Appendix A. District Water Management Plan

Beaver Slough Drainage District (District)

District Water Management Plan (DWMP)

Coos County, Oregon

Township 27S, Range 13W Sections 21, 22, 27, 28, 29, 32, 33, 33, 34
Township 28S, Range 13W Sections 2, 3

Adopted September 23, 2015

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1.0 Plan Purpose

Beaver Slough Drainage District (District) has developed infrastructure that allows water levels to be managed independently in different areas of the District, resulting in the necessity for a District Water Management Plan (DWMP). The purpose of the DWMP is to provide a framework and process to allow every landowner in the District an opportunity to maximize their management objectives, within their ownership, without affecting other District members. The District by statute and policy has an obligation to serve the best interests of all members of the District.

2.0 Organization / Responsibilities

The District covers over 1,700 acres, West of Coquille, Oregon in Townships 27 & 28 S, Range 13W. Formed in 1906, The District provides for and operates the infrastructure necessary to protect the land within the District from daily high tides as well as facilitate drainage from China Camp Creek and associated landowner parcels. The District is organized under the authority of ORS 547 and is bound by Federal, State, and local law, rules, and regulations to operate the District within the conditions of various permits issued. The DWMP is designed to ensure that water management practices on individual parcels have no negative impact on the larger unit or neighboring properties. The four unit water management plans and the associated parcel management plans must also conform to the DWMP. The District is responsible to ensure the DWMP and results on the ground comply with the applicable law, rules, and permit conditions. See figure 2.1

Figure 2.1

Beaver Slough Drainage District – Organization Chart

Enabling legislation
(Federal, State,Local)
|
|
Joint DSL and USACE Permit
ODF&W - NOAA/NMFS Fish Passage Approval
|
|
Beaver Slough Drainage District
|
|
Board of Supervisors
(BoS)
|
|
District Water Management Plan
(DWMP)
|
|

UNIT 1	UNIT 2	UNIT 3	GARDEN VALLEY
UNIT 1 Water Management Plan	UNIT 2 Water Management Plan	UNIT 3 Water Management Plan	G Valley Water Management Plan
(U1WMP)	(U2WMP)	(U3WMP)	(GVWMP)
|	|	|	|
|	|	|	|
Parcel Water Management Plan	Parcel Water Management Plan	Parcel Water Management Plan	Parcel Water Management Plan
(PWMP)	(PWMP)	(PWMP)	(PWMP)
|	|	|	|
C & S WATERMAN RANCH, LLC	CHINA CAMP GUN CLUB, INC.	BONES, TIM	BURRIS, BARBARA L.
EVERETT-ONA ISENHART RANCH,INC;ETAL	ENYEART, ALBERT S.	CHARLIE & SHARON WATERMAN TRUST	HOPMANS, JAN W.
FRED MESSERLE & SONS, INC.	OREGON DEPARTMENT OF FISH AND WILDLIFE	DOMENIGHINI FAMILY LTD PARTNERSHIP	FOSTER , LISA
FULTS KLINE, ELSIE; ET AL		HACKETT INVESTMENTS, LLC	KELLEY M. KINKADE REV. LIVING TRUST
ISENHART, LAURA; ETAL		GARDNER , MICHAEL F.	MILLER , PEARL T.; LIE
ROSEBURG FOREST PRODUCTS CO.		WHEELER , RAYMOND C. & JUDY A	CHUPKA, MICHAEL
SODERBERG , KARL P.			OLSEN, GAIL A
STATE OF OREGON, ODOT			OXBOW TIMBER I, LLC
			ROSE, VERNA L. & DAVID, LESTER FREDERICK
			ROSEBURG RESOURCES CO.
			SANDERS, F. DARRELL & LINDA M.
			WISELY , DONALD E.

3.1 Assumptions / Definitions

3.2 Elevations

All elevations referenced in this document are NAVD88.

3.3 District Infrastructure

The District is divided into four management units (1, 2, 3, Garden Valley) with the ability to manage water levels independently in each unit (Appendix B). Interior berms, culverts, bridges, and other diversion infrastructure will allow individual parcels to be isolated from the effects of managing different water levels on neighboring parcels both within the same unit or other units.

The main culvert / tide gate structure at the entrance to the Coquille River will be constructed of steel reinforced concrete, on a fabric reinforced aggregate mat pad, with seven openings (Unit 1 – A,B, Unit 2 – A,B,C,D, Unit 3 -A, (Appendix C) each ten feet wide and eight feet high The tide gates would be standard Nehalem Marine ***NSRG 10X8 RK*** side hinged gates mounted on a sliding frame that would move vertically on the face of the culvert. The mechanical lift system for the slide gate frame would be powered by hydraulic cylinders that would receive their moving force from energy harvested from the Muted Tidal Regulator (MTR) float system mounted on the upstream end of the culvert structure. The side hinged gates would open and the frames would rise on an outgoing tide with the side hinged gates closing and the slide gate frame dropping when a predetermined adjustable set point, based on the inside water level, triggers the MTR mechanism. Auxiliary power would be used to adjust the slide gate frames to achieve desired set points for winter operations and storm events. See also section 3.9.

3.4 District Responsibilities

3.4.1 The District is responsible for the operation, maintenance, repair, and improvements to the infrastructure which includes the main culvert / tide gate structures, canals, berms, dikes,

and canal crossings as well as any other items necessary for the efficient operation of the District and the administration of the DWMP.

3.4.2 The District shall appoint a water manager to operate the District's infrastructure, administer the DWMP, and perform other duties as may be assigned by the District Board of Supervisors.

3.5 Landowner Responsibilities

Individual parcel owners are responsible for the culverts and water diversion mechanisms associated with the District's interior berms including their operation, maintenance, repair, installation and improvement as well as other interior ditches, culverts, and crossings on their property.

3.5.1 New interior culverts and water diversion mechanisms will meet fish passage requirements of OAR 635 – 412 – 0035(5). Recommended minimum – 48" culvert, installed at - 1.0 invert or deeper, equipped with side hinge gate.

3.5.2 Individual parcel owners are expected to work with other landowners within their unit to develop water level requests for irrigation, stock water, drainage, and over winter habitat. See also section 3.8.

3.5.3 Landowners are responsible to protect their property from requested water levels within their unit.

3.6 Management Considerations

3.6.1 Water levels within the different units will be adjusted to meet landowner management objectives as conditions on the ground dictate within the three defined seasons, Winter, Spring Drain Out, Summer (dry season) (see also section 3.6) not on a strict calendar date or schedule.

3.6.2 Changes in water levels are to be transitional in nature rather than done abruptly to prevent damage to District or landowner infrastructure.Increased system capacity will allow for movement of larger volumes of water in shorter time periods, but caution must be taken to avoid negative impacts to infrastructure or landowner property.

3.6.3 the most problematic scenario from a mechanical and fish passage compliance standpoint is high head on the outside (high incoming tide) and low water on the inside most likely in the dryer summer months and winter dry/cold weather events. Increased system capacity and lower interior berm heights will affect both timing and set points compared to historical operations for drainage or irrigation. See also Section 8.5.

3.6.4 Storm/flood events would negate the effects of the District infrastructure as the Coquille River water level rises and is above the Out of System range (interior 5.5 feet, see 3.7.2). Care must be taken to minimize impact on berms, river banks, roads, culverts and tide gates as water levels equalize. The District will back fill from Beaver Creek and then from the main stem of the Coquille River over the river banks with additional volume added by opening knife gates at the river during rising water events. Rapid and efficient equalization is preferable. . See also Section 8.5.

3.6.5 Good management practices for Agricultural drainage and irrigation will enhance habitat for fish and wildlife as well as contribute to improved water quality. . See also Section 8.5.

3.6.6 When managing different water levels, care must be taken to avoid unintended consequences both within the District and outside in the Coquille River System such as.

- Affecting water levels within the Coquille River system and neighboring parcels.

- Creating erosion, increased turbidity, or degrading water quality
- Providing habitat that allows for the increase in mosquito populations with the associated disease and public health concerns.

3.7 Seasons

Three distinct water management seasons during the year will require differing water level adjustment to meet landowner objectives. See also section 4.0 they are:

- Winter – October to March
- Spring Drain Out – April to May
- Summer (Dry season) – June to September

3.8 Water Level Categories

3.8.1 Contingency

Extraordinary, unexpected events such as infrastructure or equipment failure, earthquake damage, extreme weather events, and debris interference could limit the operational capacity of the system. The District and affected landowners are expected to take all reasonable actions to return the system to working water levels.

3.8.2 Out of System

The Out of System range is when the interior water levels exceed 5.5 feet due to a storm event. The expected response is to utilize the maximum capacity of the District's infrastructure to get water levels within the District back down into the working level range as rapidly as possible.

3.8.3 Working Water Level

The working level range is appropriate to water levels less than five and one-half feet with the operation of the side hinged tide gates mounted on a sliding frame, controlled with a muted tidal regulator, operating in one of two modes, drainage or inundation.

3.7.3.1 In drainage mode the working water level would be "Maximum Dry Out" where the objective would be to draw off the maximum amount of water possible in the least amount of time in order to allow soil temperature to rise, encourage forage growth, and create capacity to store ground and rain water to be discharged on the next low tide cycle.

3.7.3.2 In inundation mode there are three working water levels available where each level has particular objectives.

1. Over Winter Habitat

   - Refuge and Food for juvenile COHO Salmon and other salmonids
   - Enhanced fish passage capability including direct access from the Coquille River system during a rising river
   - Refuge and food for water fowl and shore birds
   - Rapid equalization between Coquille River and field levels
   - Sediment retention to stabilize or reverse subsidence

2. Base Flushing

- Maintain Channels & Clean Sediment
- Reduce in water vegetation and algae growth
- Lower water temperature, increase dissolved oxygen
- Provide fish habitat and enhance fish passage capability

3. Irrigation
   - Raise water table
   - Flood interior parcels to encourage forage growth

     Note! Caution must be used to select water levels that do not create ponding that could encourage mosquito production or trap fish

3.8 Operating Water Level Change Requests

All water level change requests from individual parcel owners will be directed to the District water manager and confirmed in writing via memo or email within the context of the approved DWMP. All requests shall include the date, time, parcel, and water level change requested.

3.9 Infrastructure Capability

The river tide gates equipped with standard Nehalem Marine ***NSRG 10X8 RK*** side hinged gates will allow unrestricted out flow and provide redundancy for the system in contingency situations. The ability of the tide gate frame, controlled by a muted tidal regulator, to move vertically, creating an unrestricted opening at the bottom of the culvert, will enable the system to achieve the open time, velocity, fish passage and access conditions specified in the ODF&W – NOAA/NMFS approved fish passage plan. The design and operation

of all new infrastructure within the District, proposed in the C3P and WLRP projects as well as any added in the future will be included in a fish passage plan approved by the Oregon Department of Fish and Wildlife and NOAA National Marine Fisheries Service.

3.10 Calibration

The District infrastructure is a complex and dynamic system with many factors that will interact and change over time. These factors include tides, weather, climate, changes in R factor, Coquille river system, individual parcel management, and other contingencies.

Many of the relationships between and effects of these various factors are unknown at this time. The operation and management of the system needs to be flexible and responsive to allow the anticipated evolution of conditions on the ground as well as meet the objectives of District landowners and other stakeholders.

4.0 Operation Protocols

BEAVER SLOUGH DRAINAGE DISTRICT - OPERATING PROTOCOLS					
SEASON	**UNIT**	**WATER LEVEL**	**TARGET ELEVATION RANGE**		
WINTER - Oct to Mar:					
	Units 1&3				
		Basic Flush Level until first flood event or cattle are pulled	3.0	to	3.5
		After first flood event transition to Over Winter Habitat Level	4.5	to	5.5
	Unit 2				
		Complete transition to Over Winter Habitat Level	4.5	to	5.5
SPRING DRAIN OUT – Apr to May:					
	Units 1&3				
		Maximum Dry Out – maximum elevation	2.0	to	4.0
		Transition to Basic Flush Level as conditions allow	3.0	to	3.5
	Unit 2				
		Transition back to Basic Flush Level	3.5	to	4.0
SUMMER – Jun to Sep:					
	Units 1&3				
		Complete Transition from Maximum Dry Out to Basic Flush Level	3.0	to	3.5
		Irrigation Level – Every 10 to 14 days as per coordinated request from landowners	4.0	to	4.5
	Unit 2				
		Basic Flush Level	3.5	to	4.0
		Sept to October begin transition to Over Winter Habitat Level	4.5	to	5.5

5.0 Reporting

The District will collect water elevation level and temperature data from the Coquille River and Units 1, 2, 3 in the proximity of the river culvert / tide

gate structure as well as the upstream outlet of Garden Valley on a daily schedule at fifteen minute intervals. Additionally, the District will maintain a log of all water level change requests, equipment adjustments, and contingency events as well as a maintenance log for district infrastructure. The district will publish collected data and logs in a reasonable and timely manner. An annual operating summary for the previous year will be presented at each land owner annual meeting. The District shall co- operate with associated monitoring efforts by sharing data and facilitating the location of hardware and access to District infrastructure.

