, the functions in moderating flooding may also be enhanced.

Prior to Benton County ownership of the wetland, significant impacts were made to the resource in an effort to improve farming/development at the site. Since Benton County began managing the site, public access has been enhanced, efforts have been made to encourage natural vegetation growth (including several endangered species), surveys have been conducted to assess plant and animal diversity, specific priority conservation areas have been identified and designated, and routine monitoring has been conducted to inform management. This technical report sets forth the plans for the next phases of site management while addressing the major historic issues at the site.

The report lists future management goals and objectives, describes specific actions and the rational for those actions, and establishes metrics of success to be used in future monitoring and adaptive management efforts. The three primary goals for ongoing site restoration are to:

1. Restore wetland hydrology through surface contouring, upland feature reduction, and increased soil saturation;

2. Restore vegetation diversity through woody plant reduction, invasive weed control, and native vegetation seeding;

3. Increase environmental education and outreach opportunities through habitat restoration demonstration areas, educational signage, and volunteer group stewardship work.

The specific objectives and actions to be used in achieving these goals are outlined for project implementation during Phase 2, and the rationale behind each of these actions is presented. Notes and considerations for each action for Phase 2 are also provided. A timetable for completion of the actions is set forth, and metrics for measuring and monitoring project success are presented.

Technical Team Overview

The Benton County Natural Areas & Parks Department (NAPD) Advisory Board and Board of Commissioners approved the formation of the Jackson-Frazier Wetland Technical Team in January 2017. The technical team members were selected by the NAPD natural resources coordinator with input provided by the project consultant and the NAPD director. Technical team members were selected based on their professional experience with: wetland restoration, management of parks/open space (including land adjacent to Jackson-Frazier), and their availability to provide their support during the Phase 1 project period.

Technical Team members were tasked with providing the following support:

- Share experience and, where possible, resources to support current and future work phases;
- Review and provide guidance on the project scope of work including vision, goals, and objectives;
- Review and provide input on work completed by county staff and project consultant leading to large scale wetland restoration at Jackson-Frazier Wetland.

Technical Team Members (Phase 1)

Name	Organization	Current Position
Adam Stebbins	Benton County Natural Areas & Parks	Natural Resources Coordinator
Jared Jebousek	United States Fish & Wildlife, Partners for Fish and Wildlife Program	Fish & Wildlife Biologist
Jeff Baker	Greenbelt Land Trust	Stewardship Manager
Jude Geist	City of Corvallis Parks and Recreation	Parks Operations Supervisor
Ray Fiori	RTF Consulting	Wetland Consultant
Donna Schmitz	Benton Soil & Water Conservation District	Resource Conservationist
Mary Santelmann	Oregon State (Ex Officio Review of Final Report)	OSU Water Resources Program Director, wetlands scientist

Project Background

Over the past 25 years, the Jackson-Frazier Wetland has been owned by Benton County and managed by Benton County Natural Areas & Parks. During the last quarter century, the original mission of this highly popular natural area has endured:

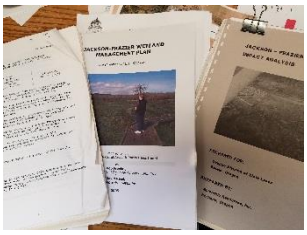
The wetland will serve as a model for natural area protection, restoration, and management, including research, application of different management implementation, experimentation, and monitoring (Jackson Frazier Wetland Management Plan Refinement, 2005).

Many major accomplishments have occurred to fulfill the Jackson-Frazier Wetland mission, including:

- Providing permanent protection of the resource;
- Leading and supporting plant and animal surveys;
- Enhancing native species including several rare species;
- Designating priority conservation areas and associated restoration techniques;
- Completing routine monitoring to inform adaptive management approaches.

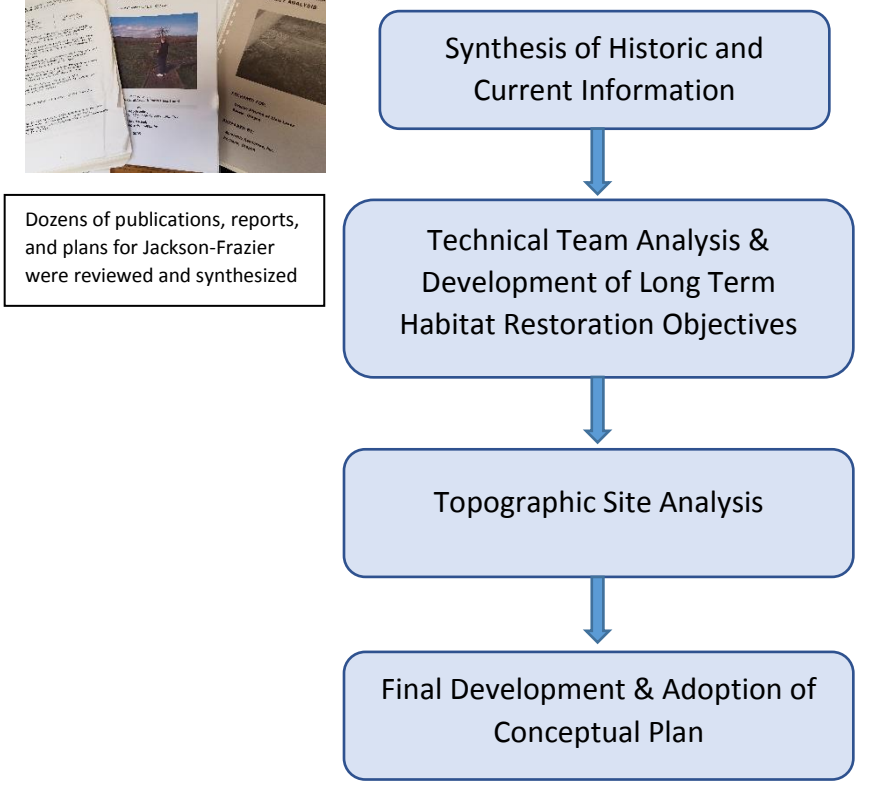
Starting in 2015, Benton County Natural Areas & Parks staff began discussions with the volunteer-citizen advisory board on the historic landscape level impacts proposed for restoration work. The Benton County Natural Areas & Parks Board, in addition to the Board of Commissioners, were provided public presentations by parks staff that summarized current site limitations and a proposed process for addressing these issues with the goal of increasing significant wetland functions and values (see **Appendix B**- Project Approval Presentation). Unanimous support was given by the boards, and parks staff began implementation of the Phase 1 Jackson-Frazier Long Term Habitat Restoration Plan.

Phase 1 focuses on key habitat information developed and collected at Jackson-Frazier Wetland starting in 1986 until the present. The wealth of information developed through university research, agency investigations, county management, and other sources provides many details on site characteristics to inform conceptual plan development. In addition, a Technical Team was called together and facilitated by the Benton County Natural Resources Coordinator to provide a substantial and diverse amount of professional experience regarding wetland management and restoration. Figure 1 shows the Phase 1 project workflow process leading to the development of a conceptual plan for major restoration of the wetland.



Dozens of publications, reports, and plans for Jackson-Frazier were reviewed and synthesized

Figure 1. *Phase 1 Project Workflow*



Phase 1 Technical Team Field Trip to Jackson-Frazier Wetland (3/17/17)

After Phase 1 project completion, staff and partners will begin implementation of the conceptual plan leading to large scale habitat work within the priority wetland restoration area (Phase 2).

Project Vision

The Technical Team developed guidance on the desired future state of the Jackson-Frazier Wetland priority habitat area (see **Management Background**). The following vision statement was adopted by the Technical Team to guide and inspire work:

Increase and preserve the diversity, functions, and values within the high priority Jackson-Frazier Wetland conservation area

In order to accomplish the project vision, a phased approach was taken, starting with the Phase 1 conceptual plan development and adoption. Phase 2 will be the implementation of all Phase 1 goals and objectives, focused on large scale alteration of the wetland landscape to restore and preserve wetland features.

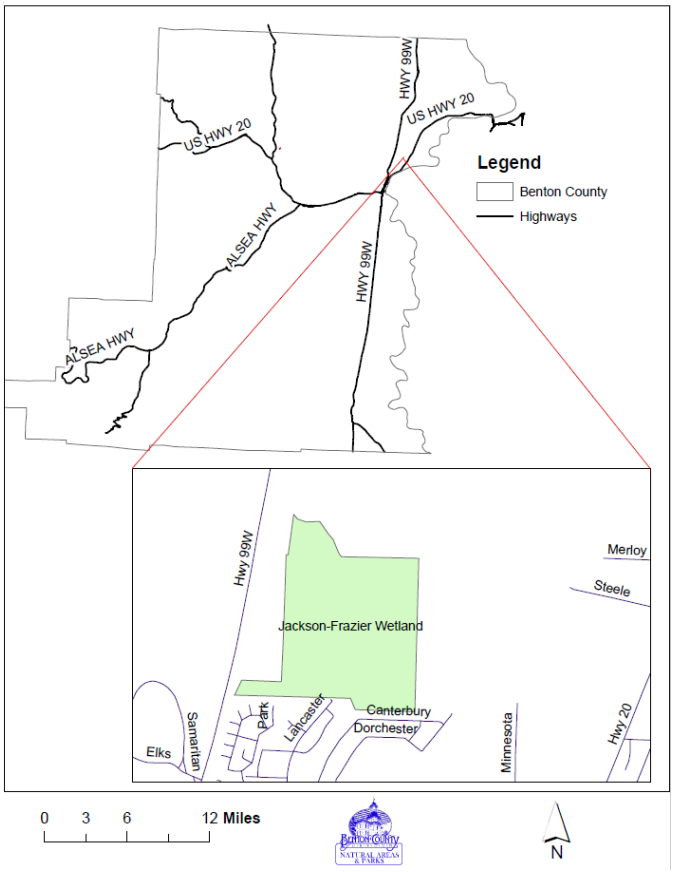
Site Description

The Jackson-Frazier Wetland Management Plan (updated 2005), and the Benton County Habitat Conservation Plan (2010) provide extensive natural resources information for the site. Key site characteristics that directly support restoration plan development are summarized to provide reference for understanding Phase 1 plan goals and objectives.