6.0 Review / Amendment

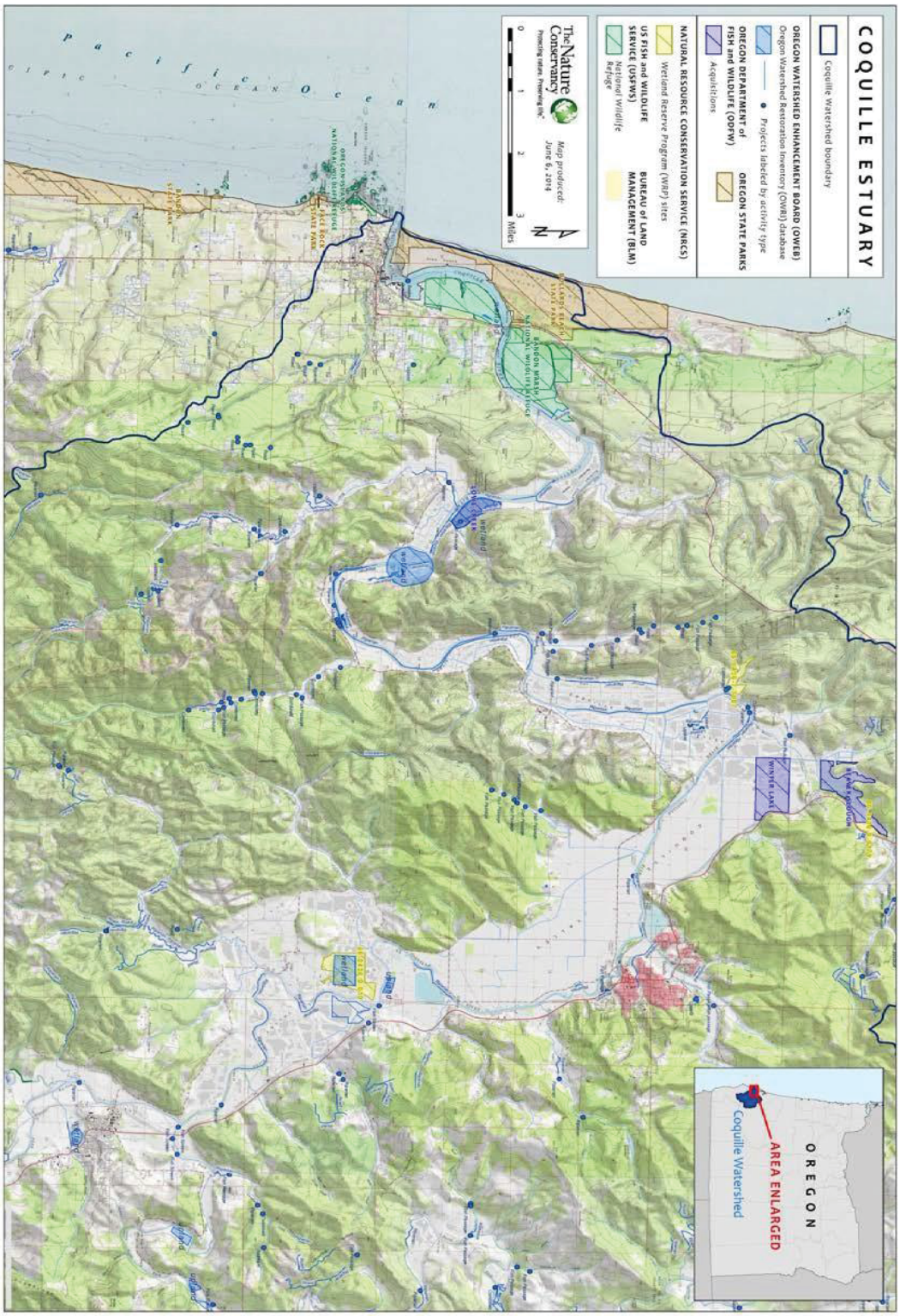
Prior to the first day of May of each year, the Board of Supervisors will conduct a review of the DWMP and operation of the system that allows for input and comment from District land owners, permitting agencies, other stakeholders, and the public. Proposed amendments to the DWMP, including unit and parcel management water plans, must be presented to the Board of Supervisors for consideration no later than fifteen days prior to the Board of Supervisors meeting in conjunction with the annual land owners meeting.

7.0 Dispute Resolution

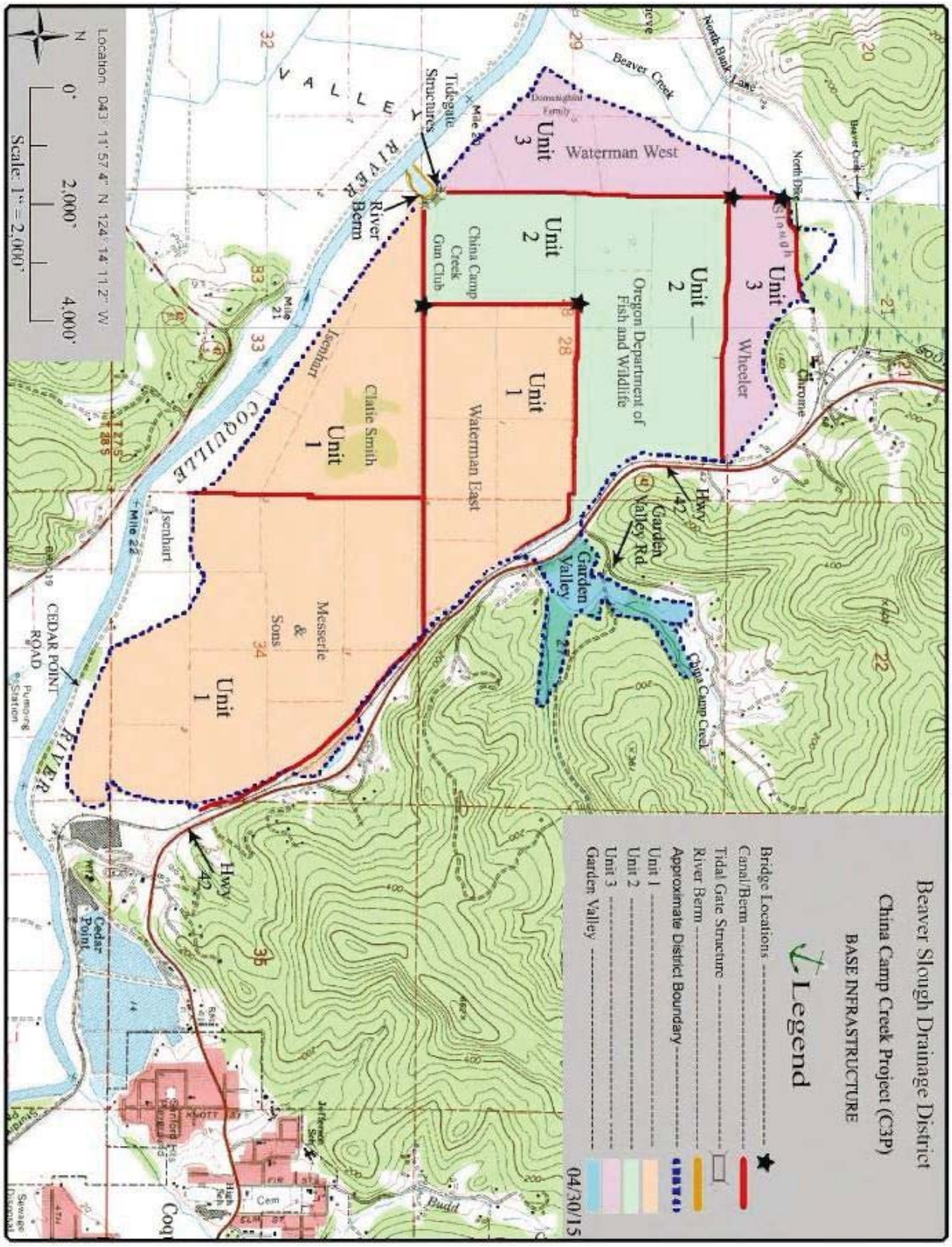
All disputes or objections to the DWMP or the administration there of will be presented in writing to the District water manager for review. If not resolved after review, the matter will be presented to the Board of supervisors for resolution.

8.0 Appendices

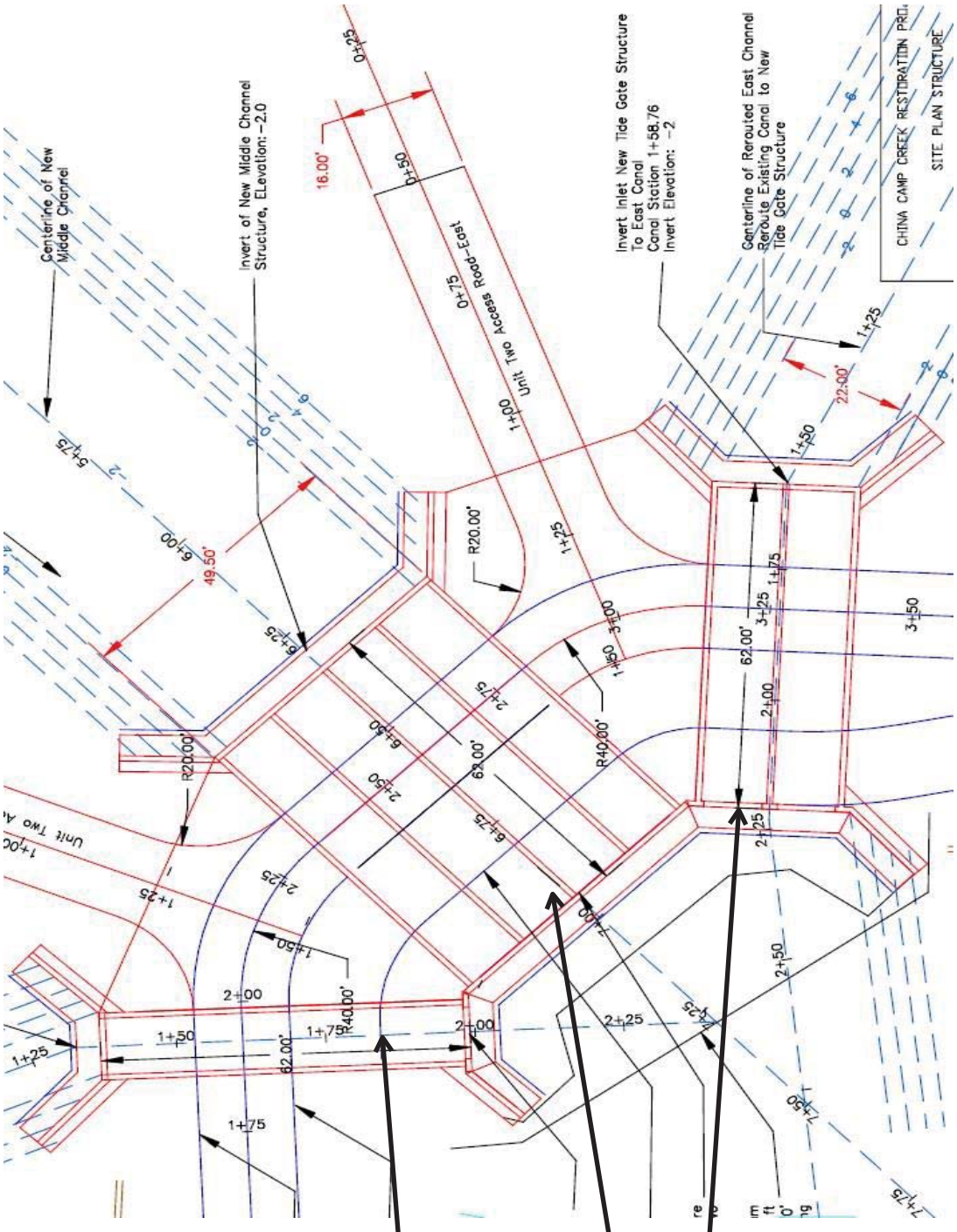
8.1 Appendix A BSDD - Vicinity Map



8.2 Appendix B BSDD Infrastructure and Management Unit Map



8.3 Appendix C BSDD - Tide Gate Array



- **Unit 1 - A, B**
- **Unit 2 - A, B, C, D**
- **Unit 3 - A**

8.4 Appendix D Contact List

District Water Manager

Beaver Slough Drainage District – Board of Supervisors Chairman

	Fred Messerle
Vice – Chairman	John Knutson
Director	Mark Isenhart
Director	Ray Wheeler
Director	Melissa Bronson

Oregon Department of State Lands US

Army Corps of Engineers ODF&W Fish

Passage Unit

NOAA / NMFS

Other Permitting Agencies

Land Owners??????