Location

Jackson-Frazier Wetland is located northeast of Corvallis, immediately outside the Corvallis Urban Growth Boundary at the north end of Lancaster Street (**Figure 2**). The natural area managed by the County now encompasses 144.5 acres. Of this, 131.68 acres are wetland and approximately 14 acres are upland (non-wetland) that were farmed until the county acquired ownership.

Figure 2. Site Location



Hydrology

Analysis of 1936-2014 aerial photography (**Figures 3-6**), shows a fine pattern of drainage furrows and a recently excavated ditch connecting with Stewart Slough that drains the wetland to the southeast. Prior to this major ditching, the wetland drained northeasterly into Frazier Creek Ditch (Scientific Resources, 1986). Both Stewart Slough and Frazier Creek Ditch flow into the Willamette River (**Figure 7**). Historically, the wetland contained no human made ponds although two shallow depressions were excavated as duck ponds during the 1930s and 1950s. In 1985, wetland drainage was deliberately, although superficially, altered by the landowner, this damage was later assessed by Scientific Resources, Inc. (see **Management Background**). The confluence of Jackson and Frazier Creeks is north and west of the County-owned wetland, located in the northeast part of Owens Farmn (property owned by the City of Corvallis and The Greenbelt Land Trust, Inc.) west of Highway 99W. Discharge into and out of the wetland was measured by Buffkin (1985) from November 1983 to February 1984 as part of the Impact Study authorized by DSL after site impacts occurred (see **Site Impacts**). Buffkin observed up to 180 CFS inflow and up to 95 CFS outflow, and determined there was minimal water retention in the wetland during saturated conditions (Scientific Resources, 1986). Historic and current drainages are visible on LIDAR derived 'bare earth' imagery showing the site landform (see **Figure 8**).

Figure 3. *Jackson-Frazier 1936 Aerial Imagery*

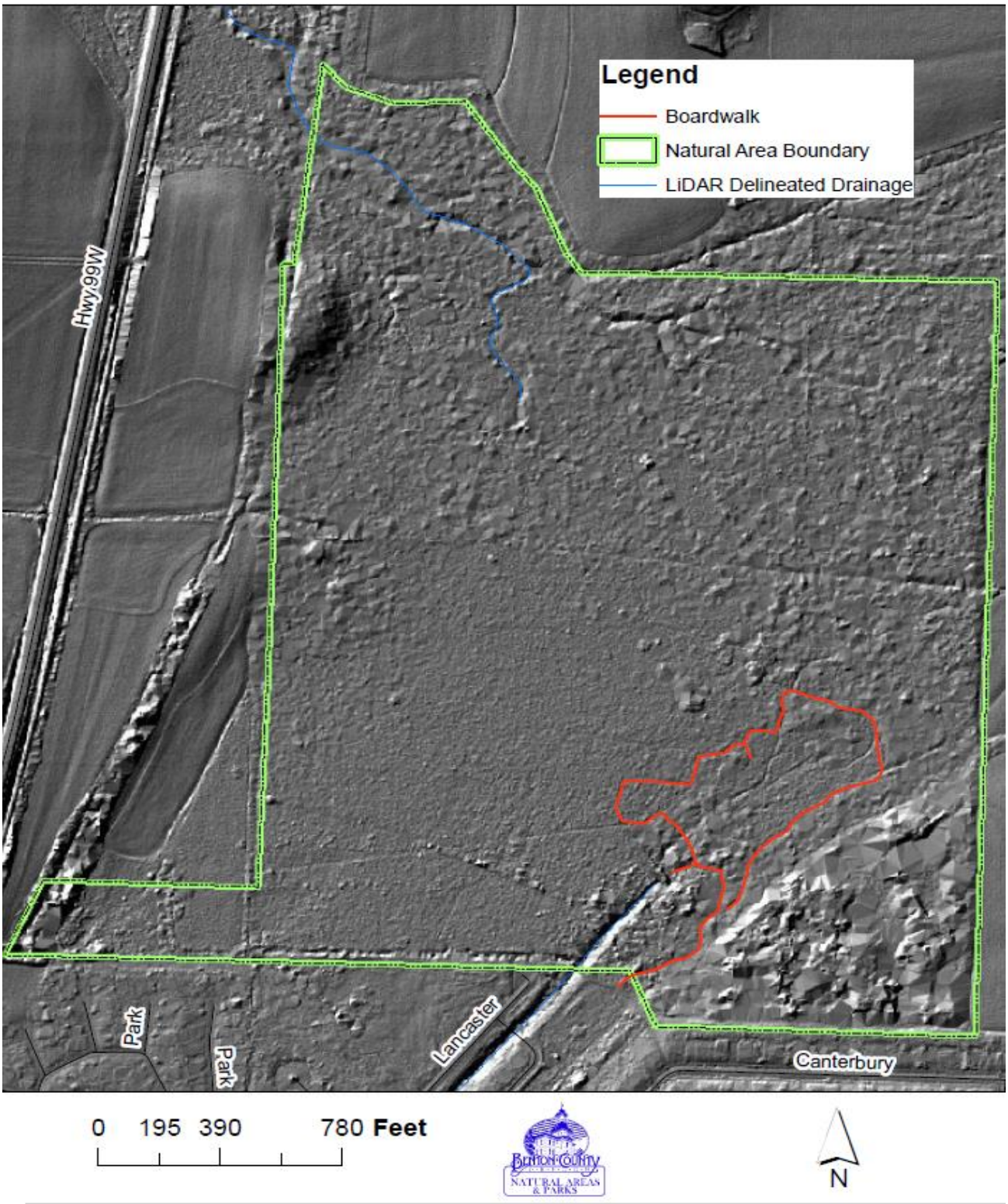
Figure 4. *Jackson-Frazier 1944 Aerial Imagery*

Figure 5. *Jackson-Frazier 1954 Aerial Imagery*

Figure 6. *Jackson-Frazier 1969 Aerial Imagery*

Figure 7. *Jackson-Frazier 2015 Aerial Imagery*

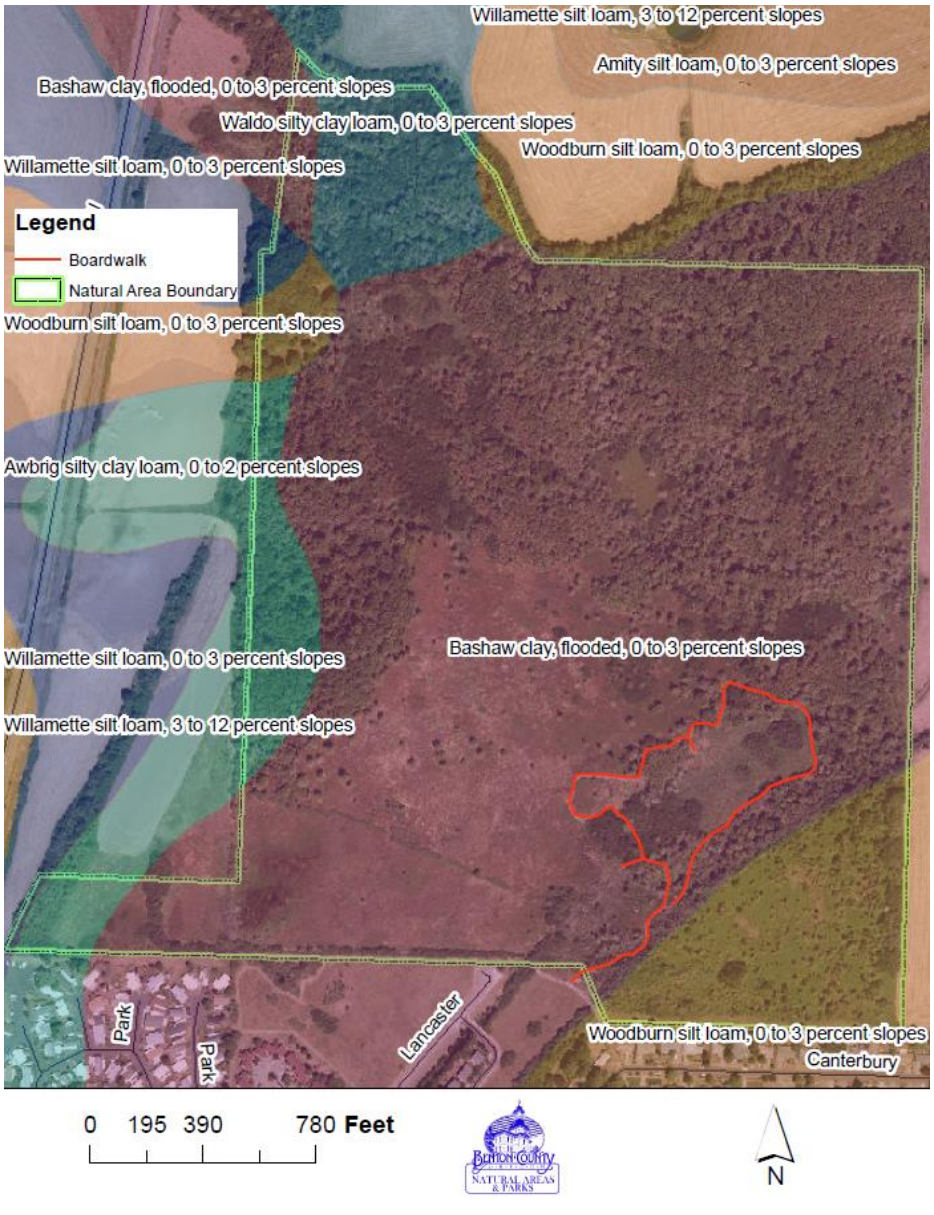
***Figure 8**. Jackson-Frazier Wetland Surface Reinforced Drainage & Bare Earth (2013 LIDAR)*



Soils

The Benton County Area Soil Survey (Knezevich, 1975, revised 2000) identifies four major soil series in the wetland area: Awbrig silty clay loam (Aw-5.1%), Waldo silty clay loam (Wa–5.8%), Bashaw clay (Bc–77.5%), , and Woodburn silt loam (WoA–10.5%). The first three are hydric soils developed under a deficit of soil oxygen, conducive to high quality wetland habitat and the Woodburn soil is an upland soil. Bashaw clay and Waldo silty clay are the most prominent, and the Waldo soil is found primarily in association with inflowing streams and tall ash trees that are thriving within the forested wetland habitat areas (Scientific Resources, 1986; NRCS).