8.5 Appendix E Operations Narrative

8.6 Appendix F Technical Data

8.7 Appendix G Biological Data

DWMP APPENDIX E_8.5

System Operations Narrative

The objective of this narrative is to give perspective to the history and development of the China Camp Creek Project (C3P) and the Winter Lake Restoration Project (WLRP) as well as explain the expected operation and management of the Beaver Slough Drainage District's infrastructure in the future.

The purpose of the Beaver Slough Drainage District (District) is to protect the land within the District boundaries from daily high tides and facilitate drainage of associated landowner parcels and China Camp Creek.

The project design and development process has brought to the forefront that, given the sheer size and scale of the projects, the complexity of the interrelated parts, and the dynamic nature involved, we must realize the limits of our planned actions as well as the potential unintended consequences. Pragmatic and cautious implementation and adjustments are vitally important. Every attempt has been made to deal with issues as they have been raised, resolve conflicts, and maximize the benefits to all stakeholders. Since 2008 to date, over three hundred contacts, events, meetings, tours, and presentations have allowed opportunities to educate, inform, and gather additional input from District landowners, stake holders and the public. The process has been transparent and great care has been taken to address all issues raised and then making design adjustments as practical and necessary.

Factors that came to light during the design process include:

- Land subsidence, estimated to be six to eight feet, within the District over the last one-hundred plus years due to the lack of silt retention, decomposition of organic soils, and reduction of vegetative recovery dramatically increases the volume of water associated with these projects. Modeling studies reveal the larger volumes could impact tide levels and time intervals throughout the Coquille River system, affect neighboring properties, and contribute to erosion. Target fish passage velocities and tide gate open time durations are also affected. The ability of the proposed infrastructure to control water levels will allow mitigation of the negative impacts as well as adaption to conditions on the ground in the future.
- Pooling of water over different tide cycles could result in fish stranding with an associated potential for predation, favorable conditions for uncontrolled mosquito population increases, and degradation of water quality. The ability to adjust interior water level set points will facilitate management of these issues.

- The possibility that ground water movement to adjoining properties would be of concern. Analysis of soil types, monitoring of pre-project conditions, which reveal a loss of ground water during the dry season and the canal structure surrounding Unit 2 with twice daily low tide cycles and large reservoir capacity all point to ground water movement not being a significant factor.
- The idea that restoration efforts would be at the expense of agriculture and family farms has been difficult to address. Central to this issue is the fact that any replacement or major repair of the culvert/tide gate structures is a "trigger event" for fish passage. Any new infrastructure must be in compliance with current law and regulations. Failure of District infrastructure would result in the reversion of the lands to an unmanaged wetland with a complete loss of agricultural production.
- The agricultural operations cannot generate sufficient income from the land to pay all of the costs associated with fish passage compliance. Participation and co-operation from entities focused on supporting and enhancing fish populations is both necessary and fitting to bring additional resources to balance the cost of the projects. Creation of workable partnerships is necessary for success.
- Early in the design process there was not enough focus on the seasonal nature of achieving a balance between agricultural production and ecological function. The needs of both are not mutually exclusive. Looking for "win win" possibilities is important to the successful implementation of the projects and future operation of the District infrastructure and drainage system.

  There are several examples of the synergy available to all:

  - The highest, most important value for agricultural production is grazing from spring (April) to fall (October). There is minimal grazing activity during the winter high water season. The highest, most important value for fish production is over winter habitat for the ESA endangered juvenile Coho salmon from fall (October) to spring (April). Access to the area is not a major factor for the juvenile Coho salmon in the summer dry season. The result being no conflict and a win for both values with minimal conflict.
  - Inclusion of additional bridge structures for canal crossings has multiple benefits for the District and various landowners. These crossing will allow cost savings in the project construction process as well as operations and maintenance opportunities in the future. Additionally, more resources will be available to address repair and improvement of the north dike. Details of these crossings are currently being developed. See 8.2 Appendix B

- The original culvert/tide gate design contemplated an array of 8' wide 10' tall side hinged tide gates controlled by muted tidal regulators. This design concept presented several difficult engineering problems, including dampening the impact of the gates closing with a head of water pushing them from the Coquille River, absorbing the energy of the closing so as to not damage the gates or the culvert structures, and how to maximize the time open with reduced velocities to accommodate fish passage. With the tide gates default closed during a rising river and high water events a major challenge was how to provide for fish passage during a critical time for juvenile Coho salmon to have access to the off channel areas.

  The solution was to rotate the gates ninety degrees to 10' wide and 8' high providing for twenty-five percent more low water capacity and reduced water velocities. The side hinged gates will be mounted on a frame that can move vertically, eliminating the issues involved with dampening the gate closing. The muted tidal regulator (MTR) is used to control the vertical rise and fall of the tide gate frame which acts as a typical slide gate such as used in dams and waterway applications. Using a hydraulic system to control the action of the slide gate allows energy from the MTR or a supplemental energy source to be used to ensure open time objectives are met. Additional to the ability to enhance fish passage conditions is the bonus of faster equalization and the opportunity for greater silt retention.
- Many other benefits may accrue from the ability to manage water levels throughout the District.

    - Other fish and wildlife species have additional access to improved habitat.
    - The intense forage grazing in the dry season provides high quality feed for the migratory water fowl that use the Coquille Valley in the wet winter season.
    - Improved water quality benefits the entire Coquille River system.
    - Greater water movement and flushing reduces maintenance dredging in the District's drainage system and vegetation growth.

- Larger infrastructure capacity can extend both the grazing time available, because of faster drain out, and access to habitat due to improved fish passage conditions.
- Recreational opportunities are enhanced both within the District and the region.
- All economic sectors are supported and have the ability to take advantage of greater opportunities.
- Property values and the local tax base are supported and maintained.
- Faster water level equalization and reduced erosion during winter high water events.
- Increased opportunities for silt retention and reversal of subsidence.

District landowners have had three primary objectives from the onset.

- Landowners through the Drainage District will own the District infrastructure and operate it for the benefit of all.
- No landowner will be subject to an unreasonable negative impact to their property because of the proposed C3P or WLRP.
- Every District landowner will have the ability to meet their management objectives for their property to the greatest extent possible within applicable statutes, rules, and regulations.

The complexity and dynamic nature of the projects as well as the operation of the district going forward, which could well include additional agricultural and habitat improvements, requires the DWMP to have a process for review and amendment that is responsive to conditions on the ground. As the projects mature there will be changes in the roughness and the R factor with in the restoration areas, channels may resize, and growth of vegetation will necessitate changes in the operation of the District infrastructure and amendments to the DWMP.

Essential to the process is transparency and inclusion of input from all stakeholders (landowners, regulatory agencies, funders, other governmental agencies, and the public). Responsibility and authority for the operation of the District infrastructure and administration of the DWMP will be with the landowners through the Beaver Slough Drainage District.

Project funding and permit approval is dependent on the District having permanent, legal access to landowner properties for the purpose of efficient and effective operation, maintenance, repair, and improvement of District infrastructure as well as administration

of the DWMP. The District has reached agreement with affected landowners on the primary access route to the District infrastructure.

Implementation of the DWMP and activation of the various improvements and changes to parts of the District Infrastructure will need to be done in a measured manner to enable a better understanding of how the system will react and to avoid unintended consequences. Given the size, scale, distances, and dynamic nature of the District infrastructure and landowner parcels, the operating levels are defined in ranges rather than absolute values. Given the inherent variability of tides and weather as well as the distances and time involved in the movement of water, the cost and effort to achieve a consistent set point on a given daily tide is not feasible. Operation within the target ranges for different seasons and operational modes will take time to develop, being a work in progress for some time. Based on the information available at this time, the assumption is made that interior water levels greater than 5.5 feet are to be considered a high water event with the focus being on protecting District and landowner infrastructure until the Coquille River system drops to levels that allow the District infrastructure and drainage system to return to scheduled operating parameters.

The District is committed to maintaining water loggers to monitor water levels and temperatures both in the Coquille River and each management unit to document the effects of implementing and administrating the DWMP. The District has been collecting this data since March of 2011 and understands the importance of continuing into the future. Individual parcel owners and other stakeholders are encouraged to do more extensive monitoring and data collection as may fit their individual needs. The District will be co-operative in sharing data, providing access, and locating monitoring equipment.

The proposed culvert/tide gate structure at the Coquille River is designed to combine proven components, concrete box culverts, side hinged tide gates, sliding flood gates, muted tidal regulators, and hydraulic power, with the objective being to regulate water levels independently between units 1, 2, and 3. This structure will enable landowners to meet their various management objectives, protect the entire District from daily high tides, provide drainage capacity, and the capability during high water events to open access to the Coquille River for the purposes of fish passage, inside/outside water level equalization, and silt retention. The new structure will be capable of moving over three times the volume of water as the current culvert/tide gates.

A typical tide cycle would see the side hinge gates open as the water level in the Coquille River drops below the interior water level during an outgoing tide. As the water levels drop, energy harvested from the Muted Tidal Regulator (MTR) is used through the hydraulic system to raise the slide gate frame, allowing the full culvert capacity to be utilized. As the tide changes at low tide the incoming water will begin to flow from the

Coquille River back into the District the side hinge gates can easily close with no significant head or impact on the structure. Water continues to flow in through the entire culvert width as the slide gate frame is in a raised position until the interior set point is reached. At the set point the slide gate frame, with the side hinge gates already closed, slides down, closing the culvert opening and stopping the inflow of water. The gates will remain closed through the remainder of the high tide cycle until the Coquille River water level again drops below the interior water level, allowing the side hinged gates to open again. During a high water event the slide gates can be raised using supplemental power to the hydraulic system to allow the culverts to be open through the entire high water event until it is possible to return to working water levels. Please note that tide levels and times change each tide.

The District has applied for a Fish Passage Exception as provided for in OAR 635-412 and authorized by ORS 496.138. This exception request may be accessed at

www.coquilleworkinglandscapes.com

An additional mitigating factor with regard to fish passage is the twice daily high and low tides provide a slack water opportunity four times a day for fish passage as opposed to the continuous flows in one direction in non-tidal conditions.

Development of a management plan for the Garden Valley unit on the East side of Highway 42N is dependent on the landowners in that area coming to agreement on how they wish to operate their properties. In the late 1960's the area was sub-divided, resulting in eleven parcels with land inside the District's boundaries, where there had been only two parcels since the District formation in 1906. The sub-division plan had no requirement or provision for maintenance of the China Camp Creek channel in the Garden Valley area East of Highway 42N. Historical accounts suggest there have been no organized efforts by Garden Valley landowners to do any comprehensive maintenance on the China Camp Creek channel since the mid 1980's. Currently the Garden Valley area properties within the District are experiencing poor drainage due to China Camp Creek and associated drainage ditches being bank full of sediment as well as numerous beaver dams and other obstructions. Historically, the District has maintained the China Camp Creek channel to the West end of the ODOT culvert under Highway 42N while protecting the Garden Valley area from daily high tides with the culvert/tide gates and protective berm at the Coquille River. The 6' X 6' concrete box culvert carrying China Camp Creek under Highway 42N is undersized and does not meet current fish passage criteria. At some point in the future, when this culvert is upgraded to comply with fish passage criteria, the impact on the Garden Valley area will be significant both from a drainage and back flood standpoint. Current District infrastructure design, West of Highway 42N, will route China Camp Creek through Unit 1 and meet fish passage criteria.

Management choices for landowners within the Garden Valley Unit range from full restoration, partial restoration with agricultural components, conservation easements, to complete agricultural production. Because of their location in the flood plain and subsidence over time, the first properties in Garden Valley are some of the lowest elevations in the District. The District is committed to protecting these properties from the effects of tidal influence and water management practices in Unit 1.

Depending on the management and operating choices selected by Garden Valley landowners, the District will have to develop appropriate water control capability. This water control capability could range from a fish passage compliant tide gate structure, a modified seasonal water control structure, or no water control structure at all.

Because of active litigation between six landowners within the Garden Valley Unit and the District, it is not possible to move forward with the development of a management plan for the Garden Valley management unit until the legal issues are resolved.

The intent of the DWMP is to provide a framework for the operation of the District's infrastructure. The key factors for success are the ability to manage water levels independently in the different management units and the capability to change water levels to react to conditions on the ground.

The District appreciates the efforts and inputs from all stakeholders. We welcome the opportunity to move forward with the C3P and WLRP for the benefit of our landowners and other stakeholders.