Figure 9. *Jackson-Frazier Soils Map (source: NRCS)*



Wetland Types

The National Wetland Inventory provides wetland types employing the Cowardin classification based on hydrology, substrate, and vegetation (Cowardin et al. 1979). There are four Cowardin wetland types in the Jackson-Frazier wetland: PEMC Palustrine Emergent Seasonally Flooded; PEMF Palustrine Emergent Semi-permanently Flooded; PSSC Palustrine Shrub/Scrub Seasonally Flooded; and PFOC Palustrine Forested Seasonally Flooded. The wetland was delineated as a jurisdictional wetland in 1986 (Scientific Resources Inc. 1986). There are several habitat types that closely align with the wetland management areas, adopted as part of the Benton County Habitat Conservation Plan (see **Management Background**). The Oregon Rapid Wetland Assessment Protocol (ORWAP) report and map developed for the site shows significant wetland functions and values (**Appendix C**). The location of the wetland within the Jackson-Frazier watershed, provides several current and long term benefits to water quality, flood storage, and habitat. The Jackson-Frazier watershed will continue to experience development of open space, leading to increased importance on coordinating to reduce impacts to and increase enhancement of Jackson-Frazier Wetland.

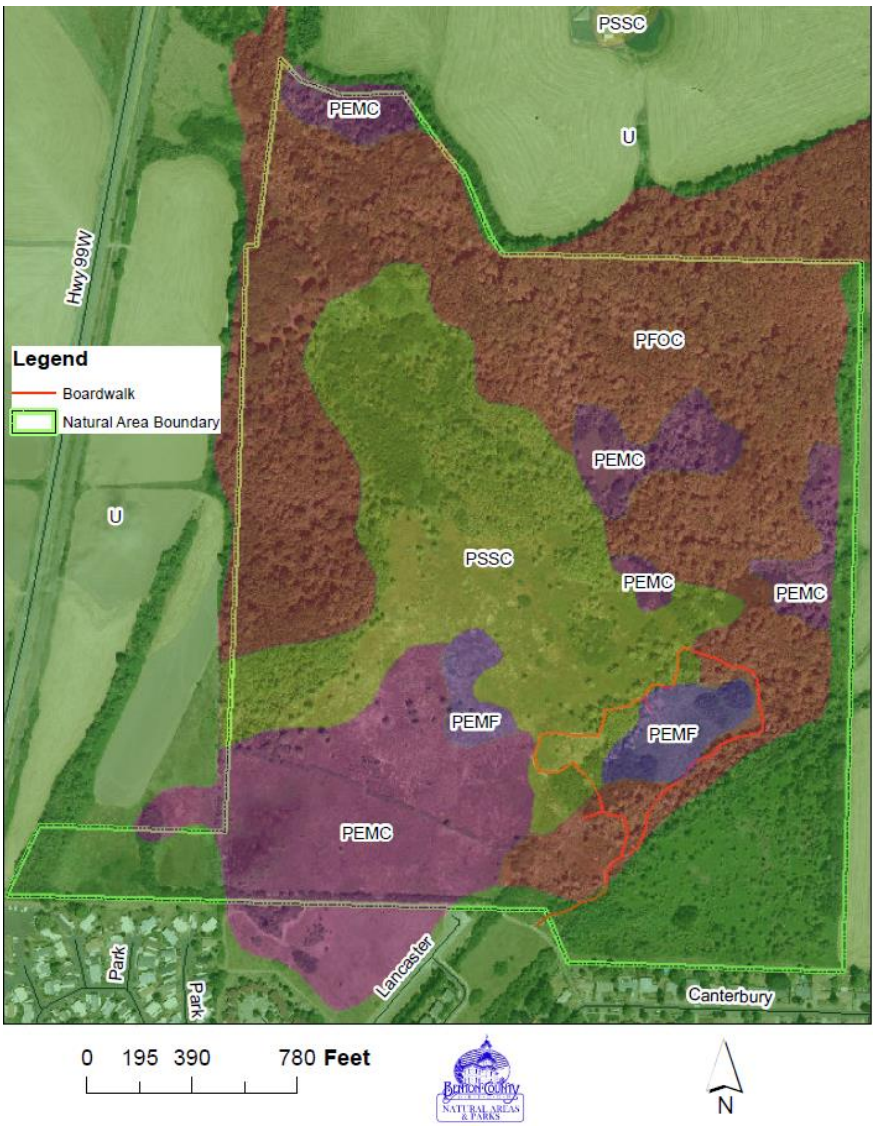


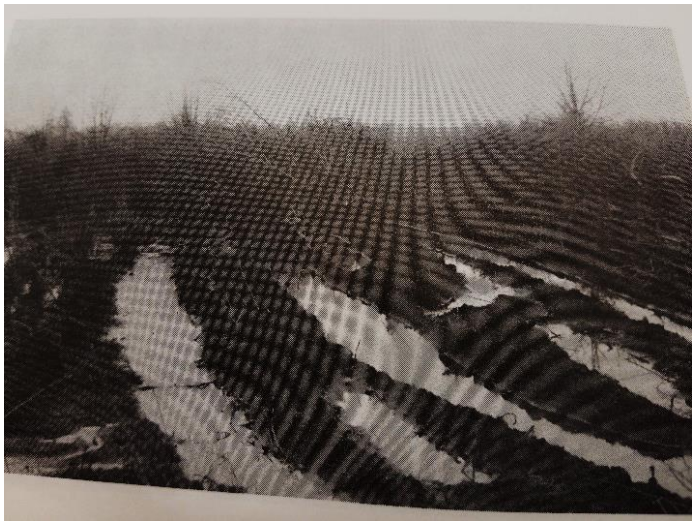
Figure 10. *Jackson-Frazier Cowardin Wetland Classifications*

Site History

Interpretive sign at Jackson-Frazier, showing Kalapuya burning of prairie habitat

In the 1830s the 'Jackson-Frazier tract' was part of a vast wet prairie maintained by frequent Native American burning by the Kalapuya Tribe, which occupied the central Willamette Valley, subsisted mainly on plant foods including tarweed and grass seeds as well as camas and onion bulbs, foods favored by periodic burning (Boyd, 1986). Through several early settlement ownerships, the wetland was never planted or intensively farmed because of poorly drained, heavy soils; nonetheless, the area was harvested for "rough" native hay and heavily grazed until the early 1960s (Management Plan, 2005). Waterfowl were hunted in the parcel and two shallow duck ponds created in the 1930s (Management Plan, 1992). In the 1960s, Jackson-Frazier wetland ownership passed to a speculative owner, grazing stopped, and the owner unsuccessfully petitioned the County to zone the property for industrial use. Initially the land was zoned Urban Residential (UR -1), rezoned in 1974 to Urban Residential (UR-3), rezoned again for Exclusive Farm Use (EFU) in 1979, and removed from the City planning area because of revised population projections (Benton County Ordinance 91-0083). By the late 1970s, the County Comprehensive Plan was under preparation.

Grazing occurred until from settlement until the 1960s, reducing encroachment of shrubs and trees into the wet prairie habitat



Detail of northwest corner of wetland, scraped by previous property owner in 1985 (Scientific Resources Inc. 1986)

Wetland ownership passed to the Marshall Land Company in June 1984. In November 1985, the owner cleared the property by scraping approximately 13 acres and developed/deepened several ditches without appropriate permits from the County, state, or federal government. After an impact analysis was conducted for the Division of State Lands (DSL) (Scientific Resources Inc. 1986), the DSL served the owner with a Restoration Order. Sometime after 1986, the principal owner moved away from the area without paying property taxes; however, Benton County was still required, under LCDC order, to protect the Goal 5 resource and the "segmented" County Comprehensive Plan remained in non-compliance. Finally on October 22, 1990, Benton County foreclosed on the wetland owner for failure to pay taxes and Benton County assumed title. County Community Development Department then revised the ESEE analysis and rezoned 131 acres as Open Space, and placed the entire delineated 147-acre wetland in a Wetland Overlay Zone in February 1991. These steps completed the LCDC

obligation to protect the wetland and fulfilled Oregon's land use program requirements (Management Plan, 2005).

Management Background

Major Site Alterations

1954 aerial imagery of Jackson-Frazier Wetland area showing ditch system and southeast drainage patterns that were developed starting in the 1930's

Prior to the 1920s, the wetland drained northeast by what has become known as Frazier Creek Ditch. Originally, there was no well-developed drainage to the south. That changed in the 1930s when a major ditch connecting southward to Stewart Slough was excavated, providing the wetland with the two major drainages existing today (see Figure 8). Grazing occurred after settlement, providing disturbance that reduced shrub and tree encroachment into the priority wetland restoration area/emergent wetland habitat (Management Plan, 2005). The City of Corvallis developed the East-West ditch on the southern property boundary to allow for increased drainage of Highway 99. There are no major documented alterations to the wetland property as it currently exists, until 1985. In 1985, the property owner used heavy equipment (likely a bullozer similar to Caterpillar Model D8) (Scientific Resources, 1986), to create extensive impacts within the current open wet prairie habitat. Division of State Lands funded Scientific Resources to complete a thorough study of the site after the impacts occurred, providing detailed documentation of impacts from clearing, ditching, and grading of southern portion of the site. It also described and mapped the Jackson-Frazier Wetland drainage system and delineated the wetland in accordance with Division of State Lands standards. The majority of the documented impacts occurred within the lower portion of the priority restoration area and resulted in preventing surface water from flowing into a 'vernal pond' in the southeast portion of the park by up to half, combined with increased dewatering of soils. These alterations have continued to contribute to the loss of the palustrine emergent/depressional wetland features and increased transition to upland and shrub dominated wetland habitat as duration of soil saturation is reduced. Flow monitoring was completed at locations where ditches were recently excavated by the prior property owner (see **Figure 11**. Surface Drainage after 1986 Wetland Impacts). Consultant work determined that the three east-west ditches created (Ditch C, D, and E) interrupted, channeled, and dispersed southerly surface flow, accelerating the movement of water out of the wetland (Scientific Resources, 1986 pg. 8). The ditches and scraping also resulted in the dewatering of the 'vernal pond' (i.e. emergent wetland) area historically present and providing diverse habitat values for wildlife.

Figure 11. *Surface Drainage after 1986 Wetland Impacts (Scientific Resources, 1986)*

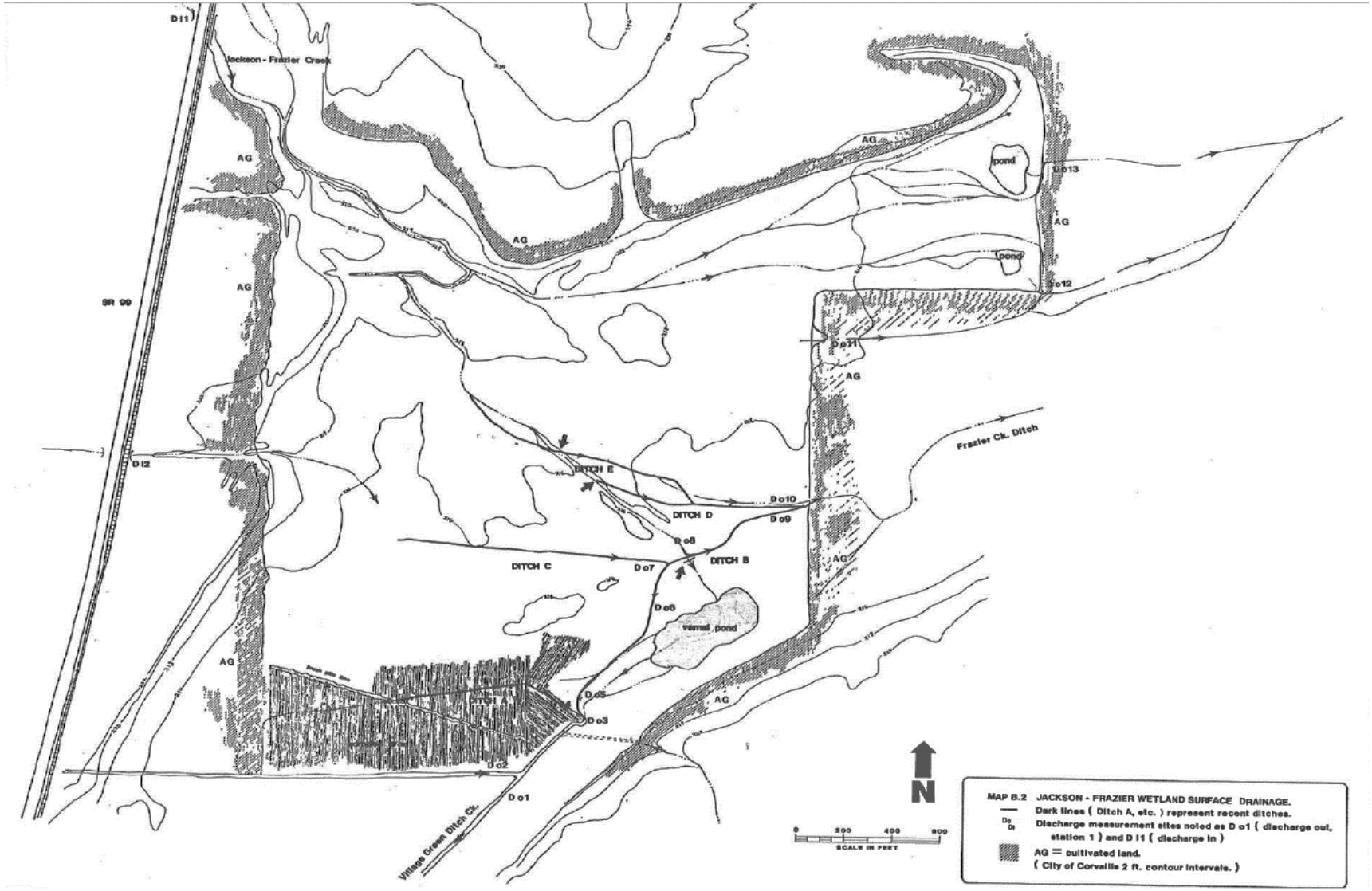


Figure 12. *Aerial image (facing west) captured after prior owner site impacts (Scientific Resources, 1985)*

Figure 13. *Berm created by prior property owner overgrown with rose (2015)*

Figure 14. Rut and furrow system created by prior property owner- present condition

Four major ditches were documented to occur during these major site alterations, to increase draining of historic 'vernal pond'. The majority of these major ditches still exist on the site, with 'Ditch B' (see **Figure 11**) providing the majority of flow conveyance offsite. In addition to documenting site impacts, the study also provides inflow and outflow data for Jackson-Frazier Creek, Frazier Ditch, and Village Green Ditch (currently known as Village Green Creek).

In summary, the major alterations to the wetland by the prior property owner that remain to the current day include:

1. Ditch system that increases surface water runoff from site, leading to reduced floodwater storage and reduced soil saturation during growing season;
2. An approximately quarter-mile earthen berm was constructed that spans the lower section of the main wetland prairie conservation area, significantly altering wetland hydrology;
3. 'Rut and furrow' system within the current wetland prairie conservation area from past earthwork;
4. Increasing amount of highly invasive Reed Canary Grass due to limited disturbance and site impacts that threaten the native vegetation diversity of the wetland.

Benton County Management

In 1990, after major impacts to the site transpired, acquisition of the Jackson-Frazier Wetland property by Benton County occurred through foreclosure proceedings. Rezoning of the property to Open Space was completed by Benton County Development Department, to fulfill protection of the property as a 'Goal 5 Significant Resource' under the Benton County Comprehensive plan. Benton County Parks gained support of the Benton County Commissioners and Parks Advisory Board to develop a management plan as required as part of the Open Space zoning designation. In 1992, the Benton County Board of Commissioners established the Jackson-Frazier Wetland Advisory Task Force with the primary purpose of developing a management plan for the now designated Jackson-Frazier Wetland.

The 1992 management plan (updated in 2005) developed habitat management units (see **Figure 15**), using an 'integrated management option' with prioritized actions for implementing the management plan as follows:

- Public Use,
- Wetland Prairie,
- Upland, and
- Mixed Wetland Forest-Shrub.

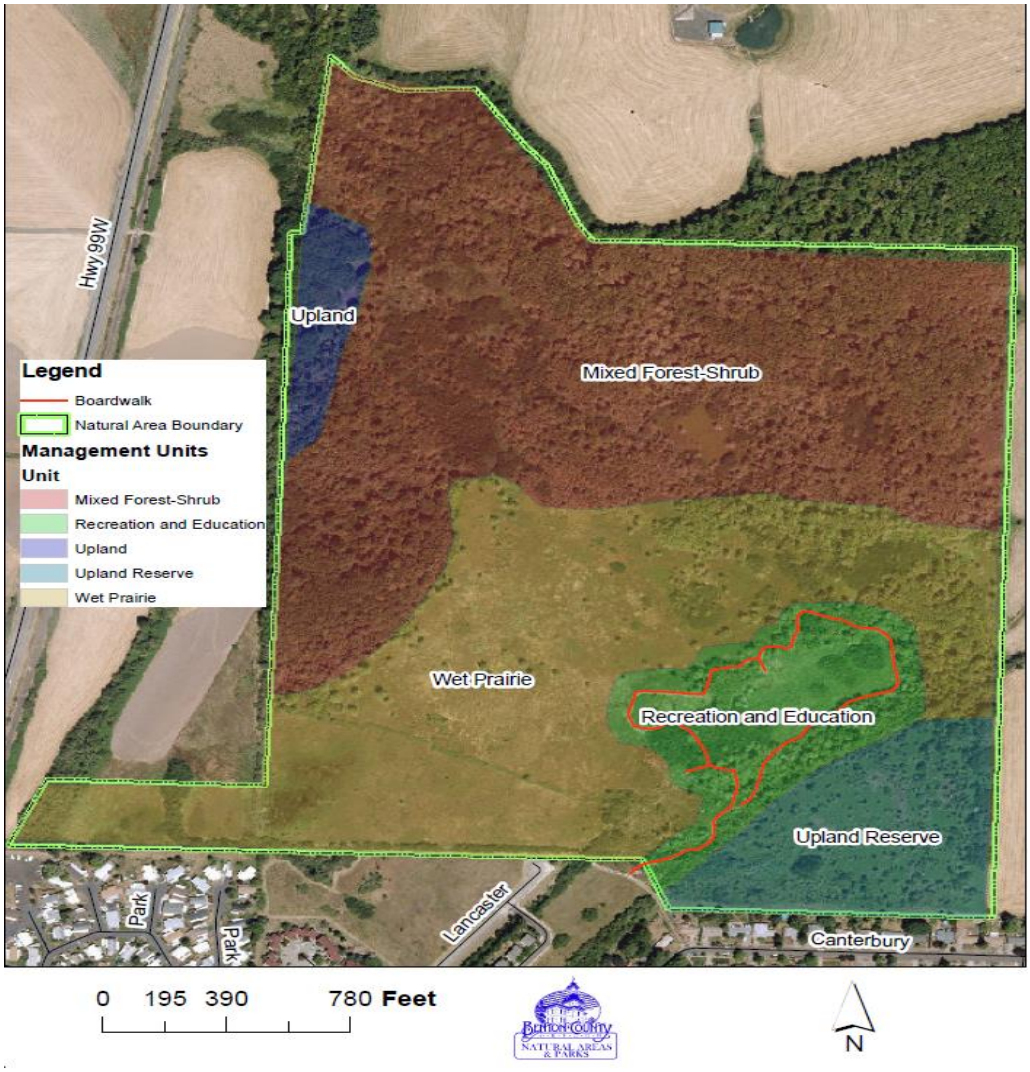
Criteria for priority work includes a degree of public use, resource sensitivity, difficulty of implementing action, and probability of success (JF Management Plan, 2005 update). The major management policy goal of Restoration placed priority on: "Where technically and economically feasible, restore damaged or degraded wetland resources to an historically documented state prevailing at Euro-American settlement time using the least intrusive methods available and serving as a model project" (pg. 34, JF Management Plan 2005 update).