BEAVER SLOUGH DRAINAGE DISTRICT
PROPOSED OUTLET STRUCTURE HYDRAULIC ANALYSIS: VELOCITY-DURATION CURVES

FINAL REPORT

Prepared for:

Nehalem Marine Mfg. Inc.
Nehalem, OR

On behalf of:

Beaver Slough Drainage District
Coquille, OR

Prepared by:

Northwest Hydraulic Consultants Inc
Seattle, WA

17 September, 2015

NHC Ref No. 0200079

Prepared by:

EXPIRES 12/31/2015

Vaughn Collins, P.E.
Associate Engineer

DISCLAIMER

This document has been prepared by Northwest Hydraulic Consultants Inc. in accordance with generally accepted engineering practices and is intended for the exclusive use and benefit of Nehalem Marine Mfg. and Beaver Slough Drainage District and their authorized representatives for specific application to the Proposed BSDD Outlet Structure in Coquille, Oregon. The contents of this document are not to be relied upon or used, in whole or in part, by or for the benefit of others without specific written authorization from Northwest Hydraulic Consultants Inc. No other warranty, expressed or implied, is made.

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1 INTRODUCTION

The Beaver Slough Drainage District (BSDD) is proposing to reconfigure the district into three units for to allow different land and water management uses to occur in each unit. The units will be divided by low berms and canals. Unit 2 will be managed for habitat restoration, while Units 1 and 3 will continue to support agriculture. Drainage from each unit will be routed through a new outlet structure that will replace the existing tide-gated culverts.

The new outlet structures will be concrete box culverts with Nehalem Marine Mfg. Muted Tidal Regulators (MTRs) controlling gate operations. The gates will be adjustable to allow seasonal water regulation and adaptive management based on continued monitoring of the projects performance.

A water management plan is required in advance of project construction. Among other items, the plan describes the water regulation system and water level seasonal management targets. The flow and velocities through the outlet culverts are of interest to the BSDD and regulatory agencies, particularly in regards to fish passage.

This report documents the latest round of hydraulic modeling undertaken by NHC in support of the project. The key output of the modeling are velocity-duration curves for each unit's outlet structure.

2 WATER MANAGEMENT SCENARIOS

Each unit will be operated to regulate water levels within a target range for a given season. For purposes of modeling a single target interior water level was used for each unit and season. For all combinations except Spring – Max Dry-Out the midpoint of the proposed range was used. For the Spring Max Dry –Out phase in Units 1 and 3 the lowest elevation in the target range was used, consistent with the intent of the operations at that time. The unit and season management scenarios are shown in Table 1.

Table 1: Water Management Scenarios by Season and Unit

	Unit 1 & Unit 3			**Unit 2**		
Season	Management Name	Target Range	Model Target	Management Name	Target Range	Model Target
Winter	Over Winter Habitat	4.5-5.5	5.0	Over Winter Habitat	4.5-5.5	5.0
Spring	Max Dry-out	2-4	2.0	Basic Flush	3.5-4	3.75
Summer	Basic Flush	3-3.5	3.25	Basic Flush	3.5-4	3.75

3 AREA-VOLUME CURVES

Surface area and volume by elevation were calculated for each unit using a composite GIS grid consisting of LiDAR for Units 1 and 3, and the latest CAD design surface provided by Tetra Tech for Unit 2. The area and volumes of the canals bounding Unit 2 were assigned to Units 1 and 3. There is additional volume and surface area below 3 foot elevation but most of this is in the canals and ditches and is not captured by the LiDAR and hence was not included in the calculations. The following table and figure give the results.

Table 2: Unit Surface Area and Volume

	Area (Ac)			Volume (Ac-ft)		
Elevation	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 1**	**Unit 2**	**Unit 3**
3.0	68	121	32	77	106	16
3.5	258	201	55	152	189	37
4.0	521	248	78	347	302	70
4.5	736	277	107	665	433	116
5.0	857	336	145	1067	577	179
5.5	919	352	179	1513	749	260
6.0	961	365	201	1983	928	356
6.5	987	370	218	2470	1112	461
7.0	1007	377	233	2969	1298	573
7.5	1022	378	244	3476	1487	693
8.0	1034	378	255	3990	1676	818
8.5	1044	378	263	4510	1865	947
9.0	1053	378	269	5035	2054	1080
9.5	1061	378	275	5563	2243	1216
10.0	1068	378	279	6096	2433	1355
10.5	1074	378	281	6631	2622	1495
11.0	1079	378	282	7169	2811	1636
11.5	1084	378	284	7710	3000	1777
12.0	1087	378	284	8253	3189	1919

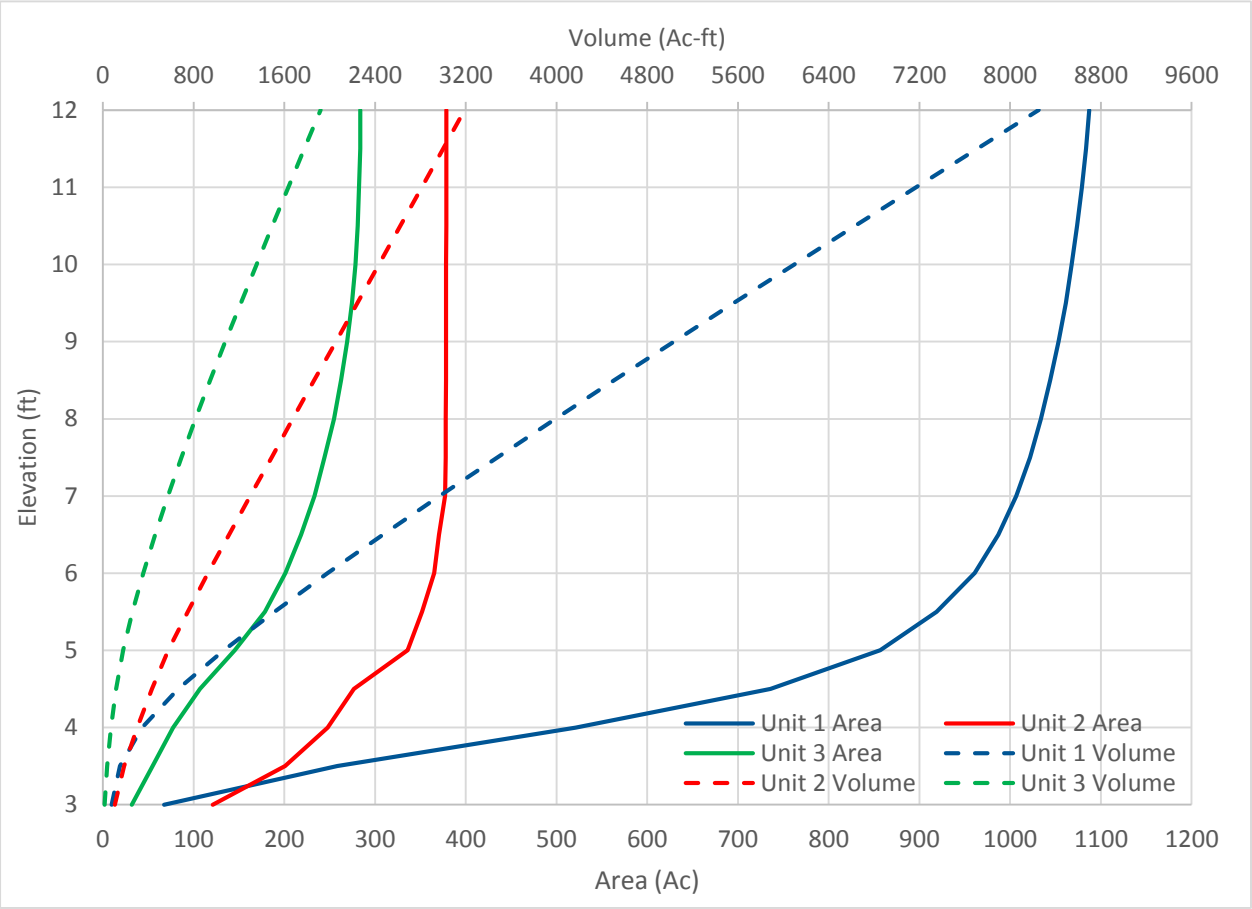

Figure 1: Unit Surface Area and Volume

4 HYDRAULIC MODELING

4.1 Model Hydrology and Boundary Conditions

The water levels that are regulated within BSDD are a function of river levels and inflow to the district. Under normal flows (the focus of the report) river levels are governed by a combination of river flow and tides. Local inflows to the District include China Camp Creek, other minor streams and seeps, and groundwater. Previous calibration efforts have shown that local inflow is dominated by groundwater under normal flow conditions.

Three seasonal simulations were conducted, using data from February 2012, April 2012, and August 2014 for the winter, spring and summer seasons respectively (Figure 2). For the hydraulic modeling of the winter and summer seasons a constant average seasonal flow was used: by removing variability in river and local inflows flow the project performance is more easily analyzed over a neap-spring tide cycle. A period of average river flow for each season was selected based on flows at the USGS South

Fork Coquille River near Powers gage. Observed river stage at the project site for the selected period was used for the model lower boundary condition (Figure 2). Constant local inflow to the BSDD was estimated based on previous calibration of the system, with adjustments for the season (Table 3).

For the Spring period a recession from flood conditions was selected based on observed Coquille River stages at the project site (Figure 2). This simulates the District transitioning from an "out of system" state back down to the operational goal range as quickly as possible, consistent with the Water Management Plan goals. Constant local inflows were again used (Table 3).

Table 3: Constant Baseflow Inputs to Model (cfs)

	Summer	**Spring**	**Winter**
Unit 1 local	2.5	5	5
Unit 1 China Camp Cr	10	20	20
Unit 2	10	20	20
Unit 3	5	10	10
Total	**27.5**	**55**	**55**

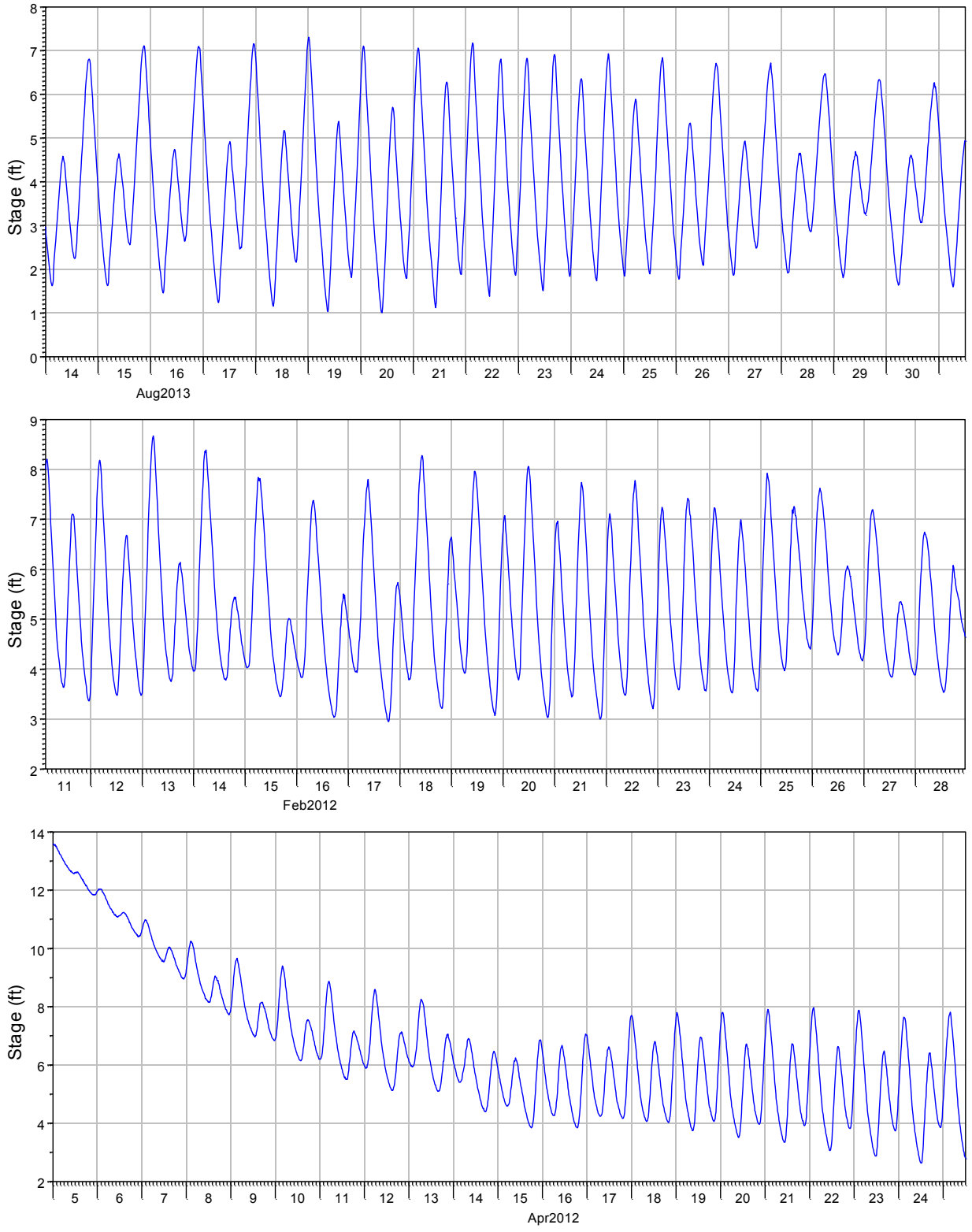

Figure 2: Observed Coquille River Stage (top-Summer, middle-Winter, bottom-Spring)

4.2 Model Geometry

The model geometry was developed from two sources. Units 1 and 3 used NHC developed geometry of existing conditions, derived from LiDAR and bathymetric survey. These units represent the main canals with reaches, and overbank areas with storage areas. Unit 2 geometry was provided by Tetra Tech as a CAD file, and represents the latest restoration design for Unit 2.