Many of the 1992 management plan recommendations have been implemented, including:

- Construction of boardwalk and interpretive/educational signage,
- Mowing and removal of shrub and trees from prairie habitat,
- Control of invasive species, and
- Controlled burning

In 2004 Benton County entered into an agreement with the U.S. Fish and Wildlife Service to participate in the Oregon Partners for Fish and Wildlife Program. This agreement covered a 10-year period with the purpose of restoring wetland resources in Jackson-Frazier Wetland (U.S. Fish and Wildlife Service, 2003). It is important to note that no landscape scale restoration work to address the major site alterations from the prior property owner, has occurred since adoption of the management plan.

Figure 15. *Jackson-Frazier Wetland Management Plan- Habitat Management Units*



Habitat Conservation Plan

The Benton County Prairie Species Habitat Conservation Plan (HCP) was initiated to bring Benton County's activities on its own lands into compliance with the Federal and State Endangered Species Acts (HCP 2010, pg. i). The HCP was adopted in 2010, with implementation starting in 2011 for designated 'Prairie Conservation Areas'. A Conservation Measure under the HCP is the designation of over 500 acres of Prairie Conservation Areas: lands within the County to be managed specifically for prairie and covered species conservation, and where habitat restoration activities may occur (HCP 2010, pg. 35). During 2011 baseline data on vegetation (native, threatened/endangered, invasive) was collected. Effectiveness monitoring to determine vegetation trends was completed in 2014 as required under the HCP. Several trends for rare vegetation were documented as part of the monitoring as shown in Figure 15. Woody species encroachment within Priority restoration area (Wetland Prairie Conservation Area)

resulted in a 62% decrease in open wetland area. In addition, invasive Reed Canary Grass, primarily within the northern portion of the priority wetland restoration area has increased more than 30%. The priority restoration area (see Long Term Restoration), wetland prairie management unit (JF Management Plan, 2005), and the Prairie Conservation Area overlap as a priority area for implementing restoration actions. After grading work is completed, effectiveness monitoring (every 3 years) and additional required monitoring under the HCP will occur to provide long term data to evaluate trends of restoration work.

Figure 16. *Habitat Conservation Plan Monitoring Trends for Jackson-Frazier Wetland (2010-2014) Threatened/Endangered Species (ESA listed)*

Site	Kincaid's lupine (Leaf Area in m^2)			Bradshaw's lomatium (No. of plants)			Nelson's checkermallow (No. of plants)		
	2011	2014	Change	2011	2014	Change	2011	2014	Change
Jackson-Frazier Wetland	1.1 m^2	0.5 m^2	-0.6 m^2 (-54.5%)	213	66	-147 (-69.0%)	224	212	-12 (-5.4%)

Long Term Restoration

Phase 1 planning is focused on developing and implementing restoration work, which results in lasting restoration of priority wetland resources.

Goals

The following goals are based on the Project Vision developed and approved by the Technical Team for the priority wetland in order of restoration priority:

1. Restore wetland hydrology through surface contouring, upland feature reduction, and increased soil saturation
2. Restore vegetation diversity through woody plant reduction, invasive weed control, and native vegetation seeding.
3. Increase environmental education and outreach opportunities through habitat restoration demonstration areas, educational signage, and volunteer group stewardship work.

Restoration Plan Objectives

The following are proposed restoration concepts developed by the project leads with review and input provided by the technical team. Project leads spent several months during the wet and dry seasons completing field visits, reviewing historical information, and discussing ideas for long term wetland restoration with the technical team and other regional wetland

professionals. Concepts are categorized under hydrology, vegetation, and environmental education and outreach as follows:

Hydrology

1) Actions: Remove previously constructed berm from restoration area (**Figure 7**).
   a) Rationale: Berm is negatively affecting flow patterns across the site and should be completely removed.
   b) Notes: Disposal location is proposed to occur on adjacent upland property. Depending on disposal location, treating existing vegetation will be advantageous prior to removal to minimize regrowth. After removal, matching of adjacent topography through disking to break up soil compaction will be completed.

2) Actions: Grade areas of previous disturbance to eliminate rut/furrow system and disable surface ditching (**Figure 14**), with disking of formerly rutted and furrowed areas. Add subtle contours (swales and depressions).
   a) Rationale: Rutting created from berm construction and surface ditching as (documented in DSL violation report) has altered the hydro-period and created difficult conditions for management actions such as mowing.
   b) Rationale: Disking these areas will restore the natural hydrology, decrease woody species encroachment, and create a seed bed for additional planting to increase species diversity.
   c) Rationale: Finished contours with subtle undulations will create varying hydrology to support greater species diversity, and aid with long term management.
   d) Notes: If disking is deemed prohibitive due to cost or risk of increasing nonnative vegetation, it may also be feasible to selectively fill the rut areas with berm soil.

3) Actions: Create small depressional wetlands, focusing efforts in reed canary grass dominated areas (see **Figure 17**).
   a) Rationale: Creation of several depressional wetlands with maximum depths of 10”-18” would increase habitat complexity with an extended hydroperiod for amphibian and waterbird production, and diversify vegetation relative to adjacent hydrologic regimes.
   b) Rationale: Redistributing material within the restoration area to create hydrologic conditions ranging from inundation to increased surface saturation during the early growing season could increase vegetation diversity to support a more diverse set of pollinator species.
   c) Notes: Without a model or the specific details of the hydrologic modifications, the potential hydrologic impacts of specific actions cannot be predicted, however, removing material and placing it in nearby upland areas could increase flood storage and delay runoff. The results will vary depending on conditions of saturation and volume already being stored in the wetland prior to receiving new precipitation.

Vegetation

1) Actions: Eliminate reed canary grass and other non-native invasive species.
   a) Rationale: presence and increasing encroachment of this highly invasive species threatens both native plant diversity and degradation of existing wildlife habitat. Dense stands of reed canary grass also impede views and range of visibility within the wetland and may create a safety hazard for visitors.
   b) Notes: Control of established, perennial non-native invasive species such as reed canary grass to be initiated the year prior to any grading work.
   c) Notes: Challenges include controlling vegetation height in late spring to allow adequate re-growth for late summer treatment, as well as herbicide application with sufficient spray volume and minimal impacts to existing priority vegetation.
   d) Notes: Flash grazing with sheep could be utilized in late spring for controlling vegetation height, which could also be incorporated into the long-term management plan if applicable however it is likely cost prohibitive and deemed incompatible with public use.
   e) Notes: Utilizing low ground pressure skid steer mowers is also a viable option. Mowing would need to be accomplished in a way so as to effectively chop up and distribute organic matter.
2) Actions: Decrease woody vegetation.
   a) Rationale: Left uncontrolled, woody vegetation will eventually overgrow and eliminate the wet prairie, which is a rare plant community in the state and which contains many of the threatened and endangered species at the site. Woody vegetation can also pose a fire hazard during times of drought.
   b) Notes: Woody vegetation has continued to encroach into the restoration area since active management/ disturbance regime ceased, with a slight set back in ~2004 from mowing.
   c) Notes: Trees over 4” DBH will need to be removed by hand, excavator, or sheering and can be utilized to increase habitat complexity in areas without active management in the near term.
   d) Notes: Select larger trees will be retained for habitat complexity, if determined to be in an actively growing condition. All female Oregon ash trees will be removed to limit seed dispersal and decrease rate of transition from a wetland prairie habitat to forest wetland habitat.
   e) Notes: Smaller trees and shrubs will be selectively treated in the fall the year prior to full scale restoration work. As with reed canary grass, early implementation will be key for successful control and vegetation height will be managed to allow sufficient regrowth for herbicide application.
3) Actions: Increase plant diversity within the site.

a) Rationale: A policy goal for the site is to be a model of a rare and threatened vegetation type that was once prevalent in the Willamette Valley (Schwindt 2006, Highland et al 2015). Active efforts to plant and maintain native species may be required in areas that have been degraded over time by disturbance, hydrologic changes, and competition from invasive species (Taylor and Santelmann 2012)
b) Notes: Once above work is completed, diversity will be incorporated with native seed and a modified version of no-till planting.
c) Notes: Early plant lists will document what species were present and used to cross reference the species that are commercially available. Native species that are currently abundant will be omitted from future planting, except in any excavated areas.
d) Notes: The key to long term restoration and sustainability will be adequate funding for a minimum of two growing seasons following planting for spot control work to allow natives to fully establish (ideally 3-4 growing seasons).
e) Notes: Also, long term funding will be necessary to keep noxious weeds and woody vegetation at tolerable levels.

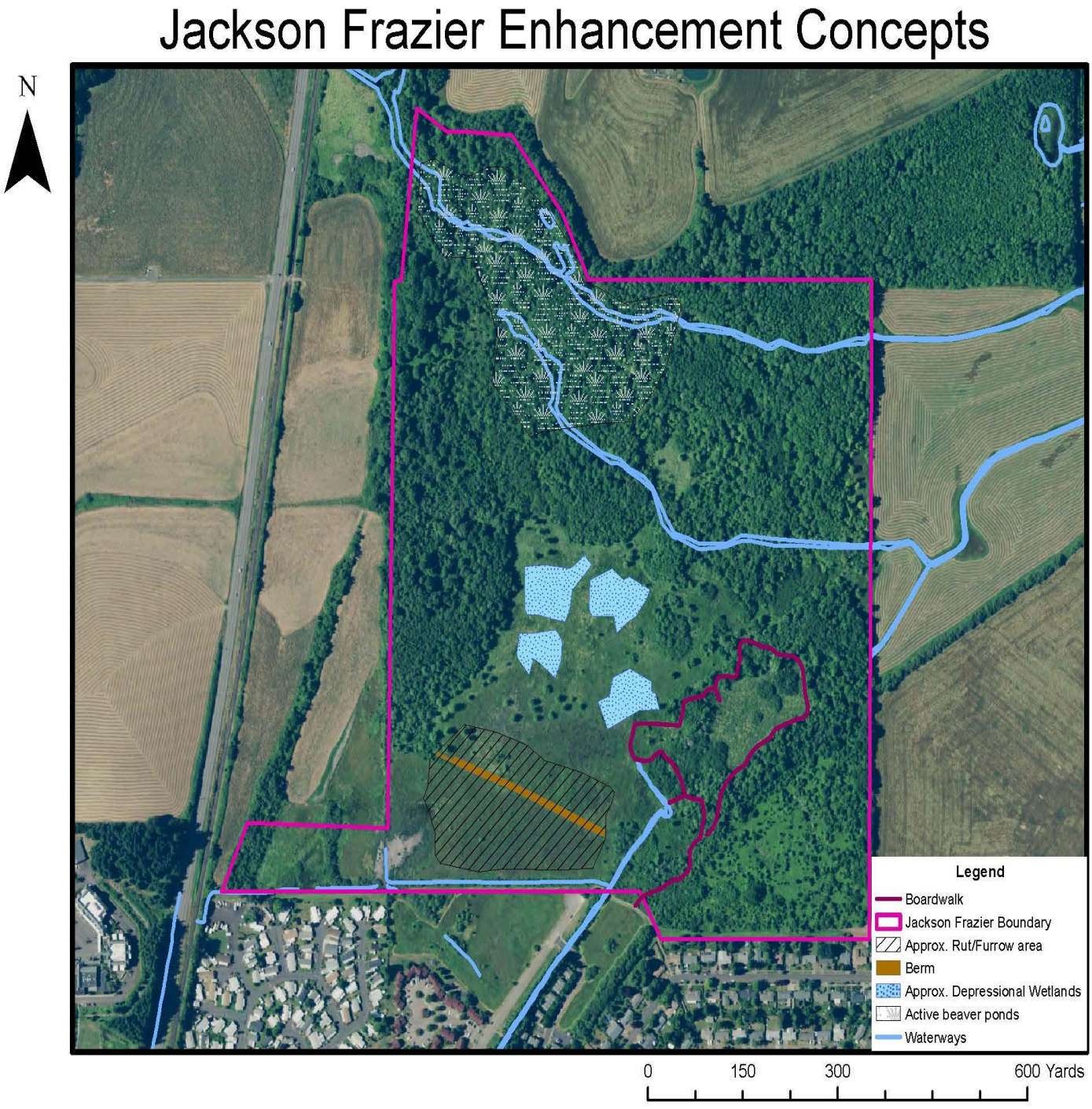
Environmental Education & Outreach

1) Actions: Construct at least one depressional wetland within proximity to boardwalk.
   a) Rationale: The location illustrated on the attached map, will greatly increase viewing opportunities with additional habitat diversity.
2) Actions: Increase plant diversity along boardwalk.
   a) Rationale: Currently the woody component along the boardwalk is dominated by native species, but the herbaceous layer consist of mostly reed canary grass. Visitor enjoyment of the diverse plant assemblages in the wetland will be enhanced if they can easily see these plant species, and the improved visibility and views in areas near the boardwalk will enhance the safety of visitor and their enjoyment of the wetland.
   b) Notes: With limited equipment access, canary grass control will be more challenging and likely take an additional growing season to control in addition to the priority restoration area.
   c) Notes: Once noxious weeds are under control, additional vegetative diversity will be incorporated by planting plugs in close proximity to the boardwalk and applying seed in the larger open areas with similar species composition as the restoration area.
   d) Notes: The above work will be an excellent opportunity for local volunteer groups to plant and manage, with professional crews controlling persistent species, such as reed canary grass which cannot be effectively hand pulled.
3) Actions: Control woody vegetation in strategic locations to demonstrate various wetland communities.
   a) Rationale: Some level of management will need to address woody growth close to the boardwalk and to allow viewing of other areas.

b) Notes: Currently, there are several representative areas of forested wetland and scrub/shrub wetland along the boardwalk scheduled for enhancement.
c) Notes: In combination with the addition of native wet prairie and emergent marsh components mentioned above, this area will have excellent educational value, illustrating the dominant Willamette Valley wetland types and species composition.

Figure 17. *Jackson-Frazier Enhancement Concepts Map* (see next page)

Figure 17. Jackson-Frazier Enhancement Concepts Map



Topographic Site Analysis

During July 10th and July 17th 2017, a topographic survey of Jackson-Frazier wetland to inform current and future management within the priority restoration area was completed. The detailed topographic survey provides 6 inch contour lines in restoration work areas, to help inform grading specifications for habitat restoration (see next page **Figures 18-20**). In conjunction with engineered project design drawings this survey also provides assurance that implementation of restoration objectives, will not adversely impact the resource or adjacent landowners. In addition, the analysis supports other identified goals such as the City of Corvallis Stormwater Master Plan (2007, Chapter 8) goal to develop flow monitoring information to accurately model the response of the wetland and discharging streams during storm events.