The proposed outlet control structures are Nehalem Marine side-hinge tide gates mounted on a vertical slide gate frame. All gates are 8 feet high and 10 feet wide and fixed to concrete box culverts of the same nominal dimension. The tide gate ensures that the gates will always be fully open on an outgoing tide. The vertical slide gate position will be controlled by an MTR based on an interior water level setpoint. The control structures were simulated in HEC-RAS using slide gates set in a lateral structure. Logic control rules were used to control gate position. The gates are still under design: for the modeling it was assumed that an interior water level change of 2 feet was required to move the gate from a fully open to fully closed position, and that the change was linear. Therefore, when the interior water level was more than 2 feet below the setpoint (i.e. target water management level), the gate was fully open. When water levels were between 2 feet below and the setpoint elevation the gate was partially closed (proportional to the distance between the actual and setpoint water level), and it was fully closed when water levels were above the setpoint. As mentioned above, when interior water levels were higher than river levels the gate was fully open and functioning as an open tide gate, regardless of the water elevation.

4.3 Results

Typical results for the three seasons simulated are shown in Figure 3. Observed water levels for the same period are shown for comparison. For the winter and summer periods the proposed project results in slightly lower low tides compared to existing conditions: this is attributed to the greater conveyance capacity of the new system. High tide levels are higher and of longer duration, as is expected with the MTR operations. The greater conveyance capacity of the proposed project results in faster post-flood drawdown, as shown in the spring period.

Velocity durations and gate open time are shown in Figure 4 and Table 4. The curves differ substantially from previous work, due to the design change from side-hinge to vertical slide gate MTRs. Side hinge MTRs slam shut due to the pressure head on the gate once a closure threshold is reached, typically when the gate edge is around a foot or two from the culvert face. In contrast, a vertical slide gate is not affected by the head and can be held open a fraction of a foot without issue. As a result, the vertical slide gate design stays partially open when the side hinge gate has shut. This increases the gate open time. However, when the gate is mostly shut on an incoming tide the high head and low gate open area result in high velocities through the gate. These velocities are highly localized, because the culvert barrel itself has much more area to convey the flow and hence much lower velocities. The high velocities also represent times that a side hinge MTR would be completely closed. Overall, the vertical hinge design offers greater open times than the side hinge design. The design also significantly improves open time compared to existing conditions (Table 4).

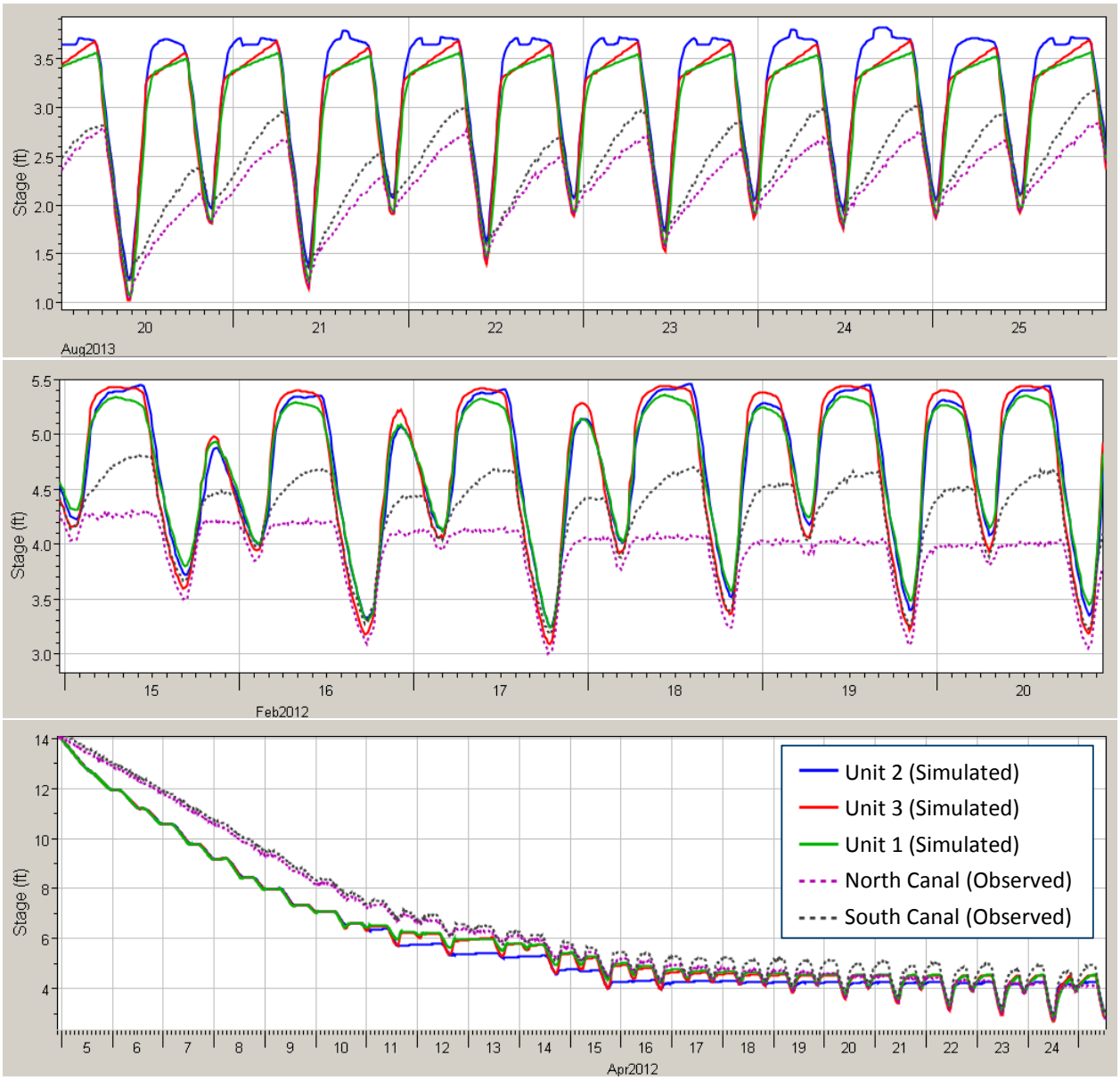

Figure 3: Typical Proposed and Existing BSDD Water Levels – Summer (top), Winter (middle), Spring (Bottom)

Table 4: Percent time of low velocities and gate open

	With-Project (Simulated)			Existing Condition (Observed[1])	
Season	**Unit**	**Percent Time Velocity +/- 2 ft/s**	**Total Percent Time Open**	**Total Percent Time Open[2,3]**	
Summer	Unit 1	34%	51%	North Canal	22%
	Unit 2	23%	99%	East Canal	12%
	Unit 3	44%	56%		
Winter	Unit 1	19%	100%	North Canal	74%
	Unit 2	17%	100%	East Canal	69%
	Unit 3	56%	100%		
Spring	Unit 1	14%	52%	North Canal	37%
	Unit 2	13%	43%	East Canal	13%
	Unit 3	24%	51%		

Notes: 1) Based on BSDD recorded water level data from the period simulated (Figure 1), assuming 0.05 ft of head is required to open the tidegates. 2) The existing tidegates only allow positive (outgoing) flow. 3) Due to reconfiguration of the district the proposed units do not correspond to the existing canals.

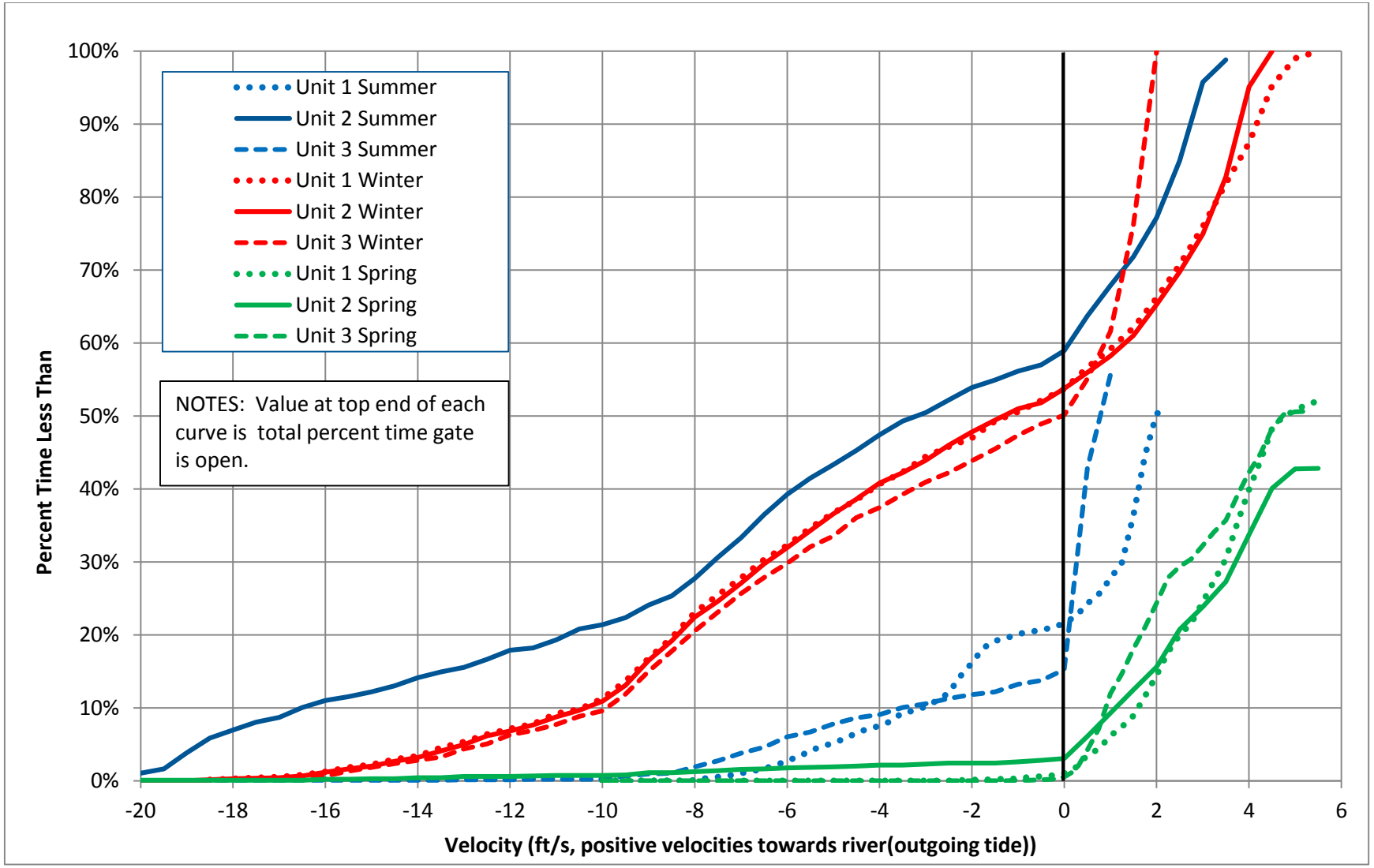

Figure 4: Velocity-Duration Curves

BEAVER SLOUGH DRAINAGE DISTRICT

DISTRICT WATER MANAGEMENT PLAN (DWMP)

APPENDIX G_8.7– BIOLOGICAL EFFECTS

INTRODUCTION

For the past six years, landowners in the Beaver Slough Drainage District (BSDD) have been collaborating with The Nature Conservancy, Oregon Department of Fish and Wildlife (ODFW), Ducks Unlimited, the Coquille Indian Tribe and other conservation organizations to develop a comprehensive management plan for the China Camp Creek drainage, near Coquille, OR between river miles 20-23 of the Coquille River, also known locally as Winter Lake. Their primary focus is the balance the needs for winter habitat and critical off-channel rearing habitat for Endangered Oregon Coast Coho salmon, wintering waterfowl and migrating shorebirds with agricultural interests.