Figure 18. *Topographic Site Analysis Map (1 of 3)*

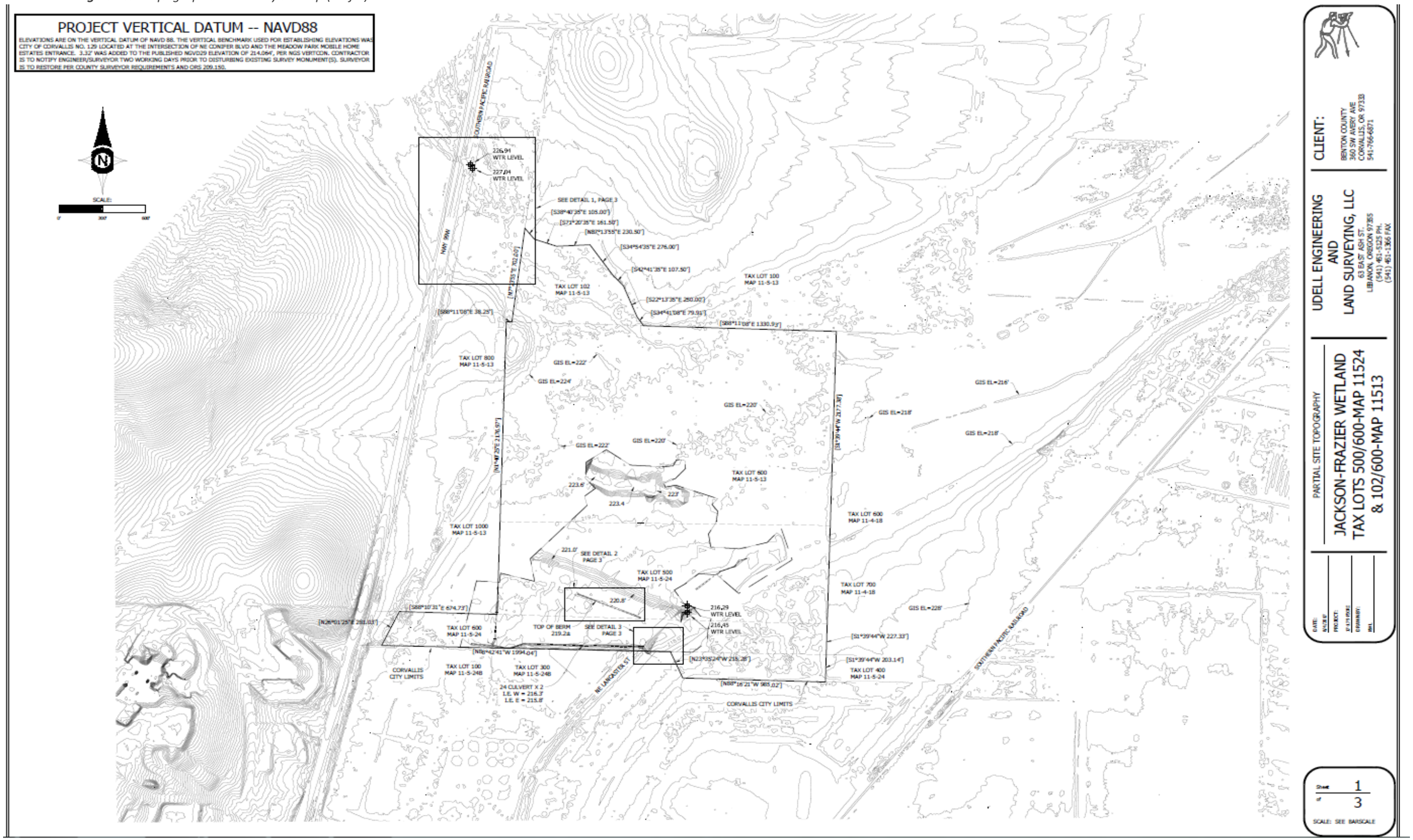


Figure 19. *Topographic Site Analysis Map (2 of 3)*

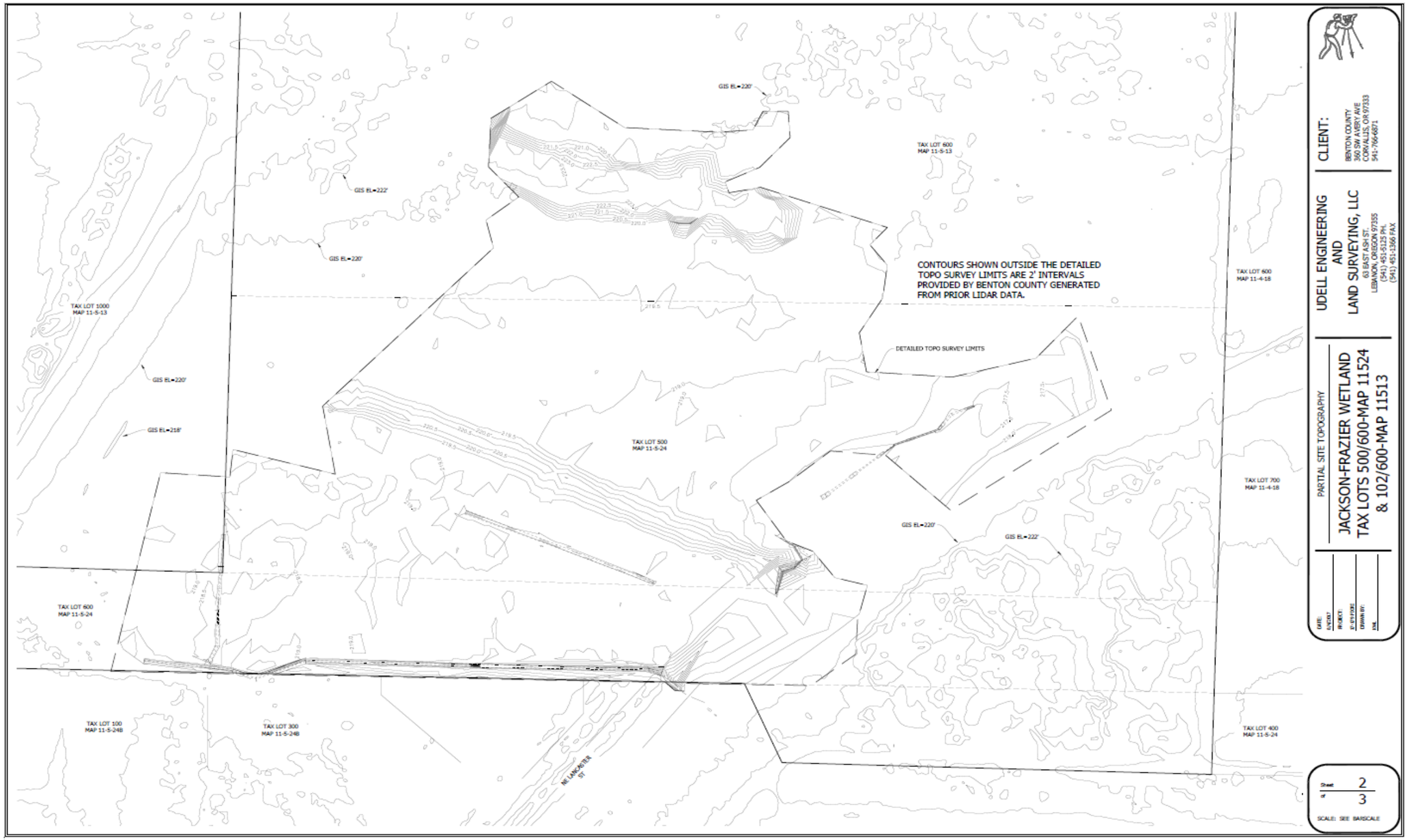
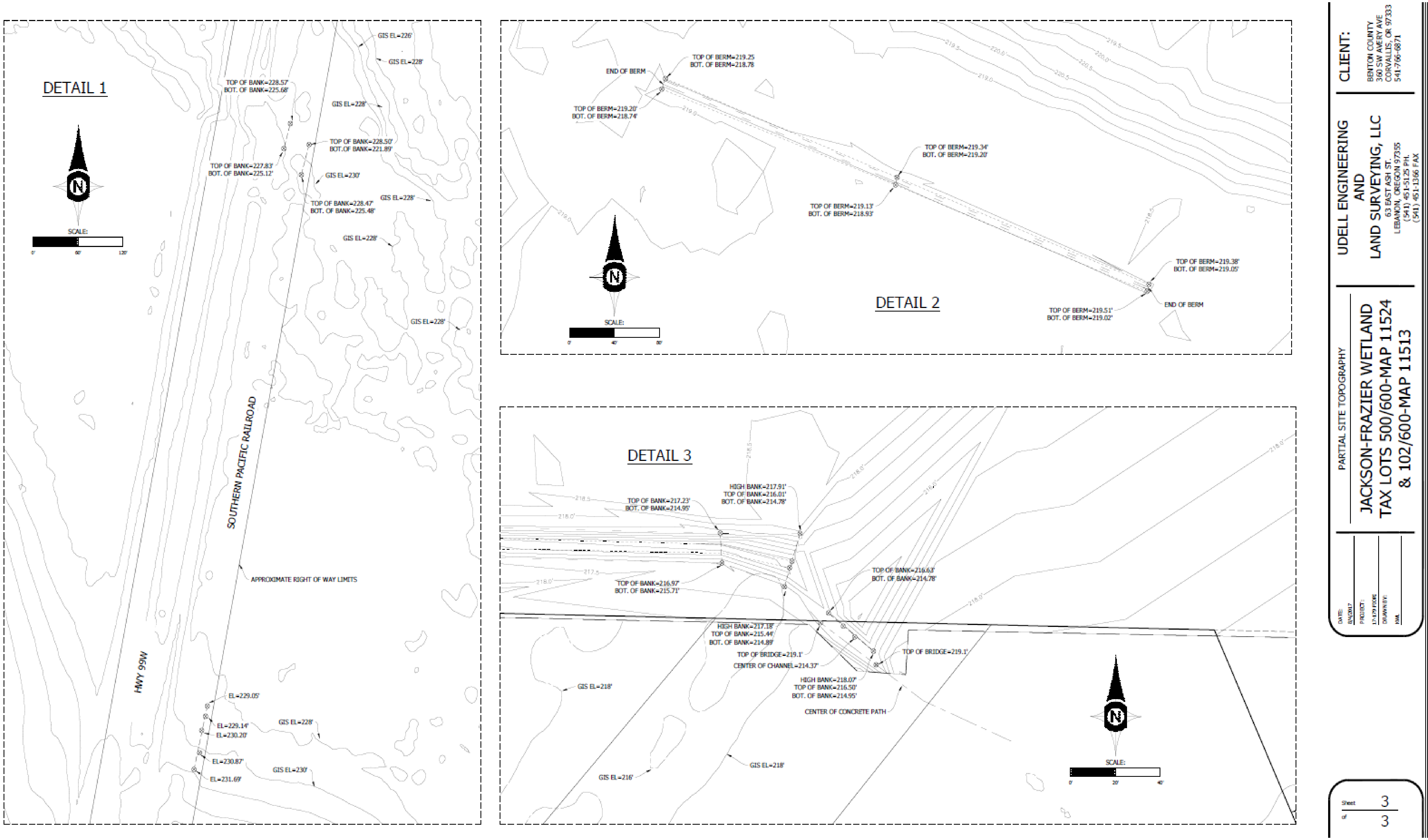


Figure 20. Topographic Site Analysis Map (3 of 3)



Permitting Evaluation

Implementation of proposed restoration objectives will trigger several County, State, and Federal permitting requirements that fall within the following permitting categories:

1) Endangered Species Act: Bradshaw's Lomatium (*Lomatium bradshawii*) listed as federally endangered, and Nelson's Checker-Mallow (*Sidalcea nelsoniana*) listed as federally threatened exist within the proposed restoration work areas. Prior to the beginning of construction work, approval from US Fish & Wildlife Service (USFWS) for temporary/potential impacts to the species and implementation of the restoration plan is required. There are opportunities to partner with USFWS Partners Program staff to evaluate and resolve any regulatory issues, utilizing the existing Benton County Prairie Species Habitat Conservation Plan and authorized Incidental Take Permit. Currently, Benton County and USFWS have a Partners for Fish and Wildlife Program Agreement until 2023 and may include support to complete proposed restoration activities. In addition, compliance with any Endangered Species Act rules are likely to be achieved through the USFWS partners agreement.

2) Floodplain Development Permit: Development in the floodplain – even if the work does not require a regular building permit or land use approval, will require a Benton County permit. The permit will need to be obtained from Benton County Community Development, contingent upon the approval that the proposed work will result in no net rise of floodwater during flood events. Documentation of the Base Flood Elevation within the location of the proposed activities is required. The completed topographic site analysis provides adequate information for permit approval, given that only excavation of material will occur.

3) Wetland Ecosystem Restoration Permit: Oregon Department of State Lands oversees the General Authorization for Wetland Ecosystem Restoration (OAR 141-089-0800 through 141-089-0815), which significantly reduces the permitting process. Documentation is needed that

Phase 2 Project Timeline

Jackson Frazier Restoration Tasks Phase 2- General Timeline			
Year 1 (2018)			
Activity	**Est. Date of Completion**	**Notes**	**Proposed Funding Sources**
Monitor plant community and hydrology	March-July	Spring hydrology for future planting plan, native species inventory, and to identify the most problematic non-native species	Benton County/OWEB/USFWS Partners Program
Mowing	July-August	Selectively mow woody species, and Reed canary grass targeted for treatment. Mow fairly tall to reduce overall height, but allow significant regrowth for treatment.	
Site Preparation	August-September	Reed canary Grass treatment, Broadcast approved broad-spectrum Herbicide in dense stands, spot treat isolated patches, and inaccessible areas for broadcast treatment.	
Site Preparation	August-September	Woody vegetation treatment, Broadcast approved broadleaf specific Herbicide, spot treat inaccessible areas	
Year 2 (2019)			
Activity	**Est. Date of Completion**	**Notes**	**Proposed Funding Sources**
Monitor seed bank response and hydrology	March-July	Early spring hydrology assessment to develop future planting plan, seed bank response and treatment effectiveness.	Benton County/OWEB/USFWS Partners Program/NAWCA
Site Preparation	June-July	Broadcast approved broad-spectrum Herbicide	
Mowing	July-August	Likely the majority of the site to reduce biomass, especially in grading areas. Allow 2 weeks after herbicide treatment.	
Tree removal	July-August	Removal of selected trees too large to mow, cut flush with ground surface, stump treatment would be advantageous to prevent re-growth	
Grading	July-September	Complete all grading/ground disturbance including berm removal, as soon as conditions allow	
Site Preparation	September	Broadcast approved broad-spectrum Herbicide, this is just a place holder and not likely needed, but could be advantageous if we get significant early rainfall followed by a long dry period.	
Custom no-till seeding	October	We will ideally plant after 2"-3" of rain to get a final response from the non-native seed Bank	
Broadcast approved broad-spectrum Herbicide	6-10 days after seeding	This is one of the most important treatments, timing will depend on seed mix and germination conditions	
Monitor native seed germination	October-December	Early surveillance is essential for diagnosing environmental and biological issues	

Phase 2 Project Timeline- continued

Year 3 (2020)			
Activity	**Est. Date of Completion**	**Notes**	**Proposed Funding Sources**
Monitor native plant establishment	February-October	Ensure native plants are establishing well, evaluate non-native species for treatment	Benton County/OWEB/USFWS Partners Program/NAWCA
Spot Spray	May-September	Target non-native species competing with native seedling recruitment, very important while native species are establishing. Ideally budget to cover the site 3-4 times throughout the growing season. applications starting early as possible to avoid non-target vegetation	
Broadcast approved selective Herbicides	May-September	This will ultimately be determined by planting mixes, problematic species, and density of non-natives. There is both grass and broadleaf specific options where non-native cover exceeds 25% (i.e. not effectively spot sprayed)	
Site Preparation	May-September	Treat bordering areas missed by broadcast treatment for non-native species, can be combined with spot spray work.	
Broadcast Native seed Mix	September-October	This would target the open areas within the boardwalk area with heavy canary grass, following year 2 treatment. Can also be used in areas of poor establishment, or heavy weed control in main prairie.	
Year 4 (2021)			
Activity	**Est. Date of Completion**	**Notes**	**Proposed Funding Sources**
Monitor native plant establishment	February-October	ensure native plants are establishing well, evaluate non-native species for treatment	Benton County/OWEB/USFWS Partners Program/NAWCA
Plug Planting	February-April	This would be targeted within the boardwalk area and potentially a volunteer project. Timing will be based on site conditions, but will need completed while we are still receiving significant rainfall	
Spot Spray	May-September	Target non-native species that threaten long term sustainability; important while native species are fully establishing. Ideally budget to cover the site 3 times throughout the growing season with applications starting early as possible to avoid non-target vegetation damage.	
Broadcast approved selective Herbicides	May-September	This will ultimately be determined by planting mixes, problematic species, and density of non-natives. There is both grass and broadleaf specific options where non-native cover exceeds 25% (i.e. not effectively spot sprayed)	
Boardwalk weed control	May-October	This could be a volunteer activity with hand work around the plug plantings, or spot spraying depending on level of intrerst. Reed canary grass should be spot treated for best control.	
Mowing	August-September	Not likely needed, but may want access trails, or to stimulate grass growth n some areas	

Phase 2 Timeline- continued

Year 5, Long term Maintenance (2022 and beyond)			
Activity	**Est. Date of Completion**	**Notes**	**Proposed Funding Sources**
Monitor non-native invasives	May-September	Evaluate non-native species and woody encroachment for treatment by site manager	Benton County/OWEB/USFWS Partners Program/NAWCA
Boardwalk weed control	May-October	This could be a volunteer activity with hand work around the plug plantings, or spot spraying depending on level of intrerst. Reed canary grass and Black berries should be spot treated for best control.	
Spot Spray	June-July	Target non-native species that threaten long term sustainability, just one-time through the site targeting areas identified by site manager	
Boardwalk weed control	May-October	This could be a volunteer activity with hand work around the plug plantings, or spot spraying depending on level of intrerst. Reed canary grass should be spot treated for best control.	
Broadcast approved selective Herbicides	July-October	Not likely needed, but something to keep in the management toolbox.	
Mowing	August-September	Not likely needed, but may want access trails, encourage shorebird utilization, target areas of woody encroachment, or various other management options.	

Long term Management

Vegetation management will be the primary on-going task at the site after initial project implementation. Native vegetation should be dominant at the site. Invasive species presence and levels should not threaten conservation values. Any Oregon Department of Agriculture listed Noxious Weeds should be controlled.

Native/non-native trees and shrubs may need to be controlled to maintain wetland prairie habitat. Controlling encroachment of non-native invasive species can be done in a variety of ways including physical control such as hand pulling and mowing. Primarily chemical control includes spot herbicide application by hand. In the event of a major invasive weed take over, broadcast spraying of individual areas could be used. Prescribed fire is another method for the enhancement of native plant communities and control of invasive species that may be considered. Any use of fire would comply with the current air quality and land use regulations or restrictions. Given neighboring land use, it is unlikely that prescribed burning will occur.

The preferred method of control will be through physical means. However, in the event that this control is not meeting long-term objectives, prescribed fire and herbicides would be the next considered control options.

During the annual review by project staff, an evaluation of the effectiveness of any methods or techniques used during that year should be made, along with a determination of new species or problems that require special attention. At that time, a review of the literature of current techniques or herbicides will be done, to determine the best approach for the following year.

Ultimately, an adaptive management strategy will be used. Such a strategy reassesses priorities for management on a yearly basis, using the following steps;

- Re-order invasive/nonnative vegetation management priorities based on the likely effects to both native and nonnative vegetation.
- Implement the plans and monitor the results of control actions.
- Evaluate the effectiveness of the methods in light of overall site goals, and use this information to modify and improve control methods.

Metrics of project success will be documented by the Benton County Prairie Species Habitat Conservation Plan- Effectiveness Monitoring protocol. This monitoring will identify when the restoration goals have been achieved and if habitat monitoring thresholds are achieved or reduced. Effectiveness monitoring will occur every three years, and after any restoration activities are completed to determine the success of work. Monitoring metrics are primarily focused on vegetation, with observational assessments of hydrology.

Education and outreach efforts will include efforts to establish long term relationships with entities that can assist in training teams of local volunteers or interns, to help with efforts to

maintain and enhance the restoration (for example, the Institute for Applied Ecology). Partnerships with faculty at local and regional colleges, community colleges, and universities could be developed through which ongoing monitoring of vegetation diversity and plant species assemblages in the management units can be tracked over time (e.g. Schwindt 2006, Highland et al. 2015).

Appendices

Appendix A. References

1. Benton County Natural Areas & Parks Prairie Management Plans (2010). Institute for Applied Ecology.
2. Benton County Prairie Species Habitat Conservation Plan (2010). Institute for Applied Ecology.
3. Benton County Ordinance 91-0083; Apply Wetland Overlay Zone to Jackson-Frazier Wetland. Adopted 3/8/1991.
4. Benton County Prairie Conservation Areas Baseline Monitoring (2011). Institute for Applied Ecology.
5. Benton County Prairie Conservation Areas Effectiveness Monitoring (2014). Institute for Applied Ecology.
6. Boyd, R. 1986. Strategies of Indian burning in the Willamette Valley. Canadian Journal of Anthropology 5:65-86.
7. City of Corvallis, Stormwater Master Plan (2007, Chapter 8).
8. Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States.
9. Highland, S., M.V. Santelmann, and *R. Schwindt. 2015. Plant Community Dynamics in Remnant and Restored Willamette Valley Wetland Prairie. Ecological Restoration 33(2):156-170.
10. Jackson Frazier Wetland Management Plan (1992). Jackson-Frazier Wetland Task Force. Referred to as 'management plan'
11. Jackson Frazier Wetland Management Plan Refinement (2005); David Reed & Associates, Bob Frenkel. Referred to as 'management plan'.
12. Jackson-Frazier Wetland Impact Analysis (1986). Scientific Resources Inc. (funding provided by Oregon Division of State Lands).
13. Jackson-Frazier Wetland- Oregon Partners for Fish and Wildlife Program contract (U.S. Fish and Wildlife Service, 2003.
14. Jones, L.D. 1998. A resource classification and vegetation change analysis of the Jackson-Frazier Wetland, Benton County Oregon. M.S. research paper, Department of Geosciences. Oregon State Univ., Corvallis.
15. Marshall, J.L. 1985. Value assessment of Jackson-Frazier Wetland, Benton County.
16. Oregon: A Case Study. M.S. thesis, Oregon State Univ., Corvallis. Drost, M. B. 1985. Preliminary investigation into the hydrology of Jackson-Frazier Wetland. M.S. research paper, Department of Geography. Oregon State Univ., Corvallis
17. NRCS soil map for Jackson-Frazier Wetland accessed on 4/1/17.

18. Highland, S., M.V. Santelmann, and *R. Schwindt. 2015. Plant Community Dynamics in Remnant and Restored Willamette Valley Wetland Prairie. Ecological Restoration 33(2):156-170.
19. Taylor, S. and M.V. Santelmann. 2014. Comparing Vegetation and Soils of Remnant and Restored Prairie Wetlands in the Northern Willamette Valley. Northwest Science 88:329-343.

Appendix B. Project Approval Presentation

Jackson-Frazier Wetland Phase 1: Long Term Habitat Enhancement Overview

Legacy Habitat Impacts

Jackson-Frazier Wetland contains several landscape features that severely limit the habitat quality across the majority of the park. These major issues for long term habitat quality from prior owners include:

- Ditch system that increases surface water runoff velocity from site, leading to reduced floodwater storage and reduced soil saturation during growing season;
- Approximately ¼ mile berm that spans the entire lower section of the main wetland prairie;
- Trenching across the majority of the open wetland area;

1986 Historic Impacts that continue to be an issue in the park

Future Issues, Project Need

- Good-Samaritan/City Development in upper watershed
- Floodwater storage
- Invasive species control
- Education

Appendix C. Oregon Rapid Wetland Assessment Protocol Map & Report

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Oregon EXPLORER — Oregon Rapid Wetland Assessment Protocol — 44.6078, -123.2390

Location Information

Within?	Layer
Yes	100-yr Floodplain
No	Special Protected Area
No	300ft of a Spring
Yes	Mapped Wetland

Watershed (HUC12): Fraizer Creek-Willamette River (170900030609)

Presettlement Vegetation Class: Tufted hairgrass

Rare Wetland Type (within 1 mile): Wet Prairie

Average Annual Precipitation: 42.21 inches

Hydologic Landscape Class: Wet

View Salinity Maps (pdf)

View Important Bird Areas (Audubon) .pdf

Soil Information (for this lat/long)

Soil Symbol: 14

Soil Name: Bashaw clay, flooded, 0 to 3 percent slopes

Hydric Rating: Yes

Hydric Percent: 98

Farmland Class: Farmland of statewide importance

Dom. Cond. Non-irrigated Capability Class: Excess Water - very severe limitations that restrict the choice of plants, require very careful management, or both

Erosion hazard: Slight

Watershed Information

Uniqueness of Watershed by Size/Type

HUC Code	HUC Name	FW, em, lg (Acres)	FW, s/f, lg (Acres)	EST, em, lg (Acres)	EST, em, lg (Acres)
HUC8: 17090003	Upper Willamette	1123.6883	358.52616	0	0
HUC10: 1709000306	Luckiamute River	26.19335	171.89757	0	0
HUC12: 170900030609	Lower Luckiamute River	17.48694	20.64164	0	0

[abbreviations: FW- freshwater (wetland); em- Emergent; lg- largest; s/f- Shrub/Forested; EST- Estuarine (wetland)

HUC Best *

HUC Code	HUC Name	Is HUC Best?	Greatest Criteria Met
HUC8: 17090003	Upper Willamette	Yes	density
HUC10: 1709000306	n/a	No	n/a
HUC12: 170900030609	Lower Luckiamute River	Yes	density

This report was generated using the ORWAP Map Viewer, a tool of the Oregon Explorer (http://oregonexplorer.info).

Appendix C. Oregon Rapid Wetland Assessment Protocol Map & Report