Due to the area's dependence on agriculture, it is recognized that a working landscapes approach will be the most effective conservation strategy in the region and the privately owned lands within the District provide unique opportunities to improve habitat while keeping lands largely in private ownership and managed for agriculture. In addition to the BSDD's urgent need to replace the failing tide gate infrastructure, conservation and agricultural partners identified an opportunity to further improve the habitat values of the lands within the Drainage District by replacing existing tide gate structures in a manner that also provides tremendous benefits to aquatic resources in the Coquille Valley. While multiple stakeholder goals will be met as a result of the project, and benefits realized for numerous aquatic species, improving habitat for Oregon Coast Coho salmon is the focus of the project proposal. Proposed actions directly align with recovery actions identified in the Coquille River Sub-basin Plan developed by the Coquille Indian Tribe for National Oceanic and Atmospheric Administration (NOAA) in 2007 and the Oregon Coast Conservation Plan developed by Oregon Department of Fish and Wildlife (ODFW), also completed in 2007.

The Coquille Valley is an extensive alluvial floodplain that extends from the mouth of the Coquille River near Bandon upstream to the limit of tidal influence at river mile 42. The Coquille Valley historically supported an estimated 17,500 acres (Scranton 2004 and Benner 1992) of tidally influenced freshwater and salt marsh wetlands. Historic Coho salmon populations have been estimated at over 450,000 returning adults annually. Many factors have led to the decline of Coho salmon populations in the Coquille Watershed over the past century including over fishing, loss of spawning habitat, hatchery influence, predation, removal of large wood, water quality, and loss of habitat connectivity, increased

sedimentation, increased water temperatures and more. The Coquille Sub-basin Plan, however, identifies lack of access to and loss of off-channel over winter habitat as the key limiting factor preventing the recovery of Coho salmon populations in the Coquille River watershed.

In addition, the Coquille Valley has long been recognized as one of the most important coastal sites in the Pacific flyway for winter waterfowl. The Pacific Coast Joint Venture (PCJV) identifies the Coquille River Valley as the most important waterfowl area between San Francisco Bay and the Columbia River. Comprised largely of flooded pasturelands, the valley is critically important to numerous species of waterfowl and shorebirds during migration and wintering periods, Taylor (1994)

OBJECTIVES AND APPROACH

Currently, two projects within the BSDD are in development, including the China Camp Creek Project (C3P) and the Winter Lake Restoration Project (WLRP) are moving from the conceptual to the design/engineering phase with permitting submitted and under consideration/approval to be followed by construction in the summers of 2015 and 2016. The C3P encompasses the entire 1,700 acres of the Drainage District and is broken into 3 management units, with Units 1 and 3 (1,300 acres) remaining in private ownership and maintained as agricultural pasture ground while improving fish passage and providing habitat benefits, and Unit 2, owned by the Oregon Department of Fish and Wildlife and the China Creek Gun Club both forming the 400 acre WLRP site. Unit 2 (WLRP) is to be restored to include tidally influenced freshwater wetlands and enhanced upland habitats. While differing management objectives exist for the multiple Units, the overarching goal is to improve agricultural conditions in Units 1 and 3, while re-establishing tidal influence processes to all three management Units in the Winter months, thus improving river-floodplain connectivity on the entire 1,700 acre site, as well as augmenting the restoration work that is being accomplished on the WLRP site. The ability to manage water independently within the three different management units and at different times of the year to meet various management objectives is made possible by the use of Muted Tidal Regulators (MTR's) which are described in Appendix E and F. The infrastructure upgrade will significantly improve river-floodplain connectivity on 1,700 acres of historic floodplain with the Coquille River. The result will improve access to and quality of critical over-wintering habitat for Coho parr and smolts seeking off-channel refugia as well as providing migration and wintering habitat for numerous species of waterfowl and shorebirds.

SUMMARY OF ECOLOGICAL BENEFITS

These projects will improve resiliency/response to expected climate change and sea level change. Restoration and creation of wetlands is a science-recommended action toward anticipated environmental changes in the years/decades to come. Pro-active planning and development of habitats

that will replace lost habitats due to climate change and sea level rise is recommended. The WLRP and C3P should be responsive to these anticipated changes.

Habitat Complexity

Re-establishment of more consistent tidal exchange on the floodplain will restore more functionality and connectivity to remnant tidal channels existing in Unit 2. The MTR-equipped tide gate is necessary to fully achieve complexity restoration objectives for over winter habitat, while maintaining private lands that are a critical piece of the restoration project.

Floodplain Connectivity

The MTR structure will significantly improve river-floodplain connectivity to the full 1,700 acres by allowing for the partial re-establishment of tidal influence (i.e. a muted tidal prism) to affect the site on a consistent basis throughout much of the year, compared to the current conditions which only allow for broad connectivity when the floodplain levees are overtopped by flood events during the winter. These flood events are variable, occurring as little as once per year to multiple times, but only occur during the winter/early spring months. The MTR technology allows tide gates to remain open at a wider range of flow rates and water elevations, providing fish access during a greater portion of the year.

Species Diversity

Re-establishment of more consistent tidal exchange on the floodplain will significantly increase overwintering opportunities for juvenile salmonid species, especially Coho salmon, to access off-channel rearing habitat. In addition, these improvements will allow resident Cutthroat Trout to access re-connected channels and China Camp Creek during the late spring and summer months providing rearing habitat as well as access to upstream spawning habitat. Juvenile Chinook salmon will also use the improved access and reconnected channels on smolt out migration as an area to feed and rest while migrating through the estuary to the ocean. Restoring 285 acres of Unit 2 (ODFW property) to forested wetlands under tidal influence will provide improved habitat over time for native fish species, neo-tropical bird species and aquatic furbearing mammals. Finally, this project will increase and improve foraging/nesting opportunities for shorebirds and waterfowl during the spring, summer and fall compared to current conditions where the majority of fish and wildlife species use occurs during the winter/spring months and is dependent upon high water events to overtop the site's levee system.

Species Migration Patterns

Re-establishment of more consistent tidal exchange on the floodplain will significantly increase opportunities for juvenile salmonid species, especially Coho salmon, to access off channel rearing habitat, in turn increasing floodplain residence time and growth of individuals. This translates to higher survival rates, ensuring the preservation of Oregon Coast Coho and other salmonid populations.

Similarly, spring and fall floodplain inundation patterns, post implementation will continue to support the maintenance of historically important migration corridor for shorebirds and waterfowl.

Sediment Transport

Re-establishment of more consistent tidal exchange on the floodplain will improve sediment transport processes eventually resulting in floodplain aggradation and tidal channel development in Unit 2. The current outdated tide gates were designed to preclude tidal exchange and flooding. As a result, the entire 1,700 acre site has experienced significant subsidence, which in turn has led to problems for agricultural and residential landowners in the drainage district.

Water Quality

Re-establishment of more consistent tidal exchange on the floodplain will improve water circulation in the existing ditches and newly created restoration tidal channels. Currently the water within the Drainage District is poor during the late spring, summer and early fall months due to low Dissolved Oxygen (DO) levels and high temperatures. By improving the circulation and connection with the Coquille River will improve DO, lower temperatures and limit the concentrations of Nitrogen (N) and Phosphorus (P) that accumulates in the warmer summer months. Also, planting 130,000 trees in Unit 2 will provide much needed shade to reduce water temperatures, when mature.

Wetland Conservation

The Coquille Valley is located along the lower 42 miles of the Coquille River in the estuary tidal zone where freshwater meets saltwater. The valley historically had an estimated 17,425 acres of tidally influenced wetlands (Benner, 1992 and Scranton, 2004). Maps of the valley from the late 1800's identify nearly 70 percent of the valley as timbered swamp or wooded bottom lands wetlands (estuary intertidal forested wetlands and palustrine forested and scrub-shrub wetlands).

Between 1870 and 1900, wetlands in this area were converted to agricultural through clearing, ditching, installation of tide gates, diking and pumping that occurred up until 1950 (Benner, 1950). Today only about 300 acres of these forested and scrub wetlands remain. The remaining acres are largely dominated by pasture grasses.

Although the project aims, in part, to ensure the maintenance of agricultural operations, the new MTR's would allow for partial re-establishment of tidal exchange and floodplain inundation patterns across the entire 1,700 acres within the BSDD, greatly improving existing conditions. Because the default position of the existing older tide gates is a closed position, this requires large flood stage events that overtop the levee system to inundate the site and allow juvenile fish to enter the area. While such events occur

annually, the frequency is variable and limited to winter and early spring periods. During below average precipitation years, for example, only one overtopping event may occur. That translates to only one opportunity for juvenile fish to access an expansive area of off-channel over winter habitat and greatly reduce the extent and duration of inundation which limits foraging opportunities for waterfowl in particular. The restoration of partial tidal influences to the 1,700 acre site via the installation of the MTR's will result in significant functional benefits compared to existing conditions. For example, floodplain access for juvenile salmonids seeking over winter refugia and forage opportunities for waterfowl and shorebirds in the fall/winter and spring will increase as compared to current conditions that are reliant on flood stage events to maximize use of the floodplain.

Benefits to Fish

From a fisheries perspective, while our proposed project will benefit a suite of species such as Chinook salmon, cutthroat trout, winter steelhead, western brook lamprey and Pacific lamprey; most importantly, the project directly addresses the key limiting factor to Coho salmon recovery identified in the Coquille River Sub-basin Plan authored by the Coquille Indian Tribe for NOAA Fisheries. This science based plan determined that smolt production and survival is the sole factor preventing population recovery of Oregon Coast Coho and that lack of off-channel winter refugia and access to that habitat was the primary limiting factor affecting smolt survival. Therefore, access to winter rearing habitat is paramount to Coho Salmon recovery. Strategy-1 of the Sub-basin Plan names the Lower Coquille Watershed, where the proposed restoration and tide gate replacement projects are located, as having the highest restoration potential.

The new MTR's would allow for the partial re-establishment of tidal exchange and floodplain inundation patterns that greatly exceed existing conditions, because currently large flood events that overtop the floodplain's levee system are required to bring fish into the system. This re-establishment of tidal exchange will increase the opportunities for Coho parr and smolts to access the floodplain for the overwintering periods fall through spring compared to existing conditions. During the warmer summer months, increased tidal exchange/water circulation will improve water quality in the canals and restored remnant tidal channels benefiting native species such as cutthroat trout.

In addition to establishing tidal exchange, Unit 2 will undergo extensive restoration activities which will not only benefit fish species but also migrating song birds, nesting and early migrating waterfowl, and aquatic furbearers. This will be accomplished by re-connecting 7-10 miles of remnant channels to the Coquille River, planting 130,000 wetland trees and shrubs, removing 3 miles of interior dikes, filling 1.5 miles of interior ditches and possibly placing 75 pieces of large wood on the ODFW property within Unit 2. This will provide high quality off channel, over winter habitat for juvenile Coho salmon. The project site is located in freshwater above any salinity measurements, so all the restoration will be accomplished in freshwater wetlands which adds benefits to over wintering Coho salmon. Based on research conducted by Baker (2008) in functioning floodplain wetland systems along the Columbia River and Coos County, juvenile salmon seek out these off-channel areas and experience significant growth

rates while overwintering in them. Considering the restoration work being planned in Unit 2, coupled with improved access to the floodplain, we fully expect to observe similar results in Unit 2 for Coho. In recent pre-project monitoring, ODFW sampling of the few Coho salmon captured in Unit 2 showed that these juvenile fish were 1.5 to 2.0 times the size of fish found outside the site in the Coquille River. While Units 1 and 3 will remain as pasture/agricultural ground, multiple studies lend support to our premise that agricultural floodplains can also confer benefits to juvenile salmon, provided that fish have access to the system as the MTR's will provide. For example, Katz, et al. (2013), introduced Chinook salmon into flooded rice fields of Northern California, and observed significant growth rates, not unlike the results reported by Baker for intact floodplain wetlands.

Similarly, Colvin et.al., (2009) found the presence of juvenile fish and recently hatched fry in intermittent watercourses of agricultural lands in the Willamette Valley and that such watercourses offered conditions suitable for spawning and juvenile rearing of native fish species. The authors suggest that agricultural conservation programs that have the potential to provide benefits to farmers while maintaining aquatic diversity in these floodplain habitats need to be clearly identified and promoted.

It should be noted that limited Coho Salmon spawning occurs in China Camp Creek, the only tributary to Winter Lake and the project site under current passage and stream habitat conditions. Therefore this project is not anticipated to significantly increase Coho salmon spawner abundance in the absence of upstream, off-site stream improvements. . A number of studies by the Yurok tribe of Northern California document that juvenile Coho salmon from the entire Klamath River basin move to freshwater, off channel sites during the fall and winter to over winter and rear in these habitats. Indeed, we expect that Coho salmon from throughout the entire Coquille River Basin will over-winter in these habitats as they did historically, and will do so again with improved access and habitat restoration.

Finally, results from fish monitoring at a similar project to our proposed work that was completed in 2011 in Skagit County, WA (the Fisher Slough project), where MTR devices were employed to reestablish muted tidal flows to the project site, lend support to our hypothesis that juvenile Coho will benefit tremendously from improved river-floodplain connectivity once MTR's are installed at the project site. Beamer et.al., (2014) concluded that restoration of the connectivity of the Fisher Slough floodplain in conjunction with current operation of the floodgate in sync with tidal cycles has provided clear benefit to juvenile estuary-rearing Chinook smolts. Specifically, increased habitat connectivity has allowed juvenile Chinook salmon to effectively utilize and benefit from the increased habitat complexity associated with the dike setback. Note that Fisher Slough resulted in 60 acres of accessible off-channel habitat while our proposed project will result in 1,700 acres of accessible over winter habitat.

ODFW has been sampling over winter fish assemblages at the C3P and WLRP site and has documented juvenile Coho salmon use, however Coho salmon represent a small fraction of the species composition(approximately 2% of the fish trapped) indicating the inability of juvenile Coho salmon juveniles to readily access the floodplain. Other non-native fishes make up the rest of the sampled population and are better able to survive the poor water quality conditions in late spring, summer and early fall months when low DO and high temperatures prevail. Baseline and post-project monitoring will be an integral component of the project and conducted by ODFW. ODFW will continue to monitor

juvenile Coho salmon in the winter months using marking techniques such as elastomer injections and Passive Integrated Transponder (PIT) tags. The proposed study design includes installing a PIT tag receiver array on or near the new MTR tide gate structures to document juvenile movement throughout the project area in Units 1, 2 and 3. ODFW is attempting to secure funding to make this project a formal research project within their research section but no decision has been made at this time. BSDD and The Nature Conservancy continue to seek funding for biological, agricultural, and economic studies to establish pre- and post-project performance. A unique opportunity exists to measure the impact of different land management programs side by side.

Benefits to Coastal Dependent and Migratory Birds

For wintering waterfowl, the Coquille Valley has long been recognized as one of the most important coastal sites in the Pacific Flyway. The PCJV identifies the Coquille Valley as the most important waterfowl area between San Francisco Bay and the Columbia River. Comprised largely of flooded pasturelands, the valley is critically important to numerous species of waterfowl and shorebirds during migration and wintering periods, Taylor (1994). According to PCJV, the area is rated as "high priority" in the US Fish and Wildlife Service's ranking of waterfowl habitat protection needs, and is the agency's top priority for protection in Oregon (1989). Mid-winter waterfowl surveys typically record anywhere from 10,000 to 60,000 ducks in the Coquille Valley, numbers that often represent nearly half the total wintering waterfowl population on the Oregon Coast (Joseph Sands, USFWS, personal communication). The valley also hosts significant populations of wintering geese and swans.

Lovvorn and Baldwin (1996) evaluated dabbling duck use of intertidal areas absent of surrounding agriculture and intertidal areas in proximity to flooded agriculture in Western Washington. They determined that birds appear to shift to agricultural habitats almost exclusively as intertidal resources are depleted, and actually depart areas where intertidal habitats are void of adjacent agricultural lands prior to mid-winter. Our project site possesses similar landscape characteristics (i.e. an agricultural/intertidal habitat mosaic) and we therefor expect that the maintenance of agricultural lands will continue to help support large mid-winter waterfowl numbers, and actually improve fall and spring migration habitat as a result of the project area being inundated on a more regular basis via improved tidal influence.

At least 11 species that are listed as priorities under the North American Waterfowl Management Plan (NAWMP 2004) will benefit from this project. Furthermore, 26 species considered priorities for Partners in Flight will benefit from the project and five species that are listed as priorities.

Unit Operation Description and Benefits

Summer Operations- June to September

Since few anadromous fish are present under current operations, water management objectives are to improve water quality and to prevent habitat conditions conducive to mosquito population increases. In Unit 2, maximum tidal water levels will be managed at 3.5 to 4.0 foot levels which will facilitate bank full conditions in the 7-10 miles of reconnected channels. This level will result in tidal exchange that will raise DO levels, reduce temperatures and reduce N and P levels. As we approach the August to Mid-October time period, when mosquitoes are less an issue and the first fall freshets trigger juvenile Coho salmon to begin searching out off-channel sites and over wintering areas, the water levels will be increased to 4.5 to 5.5 foot levels. During this time period, juvenile Chinook salmon are also migrating through the estuary and early migrant waterfowl begin to show up in the basin to utilize the Unit 2 restoration area. In Units 1 and 3, the main objective is still agricultural grazing, so water levels will be managed at the 3.0-3.5 foot levels with an increase to 4.0-4.5 foot levels as needed for landowners to irrigate pastures. Water levels in the main canals will have some level of tidal flushing (water levels 3.0-3.5 feet to improve water quality, increase DO, reduce temperature and prevent buildup of aquatic vegetation in the canals

Winter Operations – October to March

The objective of all units during this time period is to provide improved fish passage for juvenile salmonids, especially juvenile Coho Salmon. In Unit 2, water levels will be managed for 4.5 to 5.5 feet elevation during non-high water events. This will allow maximum opening time for the MTR's for juvenile salmon movement into and out of unit 2. In Units 1 and 3, grazing operations are still occurring until the first flood event or until the cattle are pulled off the sites. Once the floodplain is inundated from heavy rainfall and/or levee overtopping, cattle are removed and water levels will be managed for 4.5 to 5.5 foot levels to provide access to juvenile salmon. As described in the operation appendices, the MTR's will be lifted on a sliding frame to allow passage of juvenile Coho salmon during rising river and flood events. This will also aid the Drainage District in "equalizing" their water levels to prevent damage to their infrastructure. This operation will provide much improved fish access to off river channel over winter habitat and provide habitat for migrating and over wintering waterfowl and shorebirds.

Spring Operations- April to May

This transition period is when the agricultural landowners are attempting to drain out their pastures for grazing use and the time when Coho salmon are smolting and migrating to the ocean. In Unit 2, water levels will be slowly reduced to summer flow levels and operated at the 3.5 to 4.0 level. This level will provide water levels for rearing and migrating juvenile salmon as well as migrating waterfowl and shorebirds. In Units 1 and 3, water levels will be reduced over time to 2.0- 4.0 water levels to prepare the pastures for grazing. As the water recedes, migrating waterfowl and shorebirds will use the edge of the pastures for foraging.

INVASIVE SPECIES MANAGEMENT

Invasive plants and animals will need to be managed under the management system. The Nature Conservancy has secured $5,000 to manage invasive plant species such as Himalayan blackberry, Scotch Broom and various species of thistles on ODFW lands in Unit 2, which will be controlled by ODFW. Reed Canary grass is one species which is non-native and considered by some to be invasive. Management of Reed Canary grass will be managed by two methods. In Units 1 and 3, as well as the Gun Club property in Unit 2, Reed Canary grass will be managed by intensive grazing practices by livestock. This management system is currently in use now and provides excellent gains for livestock on private property and provides ideal forage habitat for migratory and wintering waterfowl and migratory shorebirds during the fall, winter and spring months. Current research shows that Reed Canary grass can be reduced substantially by shade. Planting approximately 130,000 trees consisting of Oregon Ash, Red Alder, willow, cottonwood, Sitka Spruce and Oregon crabapple on 240 acres of the ODFW property will provide enough shade to substantially reduce any reed canary grass within the planting zone.

Several species of non-native fish and wildlife species are present on the site. Animal species include nutria and bullfrogs. Management of these two species will include……..

Non-native fish species found within Unit 2 include brown bullheads, yellow perch, largemouth bass and bluegill. Management of these species will include the promotion of angling on ODFW's Coquille Valley Wildlife Area and habitat restoration anticipated to favor cold water species over non-native warm water species. Treatment toward eradication is not currently planned, but is a tool available to consider if necessary.

MONITORING PLANS

Monitoring plans include a number of species and environmental surveys that will be completed during and after the project. Some monitoring is currently being conducted by state agencies:

1) Plant species: ODFW in cooperation with National Resource Conservation Service (NRCS) conducted a vegetation survey in 2014 to determine species composition and percent cover as part of the pre-project monitoring. This monitoring will continue post-project. In addition, tree species composition and survival will be monitored in the planted area for five years post-project to determine tree survival.
2) Water Quality: Water quality, including temperature, DO, N and P will be monitored in 2015 as part of the pre-project monitoring and will continue to be monitored post-project by local high schools and ODFW.
3) Coho Salmon and other fish species: ODFW has been monitoring fish presence/absence and species composition for fish on the ODFW property for three years and will continue to monitor post-project to determine differences. Coho salmon have been marked using PIT tags and

elastomer marks to facilitate monitoring. ODFW is committed to exploring the opportunities to secure funds that will allow their fish research team to implement a full research project on the project site.

4) Birds: ODFW has been conducting bird surveys of the ODFW property for three years to establish pre-project population levels and species composition. These surveys have been completed once every 3 months and will be continued post project to determine species composition and numbers as planted tree species survive and mature.
5) Water Management: The BSDD will monitor water levels at the MTR tide gates to determine that the district is meeting the management outlined in the District Water Management Plan. Existing water data loggers located in the Coquille River, in each of the four management units and in China Camp Creek will be monitored for water levels and temperatures to document parameters and effects of implementing the projects. .
6) ODFW will monitor increases in recreational opportunities that have resulted from the projects and establishment of the Coquille Valley Wildlife Area (CVWMA) including fishing, hunting and wildlife viewing.
7) Project partners continue to seek resources to monitor the project impacts on Agricultural production and management.

Beaver Slough Drainage District

China Camp Creek Project - Fish Passage Exception Request

March 5, 2015

Project Location:

The China Camp Creek Project (C3P) is in the Beaver Slough Drainage District (District) located in T27S, R13W, Sections 21, 22, 27, 28, 29, 32, 33, 34 and T28S. R13W, Sections 2 & 3, at river mile 20 to 22, West of Coquille, Oregon, North of the Coquille River, and South of Highway 42N, in the area known locally as Winter lake. (See attached location map, figure 1.0)

Coordinates for the proposed culvert / tide gate structure are 43*11'44"N, 124*15'35"W.

Contact:

Fred R. Messerle, Chairman
60196 Old Wagon Road
Coos Bay, Oregon 97420

Cell: 541-404-6105
Email: bsdd.bos@gmail.com

Project Background:

The District is responsible for the culvert / tide gate structures, dikes, canals, and berms that protect over 1,700 acres of land from daily high tides and facilitate drainage of individual landowner parcels. The existing culvert / tide gate infrastructure consists of four 96" CMP culverts with top hinged wood tide gates. The metal culverts were installed in 1995 and are at the end of life. The two culverts in the North Canal were lined with 84" X 60' CMP liners and new head walls in 2014 to maintain function and preserve the associated protective dike. (Please see the referenced BSDD North Canal Culverts – Repair Plan – June 2, 2014 and the North Canal Repair Project – Summary Report January 31, 2015 for additional information available for download at http://www.coquilleworkinglandscapes.com/)

The C3P is the District's proposal to build new culvert / tide gate infrastructure that will enable landowners within the District to meet their management objectives. The new culvert / tide gate infrastructure design allows for independent control of water levels in three separate management units. (See attached BSDD Unit Map, Figure 2.0) The proposed Winter Lake Restoration project (WLRP) encompasses the entire Unit 2, which will be primarily managed for over winter Coho salmon habitat as well as other fish and wildlife values. Units 1 and 3 are privately owned and managed for agricultural production, primarily grazing.

Objectives for the C3P include:

- Maintain agricultural production and enhance ecological function
- Improve and provide OCH (off channel rearing habitat) for juvenile Coho and Chinook Salmon
- Improve fish passage for adult salmon returning to China Camp Creek
- Control water levels to allow landowners to meet their individual management objectives
- Flushing to reduce sediment in the drainage system and improve water quality
- Improve capacity and connectivity to the Coquille River for China Camp Creek and the drainage system
- Provide substantially improved access to and from the Coquille River for fish particularly the endangered Coho salmon during winter and high water events
- Encourage habitat suitable for wildlife and migratory waterfowl
- Facilitate sediment retention and soil build up

Replacement of the culvert / tide gate infrastructure is a “trigger event” as per OAR 635 Division 412 requiring fish passage approval from the Oregon Department of Fish & Wildlife for construction and operation.

Project Description:

The C3P proposal is to construct three adjacent steel reinforced concrete box culvert structures with a total of seven 8’X10’X60’ culvert openings with associated wing walls. Unit 1 would have two openings; Unit 2 would have four openings, and Unit 3 one opening. Culvert invert would be -2.0 (NAVD88). (See attached structure plan drawing, figure 3.0, and refer to the 30% structure design plans available to download from the China Camp Creek Project section at the http://www.coquilleworkinglandscapes.com/ website for more detailed information.) These structures would be located within the foot print of the existing protective berm between the North and East Canals which has the equivalent of twenty years of preloading. The support foundation would be a geo-fabric reinforced compacted aggregate mat pad. The existing culverts, piling and wood bulkheads would be removed and the main protective berm for the Coquille River would be reconstructed with appropriate access roads.

The tide gates would be standard Nehalem Marine ***NSRG 10X8 RK*** side hinged gates mounted on a sliding frame that would move vertically on the face of the culvert. The mechanical lift system for the slide gate frame would be powered by hydraulic cylinders that would receive their moving force from energy harvested from the Muted Tidal Regulator (MTR) float system on the upstream end of the culvert structure. The side hinged gates would open and the frames would rise on an outgoing tide with the side hinged gates closing and the slide gate frame dropping when a predetermined adjustable set point, based on the inside water level, triggers the MTR mechanism. Auxiliary power would be used to adjust the slide gate frames to achieve desired set points for winter operations and storm events.

Extensive hydraulic modeling has been done to predict the effects of the proposed infrastructure for the C3P both within the District and the Coquille River. Please refer to the Phase 3 Hydraulic Analysis of China Camp Creek Restoration Project and the BSDD_Hydrology Discussion Summary Report – 2014, both available for download at http://www.coquilleworkinglandscapes.com/ .

Given the size of the C3P and the associated water volumes as well as the physical constraints and cost factors involved, achieving 100% compliance with fish passage velocity and time open criteria will not be possible, thus the need to request an exception. However, consideration must be given to the fact there are two incoming and outgoing tides each day with a change in flow direction for each change in tide. Periods of minimum velocity at high and low slack water provide more benefit and opportunity for fish passage than a standard upland culvert that would experience continuous flow in one direction. Additionally the amount of ecological function to be restored as well as the sheer size involved (1,700+ acres) make a compelling argument for the C3P to be considered self-mitigating and worthy of an exception. Please refer to the USACE/DSL, November 2014, Joint Permit Application and the USFWS National Coastal Wetland Conservation Grant, June 2014, Application, available at http://www.coquilleworkinglandscapes.com/ , for more discussion as to the biological benefits as well as the details of the restoration of ecological function.

The current tide gate infrastructure is default closed and provides no fish passage during an incoming tide or a rising river flood event with limited fish passage opportunity on and outgoing tide. The proposed structure design will extend the time the tide gates are open to allow fish passage as well as reduce the flow velocity, particularly in the critical area around the tide gate itself.

In working water level mode the slide gate frame controlled by the MTR mechanism would function similar to any other MTR controlled tide gate, closing at a predetermined set point, allowing for longer time in an open position and thus more fish passage opportunity.

In winter, there are multiple options available to enhance the goals of increased access for juvenile COHO Salmon, silt retention, and system equalization. The slide gate frames could be open to provide a flow that would not exceed the desired set point on

each tide cycle. This size of the opening could be increased during a rising river in anticipation of a high water out of system event to achieve additional fish access opportunities as well as silt retention and equalization. The ability to adjust the slide gate frames to match actual conditions on the ground is a huge advantage over the present default closed infrastructure.

Project Operation:

The District will operate and maintain the infrastructure for the benefit of landowners and stakeholders within the parameters of the District Water Management Plan and the permits authorizing the project. (See the District Water Management Plan (DWMP), available to download at http://www.coquilleworkinglandscapes.com/.)

Programmatic Approval:

As provided for in OAR 635-412-0020 (3) (b) the District requests a programmatic approval for culverts and tide gates associated with berms within the District that qualify under OAR 635-412-0035 (5) (a) in areas above which no stream is present. Requirements for the programmatic structure would be a minimum 48" diameter culvert, with 4" depth and width of water, a side hinged tide gate and an invert of -1.0 (NAVD88).

Supplemental Information:

Available for download at: http://www.coquilleworkinglandscapes.com/

- Phase 3 Hydraulic Analysis of China Camp Creek Restoration Project (NHC 2013)
- BSDD_Hydrology Discussion Summary Report – 2014
- BSDD_Fish Passage Exception Request
- District Water Management Plan (DWMP)
- USACE/DSL, November 2014, Joint Permit Application
- USFWS National Coastal Wetland Conservation Grant, June 2014, Application
- BSDD_C3P Culvert/Tide Gate 30% Design Plans
- Geotechnical Investigation Report (PBS 2013)
- WLRP 30% Design Presentation
- WLRP 60% Design presentation
- WLRP 90% Design presentation
- WLRP 90% Design Plans
- BSDD North Canal Culverts – Repair Plan – June 2, 2014
- North Canal Repair Project – Summary Report January 31, 2015

Figure 1.0 - Location Map

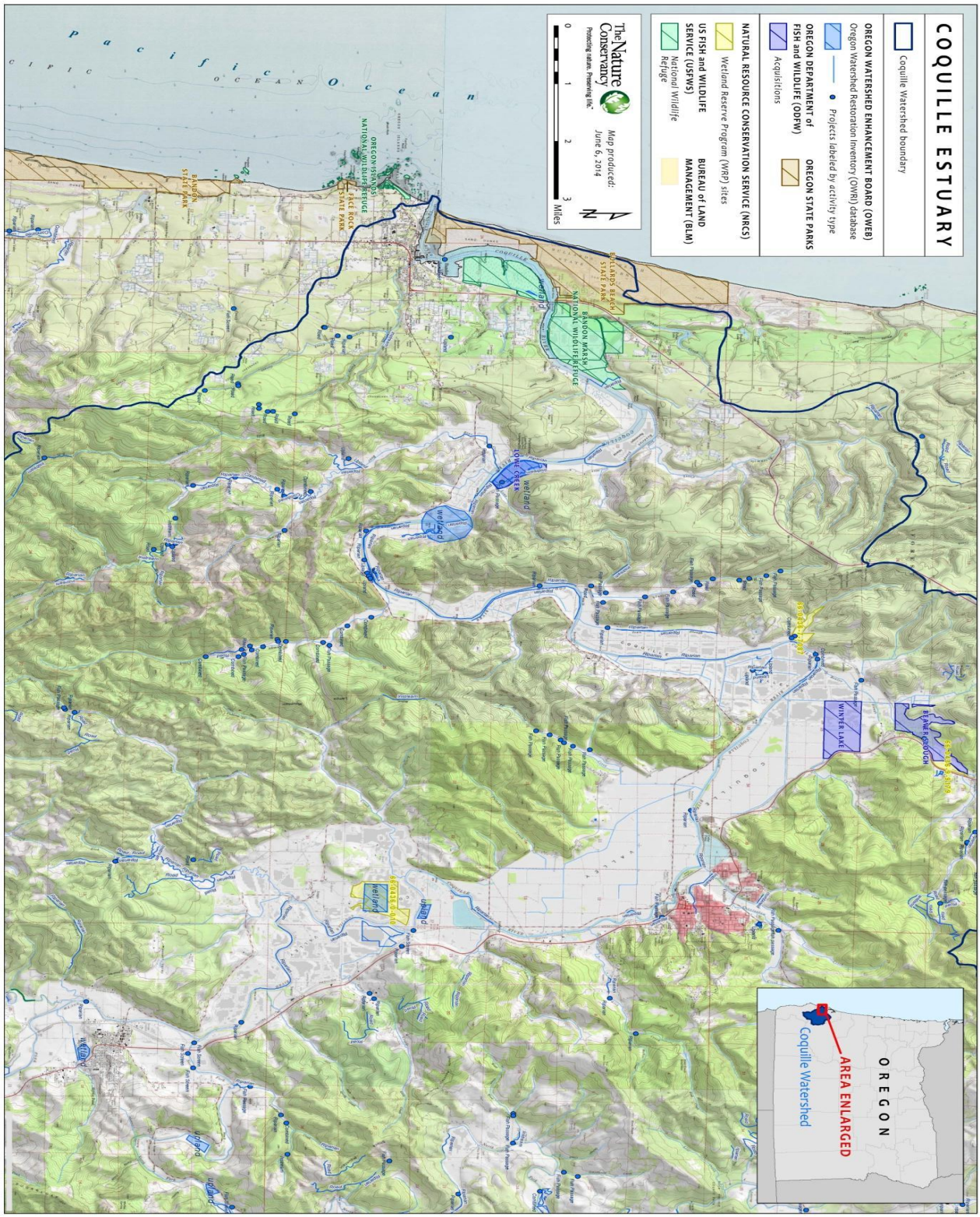

Figure 2.0 – BSDD Management Unit Map

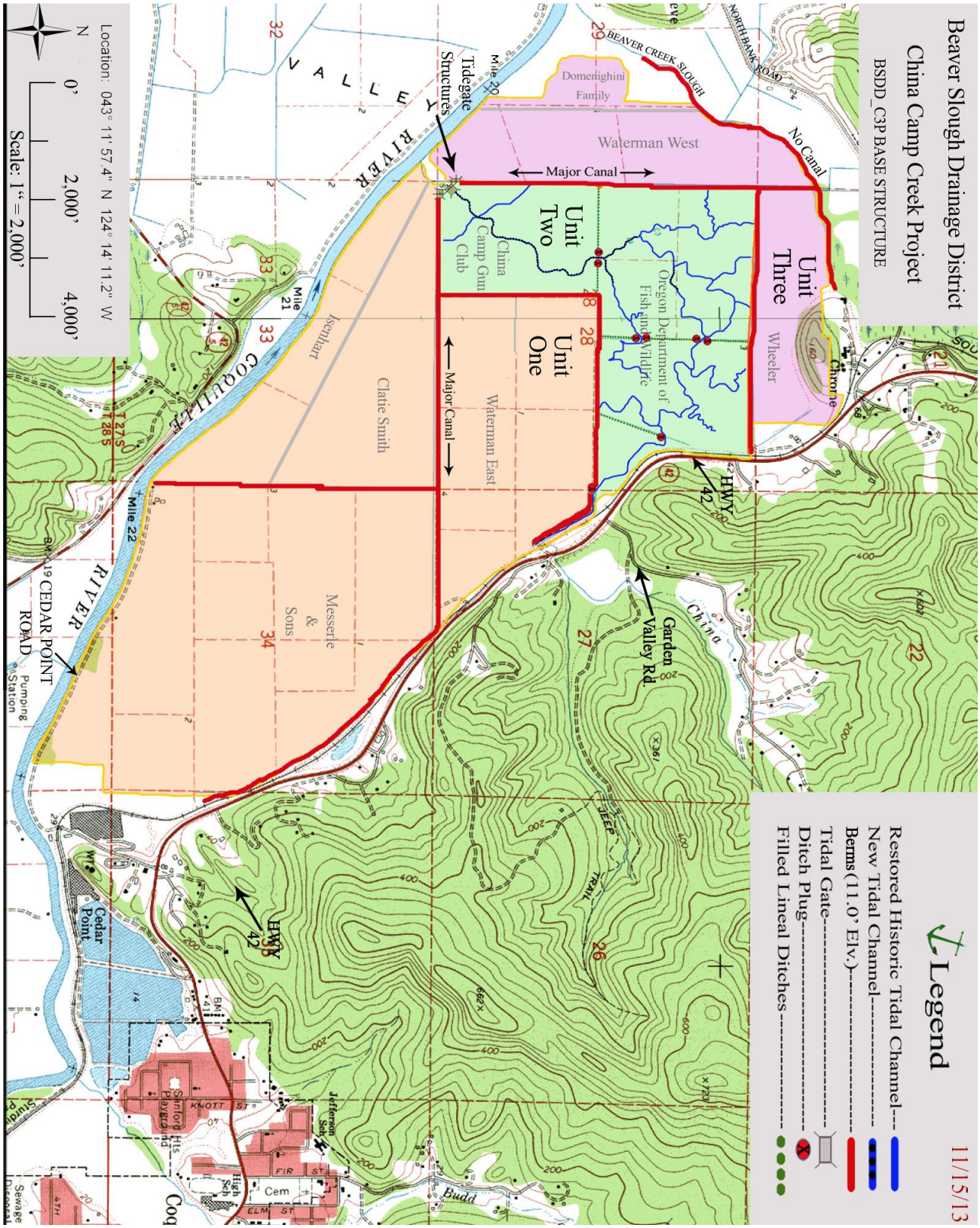

Figure 3.0 – BSDD Structure Site Plan